INVITATION TO BID
NAVARRE BEACH WELLHOUSE No. 2
ELECTRICAL UPGRADES

Invitation is hereby given that the Santa Rosa County Board of County Commissioners is calling for and requesting bids from only properly licensed Contractors for providing an upgraded electrical system and back-up engine drive for a potable water well located at the Navarre Beach Wellhouse No. 2.

The Board of County Commissioners of Santa Rosa County, Florida will receive sealed bids from qualified licensed contractors only until 9:00 a.m. (CST), August 1, 2016; at the Santa Rosa County Procurement Department, 6495 Caroline Street, Suite J, Milton, Florida 32570. A secondary delivery site is assigned as 'Suite M' at the preceding address. Bids shall be sealed and clearly labeled "**BID# 16-052 Navarre Beach Wellhouse No. 2 Electrical Upgrades**". All proposals must be in writing and delivered by hand, overnight delivery service, or mail. Please provide the original proposal, labeled "ORIGINAL" and six (6) copies labeled "COPY" (7 total complete packages) and one (1) OCR (searchable) PDF electronic file. Bids received after this time will be rejected and returned unopened to the bidder. All interested parties are invited to attend.

A pre-bid conference will be held at 10:00 a.m. (CST), on July 12, 2016, at the Navarre Beach Water and Sewer Department, 1411 Utility Drive, Navarre Beach, Florida 32561.

Project documents may be obtained online at www.santarosa.fl.gov/bids/openbids.html or secured from the Santa Rosa County Procurement Department, 6495 Caroline Street, Suite J, Milton, Florida 32570 at a non-refundable cost of $25.00 per CD; telephone (850) 983-1870.

Questions concerning this proposal should be directed to Santa Rosa County Utilities Supervisor, Mr. Terry Wallace at (850) 981-8880.

Santa Rosa County reserves the right to waive informalities in bids, to reject any or all bids with or without cause and to accept the bid that in its judgement is in the best interest of Santa Rosa County, Florida.

Santa Rosa County Board of County Commissioners encourages all segments of the business community to participate in its procurement opportunities, including small businesses, minority/women owned businesses, and disadvantaged business enterprises. The Board does not discriminate on the basis of race, color, religion, national origin, disability, sex, or age in the administration of contracts.

By order of the Board of County Commissioners of Santa Rosa County, Florida

LEGAL NOTICE
One issue – July 2, 2016 - Press Gazette; June 30, 2016 - Navarre Press; June 30, 2016 – Gulf Breeze News; and July 1, 2016 – South Santa Rosa News

Bill and proof to Santa Rosa County Procurement Department, 6495 Caroline Street, Suite J, Milton, Florida, 32570, Attn.: Dave King.

CONTRACT DOCUMENTS
For the construction of the

NAVARRE BEACH WELLHOUSE NO. 2 ELECTRICAL UPGRADES

PREPARED FOR

SANTA ROSA COUNTY
FLORIDA

VOLUME 1 OF 2
SPECIFICATIONS

For information regarding
this project, contact:

Joe Klaus, PE / CH2M HILL
25 W Cedar Street, Suite 560
Pensacola, FL 32502
Phone: 850-941-7276

Project No. 654039

JUNE 2016

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FLORIDA

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ELECTRICAL UPGRADES

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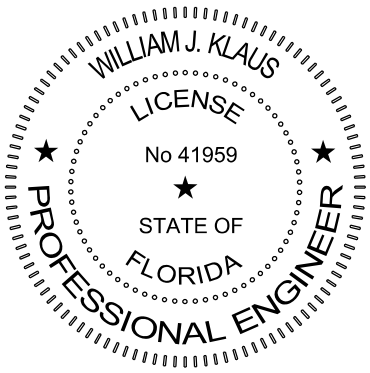
William J. Klaus, P.E. No. 41959



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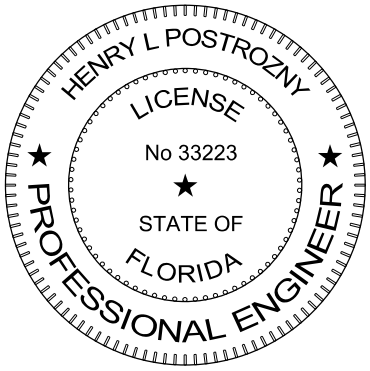

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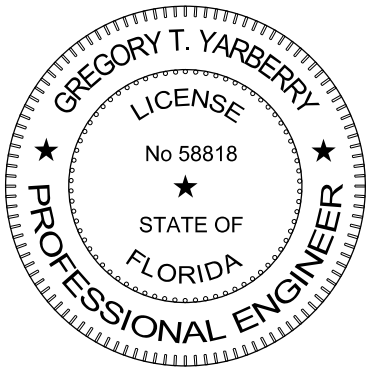

SANTA ROSA COUNTY
FLORIDA

BIDDING REQUIREMENTS
AND
CONTRACT DOCUMENTS

for the construction of the

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES

Contract No. _____

****

****

CH2M HILL

Pensacola, FL

June 2016

Project No. 654039 Copy No._____

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PART 1

PROCUREMENT REQUIREMENTS

INSTRUCTIONS TO BIDDERS

1. BID FORMS

1.1 A Bid form is included in these Specifications.

1.2 Bid documents shall be sealed and clearly labeled with the words "**Navarre Beach Wellhouse No. 2 Electrical Upgrades**", name of bidder and date and time of opening so as to guard against premature opening of any bid.

1.3 The Owner may consider as informal any bid on which there is an alteration of or departure from the Bid Form hereto attached.

1.4 The Bid shall be based upon the completion of the Work according to the drawings and specifications, together with all addenda thereto.

1.5 Evidence of all appropriate required licenses shall be attached to the Bid Documents.

2. INTERPRETATION

2.1 No oral interpretation will be made to any Bidder as to the meaning of the drawings or specifications. Every interpretation made to a Bidder will be in the form of an Addendum to the specifications. Addenda will be furnished to each Bidder, but it shall be the Bidder's responsibility to make inquiry as to Addenda issued. All such addenda shall become part of the contract and all Bidders shall be bound by such Addenda whether or not received by the Bidders.

3. FAMILIARITY WITH LAWS

3.1 It is the Bidder's responsibility to be familiar with all Federal, State, and local laws, ordinances, rules, and regulations that in any manner, affect the work. Ignorance thereof the part of the Bidder will in no way relieve him from responsibility.

4. EXAMINATION OF DOCUMENTS AND SITE

4.1 Before submitting his proposal, Bidder shall visit the site of the proposed work and familiarize himself with the nature and extent of the work and any local conditions that may in any manner affect the work to be done and the equipment, materials, and labor required.

4.2 He shall also examine the drawings, specifications, and other Contract Documents to inform himself thoroughly regarding any and all conditions and requirements that may in any manner affect the work to be performed under the contract. Copies of the "as-built" drawings for the original construction of the wellhouse are available upon request. The Owner cannot confirm the accuracy of the as-builts, and the wellhouse equipment and structure may been modified since the as-builts were prepared.

5. EVALUATION OF BIDS AND AWARD OF CONTRACT

5.1 The Owner reserves its right to reject any or all Bids, including without limitation nonconforming, nonresponsive, unbalanced or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds after reasonable inquiry and evaluation to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

5.2 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

5.3 In evaluating Bidders, Owner may consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted with the Bid Form.

5.4 Owner may conduct such investigations as Owner deems necessary to establish responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and individuals, or entities to perform the Work in accordance with the Contract Documents. To demonstrate Bidder's and major Subcontractor's qualifications to perform the Work, Bidder shall submit, at a minimum, the following written evidence within 5 days of Owner's request: financial data; previous project experience on similar projects within the past five years and with a construction cost greater than $150,000; references and contact information for the similar projects; and present project commitments. Additional data may be requested by the Owner.

5.5 If the Contract is to be awarded, Owner will award the Contract to the lowest responsible, responsive Bidder whose Bid is in the best interests of the Owner.

6. TIME OF COMPLETION

6.1 The entire project shall be completed within two hundred ten (210) calendar days from the Notice to Proceed date.

7. FORM OF AGREEMENT:

7.1 The Contract form shall be provided by the County Attorney.

8. BID GUARANTEE

8.1 Each bid shall be submitted in triplicate on the bid form provided and must be accompanied by a Certified Check or bid Bond in the amount of five percent (5%) of the Base Bid, and copies of all required licenses. Such Bid Bond or Check is given with the understanding and agreement that it guarantees: (1) that the bidder will not withdraw his bid for a period of 60 days after the bids have been opened; and, (2) that if his bid is accepted, the Bidder will enter into the written Contract with Santa Rosa County and furnish the required Performance Bond Payment Bond Insurance Certificates, within 10 days after receipt of Notice of Award of his bid. Pursuant to Florida Statutes, Section 255.05, should the contract exceed $100,000, the Contractor shall be required to execute and record performance and payment bonds. These bonds must state the name and principal business address of both the principal and the surety and a description of the project sufficient to identify it. In the event the bidder fails to comply with any of these conditions and requirements in whole or in part, the full amount of the bond or check shall be automatically forfeited to Santa Rosa County as damages on account of the default of the bidder.

END OF SECTION

(To be copied by the Bidder on his own letterhead and submitted in accordance with the Invitation to Bid.)

TO: *Santa Rosa County Procurement Department*
6495 Caroline Street, Suite J
Milton, Florida 32570

REFERENCE: ***Navarre Beach Wellhouse No. 2 Electrical Upgrades***
Project Number: 654039

LUMP SUM BID PRICE: *$_____*

Gentlemen:

I have received the Bidding Documents consisting of Drawings and Specifications (Project Manual) entitled ***Navarre Beach Wellhouse No. 2 Electrical Upgrades****, prepared by Santa Rosa County Engineering, 6051 Old Bagdad Highway, Suite 300, Milton, Florida 32570, (850) 981-7100.*

I have also received Addenda Numbers _____ and have included their provisions in my Bid. I have examined both the Bidding Documents and the site.

In submitting the Bid, I agree:

1. *To hold my bid in full force and effect for a period of sixty (60) calendar days after the time of the opening of this Bid.*

2. *To accept the provisions of the Instructions to Bidders regarding disposition of Bid Guarantee.*

3. *To enter into and execute a Contract within 10 (ten) calendar days after said Contract is delivered to me, if awarded on the basis of this Bid.*

4. *To accomplish the work in accordance with the Contract Documents.*

5. *To commence work under this Contract on or before a date to be specified in written "Notice of Proceed" by the County Attorney and to complete project within Two hundred ten (210) calendar days thereafter.*

6. *To pay as liquidated damages, the sum of $1500.00 for each consecutive calendar day after completion date, as called for in the Contract Agreement as modified.*

7. *Provide Santa Rosa County with performance Bonds and adhere to Supplementary Conditions*

I will construct this project for the lump sum price of:

LUMP SUM _____

($_____)

FIRM: _____

BY (print): _____

SIGNATURE: _____

TITLE: _____

DATE: _____

MAILING ADDRESS _____

_____

_____

PHONE (_____)_____ *FAX* (_____)_____

EMAIL _____

END OF SECTION

PART 2

CONTRACTING REQUIREMENTS

ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Engineer. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of Addenda relating to bidding requirements).

1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Engineer and Contractor, (2) between the Owner and a Subcontractor or Sub-Subcontractor, (3) between the Owner and Engineer or (4) between any persons or entities other than the Owner and Contractor. The Engineer shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Engineer's duties.

1.1.3 THE WORK

The term “Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate Contractors.

1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

1.1.7 THE PROJECT MANUAL

The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is

required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 CAPITALIZATION

1.3.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, **(2)** the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document.

1.4 INTERPRETATION

1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.5 EXECUTION OF CONTRACT DOCUMENTS

1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Engineer shall identify such unsigned Documents upon request.

1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

1.6.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Engineer and the Engineer's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-Subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Engineer or the Engineer's consultants, and unless otherwise indicated the Engineer and the Engineer's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Engineer, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Engineer and the Engineer's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-Subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Engineer and the Engineer's consultants. The Contractor, Subcontractors, Sub-Subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Engineer and the Engineer's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Engineer and the Engineer's

consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Engineer's or Engineer's consultants' copyrights or other reserved rights.

ARTICLE 2 OWNER

2.1 GENERAL

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Subparagraph **4.2.1,** the Engineer does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 The Owner shall, at the written request of the Contractor, prior to commencement of the Work and thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Furnishing of such evidence shall be a condition precedent to commencement or continuation of the Work. After such evidence has been furnished, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

2.2.2 Except for permits and fees, including those required under Subparagraph **3.7.1,** which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

2.2.4 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph **12.2** or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph **6.1.3.**

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Engineer's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Engineer. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

3.1 GENERAL

3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Engineer in the Engineer's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Subparagraph **2.2.3,** shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Engineer as a request for information in such form as the Engineer may require.

3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Engineer, but it is recognized that the Contractor's review is made in the Contractor's capacity as a Contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Engineer.

3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Engineer in response to the Contractor's notices or requests for information pursuant to Subparagraphs **3.2.1** and **3.2.2,** the Contractor shall make Claims as provided in Subparagraphs **4.3.6** and **4.3.7**. If the Contractor fails to perform the obligations of Subparagraphs **3.2.1** and **3.2.2,** the Contractor shall pay such costs and damages to the Owner as would have been avoided if

the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Engineer for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Engineer.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Engineer and shall not proceed with that portion of the Work without further written instructions from the Engineer. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage.

3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

3.4 LABOR AND MATERIALS

3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4.2 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Engineer and in accordance with a Change Order.

3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Engineer that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.6 TAX

3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Engineer and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Engineer and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

3.8 ALLOWANCES

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

3.8.2 Unless otherwise provided in the Contract Documents:

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances;
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Clause **3.8.2.1** and (2) changes in Contractor's costs under Clause **3.8.2.2.**

3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay in the Work.

3.9 SUPERINTENDENT

3.9.1 The Contractor shall employ competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for prior approval by Owner and Engineer Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

3.10.2 The Contractor shall prepare and keep current, for the Engineer's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Engineer reasonable time to review submittals.

3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Engineer.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Engineer and shall be delivered to the Engineer for submittal to the Owner upon completion of the Work.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Engineer is subject to the limitations of Subparagraph **4.2.7.** Informational submittals upon which the Engineer is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Engineer without action.

3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Engineer Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Engineer without action.

3.12.6 By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information

contained within such submittals with the requirements of the Work and of the Contract Documents.

3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals until the respective submittal has been approved by the Engineer.

3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Engineer's approval of Shop Drawings, Product Data, Samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and (1) the Engineer has given written approval to the specific deviation as a minor change in the Work, or **(**2**)** a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by the Engineer's approval thereof.

3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Engineer on previous submittals. In the absence of such written notice the Engineer's approval of a resubmission shall not apply to such revisions.

3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of Engineer or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Engineer will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Engineer. The Owner and the Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Engineer have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Subparagraph **3.12.10,** the Engineer will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

3.13 USE OF SITE

3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.14 CUTTING AND PATCHING

3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate Contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the

Owner or a separate Contractor except with written consent of the Owner and of such separate Contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.

3.15 CLEANING UP

3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16 ACCESS TO WORK

3.16.1 The Contractor shall provide the Owner and Engineer access to the Work in preparation and progress wherever located.

3.17 ROYALTIES, PATENTS AND COPYRIGHTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Engineer harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Engineer. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Engineer.

3.18 INDEMNIFICATION

3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Article **11,** the Contractor shall indemnify and hold harmless the Owner, Engineer, Engineer's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph **3.18.**

3.18.2 In claims against any person or entity indemnified under this Paragraph **3.18** by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Subparagraph **3.18.1** shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 ENGINEER

4.1.1 The Engineer is the person lawfully licensed to practice Engineering or an entity lawfully practicing Engineering identified as such in the Agreement and is referred to throughout the Contract Documents as

if singular in number. The term "Engineer" means the Engineer or the Engineer's authorized representative.

4.1.2 Duties, responsibilities and limitations of authority of the Engineer as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Engineer. Consent shall not be unreasonably withheld.

4.1.3 If the employment of the Engineer is terminated, the Owner shall employ a new Engineer against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Engineer.

4.2 ENGINEER'S ADMINISTRATION OF THE CONTRACT

4.2.1 The Engineer will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Paragraph **12.2.** The Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

4.2.2 The Engineer, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Engineer will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Subparagraph **3.3.1.**

4.2.3 The Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

4.2.4 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Engineer about matters arising out of or relating to the Contract. Communications by and with the Engineer's consultants shall be through the Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate Contractors shall be through the Owner.

4.2.5 Based on the Engineer's evaluations of the Contractor's Applications for Payment, the Engineer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

4.2.6 The Engineer will have authority to reject Work that does not conform to the Contract Documents. Whenever the Engineer considers it necessary or advisable, the Engineer will have authority to require inspection or testing of the Work in accordance with Subparagraphs **13.5.2** and **13.5.3,** whether or not such Work is fabricated, installed or completed. However, neither this authority of the Engineer nor a

decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Engineer to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

4.2.7 The Engineer will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Engineer's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate Contractors, while allowing sufficient time in the Engineer's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Engineer's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs **3.3, 3.5** and **3.12**. The Engineer's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Engineer, of any construction means, methods, techniques, sequences or procedures. The Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8 The Engineer will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph **7.4.**

4.2.9 The Engineer will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.2.10 If the Owner and Engineer agree, the Engineer will provide one or more project representatives to assist in carrying out the Engineer's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

4.2.11 The Engineer will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Engineer's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Engineer shall be furnished in compliance with this Paragraph **4.2,** then delay shall not be recognized on account of failure by the Engineer to furnish such interpretations until **15** days after written request is made for them.

4.2.12 Interpretations and decisions of the Engineer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Engineer will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

4.2.13 The Engineer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

4.3 CLAIMS AND DISPUTES

4.3.1 Definition. A Claim is a demand or assertion by one of the parties **s**eeking**,** as a matter of right,

adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate claims shall rest with the party making the Claim.

4.3.2 Time Limits on Claims. Claims by either party must be initiated within **21** days after occurrence of the event giving rise to such Claim or within **21** days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Engineer and the other party.

4.3.3 Continuing Contract Performance. Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Subparagraph **9.7.1** and Article **14,** the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before Conditions are disturbed and in no event later than **21** days after first observance of the conditions. The Engineer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Engineer shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within **21** days after the Engineer has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Engineer for initial determination, subject to further proceedings pursuant to Paragraph **4.4**.

4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph **10.6**.

4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Engineer, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Engineer, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner’s suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Paragraph **4.3**.

4.3.7 CLAIMS FOR ADDITIONAL TIME

4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

4.3.7.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding **21** days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

4.3.10 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article **14**. Nothing contained in this Subparagraph **4.3.10** shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 The Engineer will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the claimant; (2) submit a schedule to the parties indicating when the Engineer expects to take action; (3) reject the: Claim in whole or in part stating reasons for rejection; (4) recommend approval of the Claim by the other party; or (5) suggest a compromise. The Engineer may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

4.4.2 If a Claim has been resolved, the Engineer will prepare or obtain appropriate documentation.

4.4.3 If a Claim has not been resolved, the party making the Claim shall, within ten days after the Engineer's preliminary response take one or more of the following actions: (1) submit additional supporting data requested by the Engineer; (2) modify the initial Claim; or (3) notify the Engineer that the initial Claim stands.

4.4.4 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Engineer, the Engineer will notify the parties in writing that the Engineer's decision will be made within seven days, which decision shall be final and binding on the parties. Upon expiration of such time period, the: Engineer will render to the parties the Engineer's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor's default, the Engineer may, but is not obligated to, notify the surety and request the surety's assistance in resolving the: controversy.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor" does not include a separate Contractor or Subcontractors of a separate Contractor.

5.1.2 A Sub-Subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-Subcontractor or an authorized representative of the Sub-Subcontractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Engineer the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Engineer will promptly reply to the Contractor in writing stating whether or not the Owner or the Engineer, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Engineer to reply promptly shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Engineer has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3 If the Owner or Engineer has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Engineer has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Engineer makes reasonable objection to such substitute.

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Engineer. Each subcontract agreement shall preserve and protect the rights of the Owner and Engineer under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-Subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of

applicable portions of such documents available to their respective proposed Sub-Subcontractors.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph **14.2** and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2 Upon such assignment, if the Work has been suspended for more than **30** days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph **4.3**.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate Contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate Contractors and the Owner until subsequently revised.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article **3**, this Article **6** and Articles **10**, **11** and **12.**

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Engineer apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the

Contractor so to report shall constitute an acknowledgment that the Owner's or separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate Contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work, or defective construction of a separate Contractor.

6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate Contractors as provided in Subparagraph **10.2.5.**

6.2.5 The Owner and each separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Subparagraph **3.14.**

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises among the Contractor, separate Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Engineer will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

7.1 GENERAL

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Engineer; a Construction Change Directive requires agreement by the Owner and Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Engineer alone.

7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument prepared by the Engineer and signed by the Owner, Contractor and Engineer, stating their agreement upon all of the following:

- **.1** change in the Work;
- **.2** the amount of the adjustment, if any, in the Contract Sum; and
- .**3** the extent of the adjustment, if any, in the Contract Time.

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Subparagraph **7.3.3**.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.1 A Construction Change Directive is a written order prepared by the Engineer and signed by the Owner and Engineer, directing a change in the Work prior to agreement on adjustment, if any, in the

Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

7.3.3 If the Construction Change directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .**4** as provided in Subparagraph **7.3.6**.

7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Engineer of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Engineer on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under Clause **7.3.3.3**, the Contractor shall keep and present, in such form as the Engineer may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph **7.3.6** shall be limited to the following:

- **.1** costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- **.2** costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- **.4** costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- **.5** additional costs of supervision and field office personnel directly attributable to the change.

7.3.7. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Engineer. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment

accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Engineer will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article **4**.

7.3.9 When the Owner and Contractor agree with the determination made by the Engineer concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4 MINOR CHANGES IN THE WORK

7.4.1 The Engineer will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

8.1 DEFINITIONS

8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

8.1.3 The date of Substantial Completion is the date certified by the Engineer in accordance with Paragraph **9.8**.

8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the work.

8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article **11** to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

8.2.3 The Contractor shall proceed with the project expeditiously and continuously with adequate forces and shall achieve Substantial Completion within the Contract Time. Contractor shall progress with and maintain continuous construction even if construction is ahead of the approved construction schedule. If the percentage dollar value of the completed work is 15% or more below the dollar value of work that should have been completed in accordance with the approved construction schedule, further payment under this contract to Contractor shall be suspended until the percentage dollar value of completed work

is within 5% of the dollar value of work that should have been completed in accordance with the approved construction schedule.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Engineer, or of an employee of either, or of a separate Contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries; unavoidable casualties or other causes beyond the Contractor's control, then the Contract Time shall be extended by Change Order for such reasonable time as the Engineer may determine.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Paragraph **4.3**.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES

9.2.1 Before the first Application for Payment, the Contractor shall submit to the Engineer a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Engineer may require. This schedule, unless objected to by the Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Engineer an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Engineer may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

9.3.1.1 As provided in Subparagraph **7.3.8**, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determination of the Engineer, but not yet included in Change Orders.

9.3.1.2 Such applications may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an

Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.4 CERTIFICATES FOR PAYMENT

9.4.1 The Engineer will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Engineer determines is properly due, or notify the Contractor and Owner in writing of the Engineer's reasons for withholding certification in whole or in part as provided in Subparagraph **9.5.1.**

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Engineer to the Owner, based on the Engineer's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Engineer's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Engineer. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Engineer has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Engineer may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Engineer's opinion the representations to the Owner required by Subparagraph **9.4.2** cannot be made. If the Engineer is unable to certify payment in the amount of the Application, the Engineer will notify the Contractor and Owner as provided in Subparagraph **9.4.1.** If the Contractor and Engineer cannot agree on a revised amount, the Engineer will promptly issue a Certificate for Payment for the amount for which the Engineer is able to make such representations to the Owner. The Engineer may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Engineer's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Subparagraph **3.3.2,** because of:

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or another Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2 When the above reasons for withholding certification are removed, certification will be made for. amounts previously withheld.

9.6 PROGRE5S PAYMENTS

9.6.1 After the Engineer has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Engineer.

9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-Subcontractors in a similar manner.

9.6.3 The Engineer will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Engineer and Owner on account of portions of the Work done by such Subcontractor.

9.6.4 Neither the Owner nor Engineer shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs **9.6.2, 9.6.3** and **9.6.4**.

9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

9.7 FAILURE OF PAYMENT

9.7.1 If the Engineer does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Engineer or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner and Engineer, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Engineer a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.3 Upon receipt of the Contractor's list, the Engineer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Engineer's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Engineer. In such case, the Contractor shall then submit a request for another inspection by the Engineer to determine Substantial Completion.

9.8.4 When the Work or designated portion thereof is substantially complete, the Engineer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate, Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Article **11** and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Engineer as provided under Subparagraph **9.8.2.** Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Engineer.

9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Engineer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon

receipt of a final Application for Payment, the Engineer will promptly make such inspection and, when the Engineer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Engineer will promptly issue a final Certificate for Payment stating that to the best of the Engineer's knowledge, information and belief, and on the basis of the Engineer's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Engineer's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph **9.10.2** as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Engineer (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Engineer so confirms, the Owner shall, upon application by the Contractor and certification by the Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Engineer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- **.1** liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety

precautions and programs in connection with the performance of the Contract.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-Subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses **10.2.1.2** and **10.2.1.3** caused in whole or in part by the Contractor, a Subcontractor, a Sub-Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses **10.2.1.2** and **10 2 1 3**, except damage or loss attributable to acts or omissions of the Owner or Engineer or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph **3.18**.

10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Engineer.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.3 EMERGENCIES

10.3.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph **4.3** and Article **7**.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

- **.1** claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- **.2** claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** claims for damages insured by usual personal injury liability coverage;
- **.5** claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** claims for bodily injury or property damage arising out of completed operations; and
- **.8** claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph **3.18.**

11.1.2 The insurance required by Subparagraph **11.1.1** shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverage's, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Paragraph **11.1** shall contain a provision that coverage's afforded under the policies will not be canceled or allowed to expire until at least **30** days prior written notice has been given to the Owner. If any of the foregoing insurance coverage's are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph **9.10.2.** Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.2 INDEMNIFICATION AND INSURANCE

11.2.1. Contractor agrees to save harmless, indemnify, and defend Owner and its, agents, officers and employees from any and all claims, losses, penalties, interest, demands, judgments, and costs of suit, including attorneys fees and paralegals' fees, for any expense, damage or liability incurred by any of them, whether for personal injury, death, property damage, direct or consequential damages, or economic loss, including environmental impairment, arising directly or indirectly on account of or in connection with the work done by Contractor under this agreement or by any person, firm or corporation (including but not limited to the Engineer/engineer) to whom any portion of the work is subcontracted by Contractor or resulting from the use by Contractor, or by any one for whom Contractor is legally liable, of any materials, tools, machinery or other property of Owner. Owner and Contractor agree the first $100.00 of the contract amount paid by Owner to Contractor shall be given as separate consideration for this indemnification, and any other indemnification of Owner by Contractor provided for within the Contract Documents, the sufficiency of such separate consideration being acknowledged by Contractor by

Contractor's acceptance and execution of the agreement. The Contractor's obligation shall not be limited by, or in any way to, any insurance coverage or by any provision in or exclusion or omission from any policy of insurance. The Contractor agrees to pay on behalf of Santa Rosa County, as well as provide a legal defense for the Owner, both of which will be done only if and when requested by the Owner, for all claims made. Such payment on the behalf of the Owner shall be in addition to any and all other legal remedies available to the Owner and shall not be considered to be the Owner's exclusive remedy.

11.2.2. Contractor shall obtain and carry, at all times during its performance under the Contract Documents, insurance of the types and in the amounts set forth in Article **11**. All insurance policies shall be from responsible companies duly authorized to do business in the State of Florida and/or responsible risk retention group insurance companies or trusts which are registered with the State of Florida. Foreign or offshore insurance carriers are not acceptable for work under this contract unless admitted to the State of Florida. All commercial insurance carriers providing the Contractor with required insurance shall be "A" (excellent) rated with a minimum financial size category of "IX", according to the A. M. Best Key Rating Guide, latest edition. Within ten (10) calendar days after notice of award is received by Contractor and prior to the commencement of work, Contractor shall provide Owner with properly executed certificates of insurance to evidence Contractor's compliance with the insurance requirements of the Contract Documents. Said certificates of insurance shall be on forms approved by Owner, such as "Acord Form *25".* The certificates of insurance shall be personally, manually signed by the authorized representatives of the insurance company/companies shown on the certificates of insurance, with proof that they are authorized representatives thereof. Certificates of insurance shall be mailed to Santa Rosa County Board of County Commissioners in care of: Hunter Walker, County Administrator, *6495 C*aroline Street, Suite D, Milton, Florida 32570. In addition, true and exact copies of all insurance policies required hereunder shall be provided to Owner, on a timely basis, when requested by Owner.

11.2.3. The certificates of insurance and required insurance policies shall contain provisions that thirty (30) days prior written notice by registered or certified mail shall be given Owner of any cancellation, intent not to renew, or reduction in the policies or coverage's, except in the application of the aggregate limits provisions. In the event of a reduction in the aggregate limit of any policy, Contractor shall immediately take steps to have the aggregate limit reinstated to the full extent permitted under such policy.

11.2.4. All insurance coverage's of the Contractor shall be primary to any insurance or self insurance program carried by the Owner applicable to this project. The acceptance by Owner of any certificate of insurance does not constitute approval or agreement by the Owner that the insurance requirements have been satisfied or that the insurance policy shown on the certificate of insurance is in compliance with the requirements of the Contract Documents. No work shall commence at the project site unless and until the required certificates of insurance are received by the Owner

11.2.5. Contractor shall require each of its Subcontractors to procure and maintain, until the completion of the Subcontractor's work, insurance of the types and to the limits specified in Article **11**, unless such insurance requirements for the Subcontractor is expressly waived in writing by the Owner. All liability insurance policies, other than professional liability, worker's compensation and employer's liability policies, obtained by Contractor to meet the requirements of the Contract Documents shall name the Santa Rosa County Board of County Commissioners as an additional insured and shall contain severability of interest provisions. The Board of County Commissioners shall also be designated as certificate holder with the address of 6495 *C*aroline Street, Suite M, Milton, Florida 32570. If any insurance provided pursuant to the Contract Documents expires prior to the completion of the work, renewal certificates of insurance and, if requested by Owner, certified, true copies of the renewal policies, shall be furnished by Contractor within thirty (30) days prior to the date of expiration. Upon expiration of an insurance policy term during the course of work under the contract, succeeding insurance policies shall be consecutive to the expiring policy.

11.2.6 All liability policies shall be underwritten on the "occurrence" basis, unless otherwise approved in writing by the county division of risk management. “Claims made" policies, if approved by the risk manager, and subsequent insurance certificates shall provide a "retro-date" which shall include the effective date of the contract. "Claims-made" renewals or carrier and policy replacements shall reflect the original "retro-date."

11.2.7 Should at any time the Contractor not maintain the insurance coverage’s required herein, the Owner may terminate the agreement or at its sole discretion shall be authorized to purchase such coverage’s and charge the Contractor for such coverage’s purchased. The Owner shall be under no obligation to purchase such insurance, nor shall it be responsible for the coverage’s purchased or the insurance company or companies used. The decision of the Owner to purchase such insurance coverage’s shall in no way be construed to be a waiver of any of its rights under the Contract Documents.

11.2.8 Contractor shall submit to Owner a copy of all accident reports arising out of any personal injuries or property damages arising or alleged to have arisen on account of any work by Contractor or Subcontractor under the Contract Documents.

11.2.9 Duty to Provide Legal Defense. The Contractor agrees to pay, to Santa Rosa County, as well as provide a legal defense for the Owner, which shall include attorneys' fees and costs, both of which will be done only if and when requested by the Owner, for all claims as described in paragraph **13.1**. Such payment on the behalf of the Owner shall be in addition to any and all other legal remedies available to the Owner and shall not be considered to be the Owner's exclusive remedy.

11.3 PERFORMANCE BOND AND PAYMENT BOND

11.3.1 BONDS.
11.3.1 Contractor shall provide performance and payment bonds, per AIA format, in the amount of 100% of the contract amount, the costs of which to be paid by Contractor. The performance and payment bonds shall be underwritten by a surety authorized to do business in the State of Florida and otherwise acceptable to Owner; provided; however, the surety shall be rated as "A" or better and Class XII or higher rating as to financial size category and the amount required shall not exceed 2% of the reported policy holders surplus, all as reported in the most current best key rating guide, published by A.M. Best Company, Inc. of 75 Fulton Street, New York, New York 10038.

11.3.2 If the surety for any bond furnished by Contractor is declared bankrupt, becomes insolvent, its right to do business is terminated in the State of Florida, or it ceases to meet the requirements imposed by the Contract Document, the Contractor shall, within five (5) calendar days thereafter, substitute another bond and surety, both of which shall be subject to the Owner's approval.

11.3.3 As per Florida Statutes, Section 255.05, the Contractor shall be required to execute and record the performance and payment bonds. The bonds must state the name and principal business address of both the principal and the surety and a description of the project sufficient to identify it.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK
12.1.1 If a portion of the Work is covered contrary to the Engineer's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Engineer, be uncovered for the Engineer's examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2 If a portion of the Work has been covered which the Engineer has not specifically requested to examine prior to its being covered, the Engineer may request to see such Work and it shall be unc9vered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate Contractor in which event the Owner shall be responsible for payment of such costs.

12.2 CORRECTION OF WORK

12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1 The Contractor shall promptly correct Work rejected by the Engineer or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Engineer's services and expenses made necessary thereby, shall be at the Contractor's expense.

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 In addition to the Contractor's obligations under Paragraph **3.5,** if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Subparagraph **9.9.1,** or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Engineer, the Owner may correct it in accordance with Paragraph **2.4.** -

12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Paragraph **12.2.**

12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate Contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5 Nothing contained in this Paragraph **12.2** shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Subparagraph **12.2.2** relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time

within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3 ACCEPTANCE OF NONCONFORMING WORK

12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

13.1.1 The Contract shall be governed by the law of the place where the Project is located.

13.2 SUCCESSORS AND ASSIGNS

13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Subparagraph **13.2.2**, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.2.2 The Owner may, without consent of the Contractor, assign the Contract to an institutional lender providing construction financing for the Project. In such event, the lender shall assume the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

13.3 WRITTEN NOTICE

13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

13.4 RIGHTS AND REMEDIES

13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

13.4.2 No action or failure to act by the Owner, Engineer or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.5 TESTS AND INSPECTIONS

13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Engineer timely notice of when and where tests and inspections are to be made so that the Engineer may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations

concluded.

13.5.2 If the Engineer, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph **13.5.1**, the Engineer will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Engineer of when and where tests and inspections are to be made so that the Engineer may be present for such procedures. Such costs, except as provided in Subparagraph **13.5.3**, shall be at the Owner's expense.

13.5.3 If such procedures for testing, inspection or approval under Subparagraphs **13.5.1** and **13.5.2** reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Engineer's services and expenses shall be at the Contractor's expense.

13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Engineer.

13.5.5 If the Engineer is to observe tests, inspections or approvals required by the Contract Documents, the Engineer will do so promptly and, where practicable, at the normal place of testing.

13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6 INTEREST

13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

- **.1** Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- **.2** Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- .**3** After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Paragraph **3.5**, the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph **12.2,** or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of **30** consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-Subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons.

- **.1** issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped;
- **.2** an act of government, such as a declaration of national emergency which requires all Work to be stopped;
- **.3** because the Engineer has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Subparagraph **9.4.1,** or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** the Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Subparagraph **2.2.1.**

14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-Subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Paragraph **14.3** constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or **120** days in any 365-day period, whichever is less.

14.1.3 If one of the reasons described in Subparagraph **14.1.1** or **14.1.2** exists, the Contractor may, upon seven days' written notice to the Owner and Engineer, terminate the Contract and recover from the Owner only as provided in Subparagraph **14.3.1**.

14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Engineer, terminate the Contract and recover from the Owner only as provided in Subparagraph **14.3.1.**

14.2 TERMINATION FOR DEFAULT.

14.2.1 Contractor shall be considered in material default of the agreement and such default shall be considered cause for Owner to terminate the agreement, in whole or in part, as further set forth in this section, if Contractor: (1) fails to begin the work under the Contract Documents within the time specified herein; or (2) fails to properly and timely perform the work as directed by the Owner or as provided for in the approved progress schedule; or (3) performs the work unsuitably or neglects or refuses to remove materials or to correct or replace such work as may be rejected as unacceptable or unsuitable; or (4) discontinues the prosecution of the work; or (5) fails to resume work which has been suspended within a reasonable time after being notified to do so; or (6) becomes insolvent or is declared bankrupt, or commits any act of bankruptcy; or (7) allows any final judgment to stand against it unsatisfied for more than ten (10) days; or (8) makes an assignment for the benefit of creditors; or (9) fails to obey any applicable codes, laws, ordinances, rules or regulations with respect to the work; or (10) materially breaches any other provision of the Contract Documents.

14.2.2 Owner shall notify Contractor in writing of Contractor's default(s). If Owner determines that Contractor has not remedied and cured the default(s) within seven (7) calendar days following receipt by Contractor of said written notice, then Owner, at its option, without releasing or waiving its rights and remedies against the Contractor's sureties and without prejudice to any other right or remedy it may be

entitled to hereunder or by law, may terminate Contractor's right to proceed under the agreement, in whole or in part, and take possession of all or any portion of the work and any materials, tools, equipment, and appliances of Contractor, take assignments of any of Contractor's subcontracts and purchase orders, and complete all or any portion of Contractor's work by whatever means, method or agency which Owner, in its sole discretion, may choose.

14.2.3 If Owner deems any of the foregoing remedies necessary, Contractor agrees that is shall not be entitled to receive any further payments hereunder until after the project is completed. All monies expended and all of the costs, losses, damages and extra expenses, including all management, administrative and other overhead and other direct and indirect expenses (including attorneys' fees) or damages incurred by Owner incident to such completion, shall be deducted from the contract amount, and if such expenditures exceed the unpaid balance of the contract amount, Contractor agrees to pay promptly to Owner on demand the full amount of such excess, including costs of collection, attorney's fees (including appeals) and interest thereon at the maximum legal rate of interest until paid. If the unpaid balance of the contract amount exceeds all such costs, expenditures and damages incurred by the Owner to complete the work, such excess shall be paid to the Contractor. The amount to be paid to the Contractor or Owner, as the case may be, and this obligation for payment shall survive termination of the agreement.

14.2.4. The liability of Contractor hereunder shall extend to and include the full amount of any and all sums paid, expenses and losses incurred, damages sustained, and obligations assumed by Owner in good faith under the belief that such payments or assumptions were necessary or required, in completing the work and providing labor, materials, equipment, supplies, and other items therefor or re-letting the work, in settlement, discharge or compromise of any claims, demands, suits, and judgments pertaining to or arising out of the work hereunder.

14.2.5 If, after notice of termination of Contractor's right to proceed pursuant to this section, it is determined for any reason that Contractor was not in default, or that its default was excusable, or that Owner is not entitled to the remedies against Contractor provided herein, then Contractor's remedies against Owner shall be the same as and limited to those afforded Contractor below under subsection **14.3.1**, termination for convenience.

14.3 TERMINATION FOR CONVENIENCE AND RIGHT OF SUSPENSION.

14.3.1. Owner shall have the right to terminate this agreement without cause upon seven (7) calendar day's written notice to Contractor. In the event of such termination for convenience, Contractor's recovery against Owner shall be limited to that portion of the contract amount earned through the date of termination, together with any retainage withheld and reasonable termination expenses incurred, but Contractor shall not be entitled to any other or further recovery against Owner, including, but not limited to, damages or any anticipated profit on portions of the work not performed.

14.3.2. Owner shall have the right to suspend all or any portions of the work upon giving Contractor two (2) calendar days' prior written notice of such suspension. If all or any portion of the work is so suspended, Contractor's sole and exclusive remedy shall be to seek an extension of time to its schedule in accordance with the procedures set forth in the Contract Documents. In no event shall the Contractor be entitled to any additional compensation or damages. Provided, however, if the ordered suspension exceeds three (3) months, the Contractor shall have the right to terminate the agreement with respect to that portion of the work which is subject to the ordered suspension.

SECTION 00 73 00 SUPPLEMENTARY CONDITIONS

1.0 GENERAL CONDITIONS:

The following conditions supplement, modify, change, delete from or add to the General Conditions of the Contract, Articles 1 through 14. Where an Article of the General Conditions is modified or a Paragraph, Subparagraph, or Clause thereof is modified or deleted by these supplement, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

2.0 FORM OF CONTRACT AND BONDS:

The contract form as furnished by Santa Rosa County shall be utilized. Performance and Payment Bond forms as approved by Santa Rosa County shall be utilized.

3.0 MATERIALS:

Whenever "or approved equal" is indicated, items proposed for use shall be submitted for Engineer's approval. Wherever an item or class of material is specified exclusively by trade name or by name of the maker or by catalog reference, only such items shall be used unless previously approved through addenda by the Engineer. Should the Contractor desire to substitute another material for one or more specified by name they shall state the credit or extra involved by the use of such material, in there bid. No such materials shall be used unless approved in writing by the Engineer.

4.0 PROGRESS CHART:

Within ten (10) days after receipt of signed Contract the Contractor shall file with the Engineer a progress chart showing the order in which the Contractor proposes to accomplish the work, the dates on which he proposes to begin the various parts of the work and the dates he contemplates completing them.

5.0 TIME FOR COMPLETION:

Time for completion of all work included in this contract shall not exceed 210 days from date of written Notice to proceed. The number of days allowed does not include an allowance for calendar days missed due to weather. Extension of time will be allowed for delays due to weather if properly documented and reported to the Engineer.

6.0 PRECONSTRUCTION CONFERENCE:

Within ten (10) days after the effective date of the agreement, but before Contractor starts the work at the Project site, a conference will be held for review and acceptance of the schedules referred to in paragraph 4.0, to establish procedures for processing applications for payment, and to establish a working understanding among the parties as to the work.

7.0 RECORD KEEPING:

The Contractor shall maintain all relevant project records for three years after the Owner has made final payment to the Contractor.

END OF SECTION 00 73 00

INSURANCE

INSURANCE REQUIREMENTS

(1) THE CONTRACTOR SHALL OBTAIN AND MAINTAIN SUCH INSURANCE AS WILL PROTECT IT FROM: (1) CLAIMS UNDER WORKER'S COMPENSATION LAWS, DISABILITY BENEFIT LAWS, OR OTHER SIMILAR EMPLOYEE BENEFIT LAWS; (2) CLAIMS FOR DAMAGES BECAUSE OF BODILY INJURY, OCCUPATIONAL SICKNESS OR DISEASE OR DEATH OF HIS EMPLOYEES INCLUDING CLAIMS INSURED BY USUAL PERSONAL INJURY LIABILITY COVERAGE; (3) CLAIMS FOR DAMAGES BECAUSE OF BODILY INJURY, SICKNESS OR DISEASE, OR DEATH OF ANY PERSON OTHER THAN HIS EMPLOYEES INCLUDING CLAIMS INSURED BY USUAL PERSONAL INJURY LIABILITY COVERAGE; AND (4) FROM CLAIMS FOR INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY INCLUDING LOSS OR USE RESULTING THEREFROM - - ANY OR ALL OF WHICH CLAIMS MAY ARISE OUT OF, OR RESULT FROM, THE SERVICES, WORK AND OPERATIONS CARRIED OUT PURSUANT TO AND UNDER THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WHETHER SUCH SERVICES, WORK AND OPERATIONS BE BY THE CONTRACTOR, ITS EMPLOYEES, OR BY SUBCONTRACTOR(S), OR ANYONE EMPLOYED BY OR UNDER THE SUPERVISION OF ANY OF THEM, OR FOR WHOSE ACTS ANY OF THEM MAY BE LEGALLY LIABLE.

(2) THIS INSURANCE SHALL BE OBTAINED AND WRITTEN FOR NOT LESS THAN THE LIMITS OF LIABILITY SPECIFIED HEREINAFTER, OR AS REQUIRED BY LAW, WHICHEVER IS GREATER.

(3) THE CONTRACTOR SHALL REQUIRE, AND SHALL BE RESPONSIBLE FOR ASSURING THROUGHOUT THE TIME THE AGREEMENT IS IN EFFECT, THAT ANY AND ALL OF ITS SUBCONTRACTORS OBTAIN AND MAINTAIN UNTIL THE COMPLETION OF THAT SUBCONTRACTOR'S WORK, SUCH OF THE INSURANCE COVERAGES DESCRIBED HEREIN AS ARE REQUIRED BY LAW TO BE PROVIDED ON BEHALF OF THEIR EMPLOYEES AND OTHERS.

(4) THE CONTRACTOR SHALL REQUIRE THE INSURANCE AGENT/BROKER TO PROVIDE REPLACEMENT CERTIFICATES OF INSURANCE ON A TIMELY BASIS, PREFERABLY NO LATER THAN FIVE (5) DAYS PRIOR TO POLICY TERMINATION.

(5) THE CONTRACTOR SHALL OBTAIN AND MAINTAIN THE FOLLOWING INSURANCE COVERAGES AS PROVIDED HEREIN BEFORE, AND IN THE TYPE**,** AMOUNTS AND IN CONFORMANCE WITH THE FOLLOWING MINIMUM REQUIREMENTS:

A. FLORIDA STATUTORY WORKERS' COMPENSATION AND EMPLOYERS LIABILITY WITH MINIMUM LIMITS OF $500,000, WHETHER REQUIRED BY CHAPTER 440, FLORIDA STATUTES OR NOT. IN ADDITION, COVERAGE UNDER THE U. S. LONGSHOREMEN & HARBOR WORKERS' AND JONES ACT, MAY BE REQUIRED COVERAGES BY LAW OR REGULATION FOR THE WORK SPECIFIED IN THIS CONTRACT. CONTRACTOR AND SUBCONTRACTORS MAY PROVIDE A VALID CERTIFICATE OF EXEMPTION ISSUED BY THE STATE OF FLORIDA IN LIEU OF WORKERS' COMPENSATION INSURANCE COVERAGE.

B. COMMERCIAL GENERAL LIABILITY WITH MINIMUM COMBINED SINGLE LIMITS OF $1,000,000, INCLUDING COVERAGE PARTS OF BODILY INJURY, BROAD FORM PROPERTY DAMAGE, PERSONAL INJURY, INDEPENDENT CONTRACTORS, BLANKET CONTRACTUAL LIABILITY AND PRODUCTS AND COMPLETED OPERATIONS. THE EXCLUSION FOR UNDERGROUND DAMAGE, EXPLOSION AND COLLAPSE SHALL BE REMOVED THROUGH A POLICY ENDORSEMENT. THE COMMERCIAL GENERAL LIABILITY POLICY'S TOTAL POLLUTION EXCLUSION SHALL BE REMOVED BY ENDORSEMENT. COMPLETED OPERATIONS AND PRODUCTS LIABILITY SHALL BE MAINTAINED FOR A PERIOD OF TWO (2) YEARS AFTER FINAL PAYMENT.

C. AUTOMOBILE LIABILITY WITH MINIMUM COMBINED SINGLE LIMITS OF $1,000,000 FOR ALL HIRED, OWNED AND NON-OWNED VEHICLES.

D. EXCESS OR UMBRELLA LIABILITY WITH MINIMUM LIMITS OF $2,000,000 WHICH ARE NO MORE RESTRICTIVE THAN THE UNDERLYING LIMITS. UMBRELLA COVERAGE SHALL DROP DOWN TO PROVIDE COVERAGE WHERE THE UNDERLYING LIMITS ARE EXHAUSTED.

E. PROFESSIONAL LIABILITY INSURANCE WITH MINIMUM LIMITS OF $500,000 FOR ENGINEERS AND ARCHITECTS EMPLOYED BY THE CONTRACTOR, IF ANY.

F. BUILDERS RISK INSURANCE UNDERWRITTEN ON THE "ALL RISKS OF PHYSICAL LOSS" BASIS FOR REPLACEMENT COST FOR THE FULL VALUE OF THE COMPLETED PROJECT TO COVER THE OWNER AND CONTRACTOR AS THEIR INTEREST MAY APPEAR. AN INSTALLATION FLOATER MAY BE AN ALTERNATIVE IF APPROPRIATE TO THIS SPECIFIC CONTRACT.

G. CONTRACTOR SHALL PROCURE AND FURNISH OWNER’S PROTECTION LIABILITY INSURANCE POLICY NAMING SANTA ROSA COUNTY WITH THE FOLLOWING LIMITS:

1. $1,000,000 PER OCCURRENCE.
2. $2,000,000 AGGREGATE.

Certification Regarding
Debarment, Suspension, Ineligibility
And Voluntary Exclusion

Lower Tier Covered Transactions

(1) The prospective lower tier participant certifies, by submission of this document, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to the above statement, the prospective participant shall attach an explanation to this form.

_____ _____
Name Local Government

_____ _____
Title CDBG Contract Number

_____
Firm

_____
Street Address

_____
City, State, Zip

_____
Date

SWORN STATEMENT UNDER SECTION 287.133 (3) (A),
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICER AUTHORIZED TO ADMINISTER OATHS:

1. This sworn statement is submitted to _____

   by _____
   (print individual's name and title)

   for _____
   (print name of entity submitting sworn statement)

   whose business address is _____
   _____ and (if applicable) its Federal Employer Identification Number (FEIN) is _____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement: _____.

2. I understand that a "public entity crime" as defined in Paragraph 287.133(1)(g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or with the United States, including, but not limited to, any bid or contract for goods of services to be provided to any public entity or an agency or political subdivision of any other state or the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation..

3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, a s a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contrendre.

4. I understand that an "affiliate" as defined in Paragraph 287.133(1)(a), Florida Statutes, means:
   1. A predecessor or successor of a person convicted of a public entity crime; or
   2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a Public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima faca case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of public entoty crime.

5. I understand that a "person" as defined in Paragraph 287.133(1)(e), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or appeals to bid on contracts for the provisions of goods and services et by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

6. Based on the information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (Indicate which statement applies.)
   _____Neither the entity submitting this sworn statement, nor one or more of the officers,, directors, executives, partners, shareholders, employees, members, or agents who are active in management of the entity, nor any affiliate of the entity have been charged with and convicted of a public entity crime subsequent to July 1, 1989.
   _____The entity submitting this sworn statement, or one or more of the officers, directors, executives, partners, shareholders, employees, members, or agents who are active in management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.
   _____The entity submitting this sworn statement, or one or more of the officers, directors, executives, partners, shareholders, employees, members, or agents who are active in management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officers determined that it was not in the public interest to Place the entity submitting this sworn statement on the convicted vendor list. (ATTACH A COPY OF THE FINAL ORDER.)

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING IN TO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, FLORIDA STATUTES FOR CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

_____
(Signature)

Sworn to and subscribed before me this _____ day of_____, 2_____.

Personally known_____ _____

or Produced identification_____ Notary Public – State of _____

_____ My commission expires_____
(Type of identification)

_____(*Printed typed, or stamped commissioned name of notary public.)*

Certification Regarding Debarment, Suspension, And Other Responsibility Matters Primary Covered Transactions

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

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

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

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

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

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

_____ _____
Name Project Name

_____ _____
Title Project Number

_____
Firm

_____
Street Address

_____
City, State, Zip

24 CFR 24.510 & 24 CFR, Part 24, Appendix A

PART 3

SPECIFICATIONS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The completed Work will provide Owner with an upgraded electrical system and back-up engine drive for a potable water well. Work includes, but is not limited to, a new diesel engine and fuel tank to replace the existing back-up engine drive, new portable generator, new unit heaters, and new electrical equipment to replace the existing equipment. The electrical equipment includes, but is not limited to, a manual transfer switch, 230-V pump control panel, and two lighting panels.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Contractor's standard form.
2. Application for Payment.
3. Final Application for Payment.

1.02 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.

C. Lump Sum Work: List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.

D. An unbalanced or front-end loaded schedule will not be acceptable.

E. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

1.03 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.

B. Use detailed Application for Payment Form suitable to Engineer.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.

F. Preparation:

1. Round values to nearest dollar.
2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

G. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.

1.04 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.

1.05 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance data is acceptable to Engineer.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Digital Images: Submit one copy of DVD disc containing images within 5 days of being taken. Each image is to have a minimum file size of 1.4 Mb (1,400 Kb) so viewed resolution is high quality. The production of larger file sizes with higher resolution is encouraged.

1.02 RELATED WORK AT SITE

A. General:

1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Contract Documents, listed henceforth, is anticipated to be performed at Site by others.
2. Coordinate the Work of these Contract Documents with work of others as specified in General Conditions.
3. Include sequencing constraints specified herein as a part of Progress Schedule.

B. Power:

1. Agency and Contact Person: Jeremy Gunn, Gulf Power, 850-505-5354.

1.03 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during the Work.

1.04 WORK SEQUENCING/CONSTRAINTS

A. Include work sequences in the Progress Schedule.

B. Unless otherwise approved by the Owner, Contractor shall limit working hours to a period of 7 a.m. to 5 p.m., Monday through Friday, and shall not work on nationally-recognized holidays.

1.05 FACILITY OPERATIONS

A. Continuous operation of some of the Owner's facilities and providing emergency backup is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.

C. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, and similar items to maintain continuous operations of Owner's facility.

D. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

E. Process or Facility Shutdown:

1. The following existing equipment are considered critical and shall remain operational during the upgrades. Provide back-up power as necessary.
    a. Fairpoint Water Main Valve.
    b. Orthophosphate Feed Pump.
    c. Caustic Feed Pump.
    d. Elevated Tank Valve.
    e. Building Lights.
    f. Other equipment deemed critical by the Owner or not included in the lists below.
2. The following equipment are considered semi-critical and shall not be taken out of service more than one time and shall not be out of service for more than 72 continuous hours during that event.
    a. Well Pump.
    b. Chlorine Booster Pump.
    c. Gas chlorination equipment.
    d. SCADA.
3. The following equipment are considered non-critical and shall not be taken out of service more than one time and shall not be out of service for more than 7 consecutive days during that event.
    a. Diesel engine.
    b. Fuel storage tank.

4. Provide 7 days advance written request for approval of need to shut down a process or facility to Owner and Engineer.
5. Power outages will be considered upon 48 hours written request to Owner and Engineer. Describe the reason, anticipated length of time, and areas affected by the outage. Provide temporary provisions for continuous power supply to critical facility components.

F. Install and maintain temporary connections required to keep Owner's equipment on line if the duration of the outage exceeds that stated above for each of the equipment. Sequences other than those specified will be considered upon written request to Owner and Engineer, provided they afford equivalent continuity of operations.

G. Do not proceed with Work affecting a facility's operation without obtaining Owner's and Engineer's advance approval of the need for and duration of such Work.

H. Relocation of Existing Facilities:

1. During construction, it is expected that minor relocations of Work will be necessary.
2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.06 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections in accordance with Article Construction Photographs and Article Audio-Video Recordings.
2. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.07 CONSTRUCTION PHOTOGRAPHS

A. General:

1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.
2. Engineer shall have right to select subject matter and vantage point from which photographs are to be taken.
3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits.

B. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a minimum of 48 photographs of Site and property adjacent to perimeter of Site.
2. Particular emphasis shall be directed to existing equipment to remain, interior and exterior of pump building, and elevated tank.
3. Format: Digital.

C. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Weekly: Take 24 photographs using digital images.

D. Documentation:

1. Digital Images:
   a. Electronic image shall have date taken embedded into image.
   b. Archive using a commercially available photo management system that provides listing of photographs including date, keyword description, and direction of photograph.
   c. Label each disk with Project and Owner's name, and week and year images were produced.

1.08 AUDIO-VIDEO RECORDINGS

A. Prior to beginning the Work on Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, videograph Site and property adjacent to Site.

B. In the case of preconstruction recording, no work shall begin in the area prior to Engineer's review and approval of content and quality of video for that area. Particular emphasis shall be directed to existing equipment to remain, interior and exterior of pump building, and elevated tank.

C. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.

D. Video Format and Quality:

1. DVD format, with sound.
2. Video:
   a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
   b. Electronically, and accurately display the month, day, year, and time of day of the recording.
3. Audio:
   a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
   b. Indicate date, project name, and a brief description of the location of recording, including:
      1) Facility name.
      2) Street names or easements.
      3) Addresses of private property.
      4) Direction of coverage, including engineering stationing, if applicable.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGE OF MATERIALS

A. Materials to be salvaged include: Propane Storage Tank.

B. Salvage materials for Owner's use where shown.

1. Remove material with extreme care so as not to damage for future use.
2. Promptly remove salvaged materials from Work area.
3. Store materials where instructed by Owner onsite.

C. Meet with Engineer and Owner prior to starting to dismantle equipment designated to be salvaged. Engineer will indicate locations where equipment is to be disconnected.

D. Provide new or repair damaged equipment or material specified or indicated to be salvaged. Clean and protect equipment from dust, dirt, natural elements, and store as directed.

3.02 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Obtain prior written authorization of Engineer before commencing Work to cut or otherwise alter:

1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
2. Weather-resistant or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Work of others.

C. Refinish surfaces to provide an even finish.

1. Refinish continuous surfaces to nearest intersection.
2. Refinish entire assemblies.
3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and the Work is evident in finished surfaces.

D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown on Drawings.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.

B. Informational Submittal: Information submitted by Contractor that requires Engineer's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals to Engineer at the following, unless specified otherwise.

1. Available at preconstruction conference.

B. Transmittal of Submittal:

1. Contractor shall:
   a. Review each submittal and check for compliance with Contract Documents.
   b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
      1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
      2) Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form attached at end of this section.
3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Engineer's project number.

d. Date of transmittal.
e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.

4. Identify and describe each deviation or variation from Contract Documents.

C. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual specification section. Do not combine different specification sections together in submittal package, unless otherwise directed in specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

D. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual specification sections.

E. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

F. Resubmittals: Clearly identify each correction or change made.

G. Incomplete Submittals:

1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
   a. Contractor's review stamp; completed and signed.
   b. Transmittal of Contractor's Submittal; completed and signed.
   c. Insufficient number of copies.

H. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped “Not Subject to Review.”
2. Engineer will keep one copy and return submittal to Contractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:

1. Copies: Five and one reproducible, except copyrighted documents
2. Identify and Indicate:
   a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
   b. Equipment and Component Title: Identical to title shown on Drawings.
   c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
   d. Project-specific information drawn accurately to scale.
3. Manufacturer’s standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
4. Product Data: Provide as specified in individual specifications.
5. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.

C. Action Submittal Dispositions: Engineer will review, comment, stamp, and distribute as noted:

1. Approved:
   a. Contractor may incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One copy furnished Resident Project Representative.
      2) One copy retained in Engineer’s file.
      3) Remaining copies returned to Contractor appropriately annotated.

2. Approved as Noted:
   a. Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
   b. Distribution:
      1) One copy furnished Resident Project Representative.
      2) One copy retained in Engineer's file.
      3) Remaining copies returned to Contractor appropriately annotated.
3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions, and resubmit.
   b. Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
   c. Distribution:
      1) One copy furnished Resident Project Representative.
      2) One copy retained in Engineer's file.
      3) Remaining copies returned to Contractor appropriately annotated.
4. Revise and Resubmit:
   a. Contractor may not incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One copy furnished Resident Project Representative.
      2) One copy retained in Engineer's file.
      3) Remaining copies returned to Contractor appropriately annotated.

1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Copies: Submit three copies, unless otherwise indicated in individual specification section.
2. Refer to individual specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward copy to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one copy and return remaining copy with review comments to Contractor, and require that submittal be corrected and resubmitted.

B. Certificates:

1. General:
    a. Provide notarized statement that includes signature of entity responsible for preparing certification.
    b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual specification sections.
3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual specification section.
4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
6. Manufacturer's Certificate of Compliance: In accordance with Section 01 43 33, Manufacturers' Field Services.
7. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 43 33, Manufacturers' Field Services.

C. Construction Photographs and Video in accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

E. Contractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual specification section.
9. Contractor-design data related to permanent construction:
    a. List of assumptions.
    b. List of performance and design criteria.
    c. Summary of loads or load diagram, if applicable.
    d. Calculations.
    e. List of applicable codes and regulations.

f. Name and version of design software.
g. Factory test results.
h. Informational submittals requested in individual specification section.

F. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual specification section.

G. Operation and Maintenance Data: As required in Section 01 78 23, Operation and Maintenance Data.

H. Payment:

1. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.
2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.

I. Schedules:

1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule.
   a. Show for each, at a minimum, the following:
      1) Specification section number.
      2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
      3) Estimated date of submission to Engineer, including reviewing and processing time.
   b. On a monthly basis, submit updated Schedule of Submittals to Engineer if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 00 72 00, General Conditions

J. Special Guarantee: Supplier's written guarantee as required in individual specification sections.

K. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

L. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

M. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
    a. Identification of product and specification section, type of inspection or test with referenced standard or code.
    b. Date of test, Project title and number, and name and signature of authorized person.
    c. Test results.
    d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
    e. Provide interpretation of test results, when requested by Engineer.
    f. Other items as identified in individual specification sections.
3. Field:
    a. As a minimum, include the following:
        1) Project title and number.
        2) Date and time.
        3) Record of temperature and weather conditions.
        4) Identification of product and specification section.
        5) Type and location of test, Sample, or inspection, including referenced standard or code.
        6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
        7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
        8) Provide interpretation of test results, when requested by Engineer.
        9) Other items as identified in individual specification sections.

N. Testing and Startup Data: In accordance with Section 01 91 14, Equipment Testing and Facility Startup.

O. Training Data: In accordance with Section 01 43 33, Manufacturers' Field Services.

1.05 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this specification.

1. Forms: Transmittal of Contractor’s Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

CH2MHILL

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____

_____

_____

_____

_____

FROM: _____

Contractor

_____

_____

_____

Submittal No.: _____

☐ New Submittal ☐ Resubmittal

Project: _____

Project No.: _____

Specification Section No.: _____

(Cover only one section with each transmittal)

Schedule Date of Submittal:

_____

SUBMITTAL TYPE:	☐ Shop Drawing	☐ Sample	☐ Informational
	☐ Deferred		

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____

Contractor (Authorized Signature)

SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual Specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of standards and specifications of technical societies:

1. Copies of applicable referenced standards have not been bound in these Contract Documents.
2. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor's personnel, Subcontractors, Owner, and Engineer.

1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association
6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	APA – The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
21.	ASA	Acoustical Society of America
22.	ASABE	American Society of Agricultural and Biological Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society
33.	AWWA	American Water Works Association

34.	BHMA	Builders Hardware Manufacturers' Association
35.	CBM	Certified Ballast Manufacturer
36.	CDA	Copper Development Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CMAA	Crane Manufacturers' Association of America
40.	CRSI	Concrete Reinforcing Steel Institute
41.	CS	Commercial Standard
42.	CSA	Canadian Standards Association
43.	CSI	Construction Specifications Institute
44.	DIN	Deutsches Institut für Normung e.V.
45.	DIPRA	Ductile Iron Pipe Research Association
46.	EIA	Electronic Industries Alliance
47.	EJCDC	Engineers Joint Contract Documents' Committee
48.	ETL	Electrical Test Laboratories
49.	FAA	Federal Aviation Administration
50.	FCC	Federal Communications Commission
51.	FDA	Food and Drug Administration
52.	FEMA	Federal Emergency Management Agency
53.	FIPS	Federal Information Processing Standards
54.	FM	FM Global
55.	Fed. Spec.	Federal Specifications (FAA Specifications)
56.	FS	Federal Specifications and Standards (Technical Specifications)
57.	GA	Gypsum Association
58.	GANA	Glass Association of North America
59.	HI	Hydraulic Institute
60.	HMI	Hoist Manufacturers' Institute
61.	IBC	International Building Code
62.	ICBO	International Conference of Building Officials
63.	ICC	International Code Council
64.	ICEA	Insulated Cable Engineers' Association
65.	IFC	International Fire Code
66.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
67.	IESNA	Illuminating Engineering Society of North America
68.	IFI	Industrial Fasteners Institute
69.	IGMA	Insulating Glass Manufacturer's Alliance
70.	IMC	International Mechanical Code
71.	INDA	Association of the Nonwoven Fabrics Industry
72.	IPC	International Plumbing Code
73.	ISA	International Society of Automation
74.	ISO	International Organization for Standardization

75.	ITL	Independent Testing Laboratory
76.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
77.	MIA	Marble Institute of America
78.	MIL	Military Specifications
79.	MMA	Monorail Manufacturers' Association
80.	MSS	Manufacturer's Standardization Society
81.	NAAMM	National Association of Architectural Metal Manufacturers
82.	NACE	NACE International
83.	NBGQA	National Building Granite Quarries Association
84.	NEBB	National Environmental Balancing Bureau
85.	NEC	National Electrical Code
86.	NECA	National Electrical Contractor's Association
87.	NEMA	National Electrical Manufacturers' Association
88.	NESC	National Electrical Safety Code
89.	NETA	InterNational Electrical Testing Association
90.	NFPA	National Fire Protection Association
91.	NHLA	National Hardwood Lumber Association
92.	NICET	National Institute for Certification in Engineering Technologies
93.	NIST	National Institute of Standards and Technology
94.	NRCA	National Roofing Contractors Association
95.	NRTL	Nationally Recognized Testing Laboratories
96.	NSF	NSF International
97.	NSPE	National Society of Professional Engineers
98.	NTMA	National Terrazzo and Mosaic Association
99.	NWWDA	National Wood Window and Door Association
100.	OSHA	Occupational Safety and Health Act (both Federal and State)
101.	PCI	Precast/Prestressed Concrete Institute
102.	PEI	Porcelain Enamel Institute
103.	PPI	Plastic Pipe Institute
104.	PS	Product Standards Section-U.S. Department of Commerce
105.	RMA	Rubber Manufacturers' Association
106.	RUS	Rural Utilities Service
107.	SAE	SAE International
108.	SDI	Steel Deck Institute
109.	SDI	Steel Door Institute
110.	SJI	Steel Joist Institute
111.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
112.	SPI	Society of the Plastics Industry
113.	SSPC	The Society for Protective Coatings

114.	STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
115.	SWI	Steel Window Institute
116.	TEMA	Tubular Exchanger Manufacturers' Association
117.	TCA	Tile Council of North America
118.	TIA	Telecommunications Industry Association
119.	UBC	Uniform Building Code
120.	UFC	Uniform Fire Code
121.	UL	Underwriters Laboratories Inc.
122.	UMC	Uniform Mechanical Code
123.	USBR	U.S. Bureau of Reclamation
124.	WCLIB	West Coast Lumber Inspection Bureau
125.	WI	Wood Institute
126.	WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this Specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.

B. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this section.

B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill specified minimum services.

F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Engineer.
4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and facility startup and evaluation.
7. Training of Owner's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

3.03 TRAINING

A. General:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.

2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, Operation and Maintenance Data.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Post-startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

3.04 SUPPLEMENTS

A. The supplement listed below, following "End of Section", is part of this specification.

1. Form: Manufacturer's Certificate of Proper Installation.
2. Form: Manufacturer's Certificate of Compliance.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: _____

PROJECT NAME: _____

PROJECT NO: _____

PRODUCT, MATERIAL, OR SERVICE SUBMITTED: _____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Nursery and Landscape Association (ANLA): American Standards for Nursery Stock.
2. Federal Emergency Management Agency (FEMA).
3. National Fire Prevention Association (NFPA): 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. Telecommunications Industry Association (TIA): 568-C, Commercial Building Telecommunications Cabling Standard.
5. U.S. Department of Agriculture (USDA): Urban Hydrology for Small Watersheds.
6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years.

1.02 SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
2. Temporary Utility Submittals:
   a. Electric power supply and distribution plans.

1.03 MOBILIZATION

A. Mobilization shall include, but not be limited to, these principal items:

1. Obtaining required permits.
2. Installing temporary construction power, wiring, and lighting facilities.
3. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
4. Arranging for and erection of Contractor’s work and storage yard.
5. Posting OSHA required notices and establishing safety programs and procedures.
6. Having Contractor’s superintendent at Site full time.

1.04 PROTECTION OF WORK AND PROPERTY

A. Comply with Owner's safety rules while on Owner's property.

B. Keep Owner informed of serious onsite accidents and related claims.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TEMPORARY UTILITIES

A. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.

B. Sanitary and Personnel Facilities: Provide and maintain facilities for Contractor's employees, Subcontractors, and other onsite employers' employees. Service, clean, and maintain facilities and enclosures.

C. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.

3.02 PROTECTION OF WORK AND PROPERTY

A. General:

1. Maintain in continuous service existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and other utilities encountered along line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.
2. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with owner of said utility and perform work to their satisfaction.
3. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
4. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
5. In areas where Contractor's operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Contractor.

6. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to Contractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.

B. Existing Structures:

1. Replace items removed in their original location and a condition equal to or better than original.

3.03 TEMPORARY CONTROLS

A. Noise Control: Provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.

3.04 STORAGE YARDS AND BUILDINGS

A. Temporary Storage Yards: Construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

B. Temporary Storage Buildings:

1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials stored.
2. Arrange or partition to provide security of contents and ready access for inspection and inventory.
3. Store combustible materials (paints, solvents, fuels) in a well-ventilated and remote building meeting safety standards.

3.05 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Ensure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

3.06 CLEANING DURING CONSTRUCTION

A. In accordance with General Conditions, as may be specified in other Specification sections, and as required herein.

B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up and dispose of debris.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive, roadways, and other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
   a. Record Documents: As required in General Conditions.
   b. Special bonds, Special Guarantees, and Service Agreements.
   c. Consent of Surety to Final Payment: As required in General Conditions.
   d. Releases or Waivers of Liens and Claims: As required in General Conditions.
   e. Releases from Agreements.
   f. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
   g. Extra Materials: As required by individual Specification sections.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.

B. In the event Contractor is unable to secure written releases:

1. Inform Owner of the reasons.
2. Owner or its representatives will examine the Site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if: (i) Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or (ii) Contractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer a copy of the Drawings in electronic format. Drawings used for record documents will be full size.
2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   a. Color Coding:
      1) Green when showing information deleted from Drawings.
      2) Red when showing information added to Drawings.
      3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by "cloud" drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
   b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
   d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
   a. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like.
   b. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).
   c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor's notice of completion, clean entire Site or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner and Engineer.
2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
4. Clean all windows.
5. Clean and wax wood, vinyl, or painted floors.
6. Broom clean exterior paved driveways and parking areas.
7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
8. Rake clean all other surfaces.
9. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
10. Leave water courses, gutters, and ditches open and clean.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.

1.02 DEFINITIONS

A. Preliminary Data: Initial and subsequent submissions for Engineer's review.

B. Final Data: Engineer-accepted data, submitted as specified herein.

C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03 SEQUENCING AND SCHEDULING

A. Equipment and System Data:

1. Preliminary Data:
   a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
   b. Submit prior to shipment date.
2. Final Data: Submit Instructional Manual Formatted data not less than 30 days prior to installation of equipment or system equipment or system field functional testing. Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.

B. Materials and Finishes Data:

1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
2. Final Data: Submit within 10 days after final inspection.

1.04 DATA FORMAT

A. Prepare preliminary and final data in the form of an instructional manual. Prepare final data on electronic media.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title “OPERATION AND MAINTENANCE DATA” and list:
    a. Project title.
    b. Designate applicable system, equipment, material, or finish.
    c. Identity of separate structure as applicable.
    d. Identify volume number if more than one volume.
    e. Identity of general subject matter covered in manual.
4. Spine:
    a. Project title.
    b. Identify volume number if more than one volume.
5. Title Page:
    a. Contractor name, address, and telephone number.
    b. Subcontractor, Supplier, installer, or maintenance contractor’s name, address, and telephone number, as appropriate.
        1) Identify area of responsibility of each.
        2) Provide name and telephone number of local source of supply for parts and replacement.
6. Table of Contents:
    a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
    b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
7. Paper: 20-pound minimum, white for typed pages.
8. Text: Manufacturer’s printed data, or neatly typewritten.
9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
    a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
    b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
    c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
   a. Submit three copies for Engineer's review.
   b. If data meets conditions of the Contract:
      1) One copy will be returned to Contractor.
      2) One copy will be forwarded to Resident Project Representative.
      3) One copy will be retained in Engineer's file.
   c. If data does not meet conditions of the Contract:
      1) All copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
      2) Engineer's comments will be retained in Engineer's file.
      3) Resubmit two copies revised in accordance with Engineer's comments.
3. Final Data: Submit two copies in format specified herein.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content For Each Unit (or Common Units) and System:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
   c. Function, normal operating characteristics, and limiting conditions.
   d. Performance curves, engineering data, nameplate data, and tests.
   e. Complete nomenclature and commercial number of replaceable parts.
   f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
   g. Spare parts ordering instructions.
   h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
2. As-installed, color-coded piping diagrams.

3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
    a. Format:
        1) Provide reinforced, punched, binder tab; bind in with text.
        2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
        3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
        4) Identify Specification section and product on Drawings and envelopes.
    b. Relations of component parts of equipment and systems.
    c. Control and flow diagrams.
    d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
    a. Format:
        1) Organize in consistent format under separate heading for each different procedure.
        2) Provide logical sequence of instructions for each procedure.
        3) Provide information sheet for Owner's personnel, including:
            a) Proper procedures in event of failure.
            b) Instances that might affect validity of guarantee or Bond.
    b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
    c. Operating Procedures:
        1) Startup, break-in, routine, and normal operating instructions.
        2) Test procedures and results of factory tests where required.
        3) Regulation, control, stopping, and emergency instructions.
        4) Description of operation sequence by control manufacturer.
        5) Shutdown instructions for both short and extended duration.
        6) Summer and winter operating instructions, as applicable.
        7) Safety precautions.
        8) Special operating instructions.
    d. Maintenance and Overhaul Procedures:
        1) Routine maintenance.
        2) Guide to troubleshooting.
        3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00, Closeout Procedures.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data, nameplate data, and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
    d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards:
3. Electrical service.
4. Control requirements and interfaces.
5. Communication requirements and interfaces.
6. List of electrical relay settings, and control and alarm contact settings.
7. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
8. As-installed control diagrams by control manufacturer.
9. Operating Procedures:
    a. Routine and normal operating instructions.
    b. Startup and shutdown sequences, normal and emergency.
    c. Safety precautions.
    d. Special operating instructions.
10. Maintenance Procedures:
    a. Routine maintenance.
    b. Guide to troubleshooting.
    c. Adjustment and checking.
    d. List of relay settings, control and alarm contact settings.
11. Manufacturer’s printed operating and maintenance instructions.
12. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format:
    a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
    b. Each Maintenance Summary may take as many pages as required.
    c. Use only 8-1/2-inch by 11-inch size paper.
    d. Complete using typewriter or electronic printing.

3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
    a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
    b. "Unit" is the unit of measure for ordering the part.
    c. "Quantity" is the number of units recommended.
    d. "Unit Cost" is the current purchase price.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
    a. Catalog number, size, and composition.
    b. Color and texture designations.
    c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
    a. Manufacturer's recommendation for types of cleaning agents and methods.
    b. Cautions against cleaning agents and methods that are detrimental to product.
    c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
    a. Applicable standards.
    b. Chemical composition.
    c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

1.08 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.

1. Forms: Maintenance Summary Form.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

MAINTENANCE SUMMARY FORM

PROJECT:_____ CONTRACT NO.:_____

1. EQUIPMENT ITEM_____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

   a. Name_____ Telephone No. _____

   b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

8. LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

C. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

D. Facility Performance Demonstration:

1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
2. Such demonstration is for the purposes of (i) verifying to Owner entire facility performs as a whole, and (ii) documenting performance characteristics of completed facility for Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of equipment or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

1.02 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.
2. Functional and performance test results.
3. Completed Facility Performance Demonstration/Certification Form.

1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with Owner's operations personnel; to include the following:

1. Step-by-step instructions for startup of the complete facility.

2. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
    a. Description of unit processes included in the facility startup.
    b. Sequence of unit process startup to achieve facility startup.
    c. Description of computerized operations, if any, included in the facility.
    d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
    e. Signature spaces for Contractor and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.
2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers' Field Services, when required by individual Specification sections.
4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
    a. Owner/Project Name.
    b. Equipment or item tested.
    c. Date and time of test.
    d. Type of test performed (Functional or Performance).
    e. Test method.
    f. Test conditions.
    g. Test results.
    h. Signature spaces for Contractor and Engineer as witness.
5. Cleaning and Checking: Prior to beginning functional testing:
    a. Calibrate testing equipment in accordance with manufacturer's instructions.
    b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
    c. Lubricate equipment in accordance with manufacturer's instructions.
    d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.

e. Check power supply to electric-powered equipment for correct voltage.
f. Adjust clearances and torque.
g. Test piping for leaks.

6. Ready-to-test determination will be by Engineer based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by Contractor of equipment readiness for testing.
   c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.

B. Functional Testing:

1. Conduct as specified in individual Specification sections.
2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
3. Prepare Equipment Test Report summarizing test method and results.
4. When, in Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

C. Performance Testing:

1. Conduct as specified in individual Specification sections.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
6. Prepare Equipment Test Report summarizing test method and results.

7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.02 STARTUP OF UNIT PROCESSES

A. Prior to startup, equipment shall be accepted by Engineer as having met functional and performance testing requirements specified.

B. Make adjustments, repairs, and corrections necessary to complete startup.

C. Startup shall be considered complete when, in opinion of Engineer, equipment has operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.

D. Significant Interruption: May include any of the following events:

1. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
2. Failure to meet specified functional operation for more than 2 consecutive hours.
3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
4. Failure of any noncritical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
5. As determined by Engineer.

E. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.03 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of Engineer, startup has been achieved, sequence each unit process to the point that facility is operational.

B. Demonstrate proper operation of required interfaces within and between individual unit processes.

C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic operation.

3.04 SUPPLEMENTS

A. Supplements listed below, following “End of Section,” are a part of this Specification:

1. Facility Performance Demonstration/Certification Form.

END OF SECTION

FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER:_____ **PROJECT:**_____

Description (List equipment involved in facility startup):

_____

_____

_____

_____

Startup Sequence (Describe sequence for startup, including computerized operations, if any):

_____

_____

_____

_____

_____

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ **Date:** _____**, 20____**

Engineer: _____ **Date:** _____**, 20____**

(Authorized Signature)

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
2. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.
3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
    a. Part 61—National Emission Standards for Hazardous Air Pollutants.
    b. Part 82—Protection of Stratospheric Ozone.
    c. Part 273—Standards for Universal Waste Management.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof.

C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

D. Relocate: Remove, protect, clean and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on the Drawings.

E. Renovation: Altering a facility or one or more facility components in any way.

F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

G. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

H. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. Informational Submittals:

1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor's safety requirements shall conform to ANSI A10.6.

1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:

1. Detailed description of methods and equipment to be used for each operation;
2. The Contractor's planned sequence of operations, including coordination with other work in progress;
3. Procedures for removal and disposition of materials specified to be salvaged.
4. Disconnection schedule of utility services**.**

1.06 SEQUENCING AND SCHEDULING

A. The Work of this Specification shall not commence until Contractor's Demolition/Renovation Plan has been approved by Engineer.

B. Include the Work of this Specification in the progress schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Utilities and Related Equipment:

1. Notify Engineer or appropriate utilities to turn off affected services at least 48 hours before starting demolition activities.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Engineer.
3. When utility lines are encountered that are not indicated on the Drawings, notify Engineer and Owner prior to further work in that area.
4. Excavate and remove utility lines serving buildings to be demolished to a distance of 20 feet beyond the outside perimeter of the demolition.

B. Masonry: Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new Work. Where new masonry adjoins existing, the new Work shall abut or tie into the existing construction as indicated.

C. Concrete: Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Where new concrete adjoins existing, the new Work shall abut or tie into the existing construction as indicated.

D. Patching:

1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch and repair to match adjacent finished surfaces as to texture and finish.
2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.
3. Patching shall be as specified and indicated, and shall include:
   a. Fill holes and depressions caused by previous physical damage or left as a result of removals in existing masonry and concrete walls with an approved patching material, applied in accordance with the manufacturer’s printed instructions.

E. Electrical:

1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface.
2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.
3. Rework existing circuits, or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated. Existing equipment and circuiting shown are based upon limited field surveys. Verify existing conditions, make all necessary adjustments, and record the Work on the Record Drawings. This shall include, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.
4. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.
5. Raceways and cabling not scheduled for reuse.
6. Inaccessibly Concealed: Cut off and abandon in place.
7. Exposed or Concealed Above Accessible Ceilings: Remove.
8. Raceways and Cabling Scheduled for Future Use: Cap/seal and tag.
9. Relocating Equipment: Extend existing wiring or run new wiring from the source.
10. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover plate installed.
11. Where the concealed raceway is uncovered remove raceway (or extended to new location if appropriate).
12. Provide new typewritten panelboard circuit directory cards.

3.02 PROTECTION

A. Building Occupancy: Refer to Section 01 31 13, Project Coordination, for specific requirements related to concurrent occupancy of facilities to be partially demolished.

B. Dust and Debris Control:

1. Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
2. Vacuum and dust the Work area as needed.

C. Existing Work:

1. Survey the site and examine the Drawings and Specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of Owner; any Contractor-damaged items shall be repaired or replaced as directed by Engineer.
3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have Engineer approval.
5. Do not overload pavements to remain.

D. Weather Protection: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

E. Trees: Protect trees within the Site that might be damaged during demolition and are indicated to be left in place, by a 6-foot-high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the Engineer.

F. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Contractor to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Engineer.

3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.

G. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect Owner's personnel and the general public from injury due to demolition Work.
3. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to occupied portions of the structure.

3.03 TITLE TO MATERIALS

A. Title to equipment and materials resulting from demolition vested in the Contractor upon approval by Engineer of Contractor's Demolition/Renovation Plan, and the resulting authorization by Engineer to begin demolition.

3.04 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Contractor's Demolition/Renovation Plan by Engineer.

B. Salvage equipment to the maximum extent possible.

C. Owner will not be responsible for the condition or loss of, or damage to, such property after Engineer's authorization to begin demolition.

3.05 UNSALVAGEABLE MATERIAL

A. Combustible material shall be disposed of offsite and in accordance with local, state and federal regulations.

3.06 CLEANUP

A. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):
   a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied.
   b. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   d. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
2. Environmental Protection Agency (EPA).
3. NACE International (NACE): RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
4. NSF International (NSF): 61, Drinking Water System Components-Health Effects.
5. Occupational Safety and Health Act (OSHA).
6. The Society for Protective Coatings (SSPC):
   a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
   b. PA 3, Guide to Safety in Paint Applications.
   c. SP 1, Solvent Cleaning.
   d. SP 2, Hand Tool Cleaning.
   e. SP 3, Power Tool Cleaning.
   f. SP 5, White Metal Blast Cleaning.
   g. SP 6, Commercial Blast Cleaning.
   h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
   i. SP 10, Near-White Blast Cleaning.
   j. SP 11, Power Tool Cleaning to Bare Metal.
   k. SP 12, Surface Preparation and Cleaning of Metals Waterjetting Prior to Recoating.
   l. SP 13, Surface Preparation of Concrete.
   m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. MDFT: Minimum Dry Film Thickness, mils.
3. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
4. Mil: Thousandth of an inch.
5. PPDS: Paint Product Data Sheet.
6. PSDS: Paint System Data Sheet.
7. SFPG: Square Feet per Gallon.
8. SFPGPC: Square Feet per Gallon per Coat.
9. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Data Sheets:
      1) For each product, furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PDS form is appended to the end of this section.
      2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
      3) Technical and performance information that demonstrates compliance with Specification.
      4) Furnish copies of paint system submittals to the coating applicator.
      5) Indiscriminate submittal of only manufacturer's literature is not acceptable.
   b. Detailed chemical and gradation analysis for each proposed abrasive material.
2. Samples:
   a. Proposed Abrasive Materials: Minimum 5-pound sample for each type.
   b. Reference Panel:
      1) Surface Preparation:
         a) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.
         b) Provide panel representative of the steel used; prevent deterioration of surface quality.

c) Panel to be reference source for inspection upon approval by Engineer.

2) Paint:

a) Unless otherwise specified, before painting Work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.

b) Furnish additional samples as required until colors, finishes, and textures are approved.

c) Approved samples to be the quality standard for final finishes.

B. Informational Submittals:

1. Applicator's Qualification: List of references substantiating experience.
2. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
4. Manufacturer's written verification that submitted material is suitable for the intended use.
5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
6. Manufacturer's written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 3, Guide to Safety in Paint Applications.
   c. Federal, state, and local agencies having jurisdiction.

C. Mockup:

1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of Work, and special details.

2. After Engineer approval, sample spaces or items shall serve as a standard for similar Work throughout the Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years' verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. PPG.
2. Sherwin-Williams.
3. Tnemec.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Bituminous Paint	Single-component, coal-tar pitch based
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type 70% volume solids minimum, suitable for immersion service
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat
Inorganic Zinc Primer	Solvent or water based, having 85% metallic zinc content in the dry film; follow manufacturer's recommendation for topcoating
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF 61
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
Silicone/Silicone Acrylic	Elevated temperature silicone or silicone/acrylic based

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph, Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation Work and coating application Work.

C. Shop Coating Requirements:

1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Carbon Steel Pipe:
   a. Use SSPC standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve SSPC-equivalent surface.
   b. The surface preparation and application of the primer shall be performed by pipe manufacturer/supplier.

c. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.

PART 3 EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation Work and coating application Work.

B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

3.02 EXAMINATION

A. Factory Finished Items:

1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.
2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

B. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:
   a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
   b. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
   c. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
   d. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
2. The words "solvent cleaning", "hand tool cleaning", "wire brushing", and "blast cleaning", or similar words of equal intent in these Specifications or in paint manufacturer's specification refer to the applicable SSPC Specification.
3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply.
4. Ductile Iron Pipe Supplied with Asphaltic Varnish Finish: Remove asphaltic varnish finish prior to performing specified surface preparation.

5. Hand tool clean areas that cannot be cleaned by power tool cleaning.
6. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
7. Welds and Adjacent Areas:
    a. Prepare such that there is:
        1) No undercutting or reverse ridges on weld bead.
        2) No weld spatter on or adjacent to weld or any area to be painted.
        3) No sharp peaks or ridges along weld bead.
    b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
8. Preblast Cleaning Requirements:
    a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
    b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
    c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
9. Blast Cleaning Requirements:
    a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.
    b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.
    c. Use only dry blast cleaning methods.
    d. Do not reuse abrasive, except for designed recyclable systems.
    e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.
10. Post-Blast Cleaning and Other Cleaning Requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

C. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Meet requirements of SSPC SP 13.

3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean to remove loose concrete and laitance, and provide a tooth for binding. Upon approval by Engineer, surface may be cleaned by acid etching method. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces shall not be allowed.
5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

D. Gypsum Board Surface Preparation: Typically, new gypsum board surfaces need no special preparation before painting.

1. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.

E. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash and freshwater rinse.
2. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
3. Feather surrounding intact coating.
4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
5. Apply one full finish coat of specified primer to entire surface.
6. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.
7. For ductile iron pipe with asphaltic varnish finish not specified to be abrasive blasted, apply coat of tar stop prior to application of cosmetic finish coat.
8. Application of Cosmetic Coat:
    a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.
    b. Check compatibility by application to a small area prior to starting painting.
    c. If lifting or other problems occur, request disposition from Engineer.
9. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.05 SURFACE CLEANING

A. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for new, interior and exterior concrete, and metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise.
2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.
3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
6. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
7. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.
8. Keep paint materials sealed when not in use.
9. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Porous Surfaces, Such as Concrete:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.
2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
    a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.

3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

C. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with Specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting Work in question.

B. System No. 5 Exposed Metal—Corrosive Service:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	2 coat, 4 MDFT PC
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. New exposed metal surfaces located outside of structures and exposed to corrosive (coastal saline) environment including the following specific surfaces:
      1) Equipment items (e.g. pumps, motors, and related accessories, etc.) identified in the Specifications to be coated with this system.
      2) Carbon steel pipe, fittings, valves, and related accessory items identified to be coated with this system.
      3) Exterior ferrous metal surfaces of the bulk fuel storage tank and all related items including platforms and supports, etc.

C. System No. 15 High Heat-Resistant Coating—900 Degrees F Maximum:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	Inorganic Zinc Primer	1 coat, 2.5 MDFT
	Silicone	1 coat, 2 MDFT

1. Use on the following items or areas:
   a. All carbon steel (interior and exterior) surfaces of the diesel engine exhaust system components including metal flex couplings, insulated roof sleeve, and rain cap, etc.

D. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

3.08 COLORS

A. Provide as shown in Piping Schedule of Section 40 27 00, Process Piping-General.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:

1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
2. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:
    a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
    b. Fire Protection Equipment and Apparatus: OSHA Red.
    c. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:

1. Color code nonsubmerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
2. Pipe Color Coding: In accordance with Piping Schedule.
3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.
4. Pipe Supports: For non-hot-dip galvanized or alloy steel supports paint light gray, as approved by Engineer.

3.09 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA, Mikrotest.
2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.

3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
   b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.
   c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.
   d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.10 MANUFACTURER'S SERVICES

A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating system.
2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
3. As required to resolve field problems attributable to or associated with manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.11 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.12 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION

PAINT SYSTEM DATA SHEET (PSDS)

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer's Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning:_____

Ambient Temperature Limitations: min.:_____ max.:_____

Surface Temperature Limitations: min.:_____ max.:_____

Surface Profile Requirements: min.:_____ max.:_____

Attach additional sheets detailing manufacturer's recommended storage requirements and holiday testing procedures.

SECTION 26 05 02
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Requirements specified within this section apply to Division 26, Electrical. Work specified herein shall be performed as if specified in the individual sections.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Contractors Association (NECA): National Electrical Installation Standards.
2. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. Z535.4, Product Safety Signs and Labels.
3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
4. Underwriters Laboratories, Inc. (UL).

1.03 ELECTRIC SERVICE DIVISION OF RESPONSIBILITY

A. The existing facility is currently powered via three existing pole-mounted utility transformers. The three existing pole-mounted utility transformers and the associated service cables from the utility transformers to the existing weatherhead shall be reused. However, all existing conductors installed downstream of the existing service entrance cables shall be demolished and new conductors, and conduit where required, shall be provided and installed.

1.04 SPECIAL PROJECT REQUIREMENTS

A. The project consists of a major electrical upgrade to the existing facility. The Scope of Work for the electrical upgrades to be performed by the Contractor includes, but is not limited to, the following items:

1. Provide one (1) new NEMA 12, 240V well pump control panel.
2. Provide one (1) new 25KVA, 240V-240/120V transformer.
3. Provide one (1) new 125A, 240/120V, NEMA 12 manual transfer switch.
4. Provide two (2) new NEMA 12, 240/120V panelboards.

5. Provide one (1) new 10KW, 240/120V gasoline-powered portable generator.
6. Provide a new NEMA 12, motor starter for the existing chlorine booster pump.
7. All existing conductors currently installed downstream of the existing weatherhead shall be demolished and new conductors shall be installed by the Contractor. The Contractor can reuse existing conduits currently installed provided that they meet the requirements of the specifications in the Project Manual. The Contractor shall perform thorough field investigations in order to determine the specific conduits that are currently used to feed the existing loads and if they can be reused. Contractor shall submit a drawing showing the conduits that are proposed to be reused to the Engineer for review and approval prior to beginning work.
8. The Contractor shall perform thorough field investigations of the existing equipment as necessary to determine how and where the existing equipment is currently powered and controlled. The Contractor shall complete the investigations prior to submitting any of the technical submittals associated with the proposed equipment. The investigations shall include, but are not limited to, the following.
    a. Determining where the existing loads that are currently fed from and the conduits used to distribute power to the existing loads.
    b. Determining the number and ratings of all circuit breakers that are required in each of the two new panelboards
    c. Verifying the control logic of the existing elevated storage tank control panel.
    d. Verifying the control logic of the well pump control panel.
    e. Determining if the motor heater and thermostat shown in the Contract Documents are actually installed within the existing well pump motor.
9. The Scope of Work includes demolishing and replacing two existing panelboards. One existing panelboard is currently located within Wellhouse 2 and another existing panelboard is currently installed under the elevated storage tank. However, the specific loads that are fed from each of the existing panelboards need to be verified.
10. The Scope of Work includes demolishing the existing elevated storage tank control panel and replacing it with a new control panel. The detailed control logic shown on the Drawings for the new elevated storage tank control panel is based on the best information available on the required control logic for the new control panel. The Contractor shall modify the control logic as necessary to meet all of the functional requirements of the existing system at no additional cost to the Owner.

11. The control diagram included on the Drawings for the well pump control panel indicates that there is a motor heater and thermostat included within the existing well pump motor. However, the Contractor shall confirm that these components exist and adjust the control logic as required to match existing conditions at no additional cost to the Owner.
12. The Contractor shall install new buried conduit in the following locations if all or segments of the existing conduit cannot be reused:
    a. Between the elevated storage tank and Wellhouse 2.
    b. Between the elevated storage tank and the vault where the Fairpoint valve is located.
    c. Between the vault where the Fairpoint valve is located and Wellhouse 2.

1.05 SUBMITTALS

A. Action Submittals:

1. Provide manufacturers' data for the following:
    a. Electrical service components.
    b. Nameplates, signs, and labels.

1.06 QUALITY ASSURANCE

A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark or label.

C. Provide materials and equipment acceptable to AHJ for Class, Division, and Group of hazardous area indicated.

1.07 ENVIRONMENTAL CONDITIONS

A. The following areas are classified nonhazardous, wet, and corrosive. Use materials and methods required for such areas.

1. Inside the chlorine room.

B. The following areas are classified as indoor and dry:

1. Pumphouse – Pump Room.
2. Area under the existing elevated storage tank.

C. The following areas are not classified. Use dust-tight and oil-tight NEMA 12 materials and methods.

1. Areas not covered above.

PART 2 PRODUCTS

2.01 GENERAL

A. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

B. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.

C. Materials and equipment installed outdoors shall be capable of continuous operation at their specified rating within the ambient temperature range specified.

D. Equip panels installed outdoors in direct sun with sun shields.

E. Electrical ratings of materials and equipment that are reduced by increased elevation shall be derated as required for Site elevation specified.

2.02 EQUIPMENT FINISH

A. Manufacturer’s standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with, light gray color finish as approved by Engineer.

2.03 NAMEPLATES

A. Material: Laminated plastic.

B. Attachment Screws: Stainless steel.

C. Color: White, engraved to a black core.

D. Letter Height:

1. Pushbuttons/Selector Switches: 1/8 inch.
2. Other electrical equipment: 1/4 inch.

2.04 SIGNS AND LABELS

A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.

PART 3 EXECUTION

3.01 GENERAL

A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.

B. Check approximate locations of light fixtures, switches, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.

C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Keep openings in boxes and equipment closed during construction.

E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.

3.02 ANCHORING AND MOUNTING

A. Equipment anchoring and mounting shall be in accordance with manufacturer’s requirements for seismic zone criteria.

3.03 COMBINING CIRCUITS INTO COMMON RACEWAY

A. Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:

1. Analog control circuits from devices in same general area to same destination.
    a. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
    b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.

c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
d. Raceways shall be sized per General Circuit and Raceway Schedule and do not exceed 40 percent fill requirements.
e. Changes shall be documented on record drawings.

2. Discrete control circuits from devices in the same general area to the same destination.
   a. No power or analog control circuits shall be combined in same conduit with discrete circuits.
   b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
   c. Raceways shall be sized per the General Circuit and Raceway Schedule and do not exceed 40 percent fill requirements.
   d. Changes shall be documented on record drawings.
3. Power circuits from loads in same general area to same source location (such as: panelboard, switchboard, low voltage motor control center).
   a. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
   b. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
   c. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

3.04 NAMEPLATES, SIGNS, AND LABELS

A. Arc Flash Protection Warning Signs:

1. Field mark Transfer switches, pump control panels, and panelboards to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.
2. Use arc flash hazard boundary, energy level, PPE level and description, shock hazard, bolted fault current, and equipment name from study required in Section 26 05 70, Electrical Systems Analysis as basis for warning signs.

B. Multiple Power Supply Sign: Install permanent plaque or directory at each service disconnect location denoting other services, feeders, and branch circuits supplying the Well Pump House.

C. Equipment Nameplates:

1. Provide a nameplate to label electrical equipment including transfer switches, pump control panels, panelboards, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.
2. Pump control panels, transfer switches, transformers, panelboards, and terminal junction box nameplates shall include equipment designation.
3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
4. Panelboard and pump control panel nameplates shall include equipment designation, service voltage, and phases.

3.05 LOAD BALANCE

A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.

C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.06 CLEANING AND TOUCHUP PAINTING

A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.

B. Touchup Paint:

1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.
2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.07 PROTECTION FOLLOWING INSTALLATION

A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.

B. When equipment intended for indoor installation is installed at Contractor's convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

END OF SECTION

SECTION 26 05 04
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. A1011/A1011M, Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy Formability.
   c. E814, Method of Fire Tests of Through-Penetration Fire Stops.
2. Canadian Standards Association (CSA).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 18, Standard for Shunt Power Capacitors.
4. International Society of Automation (ISA): RP12.06.01, Wiring Practices for Hazardous (Classified) Locations Instrumentation–Part 1: Intrinsic Safety.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. AB 1, Molded Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
   c. C12.1 Code for Electricity Metering
   d. C12.6 Phase-Shifting Devices Used in Metering, Marking and Arrangement of, Terminals for
   e. CP 1, Shunt Capacitors.
   f. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
   g. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.
   h. KS 1, Enclosed and Miscellaneous Distribution Switches (600 Volts Maximum).
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. Underwriters Laboratories Inc. (UL):
   a. 98, Standard for Enclosed and Dead-Front Switches.
   b. 248, Standard for Low Voltage Fuses.
   c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.

d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
e. 508, Standard for Industrial Control Equipment.
f. 810, Standard for Capacitors.
g. 943, Standard for Ground-Fault Circuit-Interrupters.
h. 1059, Standard for Terminal Blocks.
i. 1479, Fire Tests of Through-Penetration Fire Stops.

1.02 SUBMITTALS

A. Action Submittals:

1. Provide manufacturers' data for the following:
   a. Control devices.
   b. Control relays.
   c. Circuit breakers.
   d. Nonfused switches.
   e. Fuses.
   f. Magnetic contactors.
   g. Firestopping.
   h. Enclosures: Include enclosure data for products having enclosures.
   i. Well Pump Control Panel.
   j. Chlorine Booster Pump Motor Starter.
   k. 10KW Gasoline Generator.

1.03 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

1. Fuses, 0 to 600 Volts: Six of each type and each current rating installed.

PART 2 PRODUCTS

2.01 MOLDED CASE CIRCUIT BREAKER THERMAL MAGNETIC, LOW VOLTAGE

A. General:

1. Type: Molded case.
2. Trip Ratings: 15-800 amps.
3. Voltage Ratings: 120, 240, 277, 480, and 600V ac.
4. Suitable for mounting and operating in any position.
5. NEMA AB 1 and UL 489.

B. Operating Mechanism:

1. Overcenter, trip-free, toggle type handle.
2. Quick-make, quick-break action.
3. Locking provisions for padlocking breaker in open position.
4. ON/OFF and TRIPPED indicating positions of operating handle.
5. Operating handle to assume a center position when tripped.

C. Trip Mechanism:

1. Individual permanent thermal and magnetic trip elements in each pole.
2. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
3. Two and three pole, common trip.
4. Automatically opens all poles when overcurrent occurs on one pole.
5. Test button on cover.
6. Calibrated for 40 degrees C ambient, unless shown otherwise.
7. Do not provide single-pole circuit breakers with handle ties where multi-pole circuit breakers are shown.

D. Short Circuit Interrupting Ratings: All new 240V equipment shall include a minimum short circuit rating of 22,000A.

E. Series Connected Ratings: Do not apply series connected short circuit ratings.

F. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).

1. Ground fault sensor shall be rated same as circuit breaker.
2. Push-to-test button.

G. Equipment Ground Fault Interrupter (EGFI): Where indicated, equip breaker specified above with ground fault sensor and rated to trip on 30-mA ground fault (UL-listed for equipment ground fault protection).

H. Magnetic Only Type Breakers: Where shown; instantaneous trip adjustment which simultaneously sets magnetic trip level of each individual pole continuously through a 3X to 10X trip range.

I. Accessories: Shunt trip, auxiliary switches, handle lock ON devices, mechanical interlocks, key interlocks, unit mounting bases, double lugs as shown or otherwise required. Shunt trip operators shall be continuous duty rated or have coil-clearing contacts.

J. Connections:

1. Supply (line side) at either end.
2. Mechanical wire lugs, except crimp compression lugs where shown.
3. Lugs removable/replaceable for breaker frames greater than 100 amperes.
4. Suitable for 75 degrees C rated conductors without derating breaker or conductor ampacity.
5. Use bolted bus connections, except where bolt-on is not compatible with existing breaker provisions.

K. Enclosures for Independent Mounting:

1. See Article Enclosures.
2. Service Entrance Use: Breakers in required enclosure and required accessories shall be UL 489 listed.
3. Interlock: Enclosure and switch shall interlock to prevent opening cover with switch in the ON position. Provide bypass feature for use by qualified personnel.

2.02 NONFUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

A. NEMA KS 1.

B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

C. Lugs: Suitable for use with 75 degrees C wire at NEC 75 degrees C ampacity.

D. Enclosures: See Article Enclosures.

E. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.03 WELL PUMP CONTROL PANEL

A. The well pump control panel shall include a NEMA 12 enclosure that contains the following components:

1. Surge protection device (SPD).
2. Solid state reduced voltage starter with an isolation contactor and bypass contactor. A solid state starter with an integral bypass contactor is acceptable.
3. 125A/2P feeder breaker for the externally located 25KVA transformer.
4. 240V-120V Control power transformer.
5. Controls and interfaces required: As shown on the Drawings.

6. The panel shall include a 300A main circuit breaker that is service entrance rated. The panel shall operate on 240V, three-phase power.
7. The control panel shall include a thermostatically controlled fan and heater to maintain the internal temperature within the panel. The control panel will be installed indoors in a heated space. However, the existing facility where the control panel will be installed is not air conditioned nor ventilated and is a high humidity environment. The control panel will be installed within an existing building at a project site with a maximum ambient temperature of 95 degrees F. If inclusion of an internal cooling fan is not sufficient to maintain the internal panel temperature within the maximum allowable ratings of the electrical equipment located within the control panel, then the manufacturer shall provide and install a side mounted air conditioner on the control panel. The maximum allowable dimensions for the new control panel is 48 inches wide by 36 inches high by 12 foot deep.

2.04 CHLORINE BOOSTER PUMP MOTOR STARTER

A. The chlorine booster pump motor starter shall consists of a NEMA 12 enclosure and the controls and indications as shown on the Drawings. The motor starter shall not exceed 12 inches wide by 18 inches high by 12 inches deep.

2.05 10KW, 240/120V PORTABLE GASOLINE GENERATOR

A. 10,000W, 120/240V.

B. Honda commercial GX engine & heavy duty frame.

C. Full GFCI protection.

D. OSHA workplace compliant – meets jobsite emission and safety requirements.

E. 2 wheel kit and lift hook.

F. Includes the following receptacles:

1. Two (2) 20A, 125V GFCI duplex receptacles.
2. One (1) 30A locking plug.
3. One (1) 30A, 125/240V locking plug.
4. One (1) 50A, 125V/250V locking plug.
5. Electric starting system.

6. The Contractor shall provide and install outdoor rated temporary cables that are suitable for connection from the proposed engine generator to the NEMA 4X, 50A circuit breaker that is located on the exterior wall of well house #2. The cables provided shall only be temporary cables that can be easily removed by the Owner when the engine generator is not in operation. The temporary cables provided shall be the property of the Owner upon successful completion of the Project.
7. The generator shall operate on gasoline and shall have a fuel tank capacity of 8.1gallons.
8. Noise Level: 76dB at rated load.
9. Model EB10000AH1 as manufactured by Honda.

2.06 FUSE, 250-VOLT AND 600-VOLT

A. Power Distribution, General:

1. Current-limiting, with 200,000 ampere rms interrupting rating.
2. Provide to fit mountings specified with switches.
3. UL 248.

B. Power Distribution, Ampere Ratings 1 Amp to 600 Amps:

1. Class: RK-1.
2. Type: Dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Types LPS-RK (600 volts) and LPN-RK (250 volts).
   b. Littelfuse; Types LLS-RK (600 volts) and LLN-RK (250 volts).

C. Power Distribution, Ampere Ratings 601 Amps to 6,000 Amps:

1. Class: L.
2. Double O-rings and silver links.
3. Manufacturers and Products:
   a. Bussmann; Type KRP-C.
   b. Littelfuse, Inc.; Type KLPC.

D. Cable Limiters:

1. 600V or less; crimp to copper cable, bolt to bus or terminal pad.
2. Manufacturer and Product: Bussmann; K Series.

E. Ferrule:

1. 600V or less, rated for applied voltage, small dimension.
2. Ampere Ratings: 1/10 amp to 30 amps.
3. Dual-element time-delay, time-delay, or nontime-delay as required.

4. Provide with blocks or holders as indicated and suitable for location and use.
5. Manufacturers:
    a. Bussmann.
    b. Littlefuse, Inc.

2.07 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

A. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.

B. Selector Switch Operating Lever: Standard.

C. Indicating Light: Push-to-test.

D. Pushbutton Color:

1. ON or START: Black.
2. OFF or STOP: Red.

E. Pushbutton and selector switch lockable in OFF position where indicated.

F. Legend Plate:

1. Material: Aluminum.
2. Engraving: Enamel filled in high contrasting color.
3. Text Arrangement: 11-character/spaces on one line, 14-character/spaces on each of two lines, as required, indicating specific function.
4. Letter Height: 7/64-inch.

G. Manufacturers and Products:

1. Heavy-Duty, Oil-Tight Type:
    a. General Electric Co.; Type CR 104P.
    b. Square D Co.; Type T.
    c. Eaton/Cutler-Hammer; Type 10250T.
2. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
    a. Square D Co.; Type SK.
    b. General Electric Co.; Type CR 104P.
    c. Eaton/Cutler-Hammer; Type E34.
    d. Crouse-Hinds; Type NCS.

2.08 TERMINAL BLOCK, 600 VOLTS

A. UL 486E and UL 1059.

B. Size components to allow insertion of necessary wire sizes.

C. Capable of termination of control circuits entering or leaving equipment, panels, or boxes.

D. Screw clamp compression, dead front barrier type, with current bar providing direct contact with wire between compression screw and yoke.

E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.

F. Yoke shall guide all strands of wire into terminal.

G. Current bar shall ensure vibration-proof connection.

H. Terminals:

1. Capable of wire connections without special preparation other than stripping.
2. Capable of jumper installation with no loss of terminal or rail space.
3. Individual, rail mounted.

I. Marking system, allowing use of preprinted or field-marked tags.

J. Manufacturers:

1. Weidmuller, Inc.
2. Ideal.
3. Electrovert USA Corp.

2.09 MAGNETIC CONTROL RELAY

A. Industrial control with field convertible contacts rated 10 amps continuous, 7,200VA make, 720VA break.

B. NEMA ICS 2, Designation: A600 (600 volts).

C. Time Delay Relay Attachment:

1. Pneumatic type, timer adjustable as shown.
2. Field convertible from ON delay to OFF delay and vice versa.

D. Latching Attachment: Mechanical latch, having unlatching coil and coil clearing contacts.

E. Manufacturers and Products:

1. Eaton/Cutler-Hammer; Type M-600.
2. General Electric Co.; Type CR120B.

2.10 TIME DELAY RELAY

A. Industrial relay with contacts rated 5 amps continuous, 3,600VA make, 360VA break.

B. NEMA ICS 2 Designation: B150 (150 volts).

C. Solid-state electronic, field convertible ON/OFF delay.

D. One normally open and one normally closed contact (minimum).

E. Repeat accuracy plus or minus 2 percent.

F. Timer adjustment from 1 second to 60 seconds, unless otherwise indicated on Drawings.

G. Manufacturers and Products:

1. Square D Co.; Type F.
2. Eaton/Cutler-Hammer.
3. General Electric Co.

2.11 ELAPSED TIME METER

A. Drive: Synchronous motor.

B. Range: 0 hour to 99,999.9 hours, nonreset type.

C. Mounting: Semiflush panel.

D. Manufacturers and Products:

1. General Electric Co.; Type 240, 2-1/2-inch Big Look.
2. Eagle Signal Controls; Bulletin 705.

2.12 MAGNETIC CONTACTOR

A. UL listed.

B. Electrically operated, electrically held.

C. Main Contacts:

1. Power driven in one direction with mechanical spring dropout.
2. Silver alloy with wiping action and arc quenchers.
3. Continuous-duty, rated As shown.
4. Poles: As shown.

D. Control: As shown.

E. Auxiliary Contacts: One normally open and one normally closed, rated 7200VA make, 720VA break, at 600V, A600 per NEMA ICS 5.

F. Enclosures: See Article Enclosures.

G. Manufacturers and Products:

1. Eaton/Cutler-Hammer; Class A201.
2. General Electric Co.; CR 353.
3. Square D Co.; Class 8910.

2.13 PHASE MONITOR RELAY

A. Features:

1. Voltage and phase monitor relay shall drop out on low voltage, voltage unbalance, loss of phase, or phase reversal.
2. Contacts: Single-pole, double-throw, 10 amperes, 120/240V ac. Where additional contacts are shown or required, provide magnetic control relays.
3. Adjustable trip and time delay settings.
4. Transient Protection: 1,000V ac.
5. Mounting: Multipin plug-in socket base.

B. Manufacturer and Product: Automatic Timing and Controls; SLD Series.

2.14 SUPPORT AND FRAMING CHANNELS

A. Carbon Steel Framing Channel:

1. Material: Rolled, mild strip steel, 12-gauge minimum, ASTM A1011/A1011M, Grade 33.
2. Finish: Hot-dip galvanized after fabrication.

B. Paint Coated Framing Channel: Carbon steel framing channel with electro-deposited rust inhibiting acrylic or epoxy paint.

C. PVC Coated Framing Channel: Carbon steel framing channel with 40-mil polyvinyl chloride coating.

D. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12-gauge minimum.

E. Extruded Aluminum Framing Channel:

1. Material: Extruded from Type 6063-T6 aluminum alloy.
2. Fittings fabricated from Alloy 5052-H32.

F. Nonmetallic Framing Channel:

1. Material: Fire retardant, fiber reinforced vinyl ester resin.
2. Channel fitting of same material as channel.
3. Nuts and bolts of long glass fiber reinforced polyurethane.

G. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.
3. Aickinstrut.

2.15 FIRESTOPS

A. General:

1. Provide UL 1479 classified hourly fire-rating equal to, or greater than, the assembly penetrated.
2. Prevent the passage of cold smoke, toxic fumes, and water before and after exposure to flame.
3. Sealants and accessories shall have fire-resistance ratings as established by testing identical assemblies in accordance with ASTM E814, by Underwriters Laboratories Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.16 ENCLOSURES

A. Finish: Sheet metal structural and enclosure parts shall be completely painted using an electrodeposition process so interior and exterior surfaces as well as bolted structural joints have a complete finish coat on and between them.

B. Color: Manufacturer’s standard color (gray) baked-on enamel, unless otherwise shown.

C. Barriers: Provide metal barriers within enclosures to separate wiring of different systems and voltage.

D. Enclosure Selections: Except as shown otherwise, provide electrical enclosures according to the following table:

ENCLOSURES			
Location	**Finish**	**Environment**	**NEMA 250 Type**
Indoor	Finished	Dry	1
Indoor	Unfinished	Dry	1
Indoor	Unfinished	Industrial Use	12
Indoor and Outdoor	Any	Wet	4
Indoor and Outdoor	Any	Denoted “WP”	3R
Indoor and Outdoor	Any	Wet and Corrosive	4X, 316 Stainless Steel
Indoor and Outdoor	Any	Wet, Dust or Oil	13

PART 3 EXECUTION

3.01 GENERAL

A. Install equipment in accordance with manufacturer’s recommendations.

3.02 WELL PUMP CONTROL PANEL

A. The Contractor shall test all modes of operation for the well pump control panel to verify that it operates as desired.

3.03 CHLORINE BOOSTER PUMP MOTOR STARTER

A. The Contractor shall test all modes of operation for the chlorine booster pump motor starter to verify that it operates as specified.

3.04 10KW PORTABLE GENERATOR

A. The Contractor shall connect the portable generator to the new 50A circuit breaker and allow it to operate all vital loads that are powered from panelboards LP1 and LP2. The Contractor shall connect and operate the portable generator for a minimum of 2 hours to verify that it can successfully operate the vital loads powered from panelboards LP1 and LP2. Note that before the generator test is performed, the Contractor shall open the circuit breakers for the following loads, before the associated generator is started, to ensure that the portable generator is not used to energize these loads when it is in operation:

1. Engine Battery Charger (Panel LP1).
2. Chlorine Room Heater (Panel LP1).

3. Well Pump Room Heater (Panel LP1).
4. Engine Jacket Water Heater (Panel LP1).
5. Heater under the elevated storage tank (Panel LP2).

3.05 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

A. Unless otherwise shown, install heavy-duty, oil-tight type in nonhazardous, indoor, dry locations, including motor control centers, control panels, and individual stations.

B. Unless otherwise shown, install heavy-duty, watertight and corrosion-resistant type in nonhazardous, outdoor, or normally wet areas.

3.06 SUPPORT AND FRAMING CHANNEL

A. Install where required for mounting and supporting electrical equipment, raceway, and cable tray systems.

B. Channel Type:

1. Interior, Wet or Dry (Noncorrosive) Locations:
   a. Aluminum Raceway: Extruded aluminum.
   b. PVC-Coated Conduit: PVC coated.
   c. Steel Raceway and Other Systems Not Covered: Carbon steel or paint coated.
2. Interior, Corrosive (Wet or Dry) Locations:
   a. Aluminum Raceway: Extruded aluminum.
   b. PVC Conduit: Type 316 stainless steel or nonmetallic.
   c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC-coated steel.
3. Outdoor, Noncorrosive Locations:
   a. Steel Raceway: Carbon steel or paint coated framing channel, except where mounted on aluminum handrail, then use aluminum framing channel.
   b. Aluminum Raceway and Other Systems Not Covered: Aluminum framing channel.
4. Outdoor Corrosive Locations:
   a. PVC Conduit: Type 316 stainless steel or nonmetallic.
   b. Aluminum Raceway: Aluminum.
   c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC coated steel.

C. Paint cut ends prior to installation with the following:

1. Carbon Steel Channel: Zinc-rich primer.
2. Painted Channel: Rust-inhibiting epoxy or acrylic paint.
3. Nonmetallic Channel: Epoxy resin sealer.
4. PVC-Coated Channel: PVC patch.

3.07 FIRESTOPS

A. Install in strict conformance with manufacturer's instructions. Comply with installation requirements established by testing and inspecting agency.

B. Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide firestops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.

END OF SECTION

SECTION 26 05 05
CONDUCTORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Association of Edison Illuminating Companies (AEIC): CS 8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 kV through 46 kV.
2. ASTM International (ASTM):
   a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. B3, Standard Specification for Soft or Annealed Copper Wire.
   c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   d. B496, Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV Through 500 kV.
   b. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
   c. 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500000 V.
4. Insulated Cable Engineer's Association, Inc. (ICEA):
   a. S-58-679, Standard for Control Cable Conductor Identification.
   b. S-73-532, Standard for Control Thermocouple Extensions and Instrumentation Cables.
   c. T-29-520, Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input of 210,000 Btu/hour.
5. National Electrical Manufacturers' Association (NEMA):
   a. CC 1, Electric Power Connectors for Substations.
   b. WC 57, Standard for Control, Thermocouple Extension, and Instrumentation Cables.
   c. WC 70, Standard for Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   d. WC 71, Standard for Nonshielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy.
   e. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
7. Telecommunications Industry Association (TIA): TIA-568-C, Commercial Building Telecommunications Cabling Standard.
8. Underwriters Laboratories Inc. (UL):
   a. 13, Standard for Safety for Power-Limited Circuit Cables.
   b. 44, Standard for Safety for Thermoset-Insulated Wires and Cables.
   c. 62, Standard for Safety for Flexible Cord and Cables.
   d. 486A-486B, Standard for Safety for Wire Connectors.
   e. 486C, Standard for Safety for Splicing Wire Connectors.
   f. 510, Standard for Safety for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
   g. 854, Standard for Safety for Service-Entrance Cables.
   h. 1072, Standard for Safety for Medium-Voltage Power Cables.
   i. 1277, Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   j. 1569, Standard for Safety for Metal-Clad Cables.
   k. 1581, Standard for Safety for Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Wire and cable.
   b. Wire and cable accessories.
   c. Cable fault detection system.
2. Cable Pulling Calculations:
   a. Ensure submitted and reviewed before cable installation.
   b. Provide for the following cable installations:
      1) Power and control conductor, and control and instrumentation cable installations in ductbanks.
      2) Feeder circuits; single conductors #4/0 and larger.

B. Informational Submittals:

1. Factory Test Report for conductors 600 volts and below.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 CONDUCTORS 600 VOLTS AND BELOW

A. Conform to applicable requirements of NEMA WC 70.

B. Conductor Type:

1. 120-Volt and 277-Volt Lighting, 10 AWG and Smaller: Solid copper.
2. 120-Volt Receptacle Circuits, 10 AWG and Smaller: Solid copper.
3. All Other Circuits: Stranded copper.

C. Insulation: Type THHN/THWN-2, except for sizes No. 6 and larger, with XHHW-2 insulation.

D. Direct Burial and Aerial Conductors and Cables:

1. Type USE/RHH/RHW insulation, UL 854 listed, or Type RHW-2/USE-2.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

E. Flexible Cords and Cables:

1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.02 600-VOLT RATED CABLE

A. General:

1. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.

2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Type 1, Multiconductor Control Cable:

1. Conductors:
   a. 14 AWG, seven-strand copper.
   b. Insulation: 15-mil PVC with 4-mil nylon.
   c. UL 1581 listed as Type THHN/THWN rated VW-1.
   d. Conductor group bound with spiral wrap of barrier tape.
   e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
2. Cable: Passes the ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
3. Cable Sizes:

No. of Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
3	0.41	45
5	0.48	45
7	0.52	45
12	0.72	60
19	0.83	60
25	1.00	60
37	1.15	80

4. Manufacturers:
   a. Okonite Co.
   b. Southwire.

C. Type 2, Multiconductor Power Cable:

1. General:
   a. Meet or exceed UL 1581 for cable tray use.
   b. Meet or exceed UL 1277 for direct burial and sunlight-resistance.
   c. Overall Jacket: PVC.

2. Conductors:
   a. Class B stranded, coated copper.
   b. Insulation: Chemically cross-linked ethylene-propylene or cross-linked polyethylene.
   c. UL rated VW-1 or listed Type XHHW-2.
   d. Color Code:
      1) Conductors, size 8 AWG and smaller, colored conductors, ICEA S-58-679, Method 1, Table 1.
      2) Conductors, size 6 AWG and larger, ICEA S-73-532, Method 4.
3. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
4. Cable Sizes:

Conductor Size	Minimum Ground Wire Size	No. of Current Carrying Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
12	12	2 3 4	0.42 0.45 0.49	45
10	10	2 3 4	0.54 0.58 0.63	60
8	10	3 4	0.66 0.75	60
6	8	3 4	0.74 0.88	60
4	6	3 4	0.88 1.04	60 80
2	6	3 4	1.01 1.16	80
1	6	3 4	1.10 1.25	80
1/0	6	3 4	1.22 1.35	80

Conductor Size	Minimum Ground Wire Size	No. of Current Carrying Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
2/0	4	3 4	1.32 1.53	80
3/0	4	3 4	1.40 1.60	80
4/0	4	3 4	1.56 1.78	80 110

5. Manufacturers:
   a. Okonite Co.
   b. Southwire.

D. Type 3, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.

1. Outer Jacket: 45-mil nominal thickness.
2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
3. Dimension: 0.31-inch nominal OD.
4. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
   b. 20 AWG, seven-strand tinned copper drain wire.
   c. Insulation: 15-mil nominal PVC.
   d. Jacket: 4-mil nominal nylon.
   e. Color Code: Pair conductors, black and red.
5. Manufacturers:
   a. Okonite Co.
   b. Alpha Wire Corp.
   c. Belden.

E. Type 4, 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.

1. Outer Jacket: 45-mil nominal.
2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
3. Dimension: 0.32-inch nominal OD.

4. Conductors:
    a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    b. 20 AWG, seven-strand, tinned copper drain wire.
    c. Insulation: 15-mil nominal PVC.
    d. Jacket: 4-mil nylon.
    e. Color Code: Triad conductors black, red, and blue.
5. Manufacturers:
    a. Okonite Co.
    b. Alpha Wire Corp.
    c. Belden.

2.03 GROUNDING CONDUCTORS

A. Equipment: Stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.

B. Direct Buried: Bare stranded copper.

2.04 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

A. Tape:

1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33+, rated for 90 degrees C minimum, meeting requirements of UL 510.
2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
3. Arc and Fireproofing:
    a. 30-mil, elastomer.
    b. Manufacturers and Products:
        1) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
        2) Plymouth; 53 Plyarc, with 77 Plyglas glass cloth tapebinder.

B. Identification Devices:

1. Sleeve:
    a. Permanent, PVC, yellow or white, with legible machine-printed black markings.
    b. Manufacturers and Products:
        1) Raychem; Type D-SCE or ZH-SCE.
        2) Brady, Type 3PS.
2. Heat Bond Marker:
    a. Transparent thermoplastic heat bonding film with acrylic pressure sensitive adhesive.
    b. Self-laminating protective shield over text.

c. Machine printed black text.
d. Manufacturer and Product: 3M Co.; Type SCS-HB.

3. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
4. Tie-On Cable Marker Tags:
   a. Chemical-resistant white tag.
   b. Size: 1/2 inch by 2 inches.
   c. Manufacturer and Product: Raychem; Type CM-SCE.
5. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.

C. Connectors and Terminations:

1. Nylon, Self-Insulated Crimp Connectors:
   a. Manufacturers and Products:
      1) Thomas & Betts; Sta-Kon.
      2) Burndy; Insulug.
      3) ILSCO.
2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
   a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
   b. Seamless.
   c. Manufacturers and Products:
      1) Thomas & Betts; Sta-Kon.
      2) Burndy; Insulink.
      3) ILSCO; ILSCONS.
3. Self-Insulated, Freespring Wire Connector (Wire Nuts):
   a. UL 486C.
   b. Plated steel, square wire springs.
   c. Manufacturers and Products:
      1) Thomas & Betts.
      2) Ideal; Twister.
4. Self-Insulated, Set Screw Wire Connector:
   a. Two piece compression type with set screw in brass barrel.
   b. Insulated by insulator cap screwed over brass barrel.
   c. Manufacturers:
      1) 3M Co.
      2) Thomas & Betts.
      3) Marrette.

D. Cable Lugs:

1. In accordance with NEMA CC 1.
2. Rated 600 volts of same material as conductor metal.

3. Uninsulated Crimp Connectors and Terminators:
    a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
    b. Manufacturers and Products:
        1) Thomas & Betts; Color-Keyed.
        2) Burndy; Hydent.
        3) ILSCO.
4. Uninsulated, Bolted, Two-Way Connectors and Terminators:
    a. Manufacturers and Products:
        1) Thomas & Betts; Locktite.
        2) Burndy; Quiklug.
        3) ILSCO.

E. Cable Ties:

1. Nylon, adjustable, self-locking, and reusable.
2. Manufacturer and Product: Thomas & Betts; TY-RAP.

F. Heat Shrinkable Insulation:

1. Thermally stabilized cross-linked polyolefin.
2. Single wall for insulation and strain relief.
3. Dual Wall, adhesive sealant lined, for sealing and corrosion resistance.
4. Manufacturers and Products:
    a. Thomas & Betts; SHRINK-KON.
    b. Raychem; RNF-100 and ES-2000.

2.05 PULLING COMPOUND

A. Nontoxic, noncorrosive, noncombustible, nonflammable, water-based lubricant; UL listed.

B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.

C. Approved for intended use by cable manufacturer.

D. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.

E. Manufacturers:

1. Ideal Co.
2. Polywater, Inc.
3. Cable Grip Co.

2.06 SOURCE QUALITY CONTROL

A. Conductors 600 Volts and Below: Test in accordance with UL 44 and UL 854.

PART 3 EXECUTION

3.01 GENERAL

A. Conductor installation shall be in accordance with manufacturer's recommendations.

B. Conductor and cable sizing shown is based on copper conductors, unless noted otherwise.

C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

D. Terminate conductors and cables, unless otherwise indicated.

E. Tighten screws and terminal bolts in accordance with UL 486A-486B for copper conductors.

F. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.

G. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 12 inches on center.

H. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.

I. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4 inch smaller than raceway inside diameter.

3.02 POWER CONDUCTOR COLOR CODING

A. Conductors 600 Volts and Below:

1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering area 1-1/2 inches to 2 inches wide.
2. 8 AWG and Smaller: Provide colored conductors.

3. Colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts, Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts, Three-Phase, Four-Wire, Delta, Center Tap, Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Brown Orange Yellow
Note: Phase A, B, C implies direction of positive phase rotation.		

4. Tracer: Outer covering of white with identifiable colored strip, other than green, in accordance with NFPA 70.

3.03 CIRCUIT IDENTIFICATION

A. Identify power, instrumentation, and control conductor circuits at each termination, and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.

B. Circuits Appearing in Circuit Schedules: Identify using circuit schedule designations.

C. Circuits Not Appearing in Circuit Schedules:

1. Assign circuit name based on device or equipment at load end of circuit.
2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.

D. Method:

1. Conductors 3 AWG and Smaller: Identify with sleeves or heat bond markers.
2. Cables and Conductors 2 AWG and Larger:
   a. Identify with marker plates or tie-on cable marker tags.
   b. Attach with nylon tie cord.
3. Taped-on markers or tags relying on adhesives not permitted.

3.04 CONDUCTORS 600 VOLTS AND BELOW

A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.

B. Do not splice incoming service conductors and branch power distribution conductors 6 AWG and larger, unless specifically indicated or approved by Engineer.

C. Connections and Terminations:

1. Install wire nuts only on solid conductors. Wire nuts are not allowed on stranded conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control, circuit conductors.
3. Install self-insulated, set screw wire connectors for two-way connection of power circuit conductors 12 AWG and smaller.
4. Install uninsulated crimp connectors and terminators for instrumentation, control, and power circuit conductors 4 AWG through 2/0 AWG.
5. Install uninsulated, bolted, two-way connectors and terminators for power circuit conductors 3/0 AWG and larger.
6. Install uninsulated terminators bolted together on motor circuit conductors 10 AWG and larger.
7. Place no more than one conductor in any single-barrel pressure connection.
8. Install crimp connectors with tools approved by connector manufacturer.
9. Install terminals and connectors acceptable for type of material used.
10. Compression Lugs:
    a. Attach with a tool specifically designed for purpose. Tool shall provide complete, controlled crimp and shall not release until crimp is complete.
    b. Do not use plier type crimpers.

D. Do not use soldered mechanical joints.

E. Splices and Terminations:

1. Insulate uninsulated connections.
2. Indoors: Use general purpose, flame retardant tape or single wall heat shrink.
3. Outdoors, Dry Locations: Use flame retardant, cold- and weather-resistant tape or single wall heat shrink.
4. Below Grade and Wet or Damp Locations: Use dual wall heat shrink.

F. Cap spare conductors with UL listed end caps.

G. Cabinets, Panels, and Motor Control Centers:

1. Remove surplus wire, bridle and secure.
2. Where conductors pass through openings or over edges in sheet metal, remove burrs, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.

H. Control and Instrumentation Wiring:

1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer’s instructions.
3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.
4. Cable Protection:
    a. Under Infinite Access Floors: May install without bundling.
    b. All Other Areas: Install individual wires, pairs, or triads in flex conduit under floor or grouped into bundles at least 1/2 inch in diameter.
    c. Maintain integrity of shielding of instrumentation cables.
    d. Ensure grounds do not occur because of damage to jacket over shield.

I. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.

3.05 CONDUCTOR ARC AND FIREPROOFING

A. Install arc and fireproofing tape on 600-volt single conductors and cables, except those rated Type TC at splices in manholes, handholes, vaults, cable trays, and other indicated locations.

B. Wrap conductors of same circuit entering from separate conduit together as single cable.

C. Follow tape manufacturer’s installation instructions.

D. Secure tape at intervals of 10 feet with bands of tapebinder. Each band to consist of a minimum of two wraps directly over each other.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE): C2, National Electrical Safety Code (NESC).
2. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC).

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product data for the following:
      1) Exothermic weld connectors.
      2) Mechanical connectors.
      3) Compression connectors.
      4) Specialty tools.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 GROUND ROD

A. Material: Copper-clad.

B. Diameter: Minimum 3/4 inch.

C. Length: 20 feet.

2.02 GROUND CONDUCTORS

A. As specified in Section 26 05 05, Conductors.

2.03 CONNECTORS

A. Exothermic Weld Type:

1. Outdoor Weld: Suitable for exposure to elements or direct burial.
2. Indoor Weld: Utilize low-smoke, low-emission process.
3. Manufacturers:
   a. Erico Products, Inc.; Cadweld and Cadweld Exolon.
   b. Thermoweld.

B. Compression Type:

1. Compress-deforming type; wrought copper extrusion material.
2. Single indentation for conductors 6 AWG and smaller.
3. Double indentation with extended barrel for conductors 4 AWG and larger.
4. Barrels prefilled with oxide-inhibiting and antiseizing compound and sealed.
5. Manufacturers:
   a. Burndy Corp.; Hyground Irreversible Compression.
   b. Thomas and Betts Co.
   c. ILSCO.

C. Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.

1. Manufacturers:
   a. Burndy Corp.
   b. Thomas and Betts Co.

2.04 GROUNDING WELLS

A. Ground rod box complete with cast iron riser ring and traffic cover marked GROUND ROD.

B. Manufacturers and Products:

1. Christy Co.; No. G5.
2. Lightning and Grounding Systems, Inc.; I-R Series.

PART 3 EXECUTION

3.01 GENERAL

A. Grounding shall be in compliance with NFPA 70 and IEEE C2.

B. Ground electrical service neutral at service entrance equipment with grounding electrode conductor to grounding electrode system.

C. Ground each separately derived system neutral with common grounding electrode conductor to grounding electrode system.

D. Bond together all grounding electrodes that are present at each building or structure served to form one common grounding electrode system.

E. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.

F. Shielded Power Cables: Ground shields at each splice or termination in accordance with recommendations of splice or termination manufacturer.

G. Shielded Instrumentation Cables:

1. Ground shield to ground bus at power supply for analog signal.
2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
3. Do not ground instrumentation cable shield at more than one point.

3.02 WIRE CONNECTIONS

A. Ground Conductors: Install in conduit containing power conductors and control circuits above 50 volts.

B. Nonmetallic Raceways and Flexible Tubing: Install equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

C. Connect ground conductors to raceway grounding bushings.

D. Extend and connect ground conductors to ground bus in all equipment containing a ground bus.

E. Connect enclosure of equipment containing ground bus to that bus.

F. Bolt connections to equipment ground bus.

G. Bond grounding conductors to metallic enclosures at each end, and to intermediate metallic enclosures.

H. Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 3/8-inch machine screws.

I. Metallic Equipment Enclosures: Use furnished ground lug; if none furnished, tap equipment housing and install solderless terminal connected to box with machine screw. For circuits greater than 20 amps use minimum 5/16-inch diameter bolt.

3.03 MOTOR GROUNDING

A. Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.

B. Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

C. Motors Less Than 10 hp: Use furnished ground lug in motor connection box; if none furnished, provide compression, spade-type terminal connected to conduit box mounting screw.

D. Motors 10 hp and Above: Use furnished ground lug in motor connection box; if none furnished, tap motor frame or equipment housing; furnish compression, one-hole, lug type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.

E. Circuits 20 Amps or Above: Tap motor frame or equipment housing; install solderless terminal with minimum 5/16-inch diameter bolt.

3.04 GROUND RODS

A. Install full length with conductor connection at upper end.

B. Install with connection point below finished grade, unless otherwise shown.

C. Space multiple ground rods by one rod length.

D. Install to 8 feet below local frost depth.

3.05 GROUNDING WELLS

A. Install for ground rods located inside buildings, asphalt and paved areas, and where shown on Drawings.

B. Install riser ring and cover flush with surface.

C. Place 6 inches of crushed rock in bottom of each well.

3.06 CONNECTIONS

A. General:

1. Abovegrade Connections: Install exothermic weld, mechanical, or compression-type connectors; or brazing.
2. Belowgrade Connections: Install exothermic weld or compression type connectors.
3. Remove paint, dirt, or other surface coverings at connection points to allow good metal-to-metal contact.
4. Notify Engineer prior to backfilling ground connections.

B. Exothermic Weld Type:

1. Wire brush or file contact point to bare metal surface.
2. Use welding cartridges and molds in accordance with manufacturer's recommendations.
3. Avoid using badly worn molds.
4. Mold to be completely filled with metal when making welds.
5. After completed welds have cooled, brush slag from weld area and thoroughly clean joint.

C. Compression Type:

1. Install in accordance with connector manufacturer's recommendations.
2. Install connectors of proper size for grounding conductors and ground rods specified.
3. Install using connector manufacturer's compression tool having proper sized dies and operate per manufacturer's instructions.

D. Mechanical Type:

1. Apply homogeneous blend of colloidal copper and rust and corrosion inhibitor before making connection.
2. Install in accordance with connector manufacturer's recommendations.
3. Do not conceal mechanical connections.

3.07 METAL STRUCTURE GROUNDING

A. Bond metal sheathing and exposed metal vertical structural elements to grounding system.

B. Bond electrical equipment supported by metal platforms to the platforms.

C. Provide electrical contact between metal frames and railings supporting pushbutton stations, receptacles, and instrument cabinets, and raceways carrying circuits to these devices.

3.08 TRANSFORMER GROUNDING

A. Bond neutrals of transformers within buildings to system ground network, and to any additional indicated grounding electrodes.

3.09 SURGE PROTECTION EQUIPMENT GROUNDING

A. Connect surge arrestor ground terminals to equipment ground bus.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): HB, Standard Specifications for Highway Bridges.
2. ASTM International (ASTM):
   a. A123/123M, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
   b. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   c. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   d. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
   e. D149, Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
3. Telecommunications Industry Association (TIA): 569B, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. National Electrical Contractor's Association, Inc. (NECA): Installation standards.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. C80.1, Electrical Rigid Steel Conduit (ERSC).
   c. C80.3, Steel Electrical Metallic Tubing (EMT).
   d. C80.5, Electrical Rigid Aluminum Conduit (ERAC).
   e. C80.6, Electrical Intermediate Metal Conduit (EIMC).
   f. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   g. TC 2, Electrical Polyvinyl Chloride (PVC) Conduit.
   h. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   i. TC 6, Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation.
   j. TC 14, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   k. VE 1, Metallic Cable Tray Systems.

6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. Underwriters Laboratories Inc. (UL):
    a. 1, Standard for Safety for Flexible Metal Conduit.
    b. 5, Standard for Safety for Surface Metal Raceways and Fittings.
    c. 6, Standard for Safety for Electrical Rigid Metal Conduit – Steel.
    d. 6A, Standard for Safety for Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless.
    e. 360, Standard for Safety for Liquid-Tight Flexible Steel Conduit.
    f. 514B, Standard for Safety for Conduit, Tubing, and Cable Fittings.
    g. 651, Standard for Safety for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
    h. 651A, Standard for Safety for Type EB and A Rigid PVC Conduit and HDPE Conduit.
    i. 797, Standard for Safety for Electrical Metallic Tubing – Steel.
    j. 870, Standard for Safety for Wireways, Auxiliary Gutters, and Associated Fittings.
    k. 1242, Standard for Safety for Electrical Intermediate Metal Conduit – Steel.
    l. 1660, Standard for Safety for Liquid-Tight Flexible Nonmetallic Conduit.
    m. 1684, Standard for Safety for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
    n. 2024, Standard for Safety for Optical Fiber and Communication Cable Raceway.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer’s Literature:
    a. Rigid galvanized steel conduit.
    b. Electric metallic tubing.
    c. PVC Schedule 40 conduit.
    d. PVC tubing (Type EB) conduit.
    e. PVC-coated rigid galvanized steel conduit, submittal to include copy of manufacturer’s warranty.
    f. Flexible metal, liquid-tight conduit.
    g. Flexible, nonmetallic, liquid-tight conduit.
    h. Flexible metal, nonliquid-tight conduit.
    i. Conduit fittings.
    j. Wireways.
    k. Surface metal raceway.

l. Junction and pull boxes used at or below grade.
m. Large junction and pull boxes.
n. Terminal junction boxes.

2. Equipment and machinery proposed for bending metal conduit.
3. Method for bending PVC conduit less than 30 degrees.
4. Conduit Layout:
   a. Provide drawings for conduit installations underground and concealed conduits including, but not limited to ductbanks, under floor slabs, concealed in floor slabs, and concealed in walls.
   b. Provide plan and section showing arrangement and location of conduit and duct bank required for:
      1) Low voltage feeder and branch circuits.
      2) Instrumentation and control systems.
   c. Electronic CAD; scale not greater than 1 inch equals 20 feet.

B. Informational Submittals: Manufacturer's certification of training for PVC-coated rigid galvanized steel conduit installer.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

B. PVC-Coated, Rigid Galvanized Steel Conduit Installer: Certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

PART 2 PRODUCTS

2.01 CONDUIT AND TUBING

A. Rigid Galvanized Steel Conduit (RGS):

1. Meet requirements of NEMA C80.1 and UL 6.
2. Material: Hot-dip galvanized with chromated protective layer.

B. Electric Metallic Tubing (EMT):

1. Meet requirements of NEMA C80.3 and UL 797.
2. Material: Hot-dip galvanized with chromated and lacquered protective layer.

C. PVC Schedule 40 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.

D. PVC Tubing (Type EB):

1. Meet requirements of NEMA TC 6 and UL 651A.
2. UL listed for reinforced concrete encasement and 90 degrees C insulated conductors.

E. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
   a. Meet requirements of NEMA C80.1 and UL 6.
   b. Exterior Finish: PVC coating, 40-mil nominal thickness; bond to metal shall have tensile strength greater than PVC.
   c. Interior finish: Urethane coating, 2-mil nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to interior or exterior coating.

F. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel with extruded PVC jacket.

G. Flexible Metal, Nonliquid-Tight Conduit:

1. Meet requirements of UL 1.
2. Material: Galvanized steel.

H. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Material: PVC core with fused flexible PVC jacket.
2. UL 1660 listed for:
   a. Dry Conditions: 80 degrees C insulated conductors.
   b. Wet Conditions: 60 degrees C insulated conductors.
3. Manufacturers and Products:
   a. Carlon; Carflex or X-Flex.
   b. T & B; Xtraflex LTC or EFC.

2.02 FITTINGS

A. Rigid Galvanized Steel Conduit:

1. General:
   a. Meet requirements of UL 514B.
   b. Type: Threaded, galvanized. Set screw and threadless compression fittings not permitted.
2. Bushing:
   a. Material: Malleable iron with integral insulated throat, rated for 150 degrees C.
   b. Manufacturers and Products:
      1) Appleton; Series BU-I.
      2) O-Z/Gedney; Type HB.
3. Grounding Bushing:
   a. Material: Malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs.
   b. Manufacturers and Products:
      1) Appleton; Series GIB.
      2) O-Z/Gedney; Type HBLG.
4. Conduit Hub:
   a. Material: Malleable iron with insulated throat with bonding screw.
   b. UL listed for use in wet locations.
   c. Manufacturers and Products:
      1) Appleton, Series HUB-B.
      2) O-Z/Gedney; Series CH.
      3) Meyers; ST Series.
5. Conduit Bodies:
   a. Sized as required by NFPA 70.
   b. Manufacturers and Products (For Normal Conditions):
      1) Appleton; Form 35 threaded unilets.
      2) Crouse-Hinds; Form 7 or Form 8 threaded condulets.
      3) Killark; Series O electrolets.
      4) Thomas & Betts; Form 7 or Form 8.
   c. Manufacturers (For Hazardous Locations):
      1) Appleton.
      2) Crouse-Hinds.
      3) Killark.
6. Couplings: As supplied by conduit manufacturer.
7. Unions:
   a. Concrete tight, hot-dip galvanized malleable iron.
   b. Manufacturers and Products:
      1) Appleton; Series SCC bolt-on coupling or Series EC three-piece union.
      2) O-Z/Gedney; Type SSP split coupling or Type 4 Series, three-piece coupling.

8. Conduit Sealing Fitting:
    a. Manufacturers and Products:
        1) Appleton; Type EYF, EYM, or ESU.
        2) Crouse-Hinds; Type EYS or EZS.
        3) Killark; Type EY or Type EYS.
9. Drain Seal:
    a. Manufacturers and Products:
        1) Appleton; Type EYD.
        2) Crouse-Hinds; Type EYD or Type EZD.
10. Drain/Breather Fitting:
    a. Manufacturers and Products:
        1) Appleton; Type ECDB.
        2) Crouse-Hinds; ECD.
11. Expansion Fitting:
    a. Manufacturers and Products:
        1) Deflection/Expansion Movement:
            a) Appleton; Type DF.
            b) Crouse-Hinds; Type XD.
        2) Expansion Movement Only:
            a) Appleton; Type XJ.
            b) Crouse-Hinds; Type XJ.
            c) Thomas & Betts; XJG-TP.
12. Cable Sealing Fitting:
    a. To form watertight nonslip cord or cable connection to conduit.
    b. For Conductors with OD of 1/2 inch or Less: Neoprene bushing at connector entry.
    c. Manufacturers and Products:
        1) Appleton; CG-S.
        2) Crouse-Hinds; CGBS.

B. Electric Metallic Tubing:

1. Meet requirements of UL 514B.
2. Type: Steel body and locknuts with steel or malleable iron compression nuts. Set screw and drive-on fittings not permitted.
3. Electro zinc-plated inside and out.
4. Raintight.
5. Coupling Manufacturers and Products:
    a. Appleton; Type 95T.
    b. Crouse-Hinds.
    c. Thomas & Betts.
6. Connector Manufacturers and Products:
    a. Appleton; Type ETP.
    b. Crouse-Hinds.
    c. Thomas & Betts.

C. PVC Conduit and Tubing:

1. Meet requirements of NEMA TC 3.
2. Type: PVC, slip-on.

D. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of UL 514B.
2. Fittings: Rigid galvanized steel type, PVC coated by conduit manufacturer.
3. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC coated by conduit manufacturer.
4. Finish: 40-mil PVC exterior, 2-mil urethane interior.
5. Overlapping pressure-sealing sleeves.
6. Conduit Hangers, Attachments, and Accessories: PVC-coated.
7. Manufacturers:
   a. Robroy Industries.
   b. Ocal.
8. Expansion Fitting:
   a. Manufacturer and Product: Ocal; OCAL-BLUE XJG.

E. Flexible Metal, Liquid-Tight Conduit:

1. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
2. Insulated throat and sealing O-rings.
3. Manufacturers and Products:
   a. Thomas & Betts; Series 5331.
   b. O-Z/Gedney; Series 4Q.

F. Flexible Metal, Nonliquid-Tight Conduit:

1. Meet requirements of UL 514B.
2. Body: Galvanized steel or malleable iron.
3. Throat: Nylon insulated.
4. 1-1/4-Inch Conduit and Smaller: One screw body.
5. 1-1/2-Inch Conduit and Larger: Two screw body.
6. Manufacturer and Product: Appleton; Series 7400.

G. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Meet requirements of UL 514B.
2. Type: High strength plastic body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.

3. Body/compression nut (gland) design to ensure high mechanical pullout strength and watertight seal.
4. Manufacturers and Products:
    a. Carlon; Type LT.
    b. O-Z/Gedney; Type 4Q-P.
    c. Thomas & Betts; Series 6300.

H. Watertight Entrance Seal Device:

1. New Construction:
    a. Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.
    b. Manufacturer and Product: O-Z/Gedney; Type FSK or Type WSK, as required.
2. Cored-Hole Application:
    a. Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.
    b. Manufacturer and Product: O-Z/Gedney; Series CSM.

2.03 OUTLET AND DEVICE BOXES

A. Sheet Steel: One-piece drawn type, zinc-plated or cadmium-plated.

B. Cast Metal:

1. Box: Malleable iron.
2. Cover: Gasketed, weatherproof, malleable iron, or cast ferrous metal, with stainless steel screws.
3. Hubs: Threaded.
4. Lugs: Cast Mounting.
5. Manufacturers and Products, Nonhazardous Locations:
    a. Crouse-Hinds; Type FS or Type FD.
    b. Appleton; Type FS or Type FD.
    c. Killark.
6. Manufacturers and Products, Hazardous Locations:
    a. Crouse-Hinds; Type GUA or Type EAJ.
    b. Appleton; Type GR.

C. Cast Aluminum:

1. Material:
    a. Box: Cast, copper-free aluminum.
    b. Cover: Gasketed, weatherproof, cast copper-free aluminum with stainless steel screws.
2. Hubs: Threaded.
3. Lugs: Cast mounting.

4. Manufacturers and Products, Nonhazardous Locations:
   a. Crouse-Hinds; Type FS-SA or Type FD-SA.
   b. Appleton; Type FS or Type FD.
   c. Killark.
5. Manufacturers and Products, Hazardous Locations:
   a. Crouse-Hinds; Type GUA-SA.
   b. Appleton; Type GR.

D. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
   a. Exterior Surfaces: 40-mil PVC.
   b. Interior Surfaces: 2-mil urethane.
4. Manufacturers:
   a. Robroy Industries.
   b. Ocal.

E. Nonmetallic:

1. Box: PVC.
2. Cover: PVC, weatherproof, with stainless steel screws.
3. Manufacturer and Product: Carlon; Type FS or Type FD, with Type E98 or Type E96 covers.

2.04 JUNCTION AND PULL BOXES

A. Outlet Box Used as Junction or Pull Box: As specified under Article Outlet and Device Boxes.

B. Conduit Bodies Used as Junction Boxes: As specified under Article Fittings.

2.05 METAL WIREWAYS

A. Meet requirements of UL 870.

B. Type: Steel-enclosed, lay-in type.

C. Cover: Hinged with friction latch.

D. Rating: Indoor.

E. Finish: Rust inhibiting phosphatizing primer and gray baked enamel.

F. Hardware: Plated to prevent corrosion; screws installed toward the inside protected by spring nuts or otherwise guarded to prevent wire insulation damage.

G. Knockouts: Without knockouts, unless otherwise indicated.

H. Manufacturers:

1. Circle AW.
2. Hoffman.
3. Square D.

2.06 ACCESSORIES

A. Identification Devices:

1. Raceway Tags:
   a. Material: Permanent, nonferrous metal.
   b. Shape: Round.
   c. Raceway Designation: Pressure stamped, embossed, or engraved.
   d. Tags relying on adhesives or taped-on markers not permitted.

B. Heat Shrinkable Tubing:

1. Material: Heat-shrinkable, cross-linked polyolefin.
2. Semi-flexible with meltable adhesive inner liner.
3. Color: Black.
4. Manufacturers:
   a. Raychem.
   b. 3M.

C. Wraparound Duct Band:

1. Material: Heat-shrinkable, cross-linked polyolefin, precoated with hot-melt adhesive.
2. Width: 50 mm minimum.
3. Manufacturer and Product: Raychem; Type TWDB.

PART 3 EXECUTION

3.01 GENERAL

A. Conduit and tubing sizes shown are based on use of copper conductors. Reference Section 26 05 05, Conductors, concerning conduit sizing for aluminum conductors.

B. Comply with NECA Installation Standards.

C. Crushed or deformed raceways not permitted.

D. Maintain raceway entirely free of obstructions and moisture.

E. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.

F. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.

G. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.

H. Group raceways installed in same area.

I. Proximity to Heated Piping: Install raceways minimum 12 inches from parallel runs.

J. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.

K. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.

L. Block Walls: Do not install raceways in same horizontal course or vertical cell with reinforcing steel.

M. Install watertight fittings in outdoor, underground, or wet locations.

N. Paint threads and cut ends, before assembly of fittings, galvanized conduit, PVC-coated galvanized conduit, or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.

O. Metal conduit shall be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.

P. Do not install raceways in concrete equipment pads, foundations, or beams without Engineer approval.

Q. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.

R. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.

3.02 REUSE OF EXISTING CONDUITS

A. Where Drawings indicate existing conduits may be reused, they may be reused only where they meet the following criteria.

1. Conduit is in useable condition with no deformation, corrosion, or damage to exterior surface.

2. Conduit is sized per the NEC.
3. Conduit is of the type specified in Contract Documents.
4. Conduit is supported as specified in Contract Documents.

B. Conduit shall be reamed with wire brush, then with a mandrel approximately 1/4 inch smaller than raceway inside diameter then cleaned prior to pulling new conductors.

3.03 CONDUIT APPLICATION

A. Diameter: Minimum 3/4 inch.

B. Exterior, Exposed: PVC-coated rigid galvanized steel.

C. Interior, Exposed: Rigid galvanized steel.

D. Interior, Concealed (Not Embedded in Concrete): Rigid galvanized steel.

E. Aboveground, Embedded in Concrete Walls, Ceilings, or Floors:

1. PVC Schedule 40.
2. Electric metallic tubing, for lighting and receptacle circuits only.

F. Direct Earth Burial: PVC-coated rigid galvanized steel.

G. Concrete-Encased Ductbank: PVC Schedule 40 for ac circuits, PVC-Coated, Rigid Galvanized Steel for dc circuits.

H. Under Slabs-On-Grade: PVC Schedule 40 for ac circuits, PVC-Coated, Rigid Galvanized Steel for dc circuits.

I. Transition from Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit.

J. Under Equipment Mounting Pads: Rigid galvanized steel conduit.

K. Corrosive Areas: PVC Schedule 40.

3.04 FLEXIBLE CONNECTIONS

A. For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other locations approved by Engineer where flexible connection is required to minimize vibration:

1. Conduit Size 4 Inches or Less: Flexible, liquid-tight conduit.
2. Conduit Size Over 4 Inches: Nonflexible.

3. Wet or Corrosive Areas: Flexible, nonmetallic or flexible metal liquid-tight.
4. Dry Areas: Flexible, metallic liquid-tight.

B. Suspended Lighting Fixtures in Dry Areas: Flexible steel, nonliquid-tight conduit.

C. Outdoor Areas, Process Areas Exposed to Moisture, and Areas Required to be Oiltight and Dust-Tight: Flexible metal, liquid-tight conduit.

D. Flexible Conduit Length: 18 inches minimum, 60 inches maximum; sufficient to allow movement or adjustment of equipment.

3.05 PENETRATIONS

A. Make at right angles, unless otherwise shown.

B. Notching or penetration of structural members, including footings and beams, not permitted.

C. Fire-Rated Walls, Floors, or Ceilings: Firestop openings around penetrations to maintain fire-resistance rating.

D. Apply heat shrinkable tubing or single layer of wraparound duct band to metallic conduit protruding through concrete floor slabs to a point 2 inches above and 2 inches below concrete surface.

E. Concrete Walls, Floors, or Ceilings (Aboveground): Provide nonshrink grout dry-pack, or use watertight seal device.

F. Entering Structures:

1. General: Seal raceway at first box or outlet with oakum or expandable plastic compound to prevent entrance of gases or liquids from one area to another.
2. Concrete Roof or Membrane Waterproofed Wall or Floor:
   a. Provide a watertight seal.
   b. Without Concrete Encasement: Install watertight entrance seal device on each side.
   c. With Concrete Encasement: Install watertight entrance seal device on accessible side.
   d. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
   e. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

3. Heating, Ventilating, and Air Conditioning Equipment:
    a. Penetrate equipment in area established by manufacturer.
    b. Terminate conduit with flexible metal conduit at junction box or condulet attached to exterior surface of equipment prior to penetrating equipment.
4. Corrosive-Sensitive Areas:
    a. Seal conduit passing through chlorine room walls.
    b. Seal conduit entering equipment panel boards and field panels containing electronic equipment.
5. Existing or Precast Wall (Underground): Core drill wall and install watertight entrance seal device.
6. Nonwaterproofed Wall or Floor (Underground, without Concrete Encasement):
    a. Provide Schedule 40 galvanized pipe sleeve, or watertight entrance seal device.
    b. Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint, on each side.

3.06 SUPPORT

A. Support from structural members only, at intervals not exceeding NFPA 70 requirements. Do not exceed 10 feet in any application. Do not support from piping, pipe supports, or other raceways.

B. Multiple Adjacent Raceways: Provide ceiling trapeze.

C. Application/Type of Conduit Strap:

1. Aluminum Conduit: Aluminum or stainless steel.
2. Rigid Steel or EMT Conduit: Zinc coated steel, pregalvanized steel or malleable iron.
3. PVC-Coated Rigid Steel Conduit: PVC-coated metal.
4. Nonmetallic Conduit: Nonmetallic or PVC-coated metal.

D. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:

1. Wood: Wood screws.
2. Hollow Masonry Units: Toggle bolts.
3. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
4. Steelwork: Machine screws.
5. Location/Type of Hardware:
    a. Dry, Noncorrosive Areas: Galvanized.
    b. Wet, Noncorrosive Areas: Stainless steel.
    c. Corrosive Areas: Stainless steel.

E. Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

3.07 BENDS

A. Install concealed raceways with a minimum of bends in the shortest practical distance.

B. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.

C. Install with symmetrical bends or cast metal fittings.

D. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.

E. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.

F. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run, and raceways are same size.

G. PVC Conduit:

1. Bends 30 Degrees and Larger: Provide factory-made elbows.
2. 90-Degree Bends: Provide rigid steel elbows, PVC-coated where direct buried.
3. Use manufacturer’s recommended method for forming smaller bends.

H. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

3.08 EXPANSION/DEFLECTION FITTINGS

A. Provide on raceways at structural expansion joints and in long tangential runs.

B. Provide expansion/deflection joints for 50 degrees F maximum temperature variation.

C. Install in accordance with manufacturer’s instructions.

3.09 PVC CONDUIT

A. Solvent Welding:

1. Apply manufacturer recommended solvent to joints.
2. Install in order that joint is watertight.

B. Adapters:

1. PVC to Metallic Fittings: PVC terminal type.
2. PVC to Rigid Metal Conduit or IMC: PVC female adapter.

C. Belled-End Conduit: Bevel unbelled end of joint prior to joining.

3.10 PVC-COATED RIGID STEEL CONDUIT

A. Install in accordance with manufacturer’s instructions.

B. Tools and equipment used in cutting, bending, threading and installation of PVC-coated rigid conduit shall be designed to limit damage to PVC coating.

C. Provide PVC boot to cover exposed threading.

3.11 WIREWAYS

A. Install in accordance with manufacturer’s instructions.

B. Locate with cover on accessible vertical face of wireway, unless otherwise shown.

C. Applications:

1. Metal wireway in indoor dry locations.
2. Nonmetallic wireway in indoor wet, outdoor, and corrosive locations.

3.12 TERMINATION AT ENCLOSURES

A. Cast Metal Enclosure: Install manufacturer’s premolded insulating sleeve inside metallic conduit terminating in threaded hubs.

B. Nonmetallic, Cabinets, and Enclosures:

1. Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
2. Metallic Conduit: Provide ground terminal for connection to maintain continuity of ground system.

C. Sheet Metal Boxes, Cabinets, and Enclosures:

1. General:
   a. Install insulated bushing on ends of conduit where grounding is not required.
   b. Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
   c. Utilize sealing locknuts or threaded hubs on sides and bottom of NEMA 3R and NEMA 12 enclosures.
   d. Terminate conduits at threaded hubs at the tops of NEMA 3R and NEMA 12 boxes and enclosures.
   e. Terminate conduits at threaded conduit hubs at NEMA 4 and NEMA 4X boxes and enclosures.
2. Rigid Galvanized, Intermediate, or Aluminum Conduit:
   a. Provide one lock nut each on inside and outside of enclosure.
   b. Install grounding bushing at source enclosure.
   c. Provide bonding jumper from grounding bushing to equipment ground bus or ground pad.
3. Electric Metallic Tubing: Provide gland compression, insulated connectors.
4. Flexible Metal Conduit: Provide two screw type, insulated, malleable iron connectors.
5. Flexible, Nonmetallic Conduit: Provide nonmetallic, liquid-tight strain relief connectors.
6. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.
7. PVC Schedule 40 Conduit: Provide PVC terminal adapter with lock nut, except where threaded hubs required above.

3.13 UNDERGROUND RACEWAYS

A. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.

B. Cover: Maintain minimum 2-foot cover above conduit and concrete encasement, unless otherwise shown.

C. Make routing changes as necessary to avoid obstructions or conflicts.

D. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.

E. Union type fittings not permitted.

F. Spacers:

1. Provide preformed, nonmetallic spacers designed for such purpose, to secure and separate parallel conduit runs in a trench or concrete encasement.
2. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.

G. Support conduit so as to prevent bending or displacement during backfilling or concrete placement.

H. Transition from Underground to Exposed: PVC-coated rigid steel conduit.

I. Installation with Other Piping Systems:

1. Crossings: Maintain minimum 12-inch vertical separation.
2. Parallel Runs: Maintain minimum 12-inch separation.
3. Installation over valves or couplings not permitted.

J. Provide expansion fittings that allow minimum of 4 inches of movement in vertical conduit runs from underground where exposed conduit will be fastened to or will enter building or structure.

K. Provide expansion/deflection fittings in conduit runs that exit building or structure belowgrade. Conduit from building wall to fitting shall be PVC-coated rigid steel.

3.14 UNDER SLAB RACEWAYS

A. Make routing changes as necessary to avoid obstructions or conflicts.

B. Support raceways so as to prevent bending or displacement during backfilling or concrete placement.

C. Install raceways with no part embedded within slab and with no interference with slab on grade construction.

D. Raceway spacing, in a single layer or multiple layers:

1. 3 inches clear between adjacent 2-inch or larger raceway.
2. 2 inches clear between adjacent 1-1/2-inch or smaller raceway.

E. Individual Raceways and Single Layer Multiple Raceways: Install at lowest elevation of backfill zone with spacing as specified herein. Where conduits cross at perpendicular orientation, installation of conduits shall not interfere with placement of under slab fill that meets compaction and void limitations of earthwork specifications.

F. Under slab raceways that emerge from below slab to top of slab as exposed, shall be located to avoid conflicts with structural slab rebar. Coordinate raceway stub ups with location of structural rebar.

G. Fittings:

1. Union type fittings are not permitted.
2. Provide expansion/deflection fittings in raceway runs that exit building or structure below slab. Locate fittings 18 inches, maximum, beyond exterior wall. Raceway type between building exterior wall to fitting shall be PVC-coated rigid steel.
3. Couplings: In multiple raceway runs, stagger so couplings in adjacent runs are not in same traverse line.

3.15 OUTLET AND DEVICE BOXES

A. General:

1. Install plumb and level.
2. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.
3. Open no more knockouts in sheet steel device boxes than are required; seal unused openings.
4. Install galvanized mounting hardware in industrial areas.

B. Size:

1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
   a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.
2. Ceiling Outlet: Minimum 4-inch octagonal device box, unless otherwise required for installed fixture.
3. Switch and Receptacle: Minimum 2-inch by 4-inch device box.

C. Locations:

1. Drawing locations are approximate.
2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by Engineer.
3. Light Fixture: Install in symmetrical pattern according to room layout, unless otherwise shown.

D. Mounting Height:

1. General:
    a. Dimensions given to centerline of box.
    b. Where specified heights do not suit building construction or finish, adjust up or down to avoid interference.
    c. Do not straddle CMU block or other construction joints.
2. Convenience Receptacle:
    a. General Interior Areas: 15 inches above floor.
    b. General Interior Areas (Counter Tops): Install device plate bottom or side flush with top of backsplash, or 6 inches above counter tops without backsplash.
    c. Industrial Areas, Workshops: 48 inches above floor.
    d. Outdoor Areas: 24 inches above finished grade.
3. Switch, Motor Starting: 48 inches above floor, unless otherwise indicated on Drawings.

E. Flush Mounted:

1. Install with concealed conduit.
2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.
3. Holes in surrounding surface shall be no larger than required to receive box.

F. Supports:

1. Support boxes independently of conduit by attachment to building structure or structural member.
2. Install bar hangers in frame construction or fasten boxes directly as follows:
    a. Wood: Wood screws.
    b. Concrete or Brick: Bolts and expansion shields.
    c. Hollow Masonry Units: Toggle bolts.
    d. Steelwork: Machine screws.
3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
4. Provide plaster rings where necessary.
5. Boxes embedded in concrete or masonry need not be additionally supported.

G. Install separate junction boxes for flush or recessed lighting fixtures where required by fixture terminal temperature.

H. Boxes Supporting Fixtures: Provide means of attachment with adequate strength to support fixture.

3.16 JUNCTION AND PULL BOXES

A. General:

1. Install plumb and level.
2. Installed boxes shall be accessible.
3. Do not install on finished surfaces.
4. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.
5. Use conduit bodies as junction and pull boxes where no splices are required and allowed by applicable codes.
6. Install pull boxes where necessary in raceway system to facilitate conductor installation.
7. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.
8. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

B. Flush Mounted:

1. Install with concealed conduit.
2. Holes in surrounding surface shall be no larger than required to receive box.
3. Make edges of boxes flush with final surface.

C. Mounting Hardware:

1. Noncorrosive Dry Areas: Galvanized.
2. Noncorrosive Wet Areas: Stainless steel.
3. Corrosive Areas: Stainless steel.

D. Supports:

1. Support boxes independently of conduit by attachment to building structure or structural member.
2. Install bar hangers in frame construction or fasten boxes directly as follows:
   a. Wood: Wood screws.
   b. Concrete or Brick: Bolts and expansion shields.
   c. Hollow Masonry Units: Toggle bolts.
   d. Steelwork: Machine screws.
3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
4. Boxes embedded in concrete or masonry need not be additionally supported.

E. At or Below Grade:

1. Install boxes for below grade conduit flush with finished grade in locations outside of paved areas, roadways, or walkways.
2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
3. Obtain Engineer's written acceptance prior to installation in paved areas, roadways, or walkways.
4. Use boxes and covers suitable to support anticipated weights.

3.17 EMPTY RACEWAYS

A. Provide permanent, removable cap over each end.

B. Provide PVC plug with pull tab for underground raceways with end bells.

C. Provide nylon pull cord.

D. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

3.18 IDENTIFICATION DEVICES

A. Raceway Tags:

1. Identify origin and destination.
2. For exposed raceways, install tags at each terminus, near midpoint, and at minimum intervals of every 50 feet, whether in ceiling space or surface mounted.
3. Install tags at each terminus for concealed raceways.
4. Provide noncorrosive wire for attachment.

3.19 PROTECTION OF INSTALLED WORK

A. Protect products from effects of moisture, corrosion, and physical damage during construction.

B. Provide and maintain manufactured watertight and dust-tight seals over conduit openings during construction.

C. Touch up painted conduit threads after assembly to cover nicks or scars.

D. Touch up coating damage to PVC-coated conduit with patching compound approved by manufacturer. Compound shall be kept refrigerated according to manufacturers' instructions until time of use.

END OF SECTION

SECTION 26 05 70
ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C57.12.00, Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   b. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
   c. 399, Recommended Practice for Industrial and Commercial Power System Analysis.
   d. 1584, Guide for Performing Arc Flash Hazard Calculations.
3. National Electrical Manufacturers Association (NEMA): Z535.4, Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70E, Standard for Electrical Safety in the Workplace.
5. Occupational Safety and Health Standards (OSHA): 29 CFR, Part 1910 Subpart S, Electrical.

1.02 SUBMITTALS

A. Action Submittals:

1. Short circuit study.
2. Protective Device Coordination Study: Submit within 60 days after approval of short circuit study.
3. Arc flash study.
4. Arc flash warning labels.

1.03 QUALITY ASSURANCE

A. Short circuit, protective device coordination, and arc flash studies shall be prepared by a professional electrical engineer registered in the State of Florida.

1.04 SEQUENCING AND SCHEDULING

A. Initial complete short circuit study shall be submitted, reviewed, and approved before the Engineer will approve Shop Drawings for any electrical equipment such as pump control panels, panelboards, transformers, transfer switches, etc.

B. Initial complete protective device coordination and arc flash studies shall be submitted within 60 days after approval of initial short circuit study.

C. Revised short circuit, protective device coordination, and arc flash studies, and arc flash labels shall be submitted 30 days before energizing electrical equipment.

D. Final short circuit, protective device coordination, and arc flash studies shall be completed prior to Project Substantial Completion. Final version of study shall include as-installed equipment, materials, and parameter data or settings entered into equipment based on study.

E. Submit final arc flash labels described herein and in compliance with NEMA Z535.4 prior to Project Substantial Completion.

1.05 GENERAL STUDY REQUIREMENTS

A. Equipment and component titles used in the studies shall be identical to equipment and component titles shown on Drawings.

B. Perform studies using one of the following electrical engineering software packages:

1. SKM Power Tools for Windows.
2. ETAP.
3. EDSA.
4. Easy Power.

C. Perform complete fault calculations for each proposed source combination.

1. Source combination may include present and future power company supply circuits, large motors, or generators.

D. Utilize proposed and existing information obtained from Contract Documents. However, it is expected that neither the Contract documents nor the existing design documents that are available will contain all of the information that will be required to perform the specified studies. Therefore, the Contractor may need to perform extensive field investigations to obtain any information that may not be available in either the Contract Documents. All labor required to perform the field investigations shall be included in the Bid Price provided by the Contractor.

E. Existing System and Equipment:

1. Extent of existing system to be incorporated within the studies shall include all of the existing system and all new equipment provided as part of this project.
2. Include fault contribution of existing motors and equipment in study.
3. Include impedance elements that affect new system and equipment.
4. Include protective devices in series with new equipment.

F. Device coordination time-current curves for low voltage distribution system; include individual protective device time-current characteristics.

1.06 SHORT CIRCUIT STUDY

A. General:

1. Prepare in accordance with IEEE 399.
2. Use cable impedances based on copper conductors, except where aluminum conductors are specified or shown.
3. Use bus impedances based on copper bus bars, except where aluminum bus bars are specified or shown.
4. Use cable and bus resistances calculated at 25 degrees C.
5. Use medium-voltage cable reactances based on use of typical dimensions of shielded cables with 133 percent insulation levels.
6. Use 600-volt cable reactances based on use of typical dimensions of THHN/THWN conductors.
7. Use transformer impedances 92.5 percent of “nominal” impedance based on tolerances specified in IEEE C57.12.00.

B. Provide:

1. Calculation methods and assumptions.
2. Typical calculation.
3. Tabulations of calculated quantities.
4. Results, conclusions, and recommendations.
5. Selected base per unit quantities.
6. One-line diagrams.
7. Source impedance data, including electric utility system and motor fault contribution characteristics.
8. Impedance diagrams.
9. Zero-sequence impedance diagrams.

C. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault at each:

1. Electric utility’s supply termination point.
2. Service entrance rated manual transfer switch.

3. Pump control panel.
4. Branch circuit panelboards.
5. Future load contributions as shown on one-line diagram.

D. Provide bolted line-to-ground fault current study for areas as defined for three-phase bolted fault short circuit study.

E. Provide bolted line-to-line fault current study for areas as defined for three-phase bolted fault short circuit study.

F. Verify:

1. Equipment and protective devices are applied within their ratings.
2. Adequacy of all new electrical equipment to withstand short circuit stresses.
3. Adequacy of transformer windings to withstand short circuit stresses.
4. Cable and busway sizes for ability to withstand short circuit heating, in addition to normal load currents.

G. Tabulations:

1. General Data:
   a. Short circuit reactances of rotating machines.
   b. Cable and conduit material data.
   c. Bus data.
   d. Transformer data.
   e. Circuit resistance and reactance values.
2. Short Circuit Data (for each source combination):
   a. Fault impedances.
   b. X to R ratios.
   c. Asymmetry factors.
   d. Motor contributions.
   e. Short circuit kVA.
   f. Symmetrical and asymmetrical fault currents.
3. Equipment Evaluation:
   a. Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
   b. Maximum fault current available.

H. Written Summary:

1. Scope of studies performed.
2. Explanation of bus and branch numbering system.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of short circuit study.
6. Comments or suggestions.

I. Suggest changes and additions to equipment rating and/or characteristics.

J. Notify Engineer in writing of existing circuit protective devices improperly rated for new fault conditions.

K. Revise data for “as-installed” condition.

1.07 PROTECTIVE DEVICE COORDINATION STUDY

A. General:

1. Prepare in accordance with IEEE 242.
2. Proposed protective device coordination time-current curves for distribution system, graphically displayed on conventional log-log curve sheets.
    a. Provide separate curve sheets for phase and ground fault coordination for each scenario.
    b. Each curve sheet to have title and one-line diagram that applies to specific portion of system associated with time-current curves on that sheet. Limit number of devices shown to four to six.
    c. Identify device associated with each curve by manufacturer type, function, and, if applicable, recommended tap, time delay, instantaneous and other settings recommended.
    d. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
    e. Apply motor protection methods that comply with NFPA 70.

B. Plot Characteristics on Curve Sheets:

1. Electric utility’s relays.
2. Electric utility’s fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands.
3. Medium-voltage equipment relays.
4. Medium-voltage and low-voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands.
5. Low-voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
6. Pertinent transformer full-load currents at 100 percent.
7. Transformer magnetizing inrush currents.
8. Transformer damage curves; appropriate for system operation and location.
9. ANSI transformer withstand parameters.
10. Significant symmetrical and asymmetrical fault currents.
11. Motor overload relay settings for motors 40 horsepower and greater.

12. Ground fault protective device settings.
13. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center.

C. Primary Protective Device Settings for Delta-Wye Connected Transformer:

1. Secondary Line-to-Ground Fault Protection: Primary protective device operating band within transformer's characteristics curve, including a point equal to 58 percent of IEEE C57.12.00 withstand point.
2. Secondary Line-To-Line Faults: 16 percent current margin between primary protective device and associated secondary device characteristic curves.

D. Separate medium voltage relay characteristics curves from curves for other devices by at least 0.4-second time margin.

E. Tabulate Recommended Protective Device Settings:

1. Relays:
   a. Current tap.
   b. Time dial.
   c. Instantaneous pickup.
   d. Electronic settings data file.
2. Circuit Breakers:
   a. Adjustable pickups.
   b. Adjustable time-current characteristics.
   c. Adjustable time delays.
   d. Adjustable instantaneous pickups.
   e. I^2t In/Out.
   f. Zone interlocking.
   g. Electronic settings data file.

F. Written Summary:

1. Scope of studies performed.
2. Summary of protective device coordination methodology.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of coordination study.
6. Appendix of complete relay and circuit breaker electronic setting files, submit electronic data files from manufacturer's software.
7. Comments or suggestions.

1.08 ARC FLASH STUDY

A. Perform arc flash hazard study after short circuit and protective device coordination study has been completed, reviewed and accepted.

B. Perform arc flash study in accordance with NFPA 70E, OSHA 29 CFR, Part 1910 Subpart S, and IEEE 1584.

C. Base Calculation: For each major part of electrical power system, determine the following:

1. Flash hazard protection boundary.
2. Limited approach boundary.
3. Restricted approach boundary.
4. Prohibited approach boundary.
5. Incident energy level.
6. Personal protection equipment (PPE) hazard/risk category.
7. Type of PPE required.

D. Produce arc flash warning labels that list items in Paragraph Base Calculation and the following additional items.

1. Bus name.
2. Bus voltage.

E. Produce bus detail sheets that list items in Paragraph Base Calculation and the following additional items:

1. Bus name.
2. Upstream protective device name, type, and settings.
3. Bus line-to-line voltage.

F. Produce arc flash evaluation summary sheet listing the following additional items:

1. Bus name.
2. Upstream protective device name, type, settings.
3. Bus line-to-line voltage.
4. Bus bolted fault.
5. Protective device bolted fault current.
6. Arcing fault current.
7. Protective device trip/delay time.
8. Breaker opening time.
9. Solidly grounded column.
10. Equipment type.
11. Gap.
12. Arc flash boundary.
13. Working distance.
14. Incident energy.
15. Required protective fire rated clothing type and class.

G. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 40 cal/cm2. Propose approaches to reduce energy levels.

H. Prepare report summarizing arc flash study with conclusions and recommendations which may affect integrity of electric power distribution system. As a minimum, include the following:

1. Equipment manufacturer's information used to prepare study.
2. Assumptions made during study.
3. Reduced copy of one-line drawing; 11 inches by 17 inches maximum.
4. Arc flash evaluations summary spreadsheet.
5. Bus detail sheets.
6. Arc flash warning labels printed in color on adhesive backed labels.

PART 2 PRODUCTS

2.01 ARC FLASH WARNING LABELS

A. Printed in multicolor on adhesive backed labels. An example label is located following end of section in Figure 1.

PART 3 EXECUTION

3.01 GENERAL

A. Adjust relay and protective device settings according to values established by coordination study.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Engineer in writing of required major equipment modifications.

D. Provide laminated one-line diagrams (minimum size 11 inches by 17 inches) to post on interior of electrical room doors.

E. Provide arc flash warning labels on equipment as specified in this section.

3.02 SUPPLEMENTS

A. The supplement listed below, following "End of Section," is a part of this Specification:

1. Figure 1: Example Arc Flash Label.

END OF SECTION

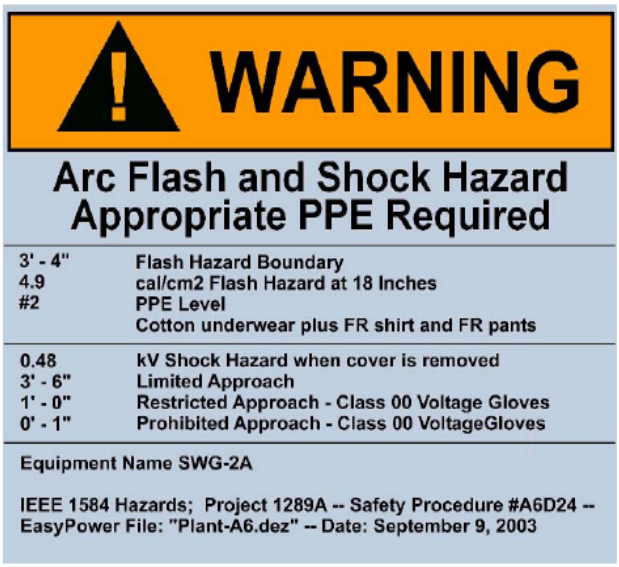


Figure 1
Example Arc Flash Label

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
   b. D923, Standard Practice for Sampling Electrical Insulating Liquids.
   c. D924, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
   d. D971, Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
   e. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
   f. D1298, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
   g. D1500, Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
   h. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
   i. D1533, Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
   j. D1816, Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VDE Electrodes.
2. Institute of Electrical and Electronics Engineers (IEEE):
   a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.
   b. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminators Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5kV through 500kV.
   c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   d. 95, Recommended Practice for Insulation Testing of AC Electric Machinery (2300V and Above) with High Direct Voltage.
   e. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.

f. 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems.
g. 450, Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
h. C2, National Electrical Safety Code.
i. C37.20.1, Standard for Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.
j. C37.20.2, Standard for Metal-Clad Switchgear.
k. C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear.
l. C37.23, Standard for Metal-Enclosed Bus.
m. C62.33, Standard Test Specifications for Varistor Surge-Protective Devices.

3. Insulated Cable Engineers Association (ICEA):
   a. S-93-639, 5-46 kV Shielded Power Cables for Use in the Transmission and Distribution of Electric Energy.
   b. S-94-649, Concentric Neutral Cables Rated 5 through 46 kV.
   c. S-97-682, Standard for Utility Shielded Power Cables Rated 5 through 46 kV.
4. National Electrical Manufacturers Association (NEMA):
   a. AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
   b. PB 2, Deadfront Distribution Switchboards.
   c. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
5. InterNational Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70B, Recommended Practice for Electrical Equipment Maintenance.
   c. 70E, Standard for Electrical Safety in the Workplace.
   d. 101, Life Safety Code.
7. National Institute for Certification in Engineering Technologies (NICET).
8. Occupational Safety and Health Administration (OSHA): CFR 29, Part 1910, Occupational Safety and Health Standards.

1.02 SUBMITTALS

A. Informational Submittals:

1. Submit 30 days prior to performing inspections or tests:
   a. Schedule for performing inspection and tests.

b. List of references to be used for each test.
c. Sample copy of equipment and materials inspection form(s).
d. Sample copy of individual device test form.
e. Sample copy of individual system test form.

2. Energization Plan: Prior to initial energization of electrical distribution equipment; include the following:
   a. Owner's representative sign-off form for complete and accurate arc flash labeling and proper protective device settings for equipment to be energized.
   b. Staged sequence of initial energization of electrical equipment.
   c. Lock-Out-Tag-Out plan for each stage of the progressive energization.
   d. Barricading, signage, and communication plan notifying personnel of newly energized equipment.
3. Submit test or inspection reports and certificates for each electrical item tested within 30 days after completion of test:
4. Operation and Maintenance Data:
   a. In accordance with Section 01 78 23, Operation and Maintenance Data.
   b. After test or inspection reports and certificates have been reviewed by Engineer and returned, insert a copy of each in Operation and Maintenance Manual.
5. Programmable Settings: At completion of Performance Demonstration Test, submit final hardcopy printout and electronic files on compact disc of as-left setpoints, programs, and device configuration files for:
   a. Protective relays.
   b. Intelligent overload relays.
   c. Variable frequency drives.
   d. Power metering devices.
   e. Uninterruptible power supplies.
   f. Electrical communications modules.

1.03 QUALITY ASSURANCE

A. Testing Firm Qualifications:

1. Corporately and financially independent organization functioning as an unbiased testing authority.
2. Professionally independent of manufacturers, suppliers, and installers of electrical equipment and systems being tested.
3. Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
4. Supervising engineer accredited as Certified Electrical Test Technologist by NICET or NETA and having a minimum of 5 years' testing experience on similar projects.
5. Technicians certified by NICET or NETA.

6. Assistants and apprentices assigned to Project at ratio not to exceed two certified to one noncertified assistant or apprentice.
7. Registered Professional Engineer to provide comprehensive Project report outlining services performed, results of such services, recommendations, actions taken, and opinions.
8. In compliance with OSHA CFR 29, Part 1910.7 criteria for accreditation of testing laboratories or a full member company of NETA.

B. Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.

C. Test instrument calibration shall be in accordance with NETA ATS.

1.04 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment listed herein has been installed.

B. Perform tests with apparatus de-energized whenever feasible.

C. Inspection and electrical tests on energized equipment shall be:

1. Scheduled with Engineer prior to de-energization.
2. Minimized to avoid extended period of interruption to the operating plant equipment.

D. Notify Engineer at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Perform tests in accordance with requirements of Section 01 91 14, Equipment Testing and Facility Startup.

B. Tests and inspections shall establish:

1. Electrical equipment is operational within industry and manufacturer’s tolerances and standards.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, NFPA 101, and IEEE C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Set, test, and calibrate protective relays, circuit breakers, fuses, and other applicable devices in accordance with values established by the short circuit, and protective device coordination, and harmonics studies as specified in Section 26 05 70, Electrical Systems Analysis.

E. Adjust mechanisms and moving parts of equipment for free mechanical movement.

F. Adjust and set electromechanical electronic relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

G. Verify nameplate data for conformance to Contract Documents and approved Submittals.

H. Realign equipment not properly aligned and correct unlevelness.

I. Properly anchor electrical equipment found to be inadequately anchored.

J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer's recommendations, or as otherwise specified in NETA ATS.

K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

L. Provide proper lubrication of applicable moving parts.

M. Inform Engineer of working clearances not in accordance with NFPA 70.

N. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

O. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by Engineer, door and panel sections having dented surfaces.
5. Repair or replace, as determined by Engineer, poor fitting doors and panel sections.

6. Repair or replace improperly operating latching, locking, or interlocking devices.
7. Replace missing or damaged hardware.
8. Finish:
    a. Provide matching paint and touch up scratches and mars.
    b. If required because of extensive damage, as determined by Engineer, refinish entire assembly.

P. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents or approved Submittals.

3.02 CHECKOUT AND STARTUP

A. Voltage Field Test:

1. Check voltage at point of termination of power company supply system to Project when installation is essentially complete and is in operation.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. Record supply voltage (all three phases simultaneously on same graph) for 24 hours during normal working day.
    a. Submit Voltage Field Test Report within 5 days of test.
4. Unbalance Corrections:
    a. Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
    b. Obtain written certification from responsible power company official that voltage variations and unbalance are within their normal standards if corrections are not made.

B. Equipment Line Current Tests:

1. Check line current in each phase for each piece of equipment.
2. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
3. If phase current for a piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

3.03 PANELBOARDS

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
2. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
3. Check panelboard mounting, area clearances, and alignment and fit of components.
4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
5. Perform visual and mechanical inspection for overcurrent protective devices.

B. Electrical Tests: Include the following items performed in accordance with manufacturer's instruction:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Each phase of each bus section.
   c. Phase-to-phase and phase-to-ground for 1 minute.
   d. With breakers open.
   e. With breakers closed.
   f. Control wiring except that connected to solid state components.
   g. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Ground continuity test ground bus to system ground.

3.04 DRY TYPE TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Physical and insulator damage.
2. Proper winding connections.
3. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
4. Defective wiring.
5. Proper operation of fans, indicators, and auxiliary devices.
6. Removal of shipping brackets, fixtures, or bracing.
7. Free and properly installed resilient mounts.
8. Cleanliness and improper blockage of ventilation passages.

9. Verify tap-changer is set at correct ratio for rated output voltage under normal operating conditions.
10. Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.5 for each:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Test Duration: 10 minutes with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
   c. Results temperature corrected in accordance with NETA ATS, Table 100.14.
   d. Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
   e. Insulation resistance test results to compare within 1 percent of adjacent windings.
2. Perform tests and adjustments for fans, controls, and alarm functions as suggested by manufacturer.

3.05 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect each individual exposed power cable No. 4 and larger for:
   a. Physical damage.
   b. Proper connections in accordance with single-line diagram.
   c. Cable bends not in conformance with manufacturer’s minimum allowable bending radius where applicable.
   d. Color coding conformance with specification.
   e. Proper circuit identification.
2. Mechanical Connections For:
   a. Proper lug type for conductor material.
   b. Proper lug installation.
   c. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
3. Shielded Instrumentation Cables For:
   a. Proper shield grounding.
   b. Proper terminations.
   c. Proper circuit identification.

4. Control Cables For:
    a. Proper termination.
    b. Proper circuit identification.
5. Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests for Conductors No. 4 and Larger:

1. Insulation Resistance Tests:
    a. Utilize 1,000-volt dc megohmmeter for 600-volt insulated conductors.
    b. Test each conductor with respect to ground and to adjacent conductors for 1 minute.
    c. Evaluate ohmic values by comparison with conductors of same length and type.
    d. Investigate values less than 50 megohms.
2. Continuity test by ohmmeter method to ensure proper cable connections.

C. Low-voltage cable tests may be performed by installer in lieu of independent testing firm.

3.06 SAFETY SWITCHES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Proper blade pressure and alignment.
2. Proper operation of switch operating handle.
3. Adequate mechanical support for each fuse.
4. Proper contact-to-contact tightness between fuse clip and fuse.
5. Cable connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Proper phase barrier material and installation.
7. Verify fuse sizes and types correspond to one-line diagram or approved Submittals.
8. Perform mechanical operational test and verify electrical and mechanical interlocking system operation and sequencing.

B. Electrical Tests:

1. Insulation Resistance Tests:
    a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
    b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
    c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.

2. Contact Resistance Tests:
    a. Contact resistance in microhms across each switch blade and fuse holder.
    b. Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3.07 MOLDED AND INSULATED CASE CIRCUIT BREAKERS

A. General: Inspection and testing limited to circuit breakers rated 70 amperes and larger and to motor circuit protector breakers rated 50 amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.
2. Proper conductor size.
3. Feeder designation according to nameplate and one-line diagram.
4. Cracked casings.
5. Connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Operate breaker to verify smooth operation.
7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:

1. Insulation Resistance Tests:
    a. Utilize 1,000-volt dc megohmmeter for 480-volt and 600-volt circuit breakers and 500-volt dc megohmmeter for 240-volt circuit breakers.
    b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
    c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
    d. Test values to comply with NETA ATS, Table 100.1.
2. Contact Resistance Tests:
    a. Contact resistance in microhms across each pole.
    b. Investigate deviation of 50 percent or more from adjacent poles and similar breakers.
3. Primary Current Injection Test to Verify:
    a. Long-time minimum pickup and delay.
    b. Short-time pickup and delay.
    c. Ground fault pickup and delay.
    d. Instantaneous pickup by run-up or pulse method.

e. Trip characteristics of adjustable trip breakers shall be within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
f. Trip times shall be within limits established by NEMA AB 4, Table 5-3. Alternatively, use NETA ATS, Table 100.7.
g. Instantaneous pickup value shall be within values established by NEMA AB 4, Table 5-4. Alternatively, use NETA ATS, Table 100.8.

3.08 PROTECTIVE RELAYS

A. Visual and Mechanical Inspection:

1. Visually check each relay for:
   a. Tight cover gasket and proper seal.
   b. Unbroken cover glass.
   c. Condition of spiral spring and contacts.
   d. Disc clearance.
   e. Condition of case shorting contacts if present.
2. Mechanically check each relay for:
   a. Freedom of movement.
   b. Proper travel and alignment.
3. Verify each relay:
   a. Complies with Contract Documents, approved Submittal, and application.
   b. Is set in accordance with recommended settings from Coordination Study.

B. Electrical Tests:

1. Insulation resistance test on each circuit to frame, except for solid state devices.
2. Test on nominal recommended setting for:
   a. Pickup parameters on each operating element.
   b. Timing at three points on time-current curve.
   c. Pickup target and seal-in units.
   d. Special tests as required to check operation of restraint, directional, and other elements in accordance with manufacturer's instruction manual.
3. Phase angle and magnitude contribution tests on differential and directional relays after energization to vectorially verify proper polarity and connections.
4. Current Injection Tests:
   a. For entire current circuit in each section.
   b. Secondary injection for current flow of 1 ampere.
   c. Test current at each device.

3.09 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually check current, potential, and control transformers for:
   a. Cracked insulation.
   b. Broken leads or defective wiring.
   c. Proper connections.
   d. Adequate clearances between primary and secondary circuit wiring.
2. Verify Mechanically:
   a. Grounding and shorting connections have good contact.
   b. Withdrawal mechanism and grounding operation, when applicable, operate properly.
3. Verify proper primary and secondary fuse sizes for potential transformers.

B. Electrical Tests:

1. Current Transformer Tests:
   a. Insulation resistance test of transformer and wiring-to-ground at 1,000 volts dc for 30 seconds.
   b. Polarity test.
2. Potential Transformer Tests:
   a. Insulation resistance test at test voltages in accordance with NETA ATS, Table 100.9, for 1 minute on:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Polarity test to verify polarity marks or H1-X1 relationship as applicable.
3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 100.5.

3.10 METERING

A. Visual and Mechanical Inspection:

1. Verify meter connections in accordance with appropriate diagrams.
2. Verify meter multipliers.
3. Verify meter types and scales conform to Contract Documents.
4. Check calibration of meters at cardinal points.
5. Check calibration of electrical transducers.

3.11 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in transfer switches, pump control panels, and panelboard assemblies for proper connection and tightness.
2. Ground bus connections in transfer switches, pump control panels, and panelboard assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

B. Electrical Tests:

1. Fall-of-Potential Test:
   a. In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
   b. Main ground electrode system resistance to ground to be no greater than 5 ohm(s).
2. Two-Point Direct Method Test:
   a. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
   b. Equipment ground resistance shall not exceed main ground system resistance by 0.50 ohm.

3.12 AC INDUCTION MOTORS

A. General: Inspection and testing limited to motors rated 1 horsepower and larger.

B. Visual and Mechanical Inspection:

1. Proper electrical and grounding connections.
2. Shaft alignment.
3. Blockage of ventilating air passageways.
4. Operate motor and check for:
   a. Excessive mechanical and electrical noise.
   b. Overheating.
   c. Correct rotation.
   d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
   e. Excessive vibration, in excess of values in NETA ATS, Table 100.10.
5. Check operation of space heaters.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for:
      1) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
      2) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 seconds and 60 seconds.
   b. Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
2. Calculate polarization index ratios for motors above 200 horsepower. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
3. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
4. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

3.13 MANUAL TRANSFER SWITCHES

A. Visual and Mechanical Inspection:

1. Check doors and panels for proper interlocking.
2. Check connections for high resistance by calibrated torque wrench applied to bolted joints.
3. Check positive mechanical and electrical interlock between normal and alternate sources.
4. Check for proper operation: Manual transfer function switch.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1, for each phase with switch CLOSED in both source positions.
   b. Phase-to-phase and phase-to-ground for 1 minute.
   c. Test values in accordance with manufacturer's published data.
2. Contact Resistance Test:
   a. Contact resistance in microhms across each switch blade for both source positions.
   b. Investigate values exceeding 500 micro-ohms.
   c. Investigate values deviating from adjacent pole by more than 50 percent.

3. Set and calibrate in accordance with Specifications, manufacturer's recommendations, and Coordination Study.
4. Perform manual transfer to allow the facility to be fed from the Owner's on-site geneator. Verify that the equipment operates as intended when fed from the generator.

3.14 BATTERY SYSTEM

A. Visual and Mechanical Inspection:

1. Physical damage and electrolyte leakage.
2. Evidence of corrosion.
3. Intercell bus link integrity.
4. Battery cable insulation damage and contaminated surfaces.
5. Operating conditions of ventilating equipment.
6. Visual check of electrolyte level.

B. Electrical Tests:

1. Measure:
   a. Bank charging voltage.
   b. Individual cell voltage.
   c. Electrolyte specific gravity in each cell.
   d. Measured test values to be in accordance with manufacturer's published data.
2. Verify during recharge mode:
   a. Charging rates from charger.
   b. Individual cell acceptance of charge.
3. Load tests for integrity and capacity; test values in accordance with IEEE 450.

3.15 PORTABLE GENERATOR SYSTEMS

A. Visual and Mechanical Inspection:

1. Proper operation of meters and instruments.
2. Compare generator nameplate rating and connection with one-line diagram or approved Submittal.
3. Verify engine-generator operation under normal load conditions.

B. Electrical and Mechanical Tests:

1. Phase rotation tests.
2. The portable generator shall be connected and operated for a minimum of 2 hours to verify that it can power the vital loads that are powered from panelboards LP1 and LP2. Specific circuit breakers in panelboards LP1 and LP2 will first need to be opened before the generator test is performed. Refer to Section 26 05 04, Basic Electrical Materials and Methods for detail.

3.16 LOW VOLTAGE SURGE ARRESTORS

A. Visual and Mechanical Inspection:

1. Adequate clearances between arrestors and enclosures.
2. Ground connections to ground bus.

B. Electrical Tests:

1. Varistor Type Arrestors:
   a. Clamping voltage test.
   b. Rated RMS voltage test.
   c. Rated dc voltage test.
   d. Varistor arrestor test values in accordance with IEEE C62.33, Section 4.4 and Section 4.9.

3.17 THERMOGRAPHIC SURVEY

A. Provide thermographic survey per NETA ATS Table 100.18 of connections associated with incoming service conductors, bus work, and branch feeder conductors No. 4 and larger at each:

1. Manual Transfer Switch.
2. Well Pump Control Panel.
3. Panelboard.

B. Provide thermographic survey of feeder conductors No. 4 and larger terminating at:

1. Motors rated 40 hp and larger.
2. Manual Transfer Switch.
3. Panelboards.
4. Well Pump Control Panel.

C. Remove necessary enclosure metal panels and covers prior to performing survey.

D. Perform with equipment energized during periods of maximum possible loading per NFPA 70B, Section 20.17.

E. Do not perform survey on equipment operating at less than 40 percent of rated load. If plant load is insufficient, perform test with supplemental load bank producing rated load on item being measured.

F. Utilize thermographic equipment capable of:

1. Detecting emitted radiation.
2. Converting detected radiation to visual signal.
3. Detecting 1 degree C temperature difference between subject area and reference point of 30 degrees C.

G. Temperature Gradients:

1. 3 degrees C to 7 degrees C indicates possible deficiency that warrants investigation.
2. 7 degrees C to 15 degrees C indicates deficiency that is to be corrected as time permits.
3. 16 degrees C and above indicates deficiency that is to be corrected immediately.

H. Provide written report of:

1. Areas surveyed and the resultant temperature gradients.
2. Locations of areas having temperature gradients of 3 degrees C or greater.
3. Cause of heat rise and actions taken to correct cause of heat rise.
4. Detected phase unbalance.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE): C57.96, Guide for Loading Dry Type Transformers.
2. National Electrical Contractor's Association (NECA): 409, Recommended Practice for Installing and Maintaining Dry-Type Transformers.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. ST 20, Dry-Type Transformers for General Applications.
   c. TP 1, Guide For Determining Energy Efficiency for Distribution Transformers.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. Underwriters Laboratories Inc. (UL):
   a. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
   b. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
   c. 1561, Standard for Dry-Type, General Purpose, and Power Transformers.

1.02 SUBMITTALS

A. Action Submittals:

1. Descriptive information.
2. Dimensions and weight.
3. Transformer nameplate data.
4. Schematic and connection diagrams.

B. Informational Submittals:

1. Test Report: Sound test certification for dry type power transformers (0 to 600-volt, primary).

PART 2 PRODUCTS

2.01 GENERAL

A. UL 1561, NEMA ST 20, unless otherwise indicated.

B. Dry-type, self-cooled, two-winding, with aluminum windings.

C. Units larger than 5 kVA suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

A. Efficiency: Meet or exceed values from the Department of Energy 2016 Efficiency Standard.

B. Meet or exceed values in Table 4.2 of NEMA TP 1.

C. Maximum Sound Level per NEMA ST 20:

1. 40 decibels for 0 kVA to 9 kVA.
2. 45 decibels for 10 kVA to 50 kVA.
3. 50 decibels for 51 kVA to 150 kVA.
4. 55 decibels for 151 kVA to 300 kVA.
5. 60 decibels for 301 kVA to 500 kVA.

D. Overload capability: Short-term overload per IEEE C57.96.

E. Wall Bracket: For single-phase units, 15 kVA to 37-1/2 kVA, and for three-phase units, 15 kVA to 30 kVA.

F. Vibration Isolators:

1. Rated for transformer’s weight.
2. Isolation Efficiency: 99 percent, at fundamental frequency of sound emitted by transformer.
3. Less Than 30 kVA: Isolate entire unit from structure with external vibration isolators.
4. 30 kVA and Above: Isolate core and coil assembly from transformer enclosure with integral vibration isolator.

G. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D Co.
3. General Electric Co.

2.02 GENERAL PURPOSE TRANSFORMER

A. Insulation Class and Temperature Rise: Manufacturer's standard.

B. Core and Coil:

1. Encapsulated for single-phase units 1/2 kVA to 25 kVA and for three-phase units 3 kVA to 15 kVA.
2. Thermosetting varnish impregnated for single-phase units 37.5 kVA and above, and for three-phase units 30 kVA and above.

C. Enclosure:

1. Single-Phase, 3 kVA to 25 kVA: NEMA 250, Type 3R, encapsulated. The dimensions of the 25KVA transformer shall not exceed 17"W x 15"D x 24"H.
2. Single-Phase, 37-1/2 kVA and Above: NEMA 250, Type 2, ventilated.
3. Three-Phase, 3 kVA to 15 kVA: NEMA 250, Type 3R, nonventilated.
4. Three-Phase, 30 kVA and Above: NEMA 250, Type 2, ventilated.
5. Outdoor Locations: NEMA 250, Type 3R.
6. Corrosive Locations: NEMA 250, Type 3R stainless steel.

D. Voltage Taps:

1. Single-Phase, 3 kVA to 10 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
2. Single-Phase, 15 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
3. Three-Phase, 3 kVA to 15 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
4. Three-Phase, 30 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.

E. Impedance: 4.5 percent minimum on units 75 kVA and larger.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NECA and manufacturer's instructions.

B. Load external vibration isolator such that no direct transformer unit metal is in direct contact with mounting surface.

C. Provide moisture-proof, flexible conduit for electrical connections.

D. Connect voltage taps to achieve (approximately) rated output voltage under normal plant load conditions.

E. Provide wall brackets for single-phase units, 15 kVA to 167-1/2 kVA, and three-phase units, 15 kVA to 112 kVA.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE):
   a. C62.1, Surge Arresters for Alternating Current Power Circuits.
   b. C62.11, Standards for Metal-Oxide Surge Arrestors for AC Power Circuits.
2. National Electrical Contractor's Association (NECA): 407, Recommended Practice for Installing and Maintaining Panelboards.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. 289, Application Guide for Ground Fault Circuit Interrupters.
   c. AB 1, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   d. KS 1, Enclosed Switches.
   e. LA 1, Surge Arrestors.
   f. PB 1, Panelboards.
   g. PB 1.1, General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. Underwriters Laboratories Inc. (UL):
   a. 67, Standard for Panelboards.
   b. 98, Standard for Enclosed and Dead-Front Switches.
   c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
   d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
   e. 508, Standard for Industrial Control Equipment.
   f. 870, Wireways, Auxiliary Gutters and Associated Fittings.
   g. 943, Standard for Ground-Fault Circuit-Interrupters.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer's data sheets for each type of panelboard, protective device, accessory item, and component.
2. Manufacturer's shop drawings including dimensioned plan, section, and elevation for each panelboard type, enclosure, and general arrangement.

3. Tabulation of features for each panelboard to include the following:
   a. Protective devices with factory settings.
   b. Provisions for future protective devices.
   c. Space for future protective devices.
   d. Voltage, frequency, and phase ratings.
   e. Enclosure type.
   f. Bus and terminal bar configurations and current ratings.
   g. Provisions for circuit terminations with wire range.
   h. Short circuit current rating of assembled panelboard at system voltage.
   i. Features, characteristics, ratings, and factory settings of auxiliary components.
   j. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Manufacturer's recommended installation instructions.
3. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled as defined in NEC Article 100.

1.04 EXTRA MATERIALS

A. Extra Materials: Furnish, tag, and box for shipment and storage the following spare parts, special tools, and material:

Item	Quantity
Touch-up paint for panelboards	One half-pint container
Special tools required to maintain or dismantle	One complete set

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Eaton/Cutler-Hammer.
2. Square D Co.
3. General Electric Co.

2.02 GENERAL

A. Provide low voltage panelboards for application at 600V or less in accordance with this Section.

B. Provide equipment in accordance with NEMA PB 1, NFPA 70, and UL 67.

C. Wire Terminations:

1. Panelboard assemblies, including protective devices, shall be suitable for use with 75 degrees C or greater wire insulation systems at NEC 75 degrees C conductor ampacity.
2. In accordance with UL 486E.

D. Load Current Ratings:

1. Unless otherwise indicated, load current ratings for panelboard assemblies, including bus and circuit breakers, are noncontinuous as defined by NEC. Continuous ratings shall be 80 percent of noncontinuous rating.
2. Where indicated “continuous”, “100 percent”, etc., selected components and protective devices shall be rated for continuous load current at value shown.

E. Short Circuit Current Rating (SCCR): Integrated equipment short circuit rating for each panelboard assembly shall be no less than the following:

1. Minimum SCCR at 208Y/120 or 120/240 volts shall be 42,000 amperes rms symmetrical.

F. Overcurrent Protective Devices:

1. In accordance with NEMA AB 1, NEMA KS 1, UL 98, and UL 489.
2. Protective devices shall be adapted to panelboard installation.
   a. Capable of device replacement without disturbing adjacent devices and without removing main bus.
   b. Spaces: Cover openings with easily removable cover.

3. Series-Connected Short Circuit Ratings: Devices shall be fully rated; series-connected ratings unacceptable.

G. Circuit Breakers:

1. General: Thermal-magnetic unless otherwise indicated, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.
2. Non-interchangeable: In accordance with NEC.
3. Bus Connection: Bolt-on circuit breakers in 480Y/277-volt, and plug-in circuit breakers in 208Y/120 and 240/120-volt branch circuit panelboards.
4. Trip Mechanism:
    a. Individual permanent thermal and magnetic trip elements in each pole.
    b. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
    c. Two and three pole, common trip.
    d. Automatically opens all poles when overcurrent occurs on one pole.
    e. Test button on cover.
    f. Calibrated for 40 degrees C ambient, unless shown otherwise.
5. Unacceptable Substitution:
    a. Do not substitute single-pole circuit breakers with handle ties for multi-pole breakers.
    b. Do not use tandem or dual circuit breakers in normal single-pole spaces.
6. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).
    a. Ground fault sensor shall be rated same as circuit breaker.
    b. Push-to-test button.
    c. Reset button.
7. Equipment Ground Fault Interrupter (EGFI): Where indicated, equip breaker specified above with ground fault sensor and rated to trip on 30-mA ground fault (UL listed for equipment ground fault protection).

H. Enclosures:

1. Provide as specified in Section 26 05 04, Basic Electrical Materials and Methods and as shown on the Drawings.
2. Material: Type 1, Type 3R, and Type 3S shall be code-gauge, hot-dip galvanized sheet steel with reinforced steel frame.
3. Finish: Rust inhibitor prime followed by manufacturer’s standard gray baked enamel or lacquer.

I. Bus:

1. Material: Copper full sized throughout length.
2. Provide for mounting of future protective devices along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.

J. Feeder Lugs: Main, feed-through, and neutral shall be replaceable, bolted mechanical or crimp compression type.

K. Equipment Ground Terminal Bus: Copper with suitably sized provisions for termination of ground conductors, and bonded to box.

1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
2. Provide individual termination points for all other grounding conductors such as feeder, grounding electrode, etc.
3. Termination points shall be bolted crimp compression lugs for conductors 6 AWG and larger.

L. Neutral Terminal Bus: Copper with suitably sized provisions for termination of neutral conductors, and isolated from box.

1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
2. Provide individual termination points for all other neutral conductors.
3. Termination points shall be bolted crimp compression lugs for conductors 6 AWG and larger.
4. Oversize Neutral: Provide oversized neutral terminal bus as indicated.

M. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances for future protective device ampere ratings indicated.

2.03 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. Multi-Section Panelboards: Where more than 42 poles are required or more than one section is otherwise indicated, provide multiple panelboards with separate fronts.

1. Panelboard sections shall be individually installed and field interconnected to form a single electrical unit.
2. Unless otherwise indicated, provide feed-through lugs on each section but last.
3. Surface-mount panels shall be individually mounted and may be different sizes.

4. Recessed-mount panels shall be individually mounted and the same size tub and flush cover.
5. Surface-mount multi-section panelboards may be comprised of sections of unequal heights.
6. Provide feed-through and main lugs in individual sections as required for field assembly of a complete multi-section panelboard.
7. Provide neutral and ground terminal bars in each section.

B. NEMA 250 Type 1 Branch Panelboard Enclosure:

1. Front trim shall be secured to box with concealed trim clamps.
2. Surface-mount panelboard front trim shall have same dimensions as box.
3. Flush panelboards front trims shall overlap box nominal 3/4 inch on all sides.
4. Door in panelboard front trim, with concealed hinges, shall provide access to protective device operating handles.
5. Doors over 30 inches in height shall have multi-point latching.
6. Door lock shall be secure with flush catch and tumbler lock; all panelboards keyed alike, with two milled keys each lock.
7. Circuit Directory: Metal frame with transparent plastic face and enclosed card, mounted inside each panel door.

2.04 POWER DISTRIBUTION PANELBOARDS

A. Branch Protective Devices:

1. Locking: Furnish devices with provisions for handle padlocking.
2. Load Connections: Wire lugs shall be mechanical or crimp compression type, removable/replaceable, and suitable for 75 degrees C rated conductors without derating switch nor conductor ampacity.
3. Provide a nameplate for each circuit, blanks for spares.

PART 3 EXECUTION

3.01 GENERAL

A. Install in accordance with NECA 407, NEMA PB 1.1 and manufacturers' written installation instructions.

B. Install securely, plumb, in-line and square with walls.

C. Install top of cabinet trim78 inches above floor, unless otherwise shown. Install cabinet so tops of protective device operating handles are no more than 78 inches above the floor.

D. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289.

E. Install filler plates in unused spaces.

F. Wiring in Panel Gutters: Train conductors neatly in groups; bundle, and wrap with nylon wire ties.

3.02 BRANCH CIRCUIT PANELBOARD

A. Mount flush panels uniformly flush with wall finish.

B. Provide typewritten circuit directory for each panelboard.

3.03 POWER DISTRIBUTION PANELBOARD

A. Provide engraved identification for each protective device.

END OF SECTION

SECTION 26 36 23
MANUAL TRANSFER SWITCHES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE): C37.90.1, Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
2. National Electrical Manufacturers Association (NEMA):
   a. ICS 1, General Standards for Industrial Control and Systems: General Requirements.
   b. ICS 2, Industrial Control and Systems Controllers, Contactors, and Overload Relays not more than 2000 volts ac or 750 volts ac.
   c. ICS 6, Industrial Control And Systems: Enclosures 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
4. Underwriters Laboratories, Inc. (UL): 1008, Transfer Switch Equipment.

1.02 SUBMITTALS

A. Action Submittals:

1. Descriptive product information.
2. Dimensional drawings.
3. Conduit entrance locations.
4. Equipment ratings.

B. Informational Submittals:

1. Factory test reports.
2. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.

2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton/Cutler Hammer.

B. Square D.

2.02 GENERAL

A. Transfer switch to be product of a single manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

B. In accordance with applicable standards of NFPA 70, NEMA ICS 1, NEMA ICS 2, NEMA ICS 6, IEEE C37.90.1, and UL 1008.

C. Rated 100 percent, in amperes, for total system transfer of motor, electric heating, discharge lamp loads, and tungsten-filament lamp loads.

1. Switches rated 400 amperes and below suitable for 100 percent tungsten-filament lamp loads.
2. Switches rated above 400 amperes suitable for 30 percent tungsten-filament lamp loads.

D. Main and arcing contacts visible for inspection with cabinet door and barrier covers removed.

E. Neutral transfer contacts for switched terminal plate with pressure contacts for solidly connected neutral conductors.

F. Suitable for 240/120 volts, single-phase three-phase, three-wire, electrical service having an available short circuit current at line terminals of 22,000 amperes rms symmetrical.

G. Switch Rating: 125A continuous amperes in nonventilated enclosure.

H. Current carrying capacity of arcing contacts shall not be used to determine the transfer switch rating.

I. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

J. Operating Conditions:

1. Ambient Temperature: Maximum 40 degrees C.
2. Equipment to be fully rated without any derating for operating conditions listed above.

2.03 ENCLOSURE

A. Type: Nonventilated NEMA 250, Type 12 with enclosure grounding terminal. Enclosure dimensions shall not exceed 21 inches wide by 12 inches deep by 48 inches high.

B. Dead front, front accessible wall mounted cabinet with 14-gauge welded steel construction.

C. Continuously hinged single door, with handle and lock cylinder.

D. Finish: Baked enamel applied over rust-inhibiting, phosphated base coating.

1. Exterior and Interior Color: Provide gray finish as approved by Engineer.
2. Unpainted Metal Parts: Plated for corrosion resistance.

2.04 TRANSFER SWITCH

A. Type: Manually operated switch.

B. Manual operating handle for transfer in either direction under either loaded or unloaded conditions.

2.05 FACTORY TESTS

A. Test to Ensure Correct:

1. Operation of individual components.
2. Sequence of operation.
3. Transfer time.

B. Dielectric strength test per NEMA ICS 1.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Secure enclosure to structural steel channels attached to wall surface.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
2. Underwriters Laboratories, Inc. (UL):
   a. 1449, Standard for Safety Surge Protective Devices.
   b. 1283, Standard for Safety Electromagnetic Interference Filters.
   c. 497A, Standard for Safety Secondary Protectors for Communication Circuits.
3. American National Standards Institute (ANSI).
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
   b. C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits - 1991.
   c. C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

1.02 SUBMITTALS

A. Product data on each suppressor type, indicating component values, part numbers, and conductor sizes. Include dimensional drawing for each, showing mounting arrangements.

B. Manufacturer’s UL certified test data and nameplate data for each SPD.

C. Electrical single-line diagram showing location of each SPD.

1.03 QUALITY ASSURANCE

A. UL Compliance and Labeling:

1. SPDs for power and signal circuits: comply with UL 1449 and complimentary listed to UL 1283 as an electromagnetic interference filter. Provide units listed and labeled by UL.
2. SPDs for telephone circuit protection: comply with UL 497A.

B. ANSI Compliance: Use SPD devices in compliance with the recommendations of IEEE C62.41.1, IEEE C62.41.2, and IEEE C62.45.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Advanced Protection Technologies, Inc.

B. Eaton, SPD Series.

C. General Electric, Tranquell.

D. Square D, Surelogic.

2.02 GENERAL

A. Unless indicated otherwise, provide direct bus connected and factory installed SPDs inside the distribution equipment.

B. SPD operating conditions: capable of performing at ambient temperatures between minus 40 degrees C and 60 degrees C, at relative humidity ranging from 0 percent to 95 percent, and at altitudes ranging from sea level to 12,000 feet.

C. Connect SPDs through a fused switch or circuit breaker as selected by the manufacturer. Provide overcurrent protection to allow full surge handling capabilities and afford safety protection from thermal overloads and short circuits.

D. SPD short circuit current rating (SCCR): no less than the SCCR of the distribution equipment.

E. Design SPD devices to protect all modes (L-L, L-N, L-G, N-G) of the electrical system being utilized.

F. Power Filter: Include a high frequency extended range power filter for each SPD complimentary listed to UL 1283 as an electromagnetic interference filter.

G. Provide SPDs with the following monitoring and diagnostics:

1. LED-type indication lights to show the normal and failed status of each protected phase.
2. Surge event counter.
3. Form C dry contact which operates when the unit fails.

H. Provide UL Type 2 SPDs.

I. EMI/RFI Noise Suppression: -50dB attenuation at 100 kHz, tested per MIL-STD 220B.

J. Voltage Protection Rating (VPR):

Voltage Rating	L-N	N-G	L-G	L-L
208Y/120	800	800	800	1200
480Y/277	1200	1200	1200	2000
240 Δ	-	-	1200	1200
480 Δ	-	-	2000	2000

2.03 SERVICE ENTRANCE AND DISTRIBUTION SPD

A. Provide SPD meeting IEEE C62.41.1 and IEEE C62.41.2 Location in accordance with Category C.

B. Surge Current Capacity:

1. Service Entrance: 240 kA per phase; 120 kA per mode.
2. Distribution: 160 kA per phase; 80 kA per mode.

C. Maximum Continuous Operating Voltage (MCOV): Not less than 115 percent of the nominal system voltage.

D. Nominal Discharge Current (I_N): 20kA.

2.04 PANELBOARD SPD

A. Provide SPD meeting IEEE C62.41.1 and IEEE C62.41.2 Location in accordance with Category B.

B. Surge Current Capacity:

1. Distribution: 160 kA per phase; 80 kA per mode.
2. Branch: 120 kA per phase; 60 kA per mode

C. Maximum Continuous Operating Voltage (MCOV): Not less than 125 percent of the nominal system voltage.

2.05 NOMINAL DISCHARGE CURRENT (I_N): 10KA.PAIRED CABLE DATA LINE INTERIOR SUPPRESSORS

A. Provide units meeting IEEE C62.41, Location Category A.

B. Use bi-polar 1,500-watt silicon avalanche diodes between the protected conductor and earth ground.

C. Provide units with a maximum single impulse current rating of 80 amperes (10 by 1,000 microsecond-waveform).

D. Breakdown voltage shall not exceed 36 volts.

2.06 PAIRED CABLE DATA LINE EXTERIOR SUPPRESSORS

A. Provide units meeting IEEE C62.41, Location Category A.

B. Design requirements: a hybrid design with a minimum of three stages, utilizing solid-state components and operating bi-directionally.

C. Meet or exceed the following criteria:

1. Maximum single impulse current rating of 10,000 amperes (8 by 20 microsecond-waveform).
2. Pulse Life Rating: 3,000 amperes (8 by 20 microsecond-waveform): 2,000 occurrences.
3. Maximum clamping voltage at 10,000 amperes (8 by 20 microsecond current waveform), shall not exceed the peak of the normal applied signal voltage by 200 percent.

PART 3 EXECUTION

3.01 APPLICATION REQUIREMENTS

A. Provide SPDs when indicated on Drawings or in the equipment specifications.

B. Provide factory installed SPDs as integral components to new switchgear, switchboards, motor control centers, panelboards and transfer switches. Externally mounted SPDs are not acceptable for new distribution equipment.

C. Externally mounted SPDs are acceptable for SPDs added to existing equipment as described below.

D. Electronic Equipment Paired Cable Conductors: Install data line suppressors at the low voltage input and output of each piece of equipment, including telephone cable entrance.

1. Use secondary protectors on lines that do not exit the structure.
2. Use primary protectors on lines that exit and enter the structure.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install suppressors according to manufacturer’s recommendations.

B. Install suppressors directly to the cabinet which houses the circuit to be protected so that the suppressor leads are straight and short, with all conductors laced, running directly to the point of connection within the panel, without loops or bends. If bends are unavoidable, no bend may exceed 90 degrees and bending radius may not be less than 6 inches.

C. Provide connecting wires as short as possible with gently twisted conductors, tied together, to prevent separation.

1. Maximum length: 24 inches.

D. Field installed conductors: as specified for building wire, not smaller than No. 8 AWG and not larger than No. 4 AWG. Provide device leads not longer than the maximum length recommended by manufacturer, unless specifically reviewed and approved by manufacturer.

E. Provide dedicated disconnecting means for SPD devices installed at main service entrance location, switchgear, and motor control centers. Provide dedicated 30-60-ampere circuit breakers (size dependent upon wire size used) with number of poles as required, as disconnecting means for SPD devices. Provide circuit breakers with interrupting capacity equal to that specified for other breakers at that location.

END OF SECTION

SECTION 40 00 64
DIESEL ENGINE DRIVE SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Work necessary to furnish, install, connect, and test one completely factory-assembled exhaust standby rated engine drive system including exhaust system with exhaust silencer, freestanding control equipment, and all related accessory items and appurtenances identified herein or shown on the Contract Drawings.

1.02 SYSTEM RESPONSIBILITY

A. The Contractor shall be responsible for furnishing and installing the complete standby power system described herein and shown on the Contract Drawings for a complete fully operational system.

B. The Contractor shall be responsible for furnishing and installing all incidental materials, not specifically shown on the Contract Drawings, and testing required for the complete system as specified.

C. The Manufacturer is responsible for supplying the engine drive system and engine control panel as specified herein.

1.03 SYSTEM DESCRIPTION

A. The engine driver system shall be comprised of a complete operating system to manually start the engine drive system upon loss of utility electrical service.

B. Engine shall be designed to drive a universal joint style shaft coupling through an engine manufacturer supplied mechanical power take off clutch assembly. Output shaft in turn to drive a vertical turbine water well pump through a right angle gear drive.

C. The new engine drive shall be a totally assembled package unit supplied with spring type vibration isolators as recommended by the engine manufacturer. The engine/base assembly shall be free of harmful critical speeds and torsional vibrations within the specified operating range of speed and capacity.

D. The diesel engine drive system shall consist of diesel engine, battery system, control system, unit instrumentation, and related accessories as specified herein.

E. The fully integrated mechanical and electrical components that constitute this system shall be designed so as to enable a fully manual system that can be started, governed, and protected with safety shutdown provisions for low oil pressure, high water or oil temperature, overspeed, low fuel level, and other indicated conditions.

1.04 SUPPLEMENTAL INFORMATION

A. Information on the existing driven equipment consisting of right angle gear drive and the vertical turbine pump is provided at the end of this section in Supplement 1, "Operational and Maintenance Manual" Data for Navarre Beach Well #2 Pump, Angle Drive and Controller at the end of this section.

1.05 SUBMITTALS

A. Submittals shall include the following specific information:

1. Shop Drawings:
   a. Complete performance data of the specific engine proposed. Rating shall be at ambient conditions as specified in service conditions. Major engine loads including jacket water circulation pumping, lubrication oil pumping, inlet air losses, and exhaust gas back pressure losses are to be included to allow determination of net output horsepower and torque rating. Indicate net engine shaft horsepower, output torque, and specific fuel consumption in gallon/hour versus HP output.
   b. Dimensional, outline Drawings showing the general arrangement, weight, and construction of the engine and all accessories.
   c. Dimensional, general arrangement Drawings, control system description, schematics and logic diagrams, detailing the construction and instrumentation arrangement of local engine control panel (ECP). One line, side section, front elevation, bill-of-materials, and schematic diagrams of the engine control cabinets.
   d. Control system description, schematic/wiring diagrams, all external signal interfaces for the ECP, wall mounted within the Wellhouse Pump Room.
   e. Catalog cuts of all major equipment items, accessories, appurtenances and instrumentation and control items and a bill-of-materials of miscellaneous equipment.
   f. Complete electrical elementary control and connection diagrams covering the electrical devices and functions provided on the engine and in the ECP. All diagrams shall be in accordance with NEMA ICS 1-101.

g. Noise projections and supporting calculations for the engine shall be supplied. Projections shall be for a 5-foot contour around engine corrected to free field conditions and shall include (referenced to 0.00002 Newton/sq.m):
   1) An "A" weighted projection on the specified contour (dBA).
   2) Spectral noise projections at 325, 63, 125, 250, 500, 1,000, 2,000, 4,000, and 8,000 Hertz on the same contour.
h. A detailed torsional analysis report describing the engine mass elastic model. Vibration amplitude projections shall be included for all critical speeds as existing between 80 and 110 percent of the specified operational speed range.
i. A fuel air exhaust mass balance and heat balance for the engine at rated operation. Radiant and convective jacket heat losses and lubrication oil cooling loads are to be included. Provide information herein for the exhaust silencer to be supplied under this Contract.
j. Complete list of spare parts which the supplier recommends be kept on hand.
k. Written installation instructions and prestartup servicing instructions.
l. Information, including costs, for 3-year and 5-year extended warranties and inspection service contracts.
m. Cooling radiator/fan performance including static pressure restriction.

2. Operation and Maintenance Manuals:
   a. Shop Drawing information as specified.
   b. Provide complete detailed information on how to operate the equipment during startup, sustained operation, test conditions, shutdown, and emergency and fault conditions.
   c. Provide information and data necessary for lubrication, tolerance adjustment, calibration, and other necessary servicing.
   d. Copies of all tests reports made on engine.
   e. Description of parts and service availability.
   f. Certification, copies of analyses, or test reports demonstrating appropriate vibration analysis and design in all modes.
   g. Certified Factory Test Report.
   h. Manufacturer’s Certificate of Performance.
   i. Manufacturer’s Certificate of Proper Installation.
   j. See additional requirements in as specified in Division 1, General Requirements.

1.06 WARRANTY/MAINTENANCE AGREEMENT

A. A complete engine package including control equipment shall be covered by the system manufacturer for a period of 2 years after acceptance of the system by the Owner. This warranty shall cover all materials provided, labor, and miscellaneous disposal items. Warrantee/Maintenance Agreement shall include quarterly maintenance checks, and a yearly preventive maintenance checks. The Bid price shall include the comprehensive Warranty/Maintenance Agreement for a period of 2 years.

B. The system manufacturer shall provide complete contract information to the Owner for separate purchase (outside of this project) of extended warranties of either 3 or 5 years' duration.

1.07 EXPERIENCE

A. A complete, engine package including accessory items shall be the product of one manufacturer, hereinafter referred to as the "Manufacturer." Manufacturer shall have been regularly engaged in the production of complete diesel engine drive systems for at least 10 years. All components shall have been designed to achieve optimum physical and performance compatibility with each other and prototype tested to prove integrated design capability. The complete system shall have been factory fabricated, assembled, and production tested.

1.08 PARTS AND SERVICE

A. A local factory parts depot from which parts may be obtained in necessary quantities at any time during the day or night, and a parts and service facility offering complete servicing including preventative maintenance service contracts shall be maintained by the system manufacturer. The parts depot and the parts and service facility shall be located within 75 miles of the point of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

A. The diesel engine and engine control panels shall be the product of the following manufacturer:

1. Caterpillar; Industrial Engine Series C4.4 ACERT engine employing Tier 4 Stage IV technology.
2. Or Engineer approved equal.

2.02 GENERAL

A. The Contractor shall provide products as specified on the Drawings and/or in the Specifications, or an Engineer approved equal.

B. Unless otherwise indicated, provide all first quality, new materials and equipment, free from any defects, in first-class condition, and suitable for the space provided. Provide materials and equipment approved by UL wherever standards have been established by the agency.

C. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

D. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications.

2.03 SERVICE CONDITIONS

A. Service Conditions are as follows:

1. Environment: Coastal marine environment (Gulf of Mexico)—corrosive environment.
2. Altitude: 10 feet above mcan sea level.
3. Atmospheric Pressure: 14.7 psia.
4. Ambient Temperature, Maximum: 105 degrees F.
5. Ambient Temperature, Minimum: 20 degree F.
6. Relative Humidity: 40 to 100 percent, high humidity.

2.04 DIESEL ENGINE

A. Engine:

1. The engine shall be general purpose, stationary, water-cooled four-cycle, in-line-type compression-ignition diesel and shall be capable of starting solely from heat of compression, and employing a 24-volt electric starting system with dual starters. The engine shall be turbocharged designed for fast response high power as increased torque capabilities.
2. The engine shall be equipped with all engine mounted sensing devices necessary to accomplish functions listed in other paragraphs of this section. Engine speed to be controlled by hydraulic actuators which position fuel supply to engine in proportion to an electrical signal received from and developed by a master electronic control unit.

3. The engine shall be equipped with a mechanical overspeed shutdown device which will positively and internally return the fuel pump rack to the no fuel position and also shall be equipped with a drive mechanism to drive a centrifugal switch which shall be set to electrically shutdown the engine before the mechanical overspeed device engages. The mechanical shutdown system shall also seal off the combustion air inlet when activated.
4. Engine to be designed to use Diesel Fuel oil No. 2 (domestic burner oil) of the ultra low sulfur variety as the combustion fuel. Engine systems requiring premium fuel will not be considered.

B. Starting System/Batteries:

1. A set of 24-volt cranking batteries shall be furnished for each starter motor on the engine. The batteries provided shall consist of four 4D Caterpillar Maintenance Free Batteries designed for engine cranking an engine of this frame size located within a building and shall provide for a minimum of four 10-second cranking periods at 20 degrees F, without being recharged. The cells shall be floor mounted in a freestanding battery box. Each set of engine cranking batteries shall be capable of supplying 24V dc power to the ECP for powering the control devices, relays, and other ancillary equipment located within the control panel. The PLC logic shall select the best of the various batteries as a power source.
2. Batteries/charging system shall be furnished with all interconnecting jumpers for cell-to-cell connections and from cells to starters on the engine. All cell-to-cell conductors shall be tinned-copper. They shall have factory applied crimped lugs and 600V THW or MTW insulation. Cell to charger/engine cables shall be Size 4/0 welding cable, minimum.
3. An automatic battery charger shall be furnished for each set of batteries. The charger shall operate from a 20A, 120-volt single-phase supply and have a 20-amp output, minimum. The charger shall be sized to fully charge each battery within 8 hours. SCR based charger designs are not acceptable. Charger shall be solid state, current-limiting design with float-equalize feature and timer. It shall also have the following features and alarms:
    a. dc cranking disconnect relay.
    b. ac and dc circuit breakers.
    c. High battery volts alarm.
    d. Low battery volts alarm.
    e. Loss of ac alarm.
    f. Battery ground alarm.
    g. Panel-type dc voltmeter and ammeter.

4. Alarms in charger shall have a relay output from one dry Form C contact, rated 10 amps. The alarm signals shall be relayed to the switchgear for annunciation locally. Additionally, the alarm signals shall also be relayed to the associated plant control system.
5. Chargers shall be mounted on the frame of the engine near the starting batteries as shown on the Drawings.
6. Each engine shall be furnished with a locally engine control panel (ECP) for monitoring and control of the engine. Each ECP shall be furnished by the engine supplier as specified.

C. Jacket Water Heaters: Provide engine-mounted thermal circulation tank-type immersion water heaters incorporating thermostatic control and contactors. Heaters shall be 1KW, 120V, single-phase, magnetic contactor and shall be disconnected during engine operation. The contactor shall be mounted in the engine control panel. Jacket water heaters shall maintain engine water temperature at 120 degrees F with an ambient temperature of 50 degrees F.

D. Fuel Pump (Engine Mounted) and Accessories:

1. An engine fuel supply pump driven off the engine shall be provided to pump fuel from an adjacent above grade fuel storage tank. This pump shall be suitable for operation with up to a 10-foot maximum diesel fuel No. 2 suction lift.
2. A fuel oil filter designed to accept replaceable filter elements shall be provided.
3. Fuel connections to the engine shall be with flexible Type 304 stainless steel armored hose suitable for the purpose at least 12 inches long.
4. The Contractor will be responsible for providing and installing all diesel fuel needed for system testing. The Contractor shall also be responsible for refilling the fuel storage tank upon completion of the engine testing. The Owner will only be responsible for any fuel usage after successful completion of all system testing and acceptance of the equipment.

E. Cooling System:

1. The jacket water cooling system shall consist of an engine mounted radiator of type and capacity recommended by the engine manufacturer. The radiator/fan shall provide the required performance with a minimum static pressure restriction of 2-inches water column and a maximum airflow of 1,500 CFM.
2. Provide an engine thermostat to regulate engine water temperature as recommended by the manufacturer. Provide a high coolant temperature device to shut down the engine through the engine control panel when the engine temperature exceeds 200 degrees F. The engine cooling system shall be filled with a mixture of water and permanent type glycol antifreeze to protect the system to the minimum temperature specified.

F. Lubricating System:

1. The engine lubricating system shall be the full-pressure type with a device to shut down the engine through the engine control panel on low oil pressure. Provide an oil filter with replaceable element and a bayonet type oil level stick. Provide a valved oil drain extension.
2. Lubrication oil shall be cooled by a water-cooled heat exchanger utilizing jacket water.

G. Exhaust System:

1. System shall consist of a super extreme grade noise attenuating exhaust silencer, metal flex connector, elbows, piping, insulated wall thimble, and mounting hardware. Contractor shall furnish and install all required supports, hangers, clamps for mounting the silencer and exhaust piping for a fully operational system as indicated on Contract Drawings. Complete system, including exhaust silencer and exhaust piping, and exhaust piping shall be wrapped in 1-1/2 inches of insulation. Insulation specified in Section 40 42 00, Breeching and Stack Insulation.
   a. Exhaust Silencer shall be sized to ensure back-pressure does not exceed the maximum limitations specified by the engine manufacturer.
   b. Metal Flex Connector: A flexible metallic connector shall be furnished to minimize vibration and accommodate thermal expansion/contraction. Size and type as recommended by the engine manufacturer. Connector shall be of Type 316 stainless steel.
   c. Insulated Wall Thimble: Exhaust shall pass through the CMU building wall by utilizing an insulated thimble constructed in conformance with NFPA 37 and 110. Thimble shall be of welded construction, consisting of an inner and outer sleeve separated by vented separators constructed to minimize the conduction of heat from the inner to the outer sleeve. The exhaust pipe shall fit within the inner sleeve and insulation material. The thimble shall include a support collar and exterior flashing on the opening surface, welded to the outer sleeve of the thimble. Furnish a rain collar to clamp on the exhaust pipe and over the thimble, to prevent the entrance of rain into the thimble. Include a mitered tail piece on the exhaust piping with a screen on terminal to prevent entrance of birds and insects.
   d. Silencer Type: A super extreme grade noise attenuating silencer for use where ambient noise levels are extremely low and a high degree of silencing is required. Features compressed acoustical fiberglass inserted between the double shell. Provides 300 to 400 degrees (F) degree reduction in surface skin temperature.
      1) Minimum sound attenuation: 45 to 60 dBA.

H. Air Intake System: The engine air intake shall be equipped with a dry type air cleaner with filter service indicator.

I. The engine shall be designed to meet Tier 2 emissions requirements. The submittal shall include detailed literature that specifically indicates that the proposed engine is certified to meet Tier 2 limits.

2.05 SIGHT FLOW INDICATORS

A. Indicators shall be provided as part of the fuel oil supply and return lines. Indicator shall be constructed of ASTM B62 bronze alloy and be provided with threaded end connections. Indicator shall include an internal Delrin rotating propeller to provide visual flow indication. Indicator housing shall include a tempered glass observation port for viewing the rotating propeller. Indicators shall have Buna-N seals.

B. Manufacturers/Products:

1. OPW Engineered Systems; VISI-FLO Series; Model 1431D.
2. Or Engineer approved equal.

2.06 ENGINE CONTROL PANEL

A. The engine shall be furnished with an engine mounted engine control panel (ECP). This control panel shall include all indicators, control switches, alarms, and signal interfaces required for satisfactory operation of the engine drive system. The control panel shall receive signals from a variety of sensors part of the engine including, but not limited to the following:

1. Temperatures:
   a. Coolant, after cooler, turbo inlet and exhaust, inlet air, engine oil, etc.
   b. Bearing and stator RTDs.
2. Pressures: Atmospheric, turbo inlet/outlet, crank case, oil, fuel, etc.
3. Level: Coolant and fuel.
4. Speed sensors.
5. Signal interfaces to voltage regulator and governor control.

B. The voltage regulator and related signal interfaces shall be part of the ECP.

C. The governor control shall be included in the ECP.

2.07 VIBRATION ISOLATORS

A. The engine shall be mounted to carbon steel structural shapes which are in turn anchored to an existing concrete pedestal. The engine shall be mounted on Korfund Series L vibration isolators. Vibration isolators shall be sized by the isolator manufacturer and shall be such to limit the maximum vibration transmissibility to 10 percent.

2.08 TORSIONAL VIBRATION

A. Each complete engine system shall be so designed, constructed, and installed as to be free from objectionable vibration in any mode. Freedom from torsional vibration shall be demonstrated by torsiograph records taken during the factory test of these units.

2.09 FACTORY PAINT

A. Each complete engine set, including the control cabinet shall be given a factory-applied primer and two finish coats of the manufacturer's premium grade heat-resistant engine paint. The color shall be as selected by the manufacturer. All areas damaged during shipment shall be touched up after installation.

2.10 SPECIAL TOOLS

A. A set of specialty tools necessary for routine maintenance of the equipment shall be furnished. Included shall be a hydrometer and two-pronged battery voltmeter.

2.11 SPARE PARTS

A. The following spare parts for each engine shall be furnished as part of the base bid:

1. One set fuel oil filter element and gaskets.
2. One lubricating oil filter element and gaskets.
3. Two air cleaner filter element.
4. One set V-belts for pump drives.
5. One set of cooling fan belt drives (if applicable).

PART 3 EXECUTION

3.01 ENGINE DRIVE SYSTEM INSTALLATION

A. The engine drive system shall be transported and installed at the site by the Contractor.

3.02 TESTS

A. Factory Test: The engine drive set shall be tested at the manufacturer's plant before shipment. The test shall consist of a steady load run of the durations listed below at each applied load rating:

1. 25 percent applied load for 1 hour.
2. 50 percent applied load for 1 hour.
3. 75 percent applied load for 1 hour.
4. 100 percent applied load for 3 hours.

B. Field Test:

1. An in-place static alignment check of all rotating components shall be made prior to first startup, after units are secured in-place and all final connections are made.
2. At a time when the engine system is complete and the raw water well can be operated from the standby source, the engine shall be given load and operational tests. The units shall be operated at full load for at least 2 hours. In addition, a 2-hour Performance Acceptance Test (PAT) shall be performed. During this test, the engine shall be operated continuously for a minimum period of 2 hours. The above tests shall be performed during normal working hours. The tests shall be coordinated with the Owner. During the tests, the manufacturer shall record all available parameters from the operating units (i.e. diesel fuel usage, output H, oil pressure, engine coolant temperature, ambient air temperature, etc.) at 15-minute intervals. The recorded information shall be documented and submitted to the Owner and Engineer. All specified functional requirements shall be verified by actual tests. Complete records shall be kept throughout the tests, including water temperature, oil pressure, ambient air temperature, etc. Operational tests shall show that the system operates as specified, and shall include verification of preliminary alarm and shutdown functions, and check of other operational options available to the operator.
3. Demonstrate engine safety shutdowns and performance results.
4. A vibration analysis shall be performed after all other tests have been completed and after a minimum of 24 hours running time has been accumulated on the engine. Required dynamic balancing shall be performed at this time to bring the running unit within the tolerance specified.

5. Tests shall be conducted by an authorized representative of the manufacturer of the engine manufacturer. Costs of this representative shall be included in the Bid for this equipment. At least 10 working days' notice of beginning of test shall be given to the Owner to allow witnessing of the tests. Required instrumentation not included in the system equipment shall be provided by the supplier. Upon completion of the tests, final adjustments and alignment check shall be made to the equipment, fuel, and oil filters shall be replaced, belt drive tensions checked, and the proper operation of all equipment demonstrated to the Contractor and the Engineer. The Owner shall be instructed in the maintenance and operation of the equipment.

3.03 MANUFACTURERS' SERVICES

A. Manufacturer's Onsite Services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Revisiting the site as required to correct problems and until installation and operation are acceptable to Contractor.
4. Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.
5. Assistance during functional and performance testing, and facility startup and evaluation.
6. Training of Owner's personnel in the operation and maintenance of respective product as required.
7. Additional requirements may be specified elsewhere.

B. Manufacturer's Certificate of Proper Installation:

1. A Manufacturer's Certificate of Proper Installation form shall be completed and signed by the equipment manufacturer's representative.
2. Such form shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

C. Training:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component).

2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Division 1, General Requirements.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

D. Onsite Services:

1. Present at site or classroom designated by Owner, the minimum person-days listed below, travel time excluded:
   a. 1 person-day for installation assistance and inspection.
   b. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
   c. 1/2 person-day for prestartup classroom onsite training.
   d. 1 person-day for facility startup.

3.04 SUPPLEMENTS

A. The supplements listed below, following "END OF SECTION," are part of this Specification.

1. Supplement 1, "Operational and Maintenance Manual" Data for Navarre Beach Well #2 Pump, Angle Drive and Controller.

END OF SECTION

BULLETIN 250

Layne

Vertical Turbine Pumps for Water Wells

NAVARRE BEACH WELL #2
OPERATIONAL AND MAINTENANCE MANUALS
Pump, Angle Drive & Controller

SINGER

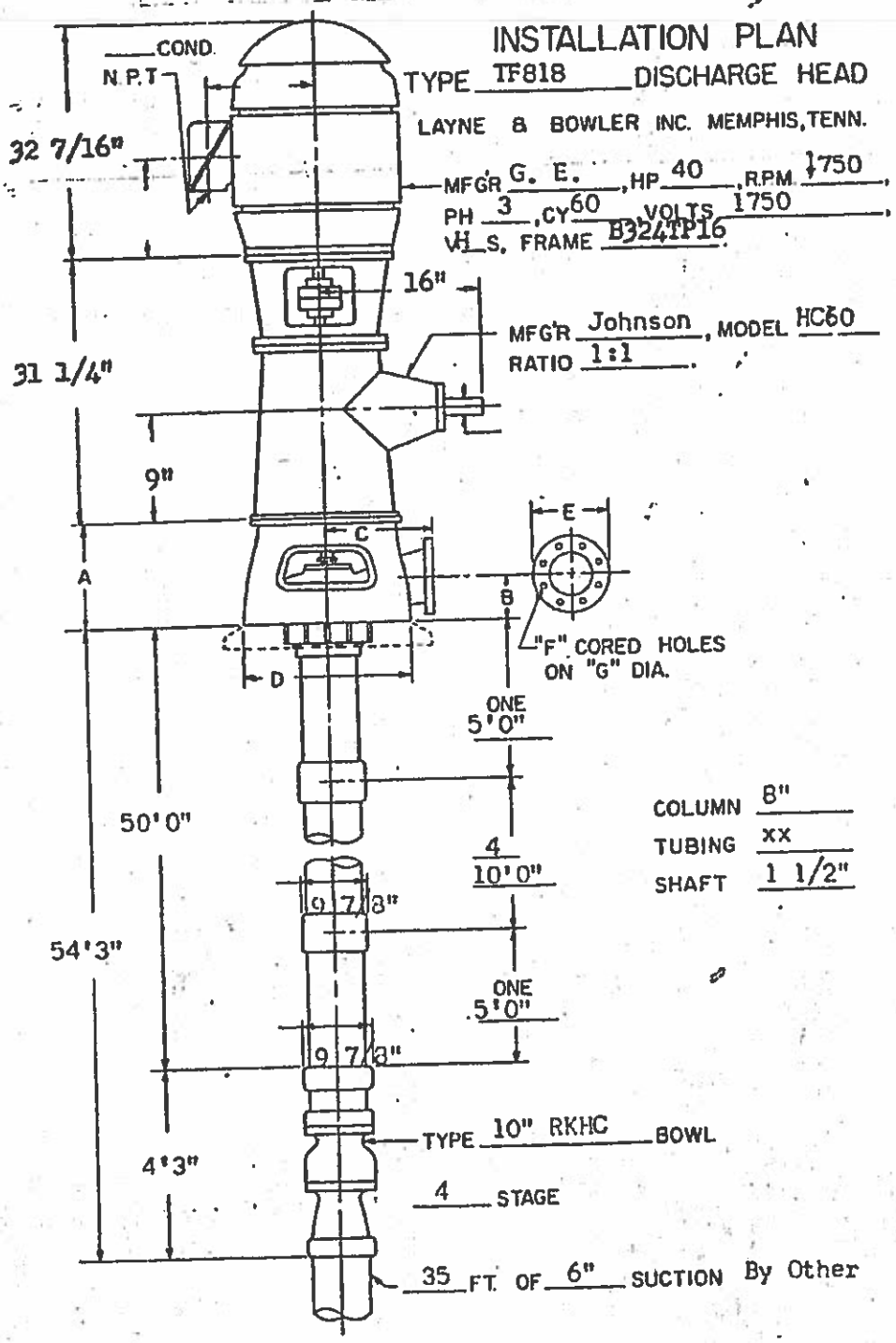
WORLD'S MOST COMPLETE WATER SERVICE ORGANIZATION Layne

40 00 64 SUPPLEMENT-1

INSTALLATION PLAN

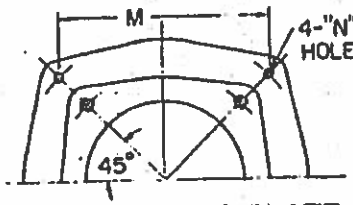
TYPE TF818 DISCHARGE HEAD

LAYNE & BOWLER INC. MEMPHIS, TENN.



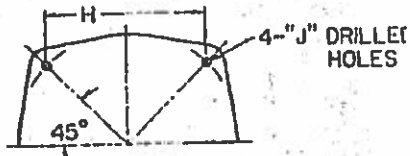
COLUMN 8"
TUBING XX
SHAFT 1 1/2"

USE THESE DIMENSIONS ONLY WHEN CERTIFIED BY FACTORY

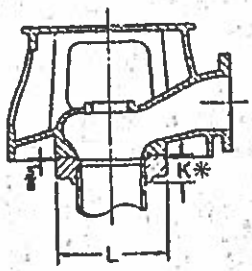


HOLES IN BASE PLATE

BASE PLATE



HOLES IN BASE OF HEAD



SECTION THRU HEAD

* FOR COLUMN SETTINGS OF 200' OR GREATER, "K"=

CUSTOMER: Santa Rosa County Beach Administration
LOCATION: Navarre Beach, Florida (Plant No. 2)
FOR APPROVAL
CERTIFIED:

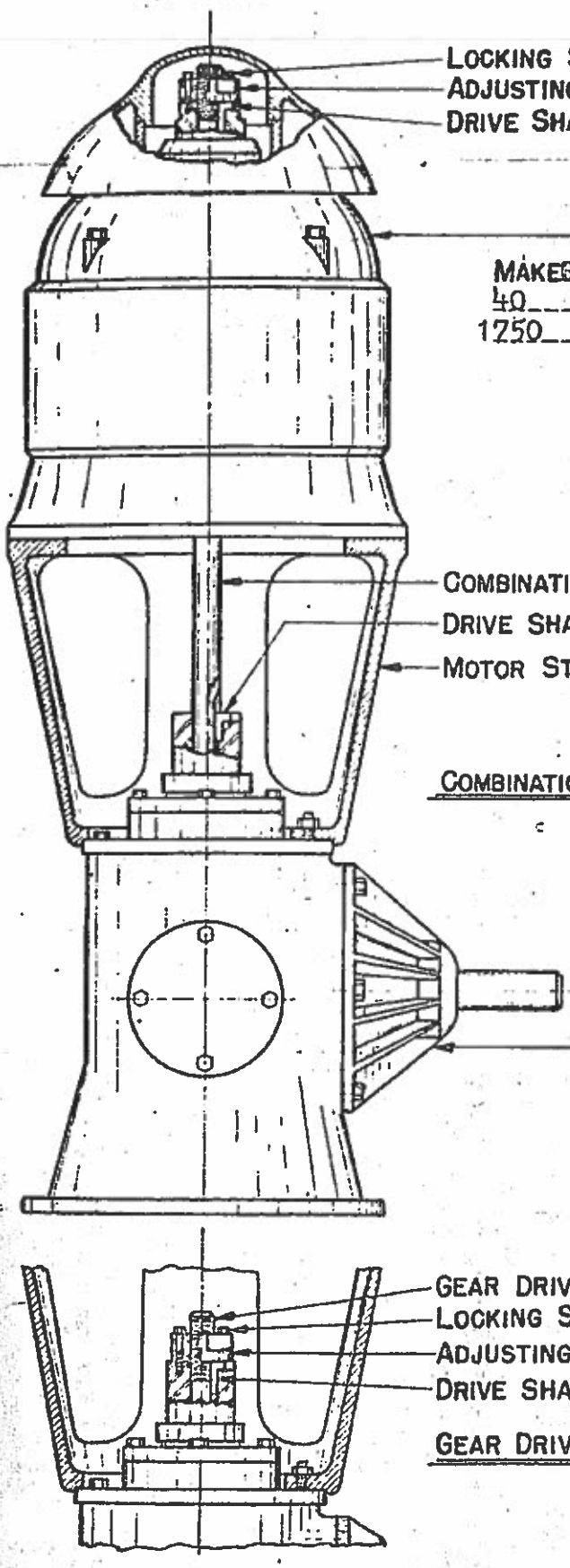
YOUR NO: 001474
OUR NO: 73D-4823
PUMP NO: 74677
DATE: August 29 1973

G.P.M. 500
T.D.H. 139
R.P.M. 1750
B.H.P.

HEAD	A	B	C	D	E	F	G	H	J	K*	L	M	N	P	R	S
TF413	13	6	11	18	9	8-3/4	7 1/8	14 1/8	1 15/16	2 13/16	10	16 13/16	7/8	21	2	17
TF613	14	6	11	18	11	8-7/8	9 1/2	14 1/8	1 15/16	2 7/8	11	16 13/16	7/8	21	2	17
TF418	13	6	14 1/2	23	9	8-3/4	7 1/2	17 5/16	1 15/16	2 13/16	10	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF618	15	6	14 1/2	23	11	8-7/8	9 1/2	17 5/16	1 15/16	2 7/8	12-1/2	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF818	18	7 3/32	14 1/2	23	13 1/2	8-7/8	11 1/2	17 5/16	1 15/16	3 1/16	13 1/2	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF1018	18	8 1/8	14 1/2	23	16	12-1	14 1/2	17 5/16	1 15/16	3 1/16	16	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF1218	20	9 5/8	16 1/2	26	19	12-1	17	19 5/8	1 15/16	3 1/16	19	23 11/16	7/8	32	3 1/4	24

HEAD	A	B	C	D	E	F	G	H	J	K*	L	M	N	P	R
TF625	15	8 1/8	18 1/4	31	11	8-7/8	9 1/2	23 11/16	1 15/16	2 7/8	12 1/2	29	1	38	3 5/8
TF825	20	8 1/8	18 1/4	31	13 1/2	8-7/8	11 1/2	23 11/16	1 15/16	3 1/16	13 1/2	29	1	38	3 5/8
TF1025	20	8 1/8	18 1/4	31	16	12-1	14 1/2	23 11/16	1 15/16	3 1/16	16	29	1	38	3 5/8
TF1225	21	9 1/8	18 1/4	31	19	12-1	17	23 11/16	1 15/16	3 1/16	19	29	1	38	3 5/8
TF1225I	21	9 1/8	18 1/4	31	19	12-1	17	23 11/16	1 15/16	4 1/16	21	29	1	38	3 5/8
TF1425	21	10 3/8	18 1/4	31	21	12-1 1/2	18 3/4	23 11/16	1 15/16	4 7/16	21	29	1	38	3 5/8
TF1227	24 1/2	9 1/8	21	36	19	12-1	17	27 1/8	1 15/16	3 1/16	19	33 3/8	1	43	4 1/2

PBO 178



MOTOR

MAKE G.E. FRAME NO. B324TP16
40 H.P. 1750 R.P.M.
1250 VOLTS 3 PHASE 60 CYCLES

COMBINATION DRIVE WITH SOLID SHAFT

GEAR DRIVE

MAKE Johnson
TYPE 1:1 FRAME NO. HC60

GEAR DRIVE WITH SEPARATE SHAFT

COMBINATION GEAR DRIVE AND HOLLOW SHAFT MOTOR
USING SOLID COMBINATION SHAFT & SEPARATE GEAR SHAFT

CURVE NO. PT1815.1

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
LOWER	4.5	1
LOWER	3.0	2
LOWER	1.5	3
LOWER	0.6	4

NOTE: ANY CHANGE IN EFFICIENCY CHANGES EITHER THE HEAD OR HORSE POWER IN PROPORTION.

LAYNE & BOWLER, INC.
Memphis, Tenn.

10" RKHC
1750 R P M

SINGLE STAGE LABORATOR
HEAD & HORSE POWER
THRUST "K" = 6.0

5RK171

A – 7 5/8" DIA.
B – 7 1/4" DIA.
C – 6 7/8" DIA.

HEAD IN FEET

HORSE POWER

HEAD CAPACITY

HORSE POWER

U. S. GALLONS PER MINUTE

Approved

Approved as Corrected

Revise and Resubmit

Date:

By:

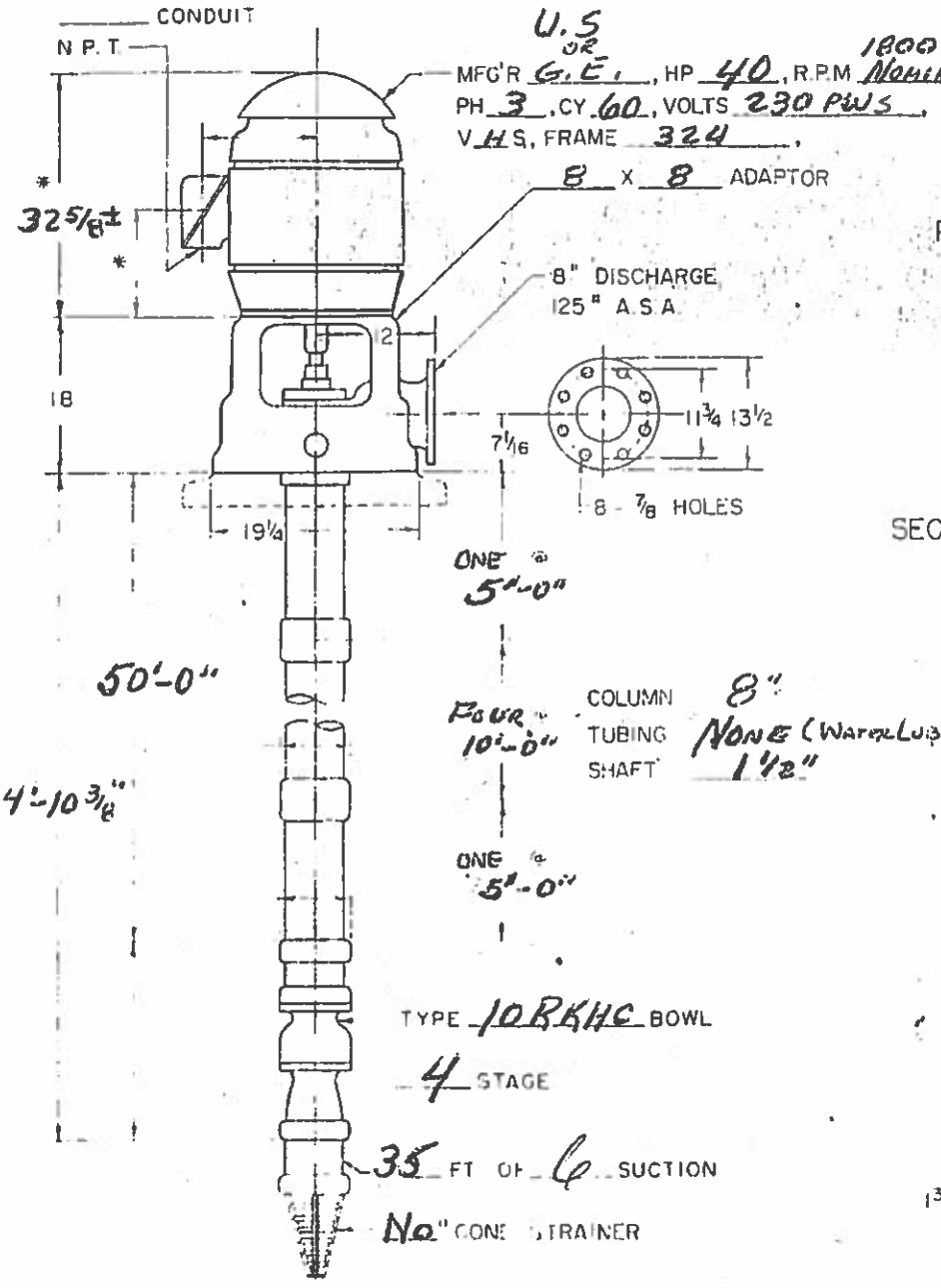
"Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication processes or to techniques of construction, and for coordination of the work of all trades."

ASKERVILLE DONOVAN ENGINEERS, INC.
P.O. BOX 260
GULFSTREAM
ONE STAGE

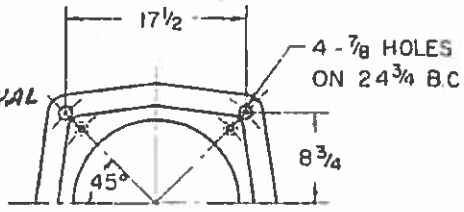
PRINTED

INSTALLATION PLAN
TYPE RF 816 DISCHARGE HEAD

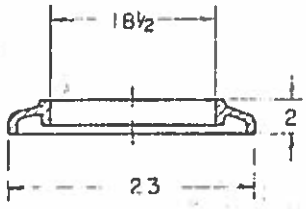
LAYNE & BOWLER, INC. MEMPHIS, TENNESSEE



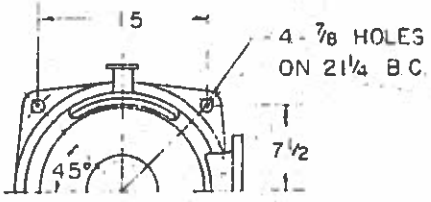
USE THESE DIMENSIONS ONLY
WHEN CERTIFIED BY FACTORY



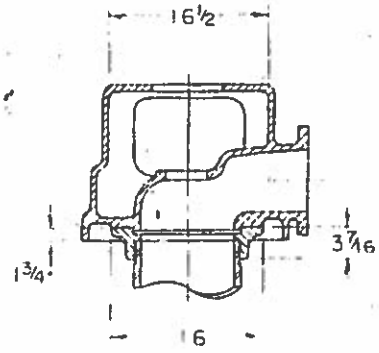
PLAN OF BASE PLATE



SECTION THRU BASE PLATE



PLAN OF HEAD



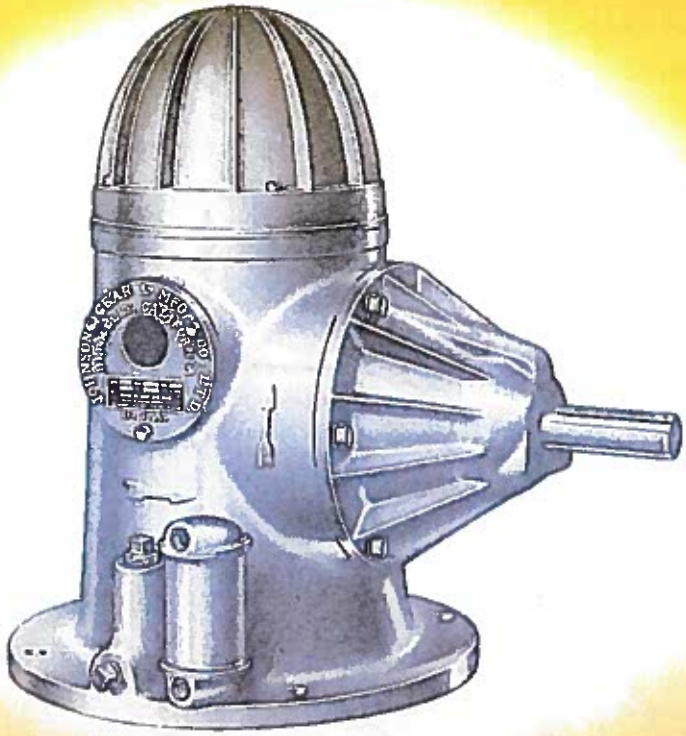
SECTION THRU ELL

500 gpm @ 139' TDH, 1750 rpm, 31.5 BHP

CUSTOMER: Santa Rosa County Beach Admin.	YOUR NO:	G.P.M: 500
LOCATION: Navarre Beach Water Plant No. 2	OUR NO:	T.D.H: 139
FOR APPROVAL: L	PUMP NO:	R.P.M: 1750
CERTIFIED:	DATE:	B.H.P: 31.5

PBO 144

CATALOG 36



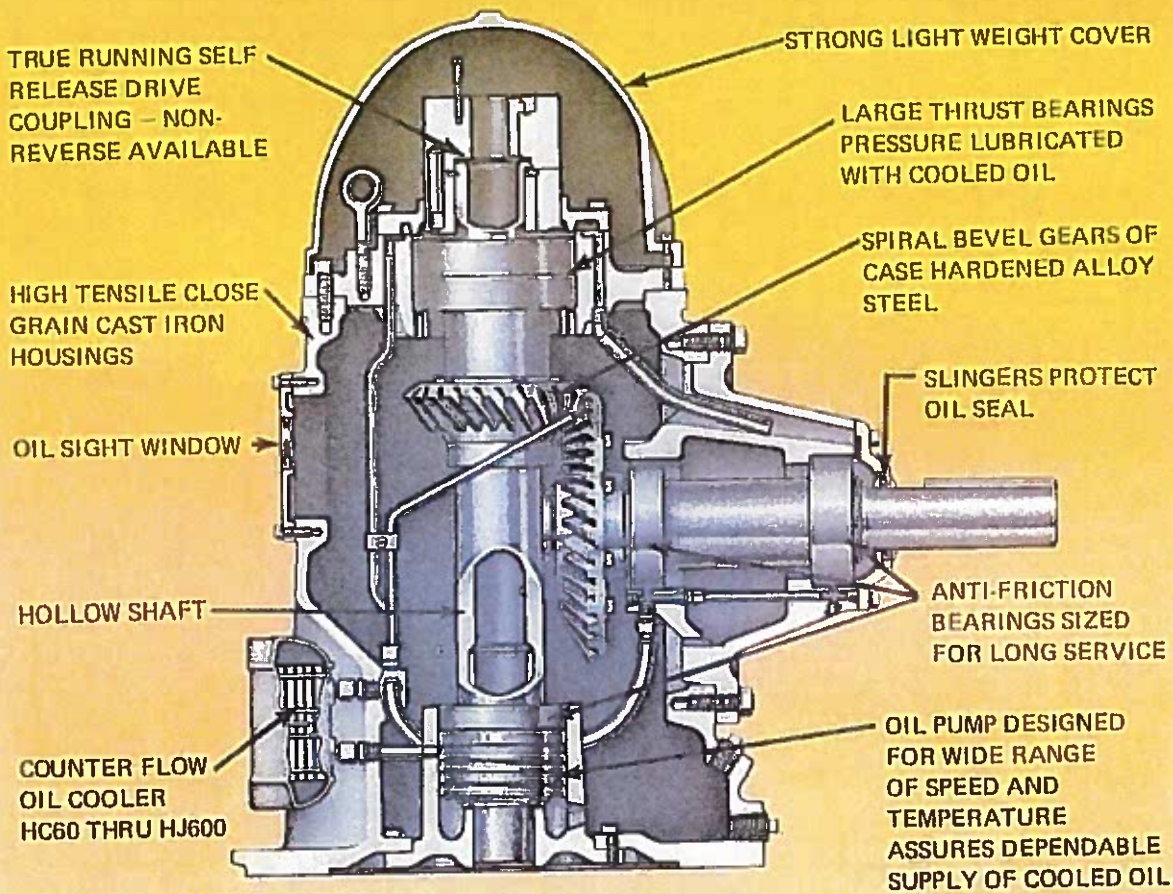
JOHNSON

Right angle TURBINE PUMP DRIVE

JOHNSON GEAR & MANUFACTURING CO., LTD.

CATALOG 36

FOR DEPENDABLE LONG LIFE, LOW OPERATING COST AND HIGH EFFICIENCY



JOHNSON *Right angle* GEAR DRIVE

SALIENT FEATURES

MATERIALS OF HIGHEST QUALITY emphasizing wide use of heat-treated and strain-relieved alloys to insure strength and dimensional stability.

DESIGN of vertical and horizontal members facilitates bench assembly of gears and bearings which are pressed in place, insuring exact and permanent positioning.

SPIRAL BEVEL GEARS of case hardened alloy steel lapped in pairs, quiet in operation.

LUBRICATION—Force feed of cooled oil to bearings and gears by positive oil pump.

TEMPERATURE—Special consideration has been given to heat dissipation and operation in the most efficient temperature range. Adequately sized housings have supplementary cooling fins on small air-cooled units, and auxiliary water cooling is provided for the large sizes.

WORLD-WIDE ACCEPTANCE in recognition of dependable safe service and economy of operation and maintenance.

OIL COOLER—Counterflow marine type with connections arranged vertically to permit water to drain in areas where freezing weather occurs. Normally self-cleaning, even with sandy water. Externally replaceable without disassembly of gear drive.

SELECTED PRECISION BALL BEARINGS used throughout to retain gears in exact position for maximum life and quietness in operation.

EFFICIENT—Maximum amount of usable power transmitted to pump.

WEATHERPROOF housing impervious to climatic conditions.

FACTORY TESTED at service RPM prior to shipment and provided with instruction manual.

EXPERIENCE—Pioneers in development of right angle gear drives for turbine pumps. Each unit a product of nearly 65 years' experience in the manufacture of quality gearing.

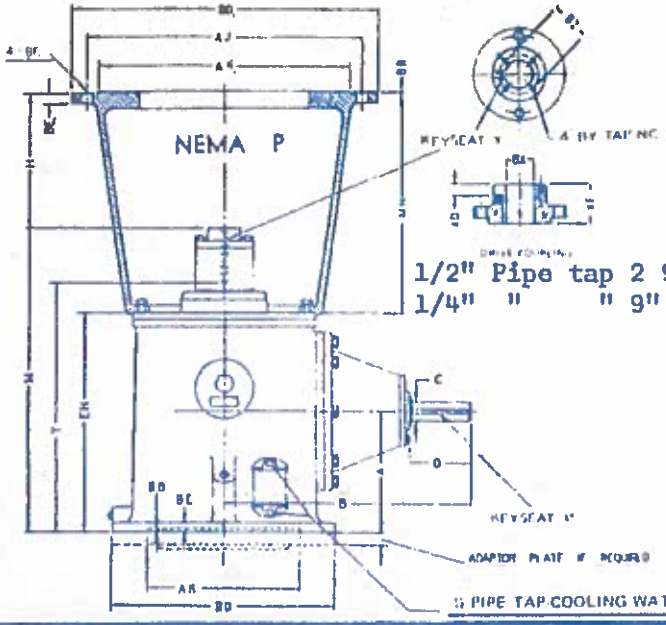
TABLE 2

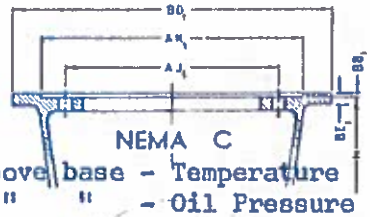
MODEL	Vert. Shaft R.P.M.	H.P.	DOWNTHRUST CAPACITY		HORIZONTAL SHAFT R.P.M. — SPEED INCREASING RATIOS — DRIVER : DRIVEN							
			Std.	Hvy.	1:2	4:7	2:3	3:4	4:5	5:6	10:11	1:1
HA 15	1160	11	2200		580	668	773	870				1160
	1460	13	2100		730	841	973	1095				1460
	1760	15	2000		880	1013	1173	1320				1760
	3460	25	1650		1730	1992	2307	2595				3460
HB 40 12" BASE	1160	30	4400		580	667	773	870		960		1160
	1460	35	4200		730	840	973	1095		1208		1460
	1760	40	4000		880	1012	1173	1320		1457		1760
	2960	46	3500		1480	1702	1973	2220		2450		2960
HB 40	1160	30	4400		580	667	773	870		960		1160
	1460	35	4200		730	840	973	1095		1208		1460
	1760	40	4000		880	1012	1173	1320		1457		1760
	3460	50	3370		1730	1990	2307	2595		2863		3460
HC 60	860	34	6000		430	494	573	645		712		860
	1160	43	5500		580	667	773	870		960		1160
	1460	52	5200		730	840	973	1095		1208		1460
	1760	60	5000		880	1012	1173	1320		1457		1760
HD 90	860	55	8300	10700	430	491	573	645	693	712	777	860
	1160	70	7700	9900	580	663	773	870	935	960	1048	1160
	1460	80	7300	9400	730	834	973	1095	1177	1208	1319	1460
	1760	90	7000	9000	880	1006	1173	1320	1419	1457	1590	1760
HE 150	580	65	10400	15700	290	330	387	431	467	480	529	580
	860	88	9400	14300	430	489	573	639	693	712	784	860
	1160	110	8800	13300	580	660	773	862	934	960	1058	1160
	1460	130	8300	12500	730	830	973	1085	1176	1208	1331	1460
	1760	150	8000	12000	880	1001	1173	1367	1418	1457	1605	1760
HF 200	580	93	12500	16500	284	330	387	435	467	481	529	580
	860	121	11400	14800	422	489	573	645	693	713	784	860
	1160	150	10500	13800	569	660	773	870	934	961	1058	1160
	1460	180	9900	13000	716	830	973	1095	1175	1210	1331	1460
	1760	200	9500	12500	863	1001	1173	1320	1417	1458	1605	1760
HG 250	580	123	14500	19800	284	330	387	435	467	481	529	580
	860	160	13000	17900	421	489	573	645	693	713	784	860
	1160	200	12200	16700	568	660	773	870	934	961	1058	1160
	1460	230	11500	15700	715	830	973	1095	1175	1210	1331	1460
	1760	250	11000	15000	862	1001	1173	1320	1417	1458	1605	1760
HH 350	580	150	17100	21000	284	333	391	432	461	481	530	580
	860	200	15500	19000	421	494	579	640	684	713	786	860
	1160	255	14400	17800	568	666	782	863	923	962	1061	1160
	1460	305	13600	16700	715	838	984	1087	1161	1211	1335	1460
	1760	350	13000	16000	862	1010	1186	1310	1400	1460	1609	1760
HH 425	580	195	19700	26000		333	391	432	461	481	530	580
	860	255	17900	24000		494	579	640	684	713	786	860
	1160	315	16600	22000		666	782	863	923	962	1061	1160
	1460	375	15700	21000		838	984	1087	1161	1211	1335	1460
	1760	425	15000	20000		1010	1186	1310	1400	1460	1609	1760
HI 500	580	230	19700	26000	284	333	391	432		481		580
	860	300	17900	24000	422	494	579	640		713		860
	1160	370	16600	22000	569	666	782	863		962		1160
	1460	440	15700	21000	716	838	984	1087		1211		1460
	1760	500	15000	20000	863	1010	1186	1310		1460		1760
HJ 600	580	278	21000	27000	284	330	391	432		486		580
	860	365	19000	25000	422	489	579	640		720		860
	1160	445	17800	23000	569	660	781	864		971		1160
	1460	530	16700	22000	716	830	983	1087		1222		1460
	1760	600	16000	21000	863	1000	1185	1310		1473		1760

JOHNSON GEAR & MANUFACTURING CO., Ltd.

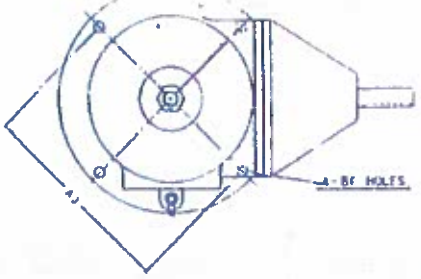
Customer . . SINGER-Layne Central Division . . . . . Order No. . 001473 . . . . . .
Customer's Reference . . "001473-P17902-100-Navarre" . . . . . .
Serial No. . 47366 . . . . . Model . . HC60 . . . . . Ratio . . 1:1 . . . . . Rotation Fig. . 1 . .
Approved by . . . PS . . . . . Date . 8/30/73 . . . . . Drive Coupling "BX" . . 1 1/2" . . . . . Type . . SR . . . . . .

NEMA P MOTOR STAND





1/2" Pipe tap 2 9/16" above base - Temperature
1/4" " " 9" " " - Oil Pressure



½ PIPE TAP COOLING WATER FOR MODEL HC60 AND UP

DIMENSIONS OF JOHNSON COMBINATION RIGHT ANGLE GEAR DRIVES TABLE 2

Model	A	B	C	D	EH	H	M	BE	BD	AJ	AK	BB	BF	Keyseat X
HA15	6 1/8	13	1 1/8	2 1/4	10 1/8		16	5/8	10	9 1/8	8 1/4	3/16	7/16	1/4 x 1/8 x 2 1/2
HB40(12)	9	16	1 1/2	3 1/2	15 1/4		22 1/4	3/4	12	9 1/8	8 1/4	3/16	7/16	3/8 x 3/16 x 3
HB40	9	16	1 1/2	3 1/2	15 1/4		22 1/4	3/4	16 1/2	14 3/4	13 1/2	3/16	11/16	3/8 x 3/16 x 3
XXX HC60	9	16	1 1/2	3 1/2	15 1/4	9"	22 1/4	3/4	16 1/2	14 3/4	13 1/2	3/16	11/16	3/8 x 3/16 x 3
HD90	11 1/8	17 1/2	2	3 1/2	19 5/8		26 1/4	1	16 1/2	14 3/4	13 1/2	3/16	11/16	1/2 x 1/4 x 3
HE150	13 1/4	20 1/2	2 5/16	4 3/4	23 1/8		31 1/4	1	20	14 3/4	13 1/2	3/16	11/16	5/8 x 3/16 x 4
HF200	15	24	2 3/4	5 1/2	26 3/8		36	1 1/8	20	14 3/4	13 1/2	3/16	11/16	5/8 x 3/16 x 5
HG250	16 1/2	29	2 3/4	5 1/2	29 7/8		40 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	5/8 x 3/16 x 5
HH350	16 1/2	30	3	5 3/4	29 7/8		41 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	3/4 x 3/8 x 5
HH425	16 1/2	31	3 1/2	6 1/4	29 7/8		41 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	7/8 x 7/16 x 5 1/4
HI500	16 1/2	33	3 3/4	7 1/2	31 7/8		45 3/8	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	7/8 x 7/16 x 5 1/4
HJ600	19	36	4	7 1/2	37		48 3/4	1 1/2	30 1/2	26	22	3/8	15/16	1 x 1/2 x 7

*Also 5/8-11 Tap on 14¾ AJ 1" Deep

MAX. DRIVE COUPLING AND KEYSEAT

Model	XF	XD	BX Fig. 1 & 4	BX Fig. 2 & 3	BY	BZ	T	Y
HA15	1 1/8	5/16	3/4	5/8	10-32	1 3/8	12 1/4	3/16 x 3/32 x 5/16
HB40	2 1/8	9/16	1 1/2	1 1/4	1/4-20	2 1/8	17 3/4	3/8 x 3/16 x 6 1/2
XXX HC60	2 1/8	5/16	1 1/2	XXX	1/4-20	2 1/8	17 3/4	3/8 x 3/16 x 6 1/2
HD90	2 1/8	5/16	1 1/2	1 1/2	1/4-20	2 1/8	22 1/8	3/8 x 3/16 x 6 1/2
HE150	2 1/8	9/16	1 15/16	1 3/4	1/4-20	2 1/2	26 1/2	1/2 x 1/4 x 7
HF200	2 5/8	11/16	2	2	1/4-20	2 1/2	30	1/2 x 1/4 x 8
HG250	3	11/16	2 1/16	2 1/16	3/8-16	3 1/4	34	1/2 x 1/4 x 9
HH350	3 1/4	13/16	2 7/16	2 7/16	3/8-16	3 1/4	34	5/8 x 5/16 x 10
HH425	3 1/4	13/16	2 7/16	2 7/16	3/8-16	3 1/4	35	5/8 x 5/16 x 11
HI500	4	13/16	2 11/16	2 11/16	1/2 16	3 3/4	39 1/2	5/8 x 5/16 x 12
HJ600	4	15/16	3 3/16	3 3/16	3/8-16	4 1/2	39 1/2	3/4 x 3/8 x 12

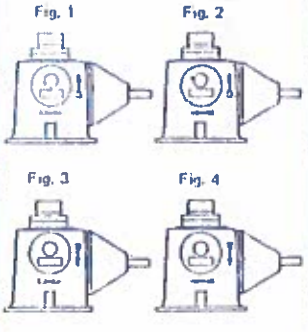
MOTOR STAND

MH	16"
BD1	16 1/2
AJ1	14 3/4
AK1	13 1/2
BB1	1/8
BF1	5/8-11
BE1	5/8

SPEC. DRIVE COUPLING

BX	
Y	
BY	
BZ	
XD	

ROTATION DIAGRAM



Tolerances: Drive Shaft "C" plus .000 minus .001; Base Rabbet "AK" plus .002 plus .005; Coupling Bore "BX" plus .0005 plus .0015; Motor Stand Rabbet "AK1" plus .000 minus .005 — Unfinished cast surfaces subject to normal variation.

BERKELEY, CALIFORNIA 94710, U. S. A.

ND-88509

SECTION 40 05 15
PIPING SUPPORT SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM): A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
2. Building Officials and Code Administrators (BOCA): Basic Building Code.
3. International Conference of Building Officials (ICBO): Uniform Building Code.
4. Manufacturers' Standardization Society (MSS):
   a. SP 58, Pipe Hangers and Supports-Materials, Design and Manufacture.
   b. SP 69, Pipe Hangers and Supports-Selection and Application.
   c. SP 89, Pipe Hangers and Supports-Fabrication and Installation.
5. National Electrical Manufacturers Association (NEMA): VEI, Metallic Cable Tray Systems.

1.02 DEFINITIONS

A. Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.

B. Nonmetallic: PVC, CPVC, and FRP.

C. Nonferrous Metals: Copper.

D. Wetted or Submerged: Submerged, or less than 1 foot above maximum liquid surface of water holding structures, below top of channel walls, under cover or slab of channels or tanks, or in other damp covered locations.

1.03 SUBMITTALS

A. Shop Drawings:

1. Drawings of piping support system, locating each support, brace, hanger, guide, component and anchor. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.

2. Drawings of piping systems including shop fabricated sections showing laying dimensions, equipment connections, anchor and support locations, and fitting dimensions.
3. Identification of pipe support material of construction (with ASTM reference number).
4. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.

1.04 DESIGN REQUIREMENTS

A. General:

1. Design, size, and locate piping support systems throughout facility, whether shown or not.
2. Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89.
3. Piping shall be supported, in general, as described hereinafter, and as shown by the pipe support details on the Drawings. Manufacturers' catalog figure numbers are typical of the types, quality, and configuration of pipe supports and hangers to be employed. Special supports and hangers may be necessary to provide the required materials in the configurations shown.
4. The Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation.
5. All submerged metal piping shall be electrically isolated from the supports with a wrap of 1/8-inch thick by 3-inch wide neoprene rubber between the pipe and support.
6. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any Drawings shall not relieve the Contractor of the responsibility for providing them throughout the Project at no increase in Contract cost.
7. All support anchoring devices, including anchor bolts, concrete inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support. Concrete anchors and anchor bolts shall be as specified in Section 05 50 00, Metal Fabrications.
8. Where piping connects to equipment it shall be supported by a pipe support and not by the equipment.
9. A pipe support or hanger shall be installed within 3 diameter lengths up through 12-inch pipe adjacent to each pipe fitting, flexible connection, flange coupling adapter, in-line device such as a valve or meter for all piping larger than 4 inch, or removable spool piece.

B. Pipe Support Systems:

1. Support Load: Dead loads imposed by weight of pipes filled with water, except air and gas pipes, plus insulation.
2. Safety Factor: Minimum of 5.
3. Maximum Support Spacing and Minimum Rod Size:
   a. Carbon Steel or Ductile Iron Piping:

Pipe Size	Maximum Support/ Hanger Spacing	Minimum Rod Size Single Rod Hangers
1 inch & smaller	6 feet	1/4 inch
1-1/2 inches thru 2-1/2 inches	8 feet	1/4 inch
3 inches and 4 inches	10 feet	3/8 inch

C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

PART 2 PRODUCTS

2.01 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated by catalogs.

B. Special support and hanger details are shown for cases where standard catalog supports are inapplicable.

C. Materials:

Location	Material of Construction	Remarks
Exterior of Buildings, Atmospherically Exposed Environment	Type 304 Stainless Steel	New Pipe Supports
Interior of Buildings, Atmospherically Exposed	Type 304 Stainless Steel	New Pipe Supports

2.02 SADDLE SUPPORTS

A. Pedestal Type: Schedule 40 pipe stanchion, saddle, and anchoring flange.

1. Nonadjustable Saddle: MSS SP 58, Type 37 with U-bolt.
   a. Grinnell; Figure 259.
   b. B-Line; Figure B3090.
2. Adjustable Saddle: MSS SP 58, Type 38 without clamp.
   a. Grinnell; Figure 264.
   b. B-Line; Figure B3093.

2.03 PIPE CLAMPS

A. Riser Clamp: MSS SP 58, Type 8.

1. Grinnell; Figure 261.
2. B-Line; Figure B3373.

2.04 CRADLE SUPPORTS

A. Restrained:

1. Britt: Figure 110.
2. Or equal.

B. Unrestrained:

1. Britt: Figure 90G.
2. Or equal.

2.05 ACCESSORIES

A. Vibration Isolation Pads:

1. Type: Neoprene Waffle.
2. Manufacturers and Products:
   a. Mason Industries; Type W.
   b. Korfund; Korpad 40.

2.06 PIPE ANCHORS

A. Type: Anchor chair with U-bolt strap.

B. Manufacturers and Products:

1. Grinnell; Figure 198.
2. B-Line; Figure B3147A or B3147B.

2.07 ANCHORING SYSTEMS

A. Material:

1. Wetted and Submerged: Type 316 stainless steel.
2. Atmospheric Exposed: Type 304 stainless steel.

B. Size: Sized by equipment manufacturer and as specified in Section 05 50 00, Metal Fabrications.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
2. Support piping connections to equipment by pipe support and not by the equipment.
3. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
4. Support no pipe from the pipe above it.
5. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
6. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
7. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
8. Install lateral supports for seismic loads at all changes in direction.
9. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
10. Repair mounting surfaces to original condition after attachments are made.
11. Wrap all stainless steel, nonmetallic, and nonferrous piping with minimum 1/8-inch thick neoprene sheet at support locations to prevent direct contact between support and piping material.

B. Standard Pipe Supports:

1. Horizontal Piping Supported From Floors:
   a. Stanchion Type:
      1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.

2) Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.

2. Standard Attachments:
   a. To Concrete Ceilings: Concrete inserts.
   b. To Steel Beams: I-beam clamp or welded attachments.
   c. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
3. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

C. Accessories:

1. Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.
2. Dielectric Barrier:
   a. Install between carbon steel members and copper or stainless steel pipe.
   b. Install between stainless steel supports and nonstainless steel ferrous metal piping.
3. Electrical Isolation: Install 1/4-inch by 3-inch neoprene rubber wrap between submerged metal pipe and oversized clamps.

END OF SECTION

SECTION 40 05 50
PIPE CORROSION PROTECTION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. B31.1, Power Piping.
   b. B31.9, Building Services Piping.
2. American Water Works Association (AWWA): C105, Polyethylene Encasement for Ductile Iron Pipe Systems.
3. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminated Thermosetting Products.

1.02 DEFINITIONS

A. See Section 40 27 00, Process Piping – General, for definitions applicable to this Section.

B. Coatings identified in this Section are for exterior surfaces of all piping and related fittings, valves, and appurtenances. Interior coatings are specified in the Detail Piping Specification for each specific pipe material.

1.03 SUBMITTALS

A. Shop Drawings: Manufacturer's descriptive literature.

B. Contract Closeout Submittals: Maintenance and operation information.

PART 2 PRODUCTS

2.01 HEAT SHRINK WRAP

A. Type: Cross-linked polyolefin wrap or sleeve with a mastic sealant.

B. Manufacturer and Product: Raychem, WPC, TPS, or flange seal.

2.02 INSULATING FLANGES, COUPLINGS, AND UNIONS

A. Materials:

1. In accordance with the applicable piping material specified in the Pipe Data Sheets. Complete assembly shall have an ANSI B31.9 (or B31.1) as applicable to the intended service rating equal to or higher than that of the joint and pipeline.
2. Galvanically compatible with piping.
3. Materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.

B. Union Type:

1. 2 Inches and Smaller:
   a. Screwed or solder-joint.
   b. O-ring sealed with molded and bonded insulation to body.
2. 2-1/2 Inches and Larger: Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.

C. Flange Insulating Kits:

1. Gaskets: Full-face Type E with O-ring seal. The flanged gasket shall be supplemented with a neoprene facing on each side to accomplish a seal.
2. Insulating Sleeves: Full-length fiberglass reinforced epoxy (NEMA LI 1, G-10 grade).
3. Insulating Washers: Fiberglass reinforced epoxy (NEMA LI 1, G-10 grade).
4. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.

D. Manufacturers and Products:

1. Dielectric Flanges and Unions:
   a. Pacific Seal, Inc., Burbank, CA.
   b. Central Plastics Co., Shawnee, OK.
   c. Epco Sales, Inc.
   d. Capitol Insulation Unions.
2. Insulating Couplings:
   a. Dresser; STAB-39.
   b. R. H. Baker; Series 216.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation:

1. See Piping Schedule of Section 40 27 00, Process Piping-General and Section 09 90 00, Painting and Coating, for additional requirements.
2. Repair abraded areas of coatings on pipe to be buried, submerged, or embedded by cleaning to bare metal and repainting to provide a protective covering equal to the original and acceptable to Engineer.

B. Carbon Steel Pipe:

1. Exposed: As specified in Section 09 90 00, Painting and Coating, System No. 5.
2. Coat accessory items to double wall containment piping per paragraph Piping Accessories below.

C. Stainless Steel: No coatings required except for identifying labels/markers as specified in this Section.

D. Piping Accessories:

1. Exposed:
   a. Field paint black and galvanized steel, brass, copper, and bronze piping components as specified in Section 09 90 00, Painting and Coating, System No. 5, as applicable to the base metal material.
   b. Accessories include, but are not limited to, expansion joints, flexible couplings, vent and drain valves, and fasteners.

E. Tape Wrap: Apply in accordance with manufacturer's instructions and as specified herein.

F. Heat Shrink Wrap: Apply in accordance with manufacturer's instructions to surfaces that are cleaned, prepared, and primed.

G. Insulating Flanges, Couplings, and Unions:

1. Applications:
   a. Dissimilar metal piping connections.
   b. Submerged to unsubmerged metallic piping connections.
   c. Where required for electrically insulated connection.
2. Pipe Installation:
   a. Insulating joints connecting immersed piping to nonimmersed piping shall be installed above maximum water surface elevation.

b. All submerged carbon steel, ductile iron, or galvanized piping in reinforced concrete basins shall be isolated from the concrete reinforcement steel.
c. Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.

3.02 PIPE PAINTING AND COLOR CODING

A. Paint and identify piping systems by color code as specified in Section 40 27 00, Process Piping-General.

B. Apply paint systems before installing piping insulation/heat tracing.

C. Apply identification and color coding to the exterior covering of insulated piping. Aluminum-jacketed insulated piping does not require painting, except for color coding as specified. Coat with applicable system as specified in Section 09 90 00, Painting and Coating.

D. Install manufactured identifying labels for piping as specified in Section 40 27 00, Process Piping-General.

END OF SECTION

SECTION 40 27 00
PROCESS PIPING—GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section and any supplemental Data Sheets:

1. Air Force: A-A-58092, Tape Antiseize, Polytetrafluorethylene.
2. American Petroleum Institute (API): SPEC 5L, Specification for Line Pipe.
3. American Society of Mechanical Engineers (ASME):
    a. Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels.
    b. Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
    c. B1.20.1, Pipe Threads, General Purpose (Inch).
    d. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
    e. B16.3, Malleable Iron Threaded Fittings Classes 150 and 300.
    f. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
    g. B16.9, Factory-Made Wrought Buttwelding Fittings.
    h. B16.11, Forged Fittings, Socket-Welding and Threaded.
    i. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
    j. B16.25, Butt Welding Ends.
    k. B31.3, Process Piping.
    l. B36.10M, Welded and Seamless Wrought Steel Pipe.
4. American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
5. American Welding Society (AWS):
    a. Brazing Handbook.
    b. A5.8/A5.8M, Specification for Filler Metals for Brazing and Braze Welding.
    c. QC1, Standard for AWS Certification of Welding Inspectors.
6. ASTM International (ASTM):
    a. A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
    b. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
    c. A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications.

d. A106/A106M, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
e. A135/A135M, Standard Specification for Electric-Resistance-Welded Steel Pipe.
f. A139/A139M, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
h. A181/A181M, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
i. A183, Standard Specification for Carbon Steel Track Bolts and Nuts.
j. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
k. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
l. A197/A197M, Standard Specification for Cupola Malleable Iron.
m. A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
n. A234/A234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
o. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
p. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
q. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
r. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
s. A563, Standard Specification for Carbon and Alloy Steel Nuts.
t. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
u. A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
v. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
w. B61, Standard Specification for Steam or Valve Bronze Castings.
x. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

y. B462, Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, and UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.
z. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.
aa. D413, Standard Test Methods for Rubber Property Adhesion to Flexible Substrate.
bb. D1330, Standard Specification for Rubber Sheet Gaskets.

7. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-43, Wrought Stainless Steel Butt-Welding Fittings.
8. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminating Thermosetting Products.

1.02 DEFINITIONS

A. Submerged or Wetted:

1. Zone below elevation of:
a. Top face of channel walls and cover slabs.
b. Liquid surface or within 3 feet above top of liquid surface.

1.03 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.
2. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Fabricated Piping:
a. Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.

b. Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.

2. Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.
3. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.
4. Pipe Corrosion Protection: Product data.

B. Informational Submittals:

1. Manufacturer's Certification of Compliance:
   a. Pipe and fittings.
   b. Welding electrodes and filler materials.
   c. Factory applied resins and coatings
2. Qualifications:
   a. Weld Inspection and Testing Agency: Certification and qualifications.
   b. Welding Inspector: Certification and qualifications.
   c. Welders:
      1) List of qualified welders and welding operators.
      2) Current test records for qualified welder(s) and weld type(s) for factory and field welding.
3. Weld Procedures: Records in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s).
4. Nondestructive inspection and testing procedures.
5. Double Wall Containment Piping Fabrication: Submit documentation of qualifications of foreman in charge of piping assembly.
6. Test logs.
7. Pipe coating applicator certification.
8. Laboratory Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.
9. Certified welding inspection and test results.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Independent Inspection and Testing Agency:
   a. Ten years' experience in field of welding and welded pipe and fittings' testing required for this Project.
   b. Calibrated instruments and equipment, and documented standard procedures for performing specified testing.
   c. Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.

d. Testing Personnel: Qualified for nondestructive test methods to be performed.
e. Inspection Services: Qualified welding inspector.

2. Welding Inspector: AWS certified, AWS QC1 qualified, with prior inspection experience of welds specified.
3. Welder and Welding Operator Qualifications:
   a. Qualified by accepted inspection and testing agency before starting Work in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code.
   b. Qualified to perform groove welds in Positions 2G and 5G for each welding process and pipe material specified.
   c. Qualification tests may be waived by Engineer based on evidence of prior qualification.
   d. Retesting: Upon Engineer's written request, retest qualified welder(s).

B. Quality Control: Provide services of independent inspection and testing agency for welding operations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 00, Common Product Requirements, and:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 PIPING

A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as a Supplement.

B. Diameters Shown:

1. Standardized Products: Nominal size.
2. Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M.

2.02 JOINTS

A. Flanged Joints: Flat-faced carbon steel flanges.

B. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

C. Flexible Mechanical Compression Joint Coupling:

1. Stainless steel, ASTM A276, Type 305 bands.
2. Manufacturers:
   a. Pipeline Products Corp.
   b. Fernco Joint Sealer Co.
   c. Or equal.

2.03 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.04 PIPE CORROSION PROTECTION

A. Coatings: See Section 09 90 00, Painting and Coating and Section 40 05 50, Pipe Corrosion Protection, for details of coating requirements.

2.05 VENT AND DRAIN VALVES

A. Pipeline 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless shown otherwise.

B. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless shown otherwise.

2.06 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer's identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

C. Flanged pipe shall be fabricated in the shop, not in the field, and delivered to the Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer.

2.07 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

C. Welding Electrodes: Verify proper grade and type, free of moisture and dampness, and coating is undamaged.

3.02 PREPARATION

A. See Piping Schedule and Section 09 90 00, Painting and Coating and Section 40 05 50, Pipe Corrosion Protection, for additional requirements.

B. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

C. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

D. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with pipe manufacturer’s instructions

3.03 WELDING

A. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by piping or fitting manufacturer.

B. Weld Identification: Mark each weld with symbol identifying welder.

C. Pipe End Preparation:

1. Machine Shaping: Preferred.
2. Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
3. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
2. Root Opening of Joint: As stated in qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:

1. Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 32 degrees F.
2. Stainless Steel and Alloy Piping: If the ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required.

G. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting soundness of weld.

I. Weld Passes: As required in welding procedure.

J. Weld Quality: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in applicable piping code.

3.04 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer’s instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:

1. Install perpendicular to pipe centerline.
2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast iron flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
10. Manufacturer: Same as pipe manufacturer.

D. Threaded and Coupled Joints:

1. Conform to ASME B1.20.1.
2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

E. Soldered Joints:

1. Use only solder specified for particular service.
2. Cut pipe ends square and remove fins and burrs.
3. After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.
4. Wipe excess solder from exterior of joint before hardened.
5. Before soldering, remove stems and washers from solder joint valves.

F. Pipe Connections at Concrete Structures: As specified in Section 40 27 01, Piping Specialties-Plant Services.

3.05 INSTALLATION—EXPOSED PIPING

A. Piping Runs:

1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 15, Piping Support Systems.

C. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

D. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

F. Piping clearance, unless otherwise shown:

1. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
3. From Adjacent Work: Minimum 1 inch(es) from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
4. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
5. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
7. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.06 INSTALLATION—BURIED PIPE

A. Joints:

1. Dissimilar Buried Pipes: Provide flexible mechanical compression joints for pressure pipe.
2. Concrete Encased or Embedded Pipe: Do not encase joints in concrete, unless specifically shown.

B. Placement:

1. Keep trench dry until pipe laying and joining are completed.
2. Pipe Base and Pipe Zone: As specified in Section 02 32 00, Trench Backfill.
3. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
4. Measure for grade at pipe invert, not at top of pipe.
5. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.
6. Prevent foreign material from entering pipe during placement.
7. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
8. Lay pipe upgrade with bell ends pointing in direction of laying.
9. Install closure sections and adapters for gravity piping at locations where pipe laying changes direction.
10. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
    a. Shorter pipe lengths.
    b. Special mitered joints.
    c. Standard or special fabricated bends.
11. After joint has been made, check pipe alignment and grade.
12. Place sufficient pipe zone material to secure pipe from movement before next joint is installed.
13. Prevent uplift and floating of pipe prior to backfilling.

C. Tolerances:

1. Deflection From Horizontal Line, except PVC, CPVC: Maximum 2 inches.
2. Deflection From Vertical Grade: Maximum 1/4 inch.
3. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.
4. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.
5. Pipe Cover: Minimum 4.5 feet, unless otherwise shown.

3.07 PIPE CORROSION PROTECTION

A. Carbon Steel Pipe:

1. Exposed: Coat with System No. 5 as specified in Section 09 90 00, Painting and Coating.

B. Piping Accessories:

1. Exposed:
   a. Field paint black and galvanized steel, brass, copper, and bronze piping components with System No. 5 as specified in Section 09 90 00, Painting and Coating, as applicable to base metal material.
   b. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.

3.08 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Application and Installation: As specified in Section 40 27 01, Process Piping Specialties-Plant Services.

3.09 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including the first block valve in the line carrying the lower pressure, unless otherwise shown.

C. Threaded Pipe Tap Connections:

1. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.
2. Limitations: Threaded taps in pipe barrel are unacceptable.

3.10 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines as shown.

3.11 INSULATION (ENGINE EXHAUST)

A. See Section 40 42 00, Breeching and Stack Insulation for engine exhaust stack/silencer insulation.

3.12 FIELD FINISHING

A. Notify Engineer at least 3 days prior to start of any surface preparation or coating application work.

B. As specified in Section 09 90 00, Painting and Coating.

3.13 PIPE IDENTIFICATION

A. As specified in Sections 09 90 00, Painting and Coating.

3.14 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 80 01, Process Piping Leakage Testing.

B. Minimum Duties of Welding Inspector:

1. Job material verification and storage.
2. Qualification of welders.
3. Certify conformance with approved welding procedures.
4. Maintenance of records and preparation of reports in a timely manner.
5. Notification to Engineer of unsatisfactory weld performance within 24 hours of weld test failure.

C. Required Weld Examinations:

1. Perform examinations in accordance with Piping Code, ASME B31.3.
2. Perform examinations for every pipe thickness and for each welding procedure, progressively, for all piping covered by this section.
3. Examine at least one of each type and position of weld made by each welder or welding operator.
4. For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

3.15 CLEANING

A. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines (except as stated below) with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

B. Blow clean of loose debris plant process air and instrument air-lines with compressed air at 4,000 fpm; do not flush with water.

C. If impractical to flush large diameter pipe at 2.5 fps or blow at 4,000 fpm velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.

D. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.

E. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.16 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Piping Schedule Legend.
2. Piping Schedule.
3. Data Sheets.

Number	Title
40 27 00.03	Carbon Steel Pipe and Fittings—General Service
40 27 00.08	Type 316 Stainless Steel Pipe and Fittings

END OF SECTION

PIPING SCHEDULE LEGEND

SERVICE

DE	Diesel Exhaust
FOF	Fuel Oil Fill
FOR	Fuel Oil Return
FOS	Fuel Oil Supply
V	Vent, Process

EXPOSURE

ALL	All
BUR	Buried
EXP	Exposed
SUB	Submerged

MATERIAL

CSTL	Carbon Steel
SST	Stainless Steel

PRESSURE TEST

G	Gravity Service: Test pressure is not shown on gravity services. Test to highest liquid level that pipe can be subject to.
H	Hydrostatic
I	In Service
P	Pneumatic
PC	Test per Uniform Plumbing Code
NA	Not Applicable

NAVARRE BEACH
WELLHOUSE NO. 2 ELECTRICAL IMPROVEMENTS
PIPING SCHEDULE

Service	Size(s) (In.)[1]	Exposure	Piping Material	Specification Section	Coating System[2]	Test Pressure-Type (psig-x) x = See Legend	Pipe-Label Colors	Remarks
DE	3”-6”	EXP	Type 316 SST	40 27 00.08	NA	I		Insulate piping inside facility per Section 40 02 00, Breeching and Stack Insulation
FOF	4”	EXP	CSTL	40 27 00.03	EXP- No. 5	40-P	Federal Safety Red	
FOR	½”-4”	EXP	CSTL	40 27 00.03	EXP- No. 5	40-P	Federal Safety Red	
FOS	½”-4”	EXP	CSTL	40 27 00.03	EXP- No. 5	40-P	Federal Safety Red	
V, Process	2”-4”	EXP	CSTL	40 27 00.03	EXP- No. 5	I	Black- White	

[1] “>” Greater Than

“<” Less Than

“<=” Less Than or Equal To

“>=” Greater Than or Equal To

“ALL” All Sizes

[2] Coating system number as specified in Section 09 90 00, Painting and Coating.

SECTION 40 27 00.03 CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE		
Item	**Size**	**Description**
Pipe		Black carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B seamless. Threaded or butt-welded. Flanged joints at valves and equipment connections.
	1-1/2" & smaller	Schedule 80.
	2" through 4"	Schedule 40.
Joints	2" & smaller	Threaded or socket-welded; flanged at equipment as required or shown.
	2-1/2" through 6”	Butt-welded or flanged at valves and equipment connections.
Fittings	2" & smaller	Threaded or socket-weld, forged carbon steel, ASTM A105/A105M, 2,000-pound WOG, conforming to ANSI B16.11; bore to match pipe inside diameter.
	2-1/2" through 4”	Wrought carbon steel butt-welding, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.
Branch Connections	2" & smaller	Threadolet or socket in conformance with Fittings above.
	2-1/2" through 4”	Butt-welding tee in accordance with Fittings above.
Flanges	2" & smaller	Forged carbon steel, ASTM A105/A105M, ANSI B16.5 Class 150 socket-weld or threaded, 1/16-inch raised face.
	2-1/2" through 4”	Forged carbon steel, ASTM A105/A105M, ANSI B16.5 Class 150 or weld neck, 1/16-inch raised face; weld neck bore to match pipe internal diameter. Use weld neck flanges when abutting butt-weld fittings.

SECTION 40 27 00.03 CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE		
Item	**Size**	**Description**
Unions	2” through 4”	Threaded or socket-weld, forged carbon steel, ASTM A105/A105M, 2,000-pound WOG, integral ground steel-to-steel seats, AAR design meeting the requirements of ANSI B16.11, bore to match pipe.
Bolting	All	Carbon steel ASTM A193/A193M, Grade B7 studs and ASTM A194/A194M, Grade 2H hex head nuts. When mating flange on equipment is cast iron and gasket is flat ring, provide ASTM A307, Grade B hex head bolts and ASTM A563, Grade A heavy hex nuts.
Interior Lining System	All	Interior surfaces of all pipe and fittings to be unlined.
Gaskets	All flanges	For Liquid Service: 1/16-inch thick compressed nonasbestos composition flat ring type. Garlock, Style 3000; Manville, Style 978.
Thread Lubricant		General Service: Teflon tape.

END OF SECTION

SECTION 40 27 00.08 TYPE 316 STAINLESS STEEL PIPE AND FITTINGS		
Item	**Size**	**Description**
Pipe	2-1/2" & smaller	Schedule 40S: ASTM A312/A312M, Type 316 seamless, pickled and passivated.
	3" thru 6"	Schedule 10S: ASTM A778, "as-welded" grade, Type 316L, pickled and passivated.
Joints	1-1/2" & smaller	Threaded or flanged at equipment as required.
	2" thru 6"	Butt-welded or flanged at valves and equipment.
Fittings	1-1/2" & smaller	Threaded: Forged 1,000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150, ASTM A351/A351M, Grade CF8M/316**.**
	2" & 2-1/2"	Butt Welded: ASTM A403/A403M, Grade WP316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows.
	3" thru 6"	Butt-Welded: ASTM A774/A774M Grade 316L conforming to MSS SP 43, "as-welded" grade, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
Branch Connections	1-1/2" & smaller	Tee or reducing tee in conformance with fittings above.
	2" thru 6"	Butt-welding tee or reducing tee in accordance with fittings above.
Flanges	All	Forged Stainless Steel: ASTM A182/A182M, Grade F316L, ASME B16.5 Class 150, slip-on weld neck. Weld slip-on flanges inside and outside.
		Type 316L "as-welded grade", conforming to MSS SP 43, wall thickness same as pipe.

SECTION 40 27 00.08 TYPE 316 STAINLESS STEEL PIPE AND FITTINGS		
Item	**Size**	**Description**
Unions	2" & smaller	Threaded Forged: ASTM A182/A182M, Grade F316, 2,000-pound or 3,000-pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.
Bolting	All	Forged Flanges: Type 316 stainless steel, ASTM A320/A320M Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress. Van Stone Flanges and anywhere mating flange on equipment is cast iron and gasket is flat ring: Carbon steel ASTM A307 Grade B hex head bolts, ASTM A563 Grade A hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress. Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

SECTION 40 27 00.08 TYPE 316 STAINLESS STEEL PIPE AND FITTINGS		
Item	**Size**	**Description**
Gaskets	All Flanges	Flanged, Water, Hot Air, Fuel Gas and Sewage Services: 1/8 inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F. continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.
Thread Lubricant	2" & smaller	General Service: 100 percent virgin PTFE Teflon tape. Fuel Gas Service: Yellow Teflon tape designed for fuel gas service, Air Force A-A-58092, AA Thread Seal Tape, Inc.

END OF SECTION

SECTION 40 27 01
PIPING SPECIALTIES – PLANT SERVICES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
   b. B16.5, Pipe Flanges and Flanged Fittings.
2. American Society for Testing and Materials (ASTM):
   a. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
3. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.02 SUBMITTALS

A. Shop Drawings:

1. Make, model, and weight of each equipment assembly/item.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction with reference to ASTM material designations.
3. Detailed Mechanical Drawings showing the equipment dimensions, size, locations of connections, and weights of associated equipment.
4. Factory finish system for each component in conformance with painting system specified.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide required piping specialty items, whether shown or not shown on the Drawings, as required by applicable codes and standard industry practice.

B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded pipe joints are not.

2.02 DEFINITIONS

A. Definitions of terms used in this section related to corrosion (e.g. submerged, exposed, etc.) are provided in Section 40 05 15, Piping Support Systems.

2.03 CONNECTORS

A. General: Type 304 stainless steel bolts, fasteners, and accessories are required for connectors intended for exposed service or where damp conditions exist. Ferrous metal components of connectors in atmospherically exposed service ("nondamp conditions") shall be coated with System No. 5 as specified in Section 09 90 00, Painting and Coating.

2.04 SIGHT FLOW INDICATORS

A. Rotary style with NPT threaded and connections, cast bronze construction. Minimum working pressure of 100 psi.

B. Manufacturer/Products:

1. Jacoby-Tarbox, Style 300S.
2. Ernst Gauge Co.
3. Or equal.

2.05 INSULATING FLANGES, COUPLINGS, AND UNIONS

A. As specified in Section 40 05 50, Pipe Corrosion Protection.

2.06 PIPE SLEEVES

A. Pipe sleeves shall be fabricated from corrosion-resistant materials or protectively coated depending upon intended service as specified in this paragraph. Where a pipe sleeve transitions between two different environments (e.g., atmospherically exposed on one end and buried/liquid service on the other), the more corrosive environment shall govern the material of construction of the wall pipe.

1. Wall Thickness: 3/16-inch minimum thickness pipe, unless otherwise noted on the Drawings.
2. Seep Ring:
   a. 3/16-inch minimum thickness center flange for water stoppage on sleeves in exterior or water bearing walls.
   b. Outside Diameter: 3 inches greater than pipe sleeve outside diameter.
   c. Continuously fillet weld on each side all around.

3. Atmospherically Exposed (Dry) Installations:
   a. Pipe sleeves shall be fabricated from carbon steel and hot dip galvanized as follows:
      1) Hot-dip applied, meeting requirements of ASTM A153.
      2) Electroplated zinc or cadmium plating is unacceptable.
   b. Buried, Damp, or Submerged Installations:
      1) Pipe sleeves shall be fabricated from Type 304 stainless steel.

B. Modular Mechanical Seal:

1. Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.
2. Fabrication: Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts, nuts, and pressure plates.
3. Size: According to manufacturer's instructions for the size of pipes shown to provide a watertight seal between pipe and wall sleeve opening, and to withstand a hydrostatic head of 40 feet of water.
4. Manufacturer: Thunderline Link-Seal, Model S.

2.07 MISCELLANEOUS SPECIALTIES

A. Quick Connect (“Kam-Lok”) Style Couplings:

1. Type: Twin cam arm actuated, male and female locking style, for fuel oil fluid service.
2. Materials: Type 304 stainless steel with EPDM gaskets.
3. End Connections: NPT threaded or flanged to match piping connections.
4. Plugs and Caps: Lockable female dust cap for each male end; lockable male dust plug for each female end.
5. Pressure Rating: 125 psi minimum at 70 degrees F.
6. Manufacturers:
   a. OPW Kamlock.
   b. Ryan Herco.

PART 3 EXECUTION

3.01 GENERAL

A. Provide accessibility to piping specialties for control and maintenance.

3.02 PIPE SLEEVES

A. Application: As specified in Paragraph PIPE SLEEVES, hereinbefore.

B. Installation:

1. Support noninsulating type securely in form work to prevent contact with reinforcing steel and tie-wires.
2. Caulk joint with rubber sealant or seal with wall penetration seal.

END OF SECTION

SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME): B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
2. American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
3. American Water Works Association (AWWA):
   a. C550, Protective Interior Coatings for Valves and Hydrants.
   b. C606, Grooved and Shouldered Joints.
   c. C800, Underground Service Line Valves and Fittings.
4. ASTM International (ASTM):
   a. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   b. B61, Standard Specification for Steam or Valve Bronze Castings.
   c. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
   d. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
   e. B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
   f. B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
   g. B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
   h. B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
   i. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
   j. D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
5. FM Global (FM).
6. International Association of Plumbing and Mechanical Officials (IAPMO).

7. Manufacturers Standardization Society (MSS):
   a. SP-80, Bronze Gate, Globe, Angle and Check Valves.
   b. SP-85, Gray Iron Globe & Angle Valves, Flanged and Threaded Ends.
   c. SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
8. Underwriters Laboratories (UL).

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
   b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.

B. Informational Submittals: Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, handwheel, operating nut, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service with the fluid being conveyed. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on Drawings or in Supplements.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in stated valve standard.

F. Valve to open by turning counterclockwise.

G. Factory mount operator, actuator, and accessories.

2.02 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

2.03 FACTORY FINISHING

A. Factory Applied Epoxy Lining and Coating:

1. Use on interior and exterior valve surfaces where identified for individual valves described herein.
2. In accordance with AWWA C550 unless otherwise specified herein.
3. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
4. Minimum 12-mil dry film thickness except where limited by valve operating tolerances.

2.04 VALVES

A. Ball Valves:

1. Type V300 Ball Valves 3 Inches and Smaller for General Water and Air Service:
   a. Two-piece, standard port, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110. For steam service, provide stainless steel ball and stem.
   b. Manufacturers and Products:
      1) Threaded:
         a) Conbraco Apollo; 70-100.
         b) Nibco; T-580-70.

B. Plug Valves:

1. Type V420 Nonlubricated plug valves 2 inches and smaller for Fuel Oil Service:
   a. Ductile iron or carbon steel body, straight-way rectangular ports, Teflon sleeves, screwed ends, wrench operator.
   b. Class: 150, rated for 275 pounds WOG.
   c. Manufacturers and Products:
      1) Duriron Co.; Figure No. G432.
      2) Tufline; Figure 066.

C. Check and Flap Valves:

1. Type V630 Overfill Prevention Valve 3 Inches and Smaller:
   a. Cast aluminum body with stainless steel cam, hard coated aluminum poppet and nitrile float.
   b. Prevents overfilling of tank by providing a positive shut off during pressurized fill.
   c. Lower Nipple: Schedule 40 steel with Duragard coating.
   d. Manufacturers and Products:
      1) OPW 61f STOP Series Model 3050.
      2) Or equal.

D. Special Purpose Valves:

1. Type V920 Foot Style Check Valves 2 Inches and Smaller:
   a. Brass body, seat and poppets. Buna-N seal with 20 mesh inlet strainer.
   b. Pressure rated for 200 psi.
   c. Threaded end style.
   d. Manufacturers and Products:
      1) Morrison Bros., Co.; Figure 335A.
      2) Or equal.
2. Type V953 Anti-Syphon Valve 3/4 through 2 inches for Fuel Oil Services:
   a. Line sized “Underwriter Approved” anti-syphon valve as shown on Mechanical and P&ID Drawings.
   b. Valve shall be bronze body construction wish dashpot for noiseless operation.
   c. Valve shall incorporate oil-proof gasketing and resilient seat to specified head conditions.
   d. Valve materials shall be acceptable for service with all fuel oil grades.
   e. Valve shall operate at hydrostatic head conditions up to 5 feet.

f. Manufacturer and Product:
1) OPW; Figure 199 ASV.
2) Preferred Utilities; Type A.

3. Type 964 Fusible Link Valves 3 Inches and Smaller:
a. NPT threaded, ductile iron body and trim fusible link valve PTFE elastomers and stainless steel trim. 200-pound WOG rating.
b. UL listed fuse link with 165 degrees F rating.
c. Valve size as indicated on the Drawings.
d. Manufacturers/Products:
1) Morrison Bros., Co.; Figure 346.
2) Or equal.

2.05 OPERATORS AND ACTUATORS

A. Manual Operators:

1. General:
a. For AWWA valves, operator force not to exceed the requirements of the applicable valve standard. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under any operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
b. Position indicator on quarter-turn valves.
c. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.

2. Exposed Operator:
a. Galvanized and painted handwheel.
b. Cranks on gear type operator.
c. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
d. Valve handwheels to accept a padlock, and wheels a chain and padlock.

3. Buried Operator:
a. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Buried operators on valves 2 inches and smaller shall have cross handle for operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.

b. Design buried service operators for quarter-turn valves to withstand 450 foot-pounds of input torque at the FULLY OPEN or FULLY CLOSED positions, grease packed and gasketed to withstand a submersion in water to 10 psi.
c. Buried valves shall have extension stems, bonnets, and valve boxes.

2.06 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each valve, bearing valve tag number shown on Drawings.

B. Coat interior and exterior of exposed accessory items with System No. 5 as specified in Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Screwed Ends:

1. Clean threads by wire brushing or swabbing.
2. Apply joint compound.

C. Valve Installation and Orientation:

1. General:
   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
   b. Install valves in location for easy access for routine operation and maintenance.
   c. Install valves per manufacturer’s recommendations.
2. Gate, Globe, and Ball Valves:
   a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
   b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.

3. Check Valves:
   a. Install valve in horizontal or vertical flow (up) flow piping only for liquid services.
   b. Install valve in vertical flow (up) piping only for gas services.
   c. Install swing check valve with shaft in horizontal position.
4. If no plug valve seat position is shown, locate as follows:
   a. Horizontal Flow: The flow shall produce an "unseating" pressure, and the plug shall open into the top half of valve.
   b. Vertical Flow: Install seat in the highest portion of the valve.

D. Install a line size Type V-300 ball valve and NPT union upstream of each solenoid valve. Valve for isolation during maintenance.

E. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

F. Extension Stem for Operator: Where the depth of the valve operating nut is 3 feet or greater below finish grade, furnish an operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer’s data.

END OF SECTION

SECTION 40 42 00
BREECHING AND STACK INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide a system of insulation for the diesel engine exhaust piping, and exhaust silencer, complete, with all appurtenances required for proper operation and to comply with requirements as shown and specified.

1.02 QUALITY ASSURANCE

A. General: Insulation systems including covering, mastics, adhesives, sealers, and facings shall have the following Fire Hazard Classifications in accordance with ASTM E84:

1. Flame spread, 25 maximum.
2. Fuel contributed, 50 maximum.
3. Smoke developed, 50 maximum.

B. Source Quality Control: Perform the following tests and inspections at factory:

1. Flame spread.
2. Smoke developed.
3. Fuel contributed.

C. Requirements of Regulatory Agencies: Comply with the applicable provisions of regulatory agencies below and others having jurisdiction:

1. Local and state building codes and ordinances.
2. Underwriters Laboratories, Inc.
3. National Fire Protection Association.

D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM E84, Surface Burning Characteristics of Building Materials.
2. Underwriters Laboratories, Inc. (UL): 723.
3. National Fire Protection Association (NFPA):
    a. 90A.
    b. 255.

E. Manufacturer's Markings:

1. Stamp or label with manufacturer's name and brand every package or standard container of covering, adhesive, and coating delivered to the jobsite for use.
2. Exposed side of insulation shall be legibly labeled by the manufacturer to show thickness, type, and manufacturer.

1.03 SUBMITTALS

A. Comply with the requirements of Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Manufacturer's catalog literature, specifications, and illustrations with the following information:
   a. Thermal properties.
   b. Physical properties.
   c. Fire hazard ratings.
   d. Facing information.
   e. Installation instructions.
   f. Jointing recommendations for butt joints and longitudinal seams.
2. Fabrication instructions for elbows and fittings.

1.04 PRODUCT, DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 61 00, Common Products Requirements.

B. Delivery of Material: Materials shall be delivered to jobsite in corrugated cartons.

C. Storage of Materials:

1. Store material in a clean, dry area out of the weather.
2. Material shall be tightly covered to protect against dirt, water, mechanical injury, or chemical damage.
3. Material shall remain in original cartons until time of installation.

1.05 JOB CONDITIONS

A. Sequencing: Obtain the Engineer's approval of insulation, adhesives, coatings, and method of installation before installing any insulation.

B. All leaks shall be sealed prior to installation of external insulation to prevent billowing and damage to insulation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Products and Manufacturers: Provide insulation as made by one of the following:

1. Owens Corning, Kaylo;
2. Or approved equal.

B. Asbestos-Free V-Grooved Block Insulation:

1. Type: Rigid hydrous calcium silicate thermal insulation.
2. Density: 15 pounds per cubic foot.
3. Thickness: 6 inches.
4. Thermal Conductivity at 500 Degrees F Mean Temperature: 0.5 Btu-in./hr. ft^2 degrees F.
5. Operating Temperature Rating: 1,200 degrees F continuous.

C. Insulation Jacket:

1. Manufacturer: Provide one of the following:
   a. Childers Products Company, "Lock-On" and "Slip-On;"
   b. Certain Teed Products Corporation;
   c. Or approved equal.
2. Type: Smooth 316 stainless steel metal jacket.
3. Thickness: 0.016 inch.
4. Fastening: Preformed "Z"-lock seam with 2-inch butt strap.
5. Bands: 1/2-inch stainless steel bands with wing seals.
6. Fittings:
   a. Type: Prefabricated stainless steel fittings.
   b. Thickness: 0.016 inch.
7. All jacketing shall have an integrally bonded polycraft weatherproof moisture barrier over the entire surface in contact with the insulation.

PART 3 EXECUTION

3.01 INSPECTION

A. Ensure that all ferrous surfaces of the exhaust system piping system accessories have been painted in accordance with Section 09 90 00, Painting and Coating, System No. 15, and are clean and dry before applying insulation.

3.02 PREPARATION

A. Ensure that piping system has been inspected and released for application of insulation.

3.03 INSTALLATION

A. General:

1. Install insulation so as to make surfaces smooth, even, and substantially flush with adjacent insulation.
2. Follow manufacturer's application instructions for all materials used.
3. Thickness of rigid insulation shall be greater than the seams or angles of breeching to which it is applied.
4. Insulation shall be continuous through sleeves and prepared openings.

3.04 CLEANING

A. Remove all debris, waste materials, and loose foreign material resulting from installation.

END OF SECTION

SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Testing Plan: Submit prior to testing and include at least the information that follows.
   a. Testing dates.
   b. Piping systems and section(s) to be tested.
   c. Test type.
   d. Method of isolation.
   e. Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Engineer in writing 5 days in advance of testing. Perform testing in presence of Engineer.

B. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
4. New Piping Connected to Existing Piping:
   a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.
   b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer.
5. Test Pressure: As indicated on Piping Schedule.

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system. For fuel oil supply or return lines use No. 2 grade diesel fuel for testing.

B. Exposed Piping:

1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.
7. Empty pipe of water prior to final cleaning or disinfection.

C. Buried Piping:

1. Test after backfilling has been completed.
2. Expel air from piping system during filling.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
6. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

7. Correct leakage greater than allowable, and retest as specified.

3.03 PNEUMATIC TEST FOR PRESSURE PIPING

A. Do not perform on: PVC or CPVC pipe.

B. Fluid: Oil-free, dry air with a minimum minus 40 degrees F dewpoint.

C. Procedure:

1. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.
2. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
3. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
4. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
5. Correct visible leakage and retest as specified.

D. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.

E. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

3.04 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by Contractor and Owner's representative to represent that test has been satisfactorily completed.

END OF SECTION

SECTION 43 40 05
ABOVE GRADE DOUBLE-WALLED FUEL STORAGE TANK SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Work necessary to furnish, install, and test, complete the above grade, double-walled fuel storage tank system including all appurtenant and accessory items specified herein. Storage tank system to supply fuel to a nearby diesel engine driving a municipal raw water supply well on an emergency basis.

1.02 GENERAL

A. See General Conditions and Division 1, General Requirements, which contain information and requirements that apply to the Work specified herein and are mandatory for this Project.

1.03 GENERAL DESIGN REQUIREMENTS

A. All-welded steel tanks, rectangular configuration, atmospheric pressure, double-containment, for above grade installation as shown. Entire unit factory-fabricated. Provide lug type angles on tank sides that can be anchored to a concrete foundation.

B. Design tank, including, wall thickness, methods and locations of support/bracing, and stiffener requirements per Underwriter's Laboratory (UL) requirements. Likewise design structural steel ladder platform and pipe supports as part of the tank system to allow for operation and maintenance of items mounted on top of the vessel. Structural design shall be prepared and sealed by a registered professional engineer (structural area of practice) licensed in the State of Florida.

C. Tank shall be a UL 2085 listed and labeled (i.e., "Special Purpose") double-walled, cylindrical tank system consisting of an interior (primary) liquid holding vessel with an exterior (secondary) containment vessel.

D. Tank shall have a 30-year warranty for all materials and fabrication for the primary and secondary tanks.

1.04 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00, Submittal Procedures. In addition, the following specific information shall be provided:

B. Action Submittals:

1. Drawings showing dimensions, openings, connections, and construction details of the tank. Tank design data submitted shall include, but shall not be limited to:
   a. Tank size, overall dimensions, and capacity.
   b. Steel thickness of inner and outer vessels.
   c. Location and details of nozzle placement and tank connection construction.
   d. Construction details of tanks plainly identifying materials of construction by ASTM number.
   e. Description of quality assurance program to be utilized.
   f. Complete description of coating materials, surface preparation, etc.
   g. Complete description of all appurtenant/accessory items (e.g. valves, fittings, tank accessories, level measurement devices, etc.) including catalog cuts, dimensional drawings, technical specifications, wiring and circuit diagrams, and related information identifying materials of construction, dimensions, etc.
   h. Installation details in accordance with the manufacturer's recommendations and instructions.
   i. Operation and Maintenance Manuals.

C. Informational Submittals:

1. Structural design calculations as specified.
2. Manufacturer's Statement of Conformance to UL 142 and 2085.
3. Manufacturer's Certificate of Pressure Testing with results.
4. Manufacturer's Certificate of Proper Installation.
5. Manufacturer's list of proposed spares, expendables, and test equipment.
6. Manufacturer’s 30-year warranty for primary and secondary tank system.
7. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data, including routine maintenance requirements prior to startup.

1.05 STANDARDS, SPECIFICATIONS, AND CODES

A. Tanks and equipment shall be designed, fabricated, tested, inspected, and delivered in accordance with the latest issue of the following Standards:

1. Underwriter's Laboratories Standard 508A (UL 508A), 2085 (UL 2085), and 142 (UL 142).
2. National Fire Protection Association (NFPA) Standard No. 30 and 30A.

3. Petroleum Equipment Institute (PET) Recommended practice (RP) 200-96 “Recommended practices for Installation of Aboveground Liquid Storage Systems.”
4. Occupational Safety and Health Act (OSHA) Standards for Safety.
5. Environmental Protection Agency, Code of Federal Regulations 40 CFR Parts 280 and 281.

1.06 QUALIFICATIONS

A. The tank manufacturer shall be experienced in the design and construction of above grade double-walled fuel storage steel tanks, such as the one specified in this section and shall have furnished such similar sized tanks for installations that have been in successful operation for a minimum of 10 years.

B. All tanks installed under this Specification shall be UL listed and labeled by the manufacturer for the intended product stored. Tanks and all related accessory items shall also be EPA and State of Florida Department of Environmental Protection (FDEP) listed and approved.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Other manufacturers' equipment will be considered in accordance with the General Conditions.

2.02 STORAGE TANK MANUFACTURERS/PRODUCTS

A. Phoenix Products Inc., “ENVIROVAULT” Model EV260 Tank.

B. Highland Tank and Manufacturing Co., “FIREGUARD” Model Tank.

C. Or Engineer Approved Equal.

2.03 TANK CONSTRUCTION

A. General: Tanks shall be in conformance with the following:

1. Underwriter’s Laboratories Standard 142 (UL142) and 2085 (UL 2085).
2. NFPA 30, 37, and 110.

B. Construction:

1. Comply with UL 2085 for protected tanks, vehicle impact resistant and projectile resistant with secondary containment. Provide label of conformance.

2. Inner and outer tanks ASTM A36 mild carbon steel, constructed in conformance with UL 142. Provide label of conformance.

C. Primary and Secondary Tank: The secondary tank shell and heads shall be manufactured of minimum 5/16-inch steel. The primary tank shell and heads shall be manufactured of minimum 1/4-inch steel. Continuous welds shall be used on all sides, inside as well as outside conforming to the American Welding Society Standards.

D. Secondary Containment with Leak Detection Access: The tank system shall include adequate interstitial space to allow for monitoring of leaks from the primary vessel. Leak detection access tubes shall be provided and located within the space between the inner tank and the outer vessel. In the event of a leak, a positive space shall be available to permit leaked fluid to flow to the monitoring point. The secondary containment system outer vessel shall be pressure testable, as specified herein.

E. Nozzles for Tanks:

1. Materials of Construction: Black carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B seamless.
2. Nozzle Thickness: Nozzles 24 inches and smaller shall be Schedule 40.
3. Joints: Butt-welded at connections to tank shell. Nozzles 3/4 through 1-1/2 inches to be NPT threaded. (Tank supplier is to provide half coupling, bushings, and other pipe fittings necessary to connect to tank accessory items.) Nozzle sizes 2 through 24 inches shall be flanged style as specified hereinafter.
4. Nozzle dimensions for instruments shall be coordinated with the instrument manufacturer's dimensional drawings to assure proper access of devices to either the primary or secondary tank interior.
5. Nozzle Flanges: Forged carbon steel, ASTM A105/A105M, ANSI B16.5 Class 150 weld neck style, flat face; weld neck bore to match pipe internal diameter.
6. Bolting: Type 304 stainless steel, ASTM A193/A193M, BM8.
7. Gaskets for Flanges: 1/8-inch thick, BUNA-N gaskets.
8. Tilt of nozzle flange face shall not exceed plus or minus ½ degree from the specified plane. Projection shall be from face of tank shell to face of pipe flange.
9. Provide the nozzles and tank accessory items on the tank as identified in the Aboveground Tank Schedule below and the Contract Drawings. Note: In some cases accessory items in this Schedule are only defined by Tag Numbers, Valve Numbers, or equipment identification numbers for brevity. Detailed specifications for equipment items are provided, or referenced, in subsequent parts of this Specification.

ABOVEGROUND TANK SCHEDULE				
Nozzle Size (Inches)	**Number of Nozzles**	**Nozzle Designation**	**Nozzle Location**	**Remarks**
3	1	Fuel Oil Supply (FOS)	Primary Tank	FOS nozzles to include the below listed items. Equipment includes: 1. 2-inch by 1-1/2-inch double tap bushing and coupling. 2. 1-1/2-inch carbon steel suction tube 3. Type V920 double poppet foot valve for the FOS suction tube bottom. 4. Type V953 anti-siphon valve mounted on top of tank FOS riser pipe.
3	1	Fuel Oil Return (FOR)	Primary Tank	1. 2-inch by 1-1/2 inch double tap bushing and coupling for FOR nozzle. 2. 1-1/2-inch carbon steel discharge tube.
4	1	Mechanical Direct Reading Fuel Level Gauge	Primary Tank	Mechanical level indicator as specified in paragraph 2.05 of this section.
2	2	Primary and Secondary (Normal) Vents	Primary Tank and Interstitial Space	Normal vents to be pressure-vacuum type vent valve, Morrison Bros.; 2-inch Figure 548 or equal. Normal tank venting system shall conform to fire codes and requirements of UL 142 and NFPA 30 Standards.
3	1	Emergency Vent	Primary Tank	Emergency vent to be Morrison Bros.; 3-inch Figure 244 or equal. Note: Emergency tank venting system shall conform to fire codes and requirements of UL 142 and NFPA 30 Standards.
3	1	Emergency Vent	Interstitial Space	Emergency vent to be Morrison Bros.; 3-inch Figure 244, or equal. Note: Emergency tank venting system shall conform to fire codes and requirements of UL 142 and NFPA 30 Standards.
12	1	Access Opening	Primary Tank	Mount gasketed bolt down 12-inch blind flange on nozzle.

ABOVEGROUND TANK SCHEDULE				
Nozzle Size (Inches)	**Number of Nozzles**	**Nozzle Designation**	**Nozzle Location**	**Remarks**
4	1	Local Fill Station/Spill Containment Basin	Inside Spill Containment Basin	Local Fill Station to generally include Equipment Box on top of tank. Components of system to include the following: 1. Equipment Box with locking cover to include the following items: a. 3-inch KAM-LOK Type 304 stainless steel male connection with dust cover. b. 3-inch Type V420 isolation plug valve. c. 3-inch carbon steel pipe and fittings. d. Double tapped adapter fitting. e. 3-inch fill tube and OPW "Tite Fill" Connection Adapter, Figure 633AST-2061, or equal. f. Type V630 Overfill Protection float valve. g. 3-inch drop tube, OPW Model 61-T, or equal.

2.04 TANK DESIGN CRITERIA/PERFORMANCE REQUIREMENTS

A. General Service Conditions:

1. Operating Pressure: Atmospheric.
2. Liquid Stored: Standard Diesel Fuel No. 2 Fuel Oil.
3. Liquid Specific Gravity: 0.85 to 0.88 at 60 degrees F.
4. Ambient Temperature: 15 to 105 degrees F.

B. Tanks shall be double wall construction with the containment tank providing 120 percent of the primary tank's maximum liquid volume. The primary tank shall be sized and constructed so as to provide a minimum of 250 gallons of useable fuel storage capacity.

C. Access opening, nozzle locations, and overall general layout of tank and accessories is shown on the Tank Data Sheet provided as a Supplement at the end of this section.

2.05 DIRECT READING MECHANICAL FUEL GAUGE (TAG NO. 76 LGT0101)

A. Direct reading, float type tank gauge for vertical mounting on above grade storage tank nozzle. Orient gauge face towards fill connection point.

B. One inch numerical display on angles face with swivel adapter base.

C. Materials of construction compatible with Diesel Fuel No. 2.

D. Manufacturer/Products:

1. OPW; 200TG-ENG.
2. Or equal.

2.06 ADDITIONAL DESIGN REQUIREMENTS

A. The fabricator shall be responsible for design of related structural items associated with the tank including access stairs and equipment platforms. The arrangement/layout of these items shall be as shown on the Contract Drawings.

B. Tank access manway shall be manufacturer's standard vapor-tight flanged manway.

2.07 APPURTENANCES

A. Provide the following tank appurtenances as part of the fueling system for the tank:

B. Local Fill Station/Spill Containment Basin:

1. Minimum 7-gallon, external, UL listed, fabricated spill containment box (with weather tight cover) surrounding the FOS fill nozzle connection of the tank.
2. Box shall include a UL listed 1-inch spring return drain valve to release spilled product into the primary tank.

C. Primary and emergency vents conforming to fire codes and requirements UL142 and NFPA 30 Standards.

D. Grounding lugs.

E. Valves as shown on the Drawings and specified in Section 40 27 02, Valves and Operators.

F. Supports:

1. Pipe Supports:
   a. Provide for all tank FOS, FOR and related piping.
   b. Spacing of supports shall be as recommended by the fabricator, but shall not be greater than 4 feet on center.
   c. Shall allow removal of the pipe.
   d. Fabricated, hot-dipped galvanized steel construction or coated with same coating system as tank specified herein.

G. Lifting Lugs: Provide suitably attached lugs.

H. Anchor Bolts: Type 316, stainless steel bolts, sized by fabricator and at least 1/2 inch in diameter, or as shown and as specified in Section 05 50 00, Metal Fabrications.

2.08 FACTORY COATINGS

A. Exterior ferrous metal surfaces of tank and all carbon steel accessory items (e.g. equipment access ladder nozzles, etc.) are to be primed, and finish coated per the coating system manufacturer's written requirements. Provide two coats of high build epoxy (TNEMEC Series 66) to achieve 16 mils minimum dry film thickness per the requirements of Section 09 90 00, Paintings and Coatings.

2.09 VALVES

A. Fuel tank system manufacturer to furnish valves identified on the Drawings for the above grade storage tank and as specified in Section 40 27 02, Valves and Operators.

2.10 ACCESSORIES

A. Quick Connect ("Kam-Lok") Style Couplings:

1. As specified in Section 40 27 01, Piping Specialties-Plant Services.

B. Identification Plate: Identify each tank with the manufacturer's name, manufacturer's location, and capacity in gallons, manufacturer's model number, and date of manufacture.

C. UL Label: Include UL File Number, UL Product Classification, and UL Product Serial Number.

D. Manways:

1. Provide flanged access manways with dimensions and at locations indicated on the Drawings.
2. The manways shall be furnished with necessary gaskets and bolts.

E. Tank Connections: All pipe extensions from the top of the primary tank and extending through the secondary tank shall be carbon steel as specified in this section and Section 40 27 00, Process Piping – General and Section 40 27 00.03, Carbon Steel Pipe and Fittings-General Service.

F. Grounding lugs per requirements of NFPA 70.

G. Anchor Bolts: Type 316, stainless steel bolts, sized by tank manufacturer and at least 1/2 inch in diameter, or as shown and as specified in Section 05 50 00, Metal Fabrications.

H. Tanks shall be marked on all sides with appropriately sized industrial quality warning signs labeled: “FLAMMABLE” “COMBUSTIBLE,” “NO SMOKING,” product identification, and other signs as required by the applicable codes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All components of a storage tank system shall be installed in accordance with the manufacturer’s instructions.

B. All storage tank systems shall be installed according to the applicable provisions of NFPA 30, 30A, and PEI/RP200-96.

C. A certified Contractor shall perform the installation of storage tank systems containing pollutants, including tanks, integral piping overfill protection, and spill containment equipment.

D. A tightness test shall be performed on the tank and integral piping before any storage tank system is placed into service.

3.02 FIELD TESTING

A. Prior to final installation, the tank shall be visually inspected for impact damage, which may have occurred during shipping, unloading, or storage. The primary tank shall then be tested for leaks by pressurizing at a minimum pressure of 3 psig and a maximum pressure of 5 psig for a minimum of 4 hours. After the primary tank has been successfully tested, the secondary tank shall be tested for leaks by pressurizing at a minimum pressure of 1-1/2 psig and a maximum pressure of 3 psig. During testing of the secondary tank, a minimum pressure of 3 psig shall be maintained on the primary tank. While under pressure, a soap solution shall be applied to all piping connections to aid in the detection of leaks. If any drop in pressure or leaks are detected, the leaks shall be repaired in accordance with the manufacturer's written recommendations. The tank shall be repaired and retested until no leaks are detected. All testing shall be performed in strict accordance with the manufacturer's written procedures. The Contractor, assisted by the manufacturer's representative, shall perform the field testing. Note: A vacuum test per the manufacturer’s written procedures may be performed in lieu of pressure testing. The Contractor shall provide 2 weeks’ advance written notice of the test date so that the Owner may witness the testing.

B. Prior to startup, all installed equipment shall be inspected for proper installation and connection by means of a functional test. Such tests shall include a leakage test with the tank full of clean fuel oil to verify that no liquid will leak from the installed tank. If any leaks are detected, the leaks shall be repaired in accordance with the manufacturer's written recommendations. The tank shall be repaired and retested until no leaks are detected. All testing shall be performed in accordance with the manufacturer's written procedures. The Contractor, assisted by the manufacturer's representative, shall perform the functional testing. Contractor to supply all fuel oil for testing.

3.03 FIELD QUALITY CONTROL

A. Functional Test:

1. Conduct on each tank.
2. Leak test as specified hereinbefore.

3.04 MANUFACTURERS' SERVICES

A. Manufacturers' services shall be provided in accordance with Section 01 43 33, Manufacturers' Field Services. A manufacturer's representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner and at such times as requested by the Owner for the minimum person-days listed for the services hereunder, travel times excluded:

1. 1 person-day for installation assistance.
2. 1/2 person-day for inspection, functional testing, certification of the installation, and training.
3. 1/2 person-day for performance testing.

3.05 SUPPLEMENTS

A. The supplement listed below, following "END OF SECTION," is part of this Specification.

1. Tank Data Sheet.

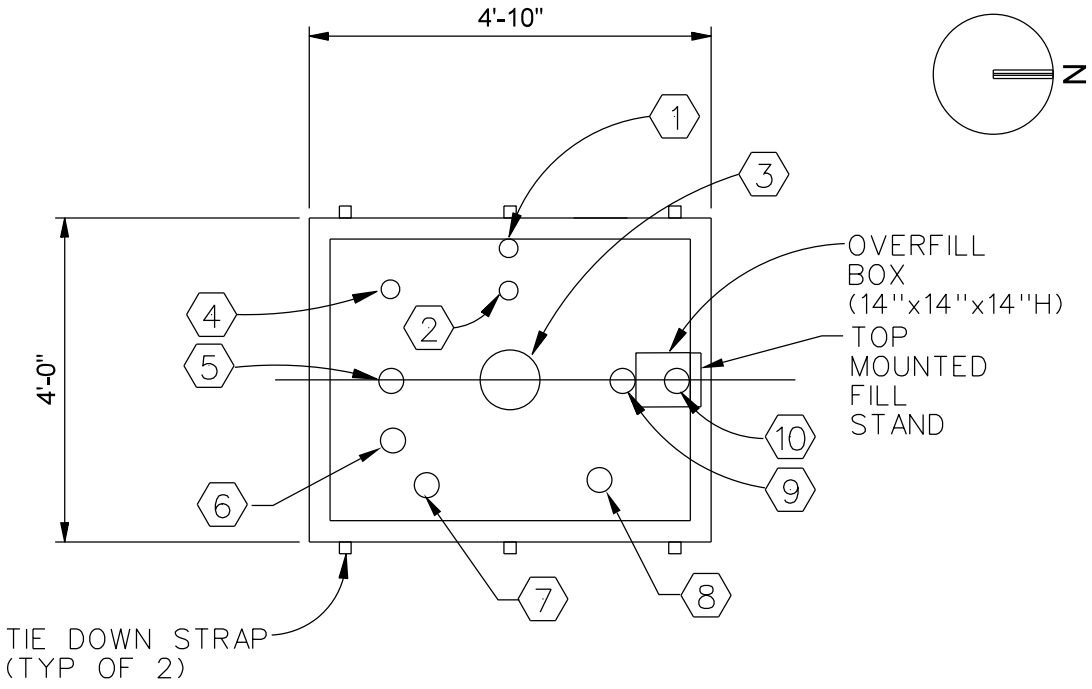
END OF SECTION

05/24/16

CH2M HILL	TANK DATA SHEET	CLIENT NAVARRE BEACH UTILITIES LOCATION NAVARRE BEACH, FL
JOB NO. 654039	BY/APPV'D HL POSTROZNY / DATE MAY 2016	ITEM NO.(S) - -
JOB NAME WELLHOUSE NO. 2 ELECTRICAL UPGRADES	SERVICE DIESEL ENGINE DRIVE BULK FUEL STORAGE TANK	SPEC. NO. 43 40 05

SKETCH:

REV.



ABBREVIATIONS:
MT = MAIN TANK (INNER)
ST = SECONDARY TANK (OUTER)

		NOZZLES	MARK NO.	QTY.	SIZE	ELEVATION
		FOR (RETURN)	1	1	3"	TOP
DIMENSIONS	4'-0" x 4'-10"	FOS (SUPPLY)	2	1	3"	TOP
HEIGHT:	4'-6"	ACCESSWAY	3	1	12"	TOP
LADDER REQUIRED:	NO	EMERGENCY VENT (MT)	4	1	3"	TOP
AMBIENT TEMPERATURE RANGE:	20-105°F	NORMAL VENT (MT)	5	1	2"	TOP
EXTERIOR LOADING:		EMERGENCY VENT (SC)	6	1	3"	TOP
PERSONNEL ROOF LOADS:	40 psf	NORMAL VENT (SC)	7	1	2"	TOP
PIPE SUPPORTS:	200 LB	MECHANICAL LEVEL GAUGE	8	1	4"	TOP
OPERATING CONTENTS:		INSTRUMENT (SPARE)	9	1	4"	TOP
TEMPERATURE:	40-85°F	FOS (TANKER CONNECTION)	10	1	4"	TOP
CHEMICAL COMPOSITION:	PETROLEUM MID-DISTILLATE		.	.	.	.
SPECIFIC GRAVITY:	0.876 (H_2O =1)		.	.	.	.
CONCENTRATION:	100%		.	.	.	.
pH RANGE:	NA		.	.	.	.
INSULATION AND HEAT SYSTEM:	NA		.	.	.	.

REMARKS: (SPECIAL CONDITIONS, START-UP, SHUTDOWN, REGENERATION, VIBRATION, ETC. THAT MAY AFFECT MECHANICAL DESIGN)

. PROVIDE TYPE 316 STAINLESS STEEL HURRICANE TIEDOWN STRAPS FOR ANCHORING TO CONCRETE SLAB.

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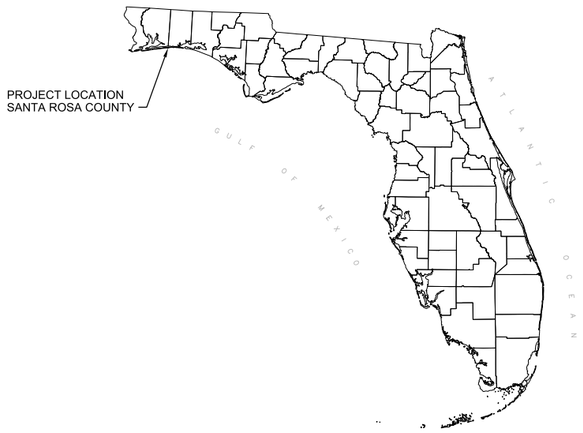
REVISION	1	2	3	4	5	PAGE
DATE/BY	.	.	.	.	.	. OF .

PART 4

DRAWINGS
(BOUND SEPARATELY)

CONTRACT DOCUMENTS
For the construction of the

NAVARRE BEACH WELLHOUSE NO. 2 ELECTRICAL UPGRADES



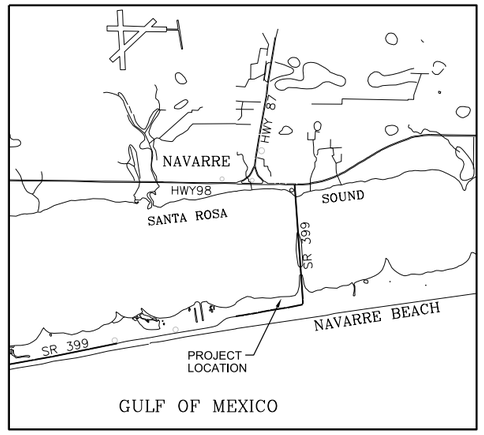
LOCATION IN FLORIDA
NTS

PREPARED FOR

SANTA ROSA COUNTY
FLORIDA

SANTA ROSA COUNTY FLORIDA

VOLUME 2 OF 2
DRAWINGS



LOCATION MAP
NTS

INDEX OF DRAWINGS

DWG NO.	TITLE
1	GENERAL - COVERSHEET AND INDEX TO DRAWINGS
2	GENERAL - ELECTRICAL LEGEND 1
3	GENERAL - ELECTRICAL LEGEND 1
4	GENERAL - PROCESS MECHANICAL LEGEND
5	ELECTRICAL - SITE PLAN
6	ELECTRICAL - DEMOLITION PHOTO DETAILS
7	ELECTRICAL - POWER PLAN
8	ELECTRICAL - OVERALL ONE LINE DIAGRAM AND PANEL SCHEDULES
9	ELECTRICAL - PUMP CONTROL PANEL WIRING DIAGRAM
10	ELECTRICAL - ELEVATED STORAGE TANK PANEL WIRING DIAGRAM
11	ELECTRICAL - WELLHOUSE NO. 2 WIRING DIAGRAM
12	ELECTRICAL - WIRING DIAGRAM
13	PROCESS MECHANICAL - DEMOLITON PHOTO DETAILS
14	PROCESS MECHANICAL - WELLHOUSE NO. 2 PLAN AND SECTION
15	PROCESS MECHANICAL - DETAILS
16	PROCESS MECHANICAL - DETAILS

For information regarding
this project, contact:

Joe Klaus, PE / CH2M HILL
25 W Cedar Street, Suite 560
Pensacola, FL 32502
Phone: 850-941-7276

Project No. 654039

JUNE 2016

BID DOCUMENTS

ONE-LINE DIAGRAM

SYMBOL	DESCRIPTION
	DRAWOUT AIR CIRCUIT BREAKER, LOW VOLTAGE
400	CIRCUIT BREAKER, THERMAL MAGNETIC TRIP SHOWN, 3 POLE, UNO
AF / AT	CIRCUIT BREAKER, STATIC TRIP UNIT, SENSOR AMP TRIP AND FRAME RATINGS SHOWN, 3 POLE, UNO
100/M	CIRCUIT BREAKER, MAGNETIC TRIP ONLY, TRIP RATING SHOWN, 3 POLE, UNO
400 400	CIRCUIT BREAKER WITH CURRENT LIMITING FUSES, TRIP AND FUSE RATING INDICATED, 3 POLE, UNO
400 225	FUSED SWITCH, SWITCH AND FUSE CURRENT RATING INDICATED, 3 POLE, UNO
100	SWITCH, CURRENT RATING INDICATED, 3 POLE, UNO
60 (3)	FUSE, CURRENT RATING AND QUANTITY INDICATED
1	MAGNETIC STARTER WITH OVERLOAD, NEMA SIZE INDICATED, FVNR UNO
AFD	ELECTRONIC STARTER/SPEED CONTROL RVSS = REDUCED VOLTAGE SOFT STARTER AFD = AC ADJUSTABLE FREQUENCY DRIVE DC = DC ADJUSTABLE SPEED DRIVE RVAT = REDUCED VOLTAGE AUTO TRANSFORMER TYPE RVRT = REDUCED VOLTAGE REACTOR TYPE
	CABLE OR BUS CONNECTION POINT
K	KEY INTERLOCK
	SURGE ARRESTER (GAP TYPE)
10	CAPACITOR - KVAR INDICATED, 3 PHASE
3	AC MOTOR, SQUIRREL CAGE INDUCTION - HORSEPOWER INDICATED
G 500/625	GENERATOR, KW/KVA RATING SHOWN
VS V 0-600V	ANALOG METER WITH SWITCH - SCALE RANGE SHOWN V = VOLTAGE KW = KILOWATTS A = AMPERAGE KVAR = KILOVARS PF = POWER FACTOR
DPM	DIGITAL POWER METER (MULTIFUNCTION)
	UTILITY REVENUE METER
	GROUND
15 KVA 480-120/240V 1 PH	TRANSFORMER, SIZE, VOLTAGE RATINGS, AND PHASE INDICATED
	SHIELDED ISOLATION TRANSFORMER
480-120V (3)	POTENTIAL TRANSFORMER, VOLTAGE RATING AND QUANTITY INDICATED
100:5 (3)	CURRENT TRANSFORMER, RATIO(100:5) AND QUANTITY INDICATED (3)
	CONNECTION POINT TO EQUIPMENT SPECIFIED IN OTHER DIVISIONS. RACEWAY, CONDUCTOR AND CONNECTION IN THIS DIVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR

ONE-LINE DIAGRAM

SYMBOL	DESCRIPTION
	DRAWOUT POWER CIRCUIT BREAKER, MEDIUM VOLTAGE
	NON DRAWOUT FUSED SWITCH, MEDIUM VOLTAGE
	DRAWOUT FUSED SWITCH AND CONTACTOR, MEDIUM VOLTAGE
	DRAWOUT FUSED SWITCH AND VACUUM CONTACTOR, MEDIUM VOLTAGE
	DRAWOUT VACUUM CONTACTOR, MEDIUM VOLTAGE
	MEDIUM VOLTAGE CABLE STRESS CONE TYPE TERMINATION, OPEN TERMINATOR OR ELBOW
	SWITCH - LOAD BREAK, GROUP OPERATED, MEDIUM VOLTAGE
	SWITCH W/ARCING HORNS, MEDIUM VOLTAGE
	DISCONNECTING FUSE - SOLID MATERIAL, MEDIUM VOLTAGE
	SWITCH - HOOK STICK OPERATED, SINGLE POLE, MEDIUM VOLTAGE
	FUSE - EXPULSION, HOOK STICK OPERATED, SINGLE POLE, MEDIUM VOLTAGE
	GROUND SWITCH, GANG OPERATED
	TERMINAL BLOCK LUG
	DELTA CONNECTION
	WYE GROUNDED CONNECTION, SOLID GROUND
R or Z	WYE NEUTRAL GROUND RESISTOR OR IMPEDANCE CONNECTION
86	RELAY OR DEVICE, FUNCTION NUMBER AS INDICATED
50:5 (1)	CURRENT TRANSFORMER, ZERO SEQUENCE, RATIO AND QUANTITY INDICATED
800/1200:5 (3)	BUSHING CURRENT TRANSFORMER, MULTI-RATIO AND QUANTITY INDICATED
MO	MOTOR OPERATOR, BREAKER OR SWITCH
EUM	ENERGY MONITORING UNIT
MRP	MOTOR PROTECTION RELAY

NOTES:

1. THESE ARE STANDARD LEGEND SHEETS. SOME SYMBOLS AND ABBREVIATIONS MAY APPEAR ON THE LEGEND AND NOT ON THE DRAWINGS.
2. FOR ADDITIONAL ABBREVIATIONS OF OTHER DIVISIONS (HVAC, MECHANICAL, AND STRUCTURAL/ARCHITECTURAL) SEE OTHER LEGENDS.

POWER SYSTEM PLAN

SYMBOL	DESCRIPTION
	CONNECTION POINT TO EQUIPMENT SPECIFIED. RACEWAY, CONDUCTOR,TERMINATION AND CONNECTION IN THIS DIVISION.
MCC-A	MAJOR ELECTRICAL COMPONENT OR DEVICE - NAME OR IDENTIFYING SYMBOL AS SHOWN.
LPXXA	PANELBOARD - SURFACE MOUNTED PANELBOARD LETTER OR NUMBER FACILITY NUMBER LP - LOW VOLTAGE PANEL DP - DISTRIBUTION PANEL
	PANELBOARD - FLUSH MOUNTED
	TERMINAL JUNCTION BOX
M	MOTOR, SQUIRREL CAGE INDUCTION
G	GENERATOR, VOLTAGE AND SIZE AS INDICATED.
LPXXA	HOME RUN - DESTINATION SHOWN
or G	EXPOSED CONDUIT AND CONDUCTORS*
or G	CONCEALED CONDUIT AND CONDUCTORS*

NOTE:
ALL UNMARKED CONDUIT RUNS CONSIST OF TWO NO. 12, ONE NO. 12 GROUND CONDUCTORS IN 3/4" CONDUIT. RUNS MARKED WITH CROSSHATCHES INDICATE NUMBER OF NO. 12 CONDUCTORS. CROSSHATCH WITH SUBSCRIPT "G" INDICATES GREEN GROUND WIRE.

G	CROSSHATCHES WITH BAR INDICATE NO.10 CONDUCTOR. SIZE CONDUIT ACCORDING TO SPECIFICATIONS AND APPLICABLE CODE.
[A1]	CONDUIT AND CONDUCTOR CALLOUT, SEE LEGEND.
	CONDUIT DOWN
	CONDUIT UP
	CONDUIT, STUBBED AND CAPPED
	CONDUIT TERMINATION AT CABLE TRAY
EX	EXISTING CONDUIT/ DUCT BANK
BD	BUS DUCT - SEE SPECIFICATIONS
CE	CONCRETE ENCASED CONDUIT
DB	DIRECT BURIED CONDUIT
FO	FIBER OPTIC CONDUIT
XXXX	CONCRETE ENCASED DUCT BANK WHERE XXXX IS THE DUCT BANK NAME. SEE CIRCUIT AND RACEWAY CODING DEFINITION
	CONCEALED CONDUIT ROUTING AREA
	CONDUIT ROUTING AREA
	CABLE TRAY
T	TRANSFORMER
J or HH	GENERAL CONTROL OR WIRING DEVICE. LETTER SYMBOLS OR ABBREVIATIONS INDICATE TYPE OF DEVICE
CS	CONTROL STATION, SEE CONTROL DIAGRAMS FOR CONTROL DEVICE(S) REQUIRED.
30	NONFUSED DISCONNECT SWITCH, CURRENT RATING INDICATED, 3 POLE
60/40	FUSED DISCONNECT SWITCH, CURRENT RATING INDICATED (60/40, 60=SWITCH RATING / 40=FUSE RATING) 3 POLE
2	COMBINATION CIRCUIT BREAKER AND MAGNETIC STARTER, NEMA SIZE INDICATED

POWER SYSTEM PLAN

SYMBOL	DESCRIPTION
100/40	BREAKER, SEPARATELY MOUNTED, CURRENT RATING INDICATED (100/40, 100 = FRAME SIZE; 40 = TRIP RATING) 3 POLE
C 2	CONTACTOR, MAGNETIC, NEMA SIZE INDICATED
L 30	LIGHTING CONTACTOR, CURRENT RATING INDICATED
2	STARTER, MAGNETIC NEMA SIZE INDICATED
XX 2	CONVENIENCE RECEPTACLE - DUPLEX UNLESS NOTED OTHERWISE WP - WEATHERPROOF C - CLOCK HANGER TL - TWIST LOCK CRE - CORROSION RESISTANT GFCI - GROUND FAULT CIRCUIT INTERRUPTER SUBSCRIPT NUMBER AT RECEPTACLE INDICATES CIRCUIT
	240V RECEPTACLE
	CONVENIENCE RECEPTACLE - QUADRUPLEX
	MULTI OUTLET ASSEMBLY
	DUPLEX CONVENIENCE RECEPTACLE - FLUSH IN FLOOR
	CONVENIENCE RECEPTACLE, PEDESTAL, DUPLEX SINGLE FACE UNLESS INDICATED OTHERWISE
L20R 20	RECEPTACLE, SPECIAL PURPOSE-NEMA CONFIGURATION AND AMPERAGE INDICATED
T	THERMOSTAT

GROUND SYSTEM PLAN

	GROUND ROD
	GROUND ROD IN TEST WELL
G	GROUNDING CONDUCTOR, SIZE AS INDICATED
	PIGTAIL FOR CONNECTION TO EQUIPMENT CABINET OR FRAME
G	EQUIPMENT GROUND BUS
N	EQUIPMENT NEUTRAL BUS

NO.	DSGN	DATE	BY	REVISION	CHK	DR
		G YARBERRY	APVD		Z BRYAN	K HORTON
		G YARBERRY	APVD			

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ch2m

GENERAL
WELLHOUSE NO. 2
ELECTRICAL LEGEND 1

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	2
SHEET	2 of 16

BID DOCUMENTS

SYMBOL	DESCRIPTION

ONE LINE PROTECTION RELAYING AND ELEMENTARY DIAGRAMS-1

51 or 52	DEVICE FUNCTION NUMBER INDICATED, SEE DEVICE TABLE
CS T	CONTROL SWITCH TRIP
CS C	CONTROL SWITCH CLOSE
43/CS	43-DEVICE FUNCTION NUMBER, SEE DEVICE TABLE
VS	VOLTMETER SWITCH
AS	AMMETER SWITCH
A	INDICATING LAMP-SWITCHBOARD TYPE INDICATING LAMP LENS COLORS INDICATED AS FOLLOWS: A - AMBER R - RED B - BLUE W - WHITE G - GREEN
V	VOLTMETER
A	AMMETER
W	WATTMETER
F	FREQUENCY METER
PF	POWER FACTOR METER
WH	WATT-HOUR METER
ETM	ELAPSED TIME METER
RPM	TACHOMETER
W XD	WATTS TRANSDUCER
PF XD	POWER FACTOR TRANSDUCER
TD	TIME DELAY
4	RELAY COIL, DEVICE FUNCTION NUMBER PER ANSI 37.2 - AMERICAN STANDARD MANUAL AND AUTOMATIC STATION CONTROL, SUPERVISORY AND ASSOCIATED TELEMETRY EQUIPMENT
7 8	NORMALLY OPEN CONTACT
3 4	NORMALLY CLOSED CONTACT
	REMOTE DEVICE
	TEST SWITCH CURRENT ELEMENT
	TEST SWITCH POTENTIAL ELEMENT
	NEUTRAL CONNECTION
	DIODE
	INSTRUMENTATION CABLE, SHIELDED
NGR	NEUTRAL GROUNDING RESISTOR
PST	PHASE SHIFTING TRANSFORMER

CIRCUIT AND RACEWAY

GENERAL CIRCUIT CONDUCTOR AND CONDUIT IDENTIFICATION

POWER CIRCUIT CALLOUTS

[P1]	[1/2"FLEX, 2#12,#12G]
[P2]	[3/4"C,2#12,1#12G]
[P3]	[3/4"C,3#12,1#12G]
[P4]	[3/4"C,4#12,1#12G]
[P5]	[3/4"C,5#12,1#12G]
[P6]	[3/4"C,6#12,1#12G]
[P7]	[3/4"C,7#12,1#12G]
[P8]	[3/4"C,8#12,1#12G]
[P9]	[3/4"C,3#12,2#14,1#12G]
[P10]	[3/4"C,3#12,3#14,1#12G]
[P11]	[3/4"C,3#12,4#14,1#12G]
[P12]	[3/4"C,3#12,5#14,1#12G]
[P13]	[3/4"C,3#12,6#14,1#12G]
[P14]	[3/4"C,3#12,7#14,1#12G]
[P15]	[3/4"C,2#10,1#10G]
[P16]	[3/4"C,3#10,1#10G]
[P17]	[3/4"C,3#10,2#14,1#10G]
[P18]	[3/4"C,3#10,3#14,1#10G]
[P19]	[3/4"C,3#10,4#14,1#10G]
[P20]	[3/4"C,3#10,5#14,1#10G]
[P21]	[1"C,2#8,1#10G]
[P22]	[1"C,3#8,1#10G]
[P23]	[1"C,3#8,2#14,1#10G]
[P24]	[1"C,3#8,3#14,1#10G]
[P25]	[1"C,3#8,4#14,1#10G]
[P26]	[1"C,3#8,5#14,1#10G]
[P27]	[1"C,2#6, 1#10G]
[P28]	[1"C,3#6, 1#8G]
[P29]	[1"C,3#6, 2#14,1#8G]
[P30]	[1"C,3#6, 3#14,1#8G]
[P31]	[1"C,3#6, 4#14,1#8G]
[P32]	[1"C,3#6, 5#14,1#8G]
[P33]	[1"C,3#4,1#8G]
[P34]	[1 1/4"C,3#4,3#14,1#8G]
[P35]	[1 1/4"C,3#4,5#14,1#8G]
[P36]	[1 1/4"C,3#3, 1#6G]
[P37]	[1 1/4"C,3#3, 3#14,1#6G]
[P38]	[1 1/4"C,3#2, 1#6G]
[P39]	[1 1/4"C,3#1, 1#6G]
[P40]	[1 1/2"C,3#1, 3#14,1#6G]
[P41]	[1 1/2"C,3#2/0, 1#4G]
[P42]	[2"C,3#3/0, 1#4G]
[P43]	[2"C,3#4/0, 1#3G]
[P44]	[4"C,3#2 (5KV), 1#6G]
[P45]	2EA [4"C,3-350KCM, 1#1G]
[P46]	[2"C,3#3/0, 1#6G]
[P47]	2EA [2"C,4#4/0, 1#2G]
[P48]	[3"C, 4-350KCM]
[P49]	[3"C, 3#1/0, 4#14, 1#6G]
[P50]	[1-1/2"C, 2#1/0, 1#6G]
[P51]	[1-1/2"C, 3#1, 1#6G]
[P52]	[1"C, 3#6, 1#8G]
[P54]	[1-1/4"C, 3#3, 1#8G]

MULTICONDUCTOR POWER CABLE CIRCUIT CALLOUTS

[PC1]	[3/4"C,1 (3C#12,1#12G) TYPE 2]
[PC2]	[3/4"C,1 (3C#10,1#10G) TYPE 2]
[PC3]	[1"C,1 (3C#8,1#10G) TYPE 2]
[PC4]	[1 1/4"C,2 (3C#12,1#12G) TYPE 2]
[PC5]	[1 1/2"C,2 (3C#10,1#10G) TYPE 2]
[PC1A]	[3/4"C,1 (2C#12,1#12G) TYPE 2]
[PC2A]	[3/4"C,1 (2C#10,1#10G) TYPE 2]

EMPTY CONDUIT

[EC-1]	[3/4"C,WITH PULL STRING]
[EC-2]	[1"C,WITH PULL STRING]
[EC-3]	[1 1/4"C,WITH PULL STRING]
[EC-4]	[1 1/2"C,WITH PULL STRING]
[EC-5]	[2"C,WITH PULL STRING]
[EC-6]	[3"C,WITH PULL STRING]
[EC-7]	[4"C,WITH PULL STRING]
[EC-8]	[5"C,WITH PULL STRING]

ANALOG CIRCUIT CALLOUTS

[A1]	[3/4"C,1 TYPE 3]
[A2]	[1"C,2 TYPE 3]
[A3]	[1"C,3 TYPE 3]
[A4]	[1"C,4 TYPE 3]
[A5]	[1 1/4"C,5 TYPE 3]
[A6]	[1 1/4"C,6 TYPE 3]
[A7]	[1 1/2"C,7 TYPE 3]
[A8]	[1 1/2"C,8 TYPE 3]
[A9]	[1 1/2"C,9 TYPE 3]
[A10]	[2"C,10 TYPE 3]
[A11]	[2"C,11 TYPE 3]
[A12]	[2"C,12 TYPE 3]
[A13]	[2"C,13 TYPE 3]
[A14]	[2"C,14 TYPE 3]
[A15]	[3/4"C,1 TYPE 4]
[A16]	[3/4"C,2 TYPE 4]
[A17]	[1"C,3 TYPE 4]
[A18]	[1 1/4"C,4 TYPE 4]
[A19]	[1 1/4"C,5 TYPE 4]
[A20]	[1 1/4"C,6 TYPE 4]
[A21]	[1 1/2"C,7 TYPE 4]
[A22]	[1 1/2"C,8 TYPE 4]
[A23]	[2"C,9 TYPE 4]
[A24]	[3/4"C,1-4 pr. TYPE 5]
[A25]	[1"C,2-4 pr. TYPE 5]

CONTROL CIRCUIT CALLOUTS

[C1]	[3/4"C,MSC]
[C2]	[3/4"C,2#14,1#14G]
[C3]	[3/4"C,3#14,1#14G]
[C4]	[3/4"C,4#14,1#14G]
[C5]	[3/4"C,5#14,1#14G]
[C6]	[3/4"C,6#14,1#14G]
[C7]	[3/4"C,7#14,1#14G]
[C8]	[3/4"C,8#14,1#14G]
[C9]	[3/4"C,9#14,1#14G]
[C10]	[3/4"C,10#14,1#14G]
[C11]	[3/4"C,11#14,1#14G]
[C12]	[3/4"C,12#14,1#14G]
[C13]	[3/4"C,13#14,1#14G]
[C14]	[3/4"C,14#14,1#14G]
[C15]	[3/4"C,15#14,1#14G]
[C16]	[3/4"C,16#14,1#14G]
[C17]	[3/4"C,17#14,1#14G]
[C18]	[3/4"C,18#14,1#14G]
[C19]	[3/4"C,19#14,1#14G]
[C20]	[1"C,20#14,1#14G]
[C21]	[1"C,21#14,1#14G]
[C22]	[1"C,22#14,1#14G]
[C23]	[1"C,23#14,1#14G]
[C24]	[1"C,24#14,1#14G]
[C25]	[1"C,25#14,1#14G]

MULTICONDUCTOR CONTROL CABLE CIRCUIT CALLOUTS

[CC5]	[3/4"C,1-5C TYPE 1]
[CC7]	[3/4"C,1-7C TYPE 1]
[CC9]	[1"C,1-9C TYPE 1]
[CC12]	[1"C,1-12C TYPE 1]
[CC19]	[1 1/2"C, 1-19C TYPE 1]
[CC25]	[1 1/2"C,1-25C TYPE 1]
[CC37]	[2"C,1-37C TYPE 1]
[CCC1]	[1-7C #12 TYPE 1]

NOTES:

1. FOR CABLE TYPES, SEE SPECIFICATIONS.
2. CONDUIT SIZES ARE BASE ON THE AREA OF THW CONDUCTORS.
3. SIZING OF CONDUCTORS #1AWG AND SMALLER BASED ON AMPACITIES AT 60 DEGREES C, SIZING OF CONDUCTORS #1/0AWG AND LARGER BASED ON AMPACITIES AT 75 DEGREES C.
4. WHERE CIRCUITS ARE UNDERGROUND, DIRECT BURIED OR CONCRETE ENCASED, MINIMUM CONDUIT SIZE SHALL BE 1".
5. FOR METRIC CONDUIT SIZES USE THE FOLLOWING CONVERSION:
   1/2" = 16 mm 1/4" = 35 mm
   3/4" = 21 mm 1 1/2" = 41 mm
   1" = 27 mm 2" = 53 mm

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
					APVD	G YARBERRY	
		G YARBERRY	Z BRYAN	K HORTON			

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

GENERAL
WELLHOUSE NO. 2
ELECTRICAL LEGEND 2

BID DOCUMENTS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	3
SHEET	3 of 16

PIPE AND FITTING SYMBOLS

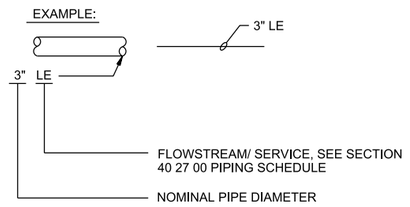
DOUBLE LINE	SINGLE LINE	
		EXISTING PIPE
		NEW PIPE
		EXISTING PIPE TO BE ABANDONED
		EXISTING PIPE TO BE REMOVED
		WELDED JOINT
		GROOVED END JOINT
		FLANGED JOINT
		MECHANICAL JOINT & PROPRIETARY RESTRAINED JOINT
		BELL & SPIGOT JOINT (LEADED)
		HUB & SPIGOT JOINT (RUBBER GASKET)
		BALL JOINT
		ADAPTER SIDE GROOVED END ADAPTER FLANGE
		FLANGED COUPLING ADAPTER
		FLEXIBLE COUPLING
		METAL BELLOWS EXP JOINT
		ELASTOMER BELLOWS EXP JOINT
		ELBOW UP
		ELBOW DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER

DOUBLE LINE	SINGLE LINE	
		REDUCING BUSHING
		UNION
		CAP
		ANCHOR
		ELBOW, 90 DEGREE
		CROSS
		TEE
		ELBOW, 45 DEGREE
		LATERAL
		KAM-LOK QUICK CONNECT COUPLING WITH DUST PLUG

NOTES:

1. ONLY FLANGED END CONNECTIONS ARE SHOWN HERE FOR DOUBLE LINE FITTINGS. FITTINGS WITH OTHER END PATTERNS ARE SHOWN SIMILARLY ON THE CONSTRUCTION DRAWINGS. ALSO SEE PIPING SPECIFICATIONS.
2. SYMBOLS SHOWN HERE FOR SINGLE LINE FITTINGS ARE GENERIC ONLY. REFER TO PIPING SPECIFICATIONS FOR SPECIFIC END CONNECTIONS FOR SINGLE LINE PIPE AND FITTINGS.
3. EXISTING PIPE AND EQUIPMENT IS SHOWN LIGHT-LINED AND/OR SCREENED AND IS NOTED AS EXISTING. NEW PIPING AND EQUIPMENT IS SHOWN HEAVY-LINED.

PIPING DESIGNATION

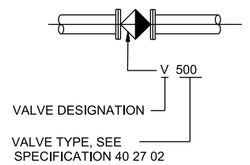


VALVE SYMBOLS

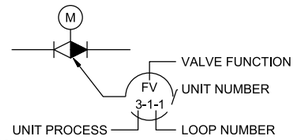
SINGLE LINE	DOUBLE LINE	
		GATE
K		KNIFE GATE
		BUTTERFLY
		GLOBE
		BALL
		SEATING PORT
		ECCENTRIC PLUG
		PLUG OR COCK
		NEEDLE
		DIAPHRAGM
		PINCH
		SWING CHECK
		BALL CHECK
		HOSE VALVE (HV- X) OR (V-X) X = NO. IN SPECS
S		SAMPLE
		MUD
		PRESSURE RELIEF
		AIR AND/OR VACUUM RELEASE
		REGULATED SIDE PRESSURE CONTROL (INTERNAL PILOT)
		REGULATED SIDE PRESSURE CONTROL (EXTERNAL PILOT)
		MULTI-PORT VALVE, ARROWS INDICATE FLOW PATTERN. SEATING PORTS ARE IMPLIED BY INDICATED FLOW PATTERN.
		TELESCOPING SCUM VALVE

VALVE DESIGNATIONS

MANUAL VALVES AND CHECK VALVES



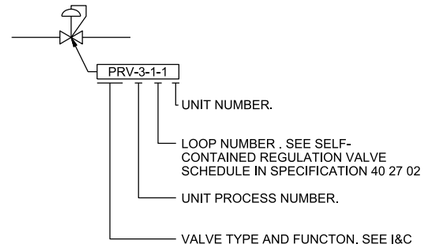
CONTROL VALVES



NOTE:

SEE I&C LEGENDS FOR FURTHER DEFINITIONS AND ACTUATOR TYPES.

SELF-CONTAINED REGULATING VALVES



ACTUATOR SYMBOLS

	PNEUMATIC DIAPHRAGM
	PNEUMATIC CYLINDER
M	ELECTRIC MOTOR
H	HYDRAULIC
	MANUAL
S	SOLENOID
E/H	ELECTRO HYDRAULIC

MECHANICAL LEGEND AND NOTES

GENERIC PIPING NOTES

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON DRAWINGS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. LOCATION AND NUMBER OF PIPE HANGERS AND PIPE SUPPORTS SHOWN IS ONLY APPROXIMATE. CONTRACTOR SHALL DESIGN SUPPORTS AS SPECIFIED IN SECTION 40 05 15.
4. ALL JOINTS SHALL BE WATERTIGHT. WALL PIPES SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO BACKFILL.
5. ALL FLEXIBLE CONNECTORS AND COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST PROTECTION AS SPECIFIED, UNLESS OTHERWISE NOTED. THRUST PROTECTION SHALL BE ADEQUATE FOR TEST PRESSURES SPECIFIED.
6. SYMBOLS, LEGENDS, AND PIPE USE IDENTIFICATIONS SHOWN SHALL BE FOLLOWED THROUGHOUT THE DRAWINGS, WHEREVER APPLICABLE. NOT ALL OF THE VARIOUS PIPING COMPONENTS ARE NECESSARILY USED IN THE PROJECT.
7. ALL BURIED PIPING SPECIFIED TO BE PRESSURE TESTED, EXCEPT FLANGED, WELDED, OR SCREWED PIPING, SHALL BE PROVIDED WITH THRUST PROTECTION AS SPECIFIED, UNLESS OTHERWISE NOTED.
8. NUMBER AND LOCATION OF UNIONS SHOWN ON DRAWINGS IS ONLY APPROXIMATE. PROVIDE ALL UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.
9. WHERE A GROOVED END COUPLING IS SHOWN, IT SHALL BE THE RIGID JOINT TYPE, UNLESS OTHERWISE SPECIFIED. WHERE A FLANGED COUPLING ADAPTER IS SHOWN, A STANDARD FLANGE SHALL BE JOINED TO THE COUPLING ADAPTER.

NOTE:
FLOW STREAM IDENTIFICATIONS ARE SPECIFIED IN SECTION 40 27 00 PIPING SCHEDULE.

NO.	DATE	DSGN	DR	CHK	APVD	REVISION	BY	APVD
	H POSTROZNY		Z BRYAN	H POSTROZNY	H POSTROZNY		H POSTROZNY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

GENERAL
WELLHOUSE NO. 2
PROCESS MECHANICAL LEGEND

BID DOCUMENTS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	4
SHEET	4 of 16

NOTES:

1. EXISTING ELEVATED STORAGE TANK CONTAINS FOUR EXISTING FLOATS THAT SHALL BE CONNECTED TO THE NEW ELEVATED STORAGE TANK CONTROL PANEL. REFER TO DRAWINGS 10 & 12 FOR DETAIL.
2. CONTRACTOR TO REPLACE ENGINE AND ELECTRICAL EQUIPMENT LOCATED IN WELLHOUSE. SEE DRAWINGS 7 & 14.

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN	G YARBERRY		Z BRYAN	K HORTON		G YARBERRY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2
SITE PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	5
SHEET	5 of 16

BID DOCUMENTS

DEMOLITION LEGEND

ITEM TO BE DEMOLISHED/ REMOVED

GENERAL NOTES

1. EXISTING ELEVATED STORAGE TANK LEVEL INDICATOR SHALL BE RELOCATED TO THE WALL ABOVE THE CHLORINE BOOSTER PUMP.
2. EXISTING ELECTRICAL EQUIPMENT SHALL BE DEMOLISHED. NEW ELECTRICAL EQUIPMENT SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR THAT SHALL RE-FEED THE EXISTING EQUIPMENT TO REMAIN.
3. EXISTING AUTODIALER SHALL BE REMOVED AND RETURNED TO THE OWNER.
4. EXISTING 120V RECEPTACLE THAT CURRENTLY FEEDS THE CAUSTIC METERING PUMP SHALL BE DEMOLISHED. A NEW 120V RECEPTACLE SHALL BE PROVIDED THAT SHALL REPLACE THE EXISTING RECEPTACLE AND SHALL BE LOCATED IMMEDIATELY ADJACENT TO THE EXISTING CAUSTIC METERING PUMP. THE NEW 120V RECEPTACLE SHALL BE ENERGIZED WHEN THE WELL PUMP IS IN OPERATION AND SHALL BE DE-ENERGIZED WHEN THE WELL PUMP IS NOT IN OPERATION.
5. REROUTE AND EXTEND EXISTING CONDUIT TO THE NEW WELL PUMP CONTROL PANEL. EXISTING CONDUCTORS INSTALLED SHALL BE DEMOLISHED AND NEW CONDUCTORS INSTALLED.
6. CONTRACTOR SHALL REMOVE EXISTING PLYWOOD BACKBOARD AND MOUNT ALL EQUIPMENT DIRECTLY TO THE CMU WALL. CONTRACTOR SHALL PAINT WALL WHERE EXISTING PLYWOOD IS CURRENTLY INSTALLED. COLOR TO MATCH EXISTING.

1 PHOTO DETAIL 1 - ELEVATED TANK
NTS

2 PHOTO DETAIL 2 - WELLHOUSE NO. 2
NTS

ELECTRICAL DEMOLITION PHOTO DETAILS
NTS

NO.	DATE	REVISION	DR	CHK	BY	APVD
DSGN	G YARBERRY		Z BRYAN	K HORTON	G YARBERRY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2
DEMOLITION PHOTO DETAILS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	6
SHEET	6 of 16

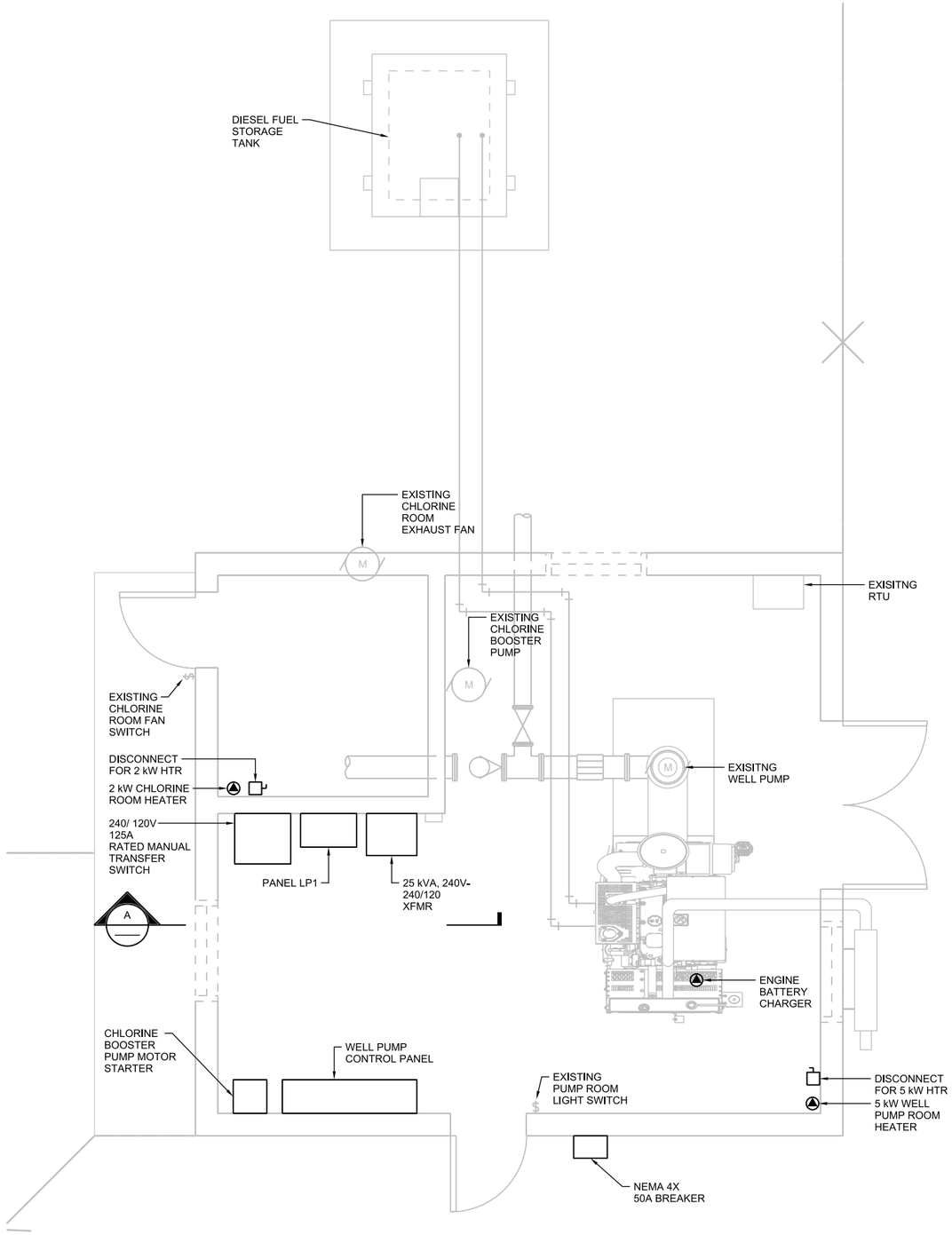
BID DOCUMENTS

GENERAL NOTES

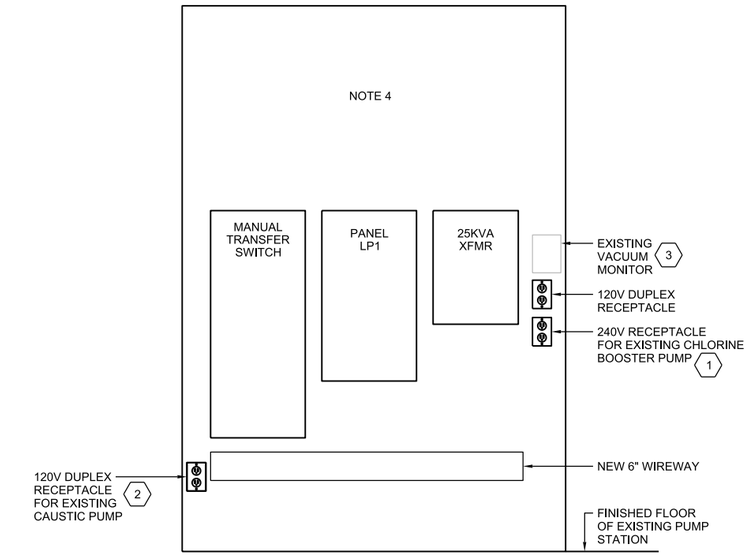
1. REFER TO DRAWINGS 11 AND 12 FOR INTERCONNECTING WIRING DIAGRAMS.

SHEET KEYNOTES

1. 240V RECEPTACLE FOR THE CHLORINE BOOSTER PUMP SHALL BE ENERGIZED WHEN THE CHLORINE BOOSTER PUMP IS CALLED TO RUN AND SHALL BE DE-ENERGIZED WHEN THE CHLORINE BOOSTER PUMP IS CALLED TO STOP. REFER TO DRAWINGS 9 AND 11 FOR DETAIL.
2. THE 120V RECEPTACLE FOR THE CAUSTIC PUMP SHALL BE ENERGIZED WHEN THE WELL PUMP IS IN ON AND SHALL BE DE-ENERGIZED WHEN THE WELL PUMP IS OFF. THE RECEPTACLE SHALL BE FED FROM PANEL LP1, BUT SHALL BE INTERLOCKED WITH THE WELL PUMP CONTROL PANEL. REFER TO DRAWINGS 9 AND 11 FOR DETAIL.
3. THE EXISTING VACUUM MONITOR SHALL BE RELOCATED AS SHOWN. THE CONTRACTOR SHALL PROVIDE [¾"C, 2#14, 1#14G] FROM THE RELOCATED VACUUM MONITOR SWITCH TO THE EXISTING RTU.
4. CONTRACTOR SHALL REMOVE EXISTING PLYWOOD BACKBOARD AND MOUNT ALL EQUIPMENT DIRECTLY TO THE CMU WALL. CONTRACTOR SHALE PAINT WALL WHERE EXISTING PLYWOOD IS CURRENTLY INSTALLED. COLOR TO MATCH EXISTING.



POWER PLAN
1/2"=1'-0"



A SECTION
3/4"=1'-0"

NO.	DATE	DSGN	DR	CHK	BY	REVISION
		G YARBERRY	G YARBERRY	Z BRYAN	K HORTON	APVD
						APVD
						G YARBERRY

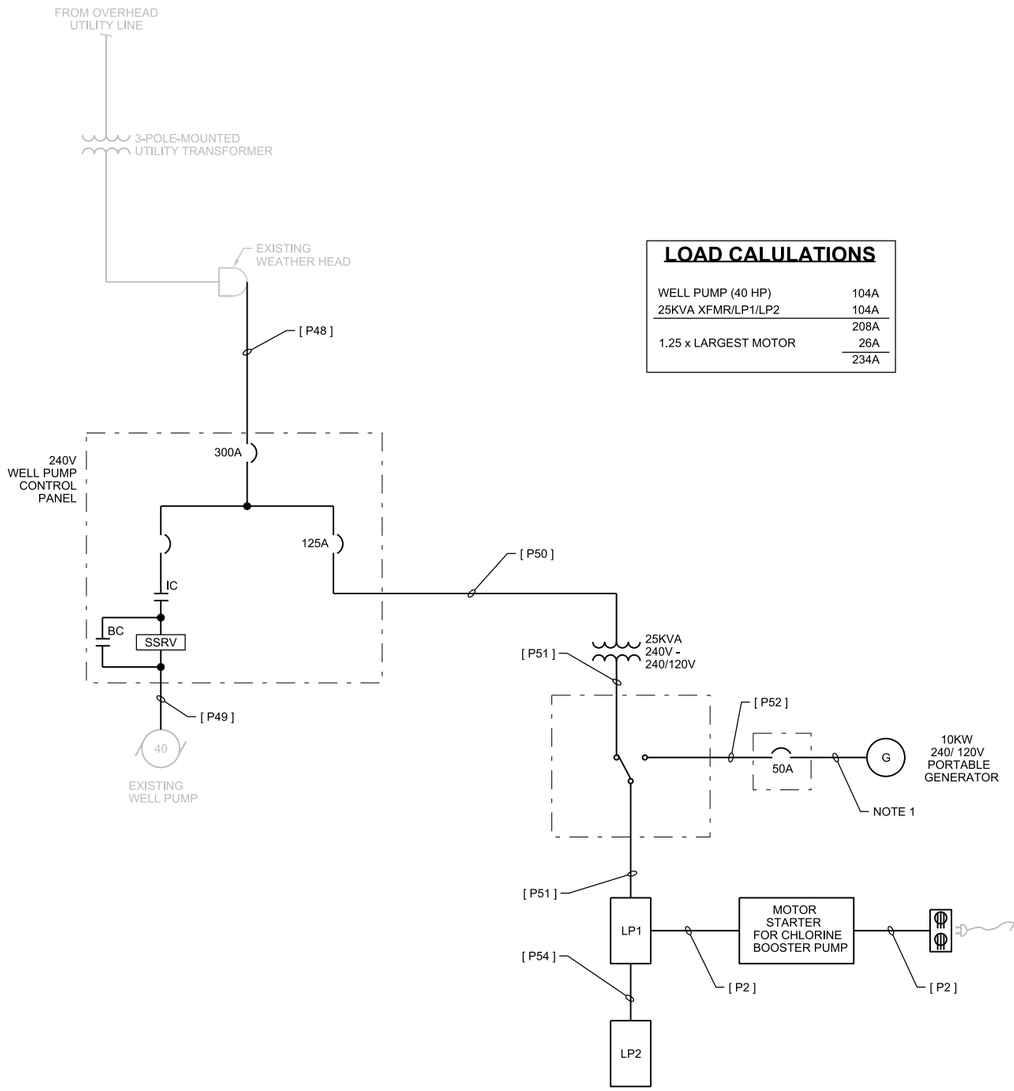
NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2 POWER PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	7
SHEET	7 of 16

BID DOCUMENTS



LOAD CALULATIONS

WELL PUMP (40 HP)	104A
25KVA XFMR/LP1/LP2	104A
	208A
1.25 x LARGEST MOTOR	26A
	234A

GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE AND INSTALL TEMPORARY CABLES THAT ARE SUITABLE FOR INSTALLATION OUTSIDE. THE CABLES PROVIDED SHALL BE TEMPORARY AND CAN BE EASILY REMOVED AND INSTALLED BY THE OWNER. THE CABLES SHALL BE DESIGNED FOR CONNECTING TO THE PORTABLE GENERATOR.

PANEL: Panel LP1 — LOCATION: Well House #2
SERVICE VOLTAGE: 120/240V — PHASE: 1 — WIRE: 3
TOTAL LOAD KVA: 18.5 — BUS SIZE: 125A — MAIN SIZE: 125A — TYPE: BKR
REMARKS: NEMA 12 Enclosure — NEUTRAL: FULL — MOUNTING: WALL

LOAD IN KVA A	LOAD IN KVA B	CIRCUIT DESCRIPTION	BKR A/P	CKT NO.	CKT NO.	BKR A/P	CIRCUIT DESCRIPTION	LOAD IN KVA A	LOAD IN KVA B
0.5		Chlorine Room Exhaust Fan/Lights	20/1	1	2	80/2	Panel LP2 (under elev. tank)	2.5	
	0.4	Well Pump Room Recepts	20/1	3	4				2.5
2.0		Engine Battery Charger	30/1	5	6	20/1	Caustic Pump Receptacle	0.25	
	0.4	RTJ-2	20/1	7	8	20/1	Well Pump Room Lights		0.4
1.0		Chlorine Room Heater (2KW)	15/2	9	10	30/2	Well Pump Room Heater (5KW)	2.5	
	1.0			11	12				2.5
0.75		Chlorine Booster Pump	20/2	13	14	20/1	Engine Jacket Water Heater	1.0	
	0.75			15	16	20/1	Spare		
		Spare	20/1	17	18	20/1	Spare		
		Spare	20/1	19	20	20/1	Spare		
				21	22				
				23	24				
				25	26				
				27	28				
				29	30				
				31	32				
				33	34				
				35	36				
				37	38				
				39	40				
				41	42				
4.3	2.6	TOTAL						6.3	5.4

PANEL: Panel LP2 — LOCATION :Under Elevated Storage Tank 2
SERVICE VOLTAGE: 120/240V — PHASE: 1 — WIRE: 3
TOTAL LOAD KVA: 4.9 — BUS SIZE:80A — MAIN SIZE:80A — TYPE: BKR
REMARKS: NEMA 12 Enclosure — NEUTRAL:FULL — MOUNTING: EXISTING RACK

LOAD IN KVA A	LOAD IN KVA B	CIRCUIT DESCRIPTION	BKR A/P	CKT NO.	CKT NO.	BKR A/P	CIRCUIT DESCRIPTION	LOAD IN KVA A	LOAD IN KVA B
0.3		Receptacle	20/1	1	2	20/1	Fairpoint Valve	0.5	
	0.3	Lighting	20/1	3	4	20/1	Well Pump Control Panel		0.3
1		Heater (2KW)	20/2	5	6	20/1	Altitude Valve	0.5	
	1			7	8	20/1	Sump Pump Pit		0.5
0.3		Orthophosphate Pump	20/1	9	10	20/1	PH Meter	0.2	
		Spare	20/1	11	12	20/1	Spare		
		Spare	20/1	13	14	20/1	Spare		
		Spare	20/1	15	16	20/1	Spare		
		Spare	20/1	17	18	20/1	Spare		
		Spare	20/1	19	20	20/1	Spare		
				21	22				
				23	24				
				25	26				
				27	28				
				29	30				
				31	32				
				33	34				
				35	36				
				37	38				
				39	40				
				41	42				
1.6	1.3	TOTAL						1.2	0.8

WELLHOUSE NO. 2 - ONE LINE DIAGRAM
NTS

NO.	DATE	DSGN	DR	CHK	BY	APVD
		G YARBERRY	Z BRYAN	K HORTON	G YARBERRY	APVD

REVISION

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2
OVERALL ONE LINE DIAGRAM
AND PANEL SCHEDULES

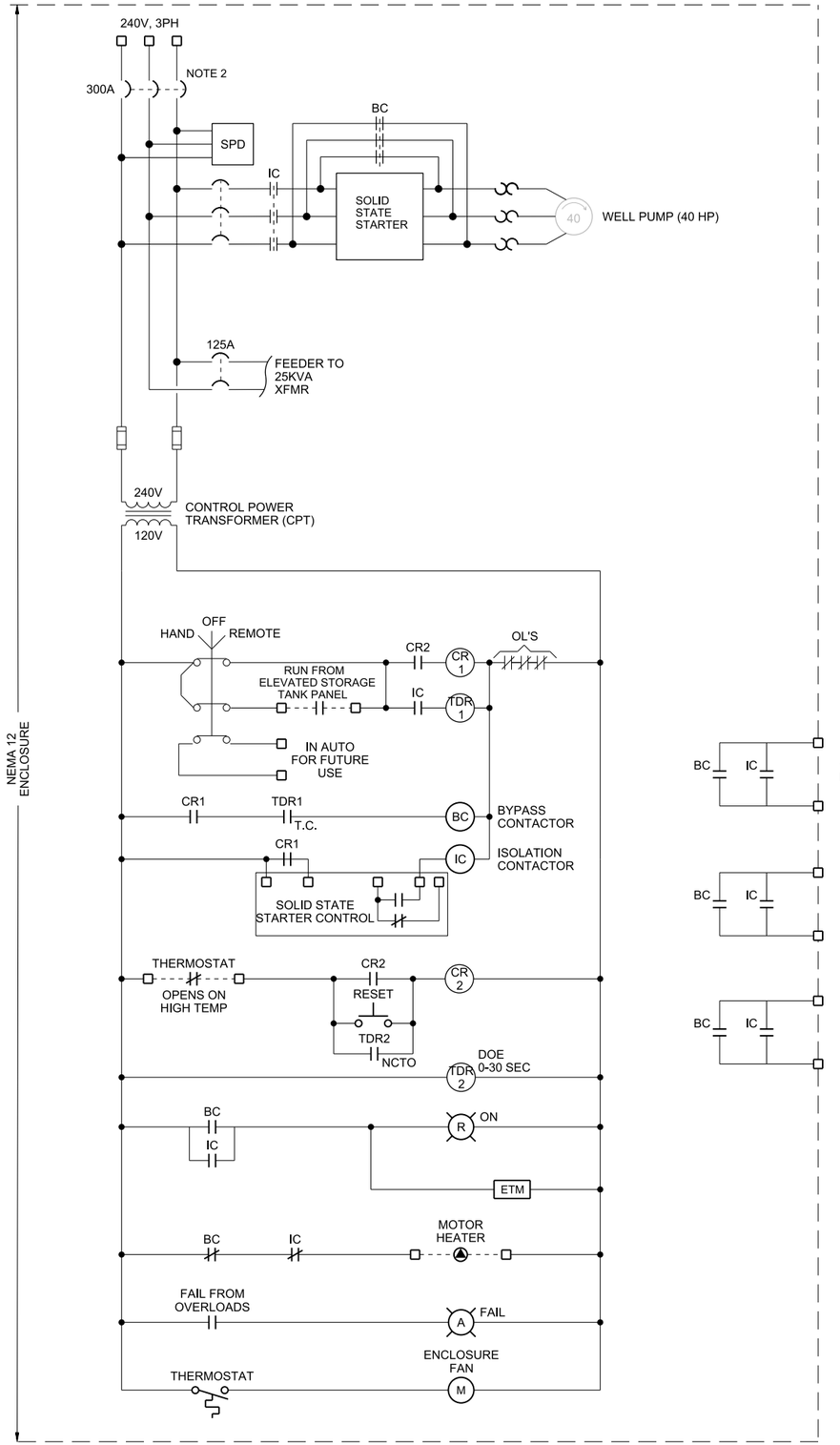
BID DOCUMENTS

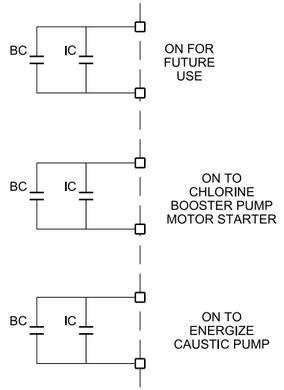
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

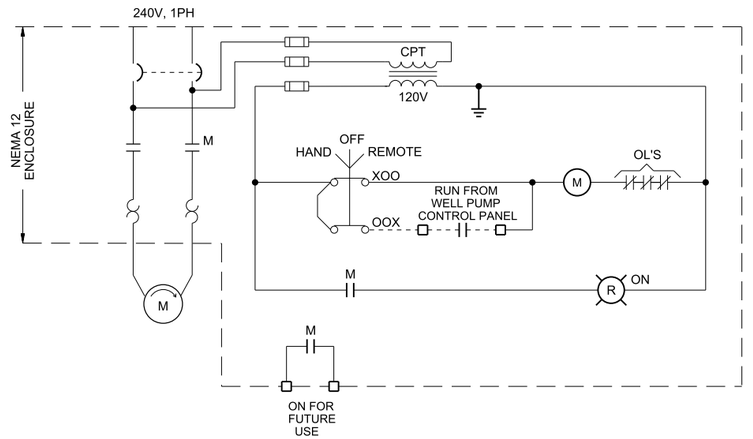
DATE	JUNE 2016
PROJ	654039
DWG	8
SHEET	8 of 16

GENERAL NOTES

1. CHLORINE BOOSTER PUMP IS AN EXISTING 1.5 HP MOTOR THAT INCLUDES A PLUG. THE MOTOR STARTER WILL BE USED TO ENERGIZE AND DE-ENERGIZE THE ASSOCIATED RECEPTACLE WHICH IS USED TO POWER EXISTING PUMP. REFER TO DRAWING 8 FOR DETAIL.
2. MAIN BREAKER SHALL BE SERVICE ENTRANCE RATED.







CHORINE BOOSTER PUMP MOTOR STARTER (NOTE 1)

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		G YARBERRY	Z BRYAN	K HORTON	APVD	G YARBERRY	

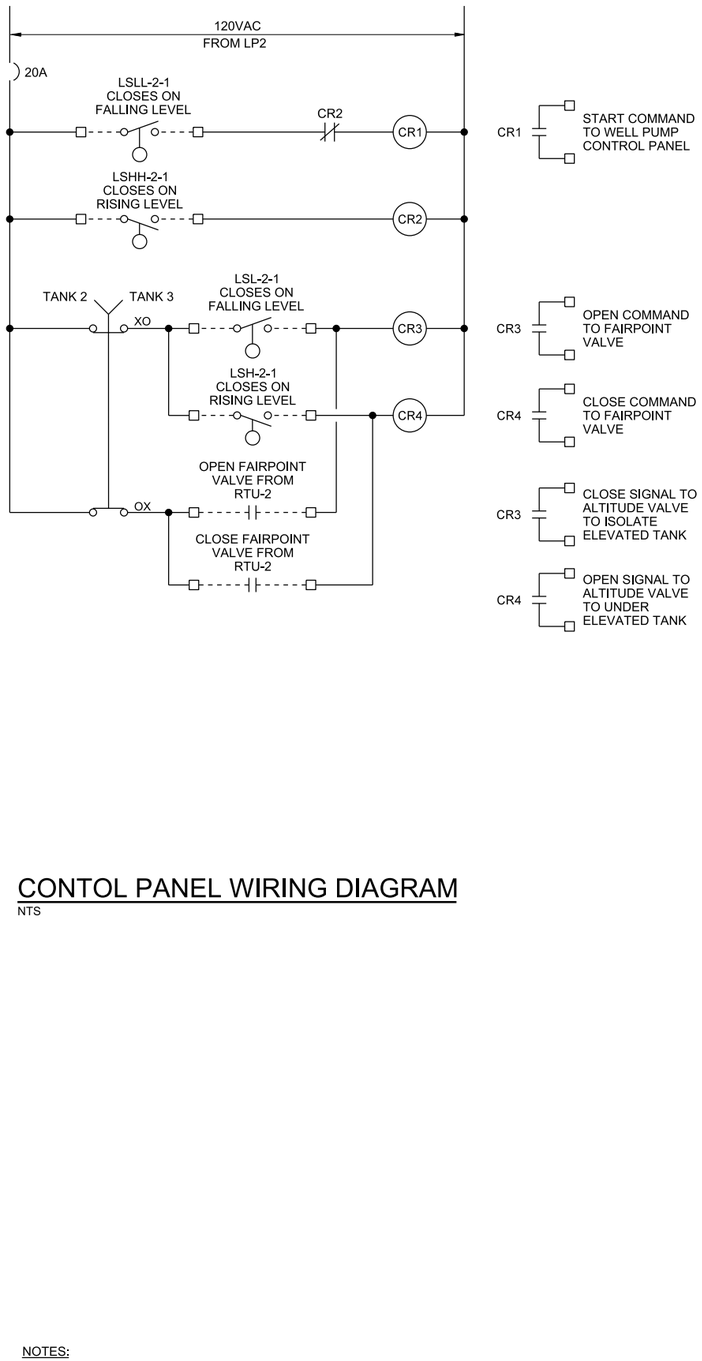
NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2 PANEL WIRING DIAGRAM

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	9
SHEET	9 of 16

BID DOCUMENTS



CONTOL PANEL WIRING DIAGRAM

NTS

NOTES:

1. CONTROL PANEL SHALL BE PROVIDED WITH A NEMA 12 ENCLOSURE.

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD
DSGN	G YARBERRY	G YARBERRY	Z BRYAN	K HORTON	APVD	G YARBERRY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL

WELLHOUSE NO. 2
ELEVATED STORAGE TANK
PANEL WIRING DIAGRAM

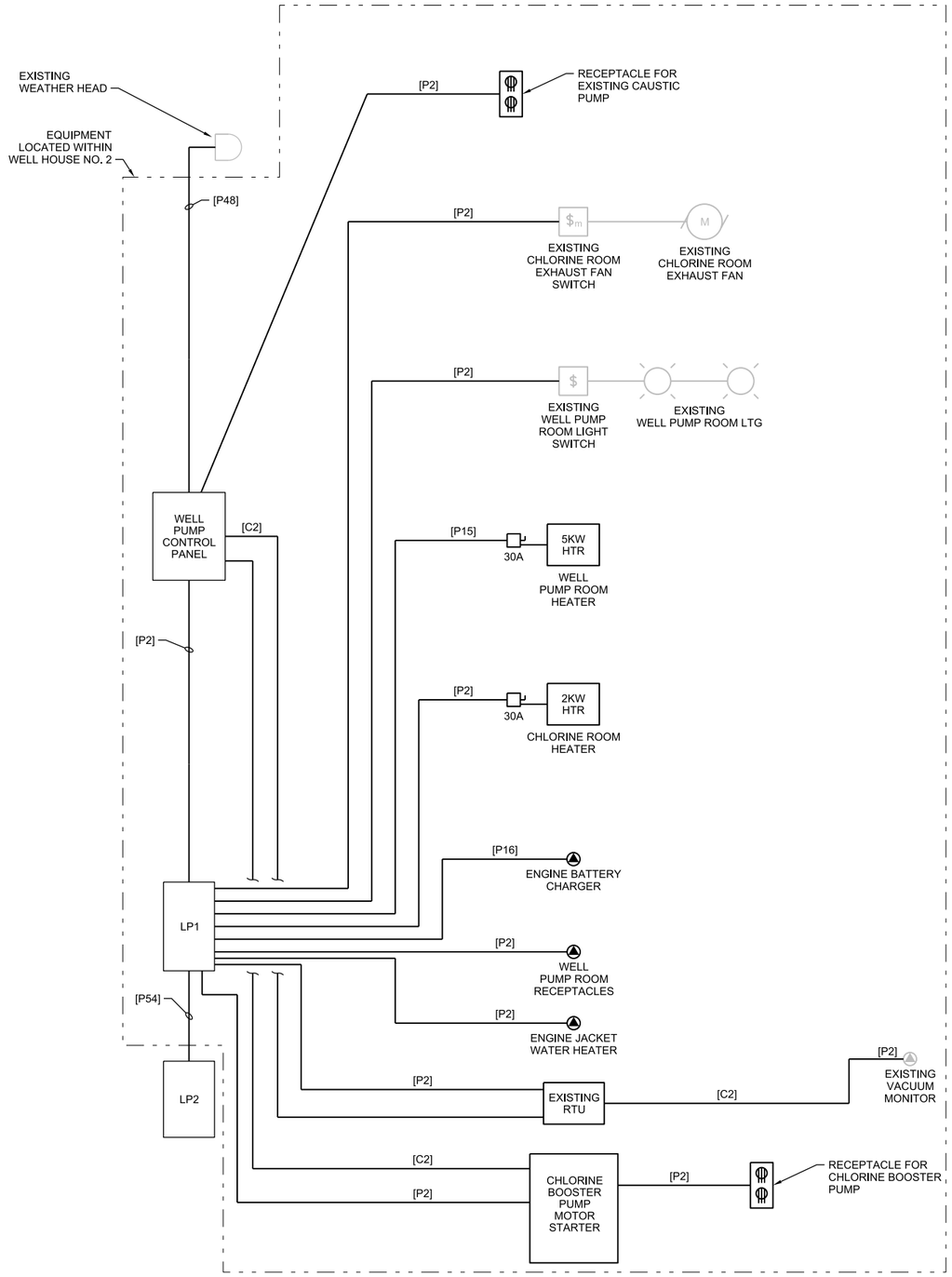
BID DOCUMENTS

AS NOTED

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	10
SHEET	10 of 16



NO.	DATE	DR	REVISION	CHK	BY	APVD
DSGN	G YARBERRY	G YARBERRY	Z BRYAN	K HOROTN	G YARBERRY	APVD

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL

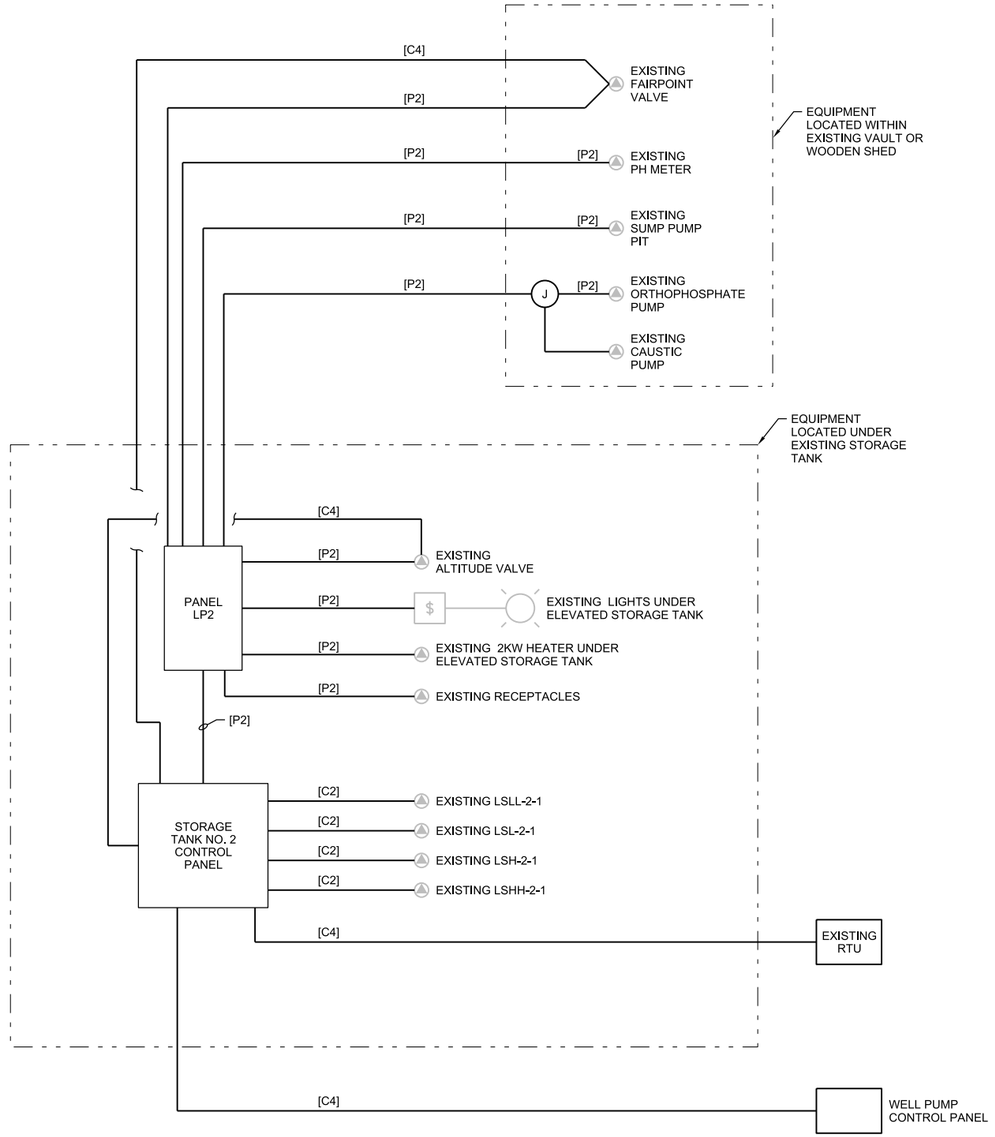
WELLHOUSE NO. 2 WIRING DIAGRAM

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	11
SHEET	11 of 16

BID DOCUMENTS



NO.	DATE	REVISION	DR	CHK	APVD	BY
DSGN	G YARBERRY	Z BRYAN	K HORTON	APVD	G YARBERRY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ELECTRICAL
WELLHOUSE NO. 2 WIRING DIAGRAM

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	12
SHEET	12 of 16

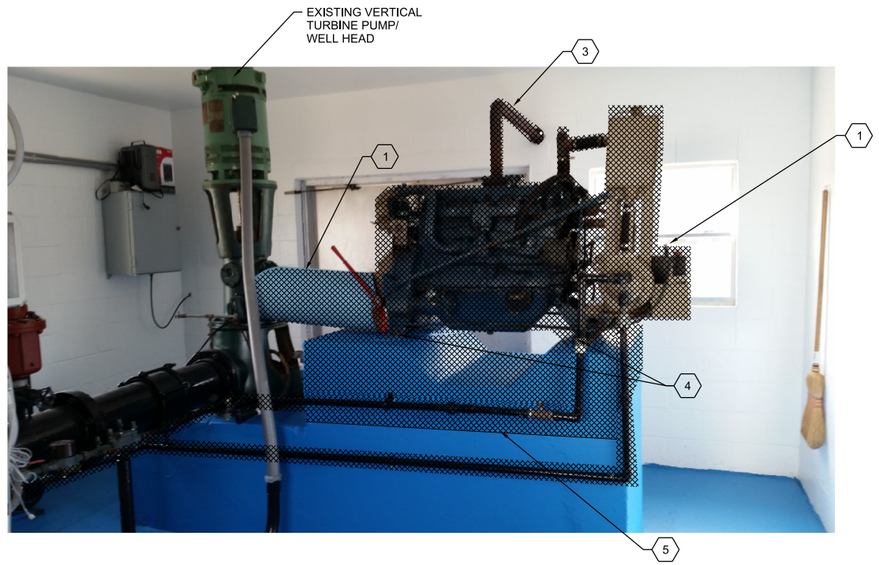
BID DOCUMENTS

SHEET KEYNOTES

1. DEMOLISH ENGINE DRIVER, INCLUDING TAKE-OFF CLUTCH AND U-JOINT DRIVELINE WITH SAFETY GUARD.
2. DEMOLISH LIQUID PROPANE TANK, CONCRETE PAD, AND PROPANE GAS PIPING.
3. DEMOLISH EXHAUST PIPING, AND PIPING TO EXISTING LIQUID PROPANE TANK.
4. CUT/ GRIND EXISTING ANCHOR BOLTS FLUSH W/ PEDESTAL SURFACE.
5. DEMOLISH TOP OF EXISTNG CONCRETE PEDESTAL TO ACCOMODATE NEW ENGINE DRIVER/ NEW PEDESTAL TOP. SUBMIT PLAN TO ENGINEER FOR APPROVAL PRIOR TO BEGINNING WORK ON PEDESTAL.

DEMOLITION LEGEND

ITEM TO BE DEMOLISHED/ REMOVED



1 PHOTO DETAIL: ENGINE DRIVER DEMOLITION
NTS
001-D-201

2 PHOTO DETAIL: LIQUID PROPANE TANK DEMOLITION
NTS
001-D-201

PROCESS MECHANICAL DEMOLITION PHOTO DETAILS
NTS

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN	H POSTROZNY		Z BRYAN	H POSTROZNY	H POSTROZNY		H POSTROZNY

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

PROCESS MECHANICAL
WELLHOUSE NO. 2
DEMOLITON PHOTO DETAILS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	13
SHEET	13 of 16

BID DOCUMENTS

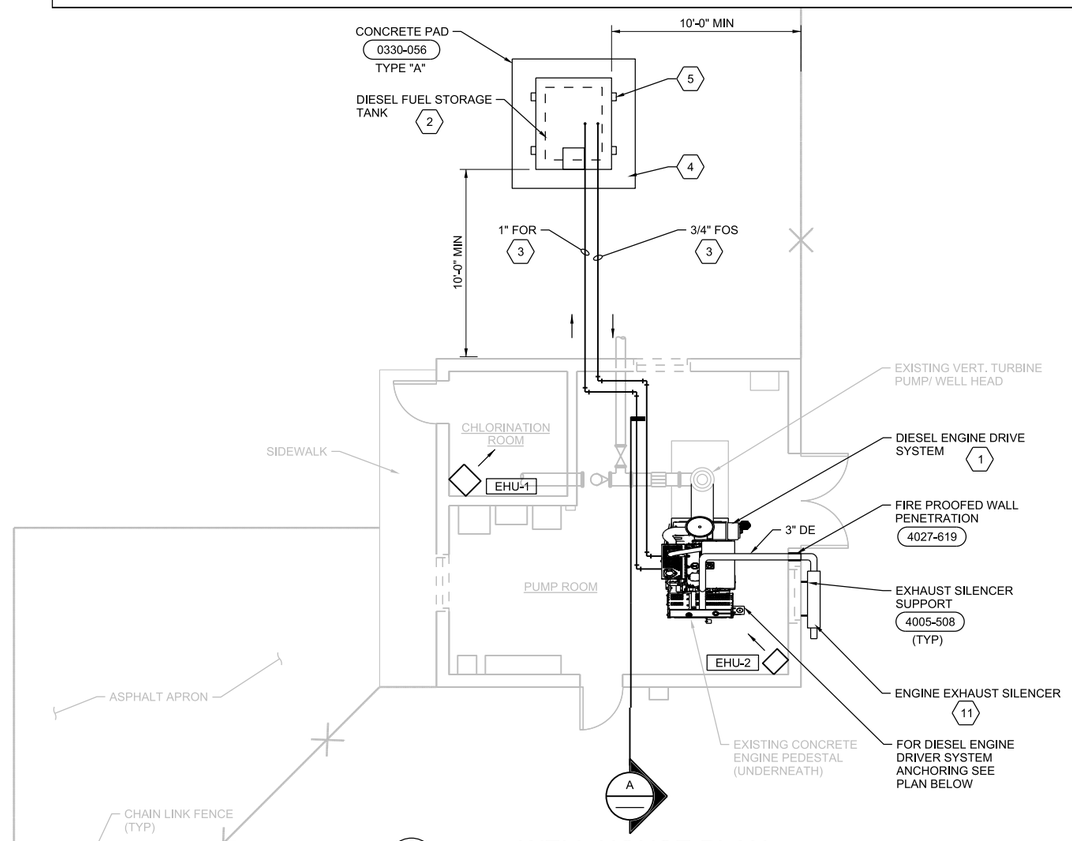
UNIT HEATERS

23 82 00.01

TAG	LOCATION	UNIT HEATER TYPE	AIR SIDE DATA							ELEC. HEAT DATA				UNIT ELECTRIC DATA				MAXIMUM DIMENSIONS					MANUFACTURER	MODEL	APPLICABLE REMARKS
			SUPPLY AIRFLOW CFM	HORIZ THROW FEET	MOTOR RPM	MOTOR POWER HP	MOTOR VOLT	MOTOR PH	TEMP RISE DEG. F	CAPACITY kW	NO. STEPS	VOLT	PH	MCA	VOLT	PH	MOUNTING HEIGHT (MIN.) FEET	PHYSICAL SIZE INCHES L	PHYSICAL SIZE INCHES W	PHYSICAL SIZE INCHES H	WEIGHT LBS.				
EHU-1	CHLORINATION ROOM	CORROSION RESISTANT ELECTRIC, SUSPENDED	405	12	1050	1/15	240	1	21	2	1	240	1	8.3	240	1	7	13 1/2	15	24 1/2	45		CHROMALOX	HD3D-200	A,B,C,D,E
EHU-2	PUMP ROOM	ELECTRIC, SUSPENDED	410	12	1650	1/40	240	1	39	5	1	240	1	21.4	240	1	8	10	13	16 1/8	32		CHROMALOX	HVH-05	A,B,C,D,E

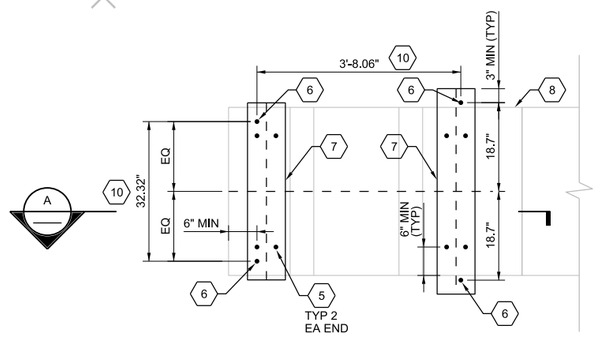
REMARKS:

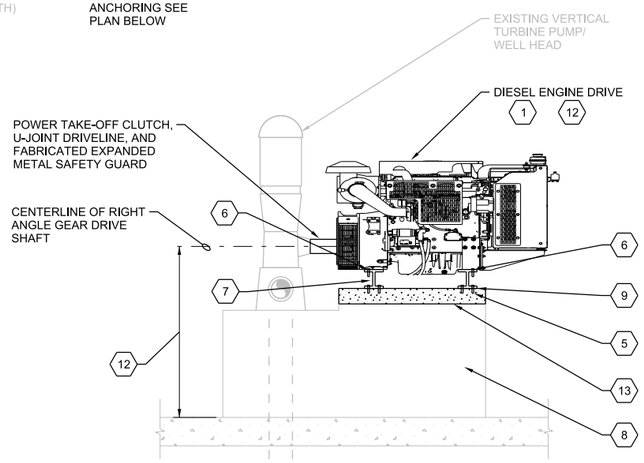
A: FACTORY INSTALLED MOTOR STARTER / HEATER CONTACTOR
B: DISCONNECT: FACTORY INSTALLED
C: WALL MOUNTING BRACKET
D: FACTORY MOUNTED THERMOSTAT
E: HORIZONTAL AIRFLOW DISCHARGE



WELL HOUSE PLAN

1/4"=1'-0"





DIESEL ENGINE DRIVER SYSTEM ANCHORING - PLAN

3/4"=1'-0"

ENGINE DRIVE AND SLAB SECTION

A NTS

GENERAL NOTES

1. SEE DETAIL 4027-600 FOR FOS/ FOR PIPING ISOMETRIC.
2. CONCRETE MIX DESIGN:
   A. CONCRETE SHALL BE IN ACCORDANCE WITH ACI 301-10.
      a. MINIMUM COMPRESSIVE STRENGTH F 4,000 PSI AT 28 DAYS.
      b. W/ CM RATIO SHAL NOT EXCEED 0.40.
      c. CONCRETE MIXTURE SHALL BE DESIGNED FOR CONCRETE EXPOSURE CLASS AND CATEGORY F0S1P0C2.
   B. AGGREGATE SHALL COMPLY WITH ASTM C33, CLASS DESIGNATION 4S AND NON-REACTIVE AS DETERMINED USING ONE OF THE FOLLOWING:
      - ASTM C1260
      - ASTMC1293
      - ASTMC1567
   C. STRENGTH TESTS:
      a. ONE SPECIMEN AT 7 DAYS FOR INFORMATION.
      b. TWO 6 INCH DIAMETER OR THREE 4 INCH DIAMETER TEST SPECIMENS AT 28 DAYS FOR ACCEPTANCE.
      c. PROVIDE A MINIMUM OF ONE SPARE TEST SPECIMEN PER SAMPLE.
   D. PROVIDE SURFACE FINISH-2.0 (S-2.0) TO FORMED CONCRETE.
   E. UNLESS NOTED OTHERWISE APPLY ASTM C309 TYPE 1 OR 1-D CURING COMPUND IN ACCORDANCE WITH MANFACTURER'S RECOMMENDATION. CURE AND SEAL J-20 BY DAYTON SUPERIOR.
   F. MOIST CURE CONCRETE FOR SUMP IN ACCORDANCE WITH 5.3.6.4(A) AND/ OR (B) OF ACI 301-10.
   F. CHAMFER EXPOSED EDGES OF CONCRETE 3/4 INCH.
3. REINFORCING STEEL:
   A. DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60.
   B. FABRICATION AND PLACEMENT SHALL BE IN ACCORDANCE WITH CRSI MSP-1 "MANUAL OF STANDARD PRACTICE."
   C. CONCRETE COVER:
      a. CAST AGAINST EARTH = 3 INCHES
      b. UNLESS OTHERWISE NOTED = 2 INCHES
   D. SUPPORT REINFORCING STEEL OFF GROUND USING PRECAST DOBIES WITH WIRE TIES.
   E. HOOKS SHALL BE ACI STANDARD HOOKS.
   F. #5 REINFORCING BARS:
      a. LAP SPLICE LENGHT = 24 INCHES
      b. EMBEDMENT LENGHT = 19 INCHES
4. NONSHRINK GROUT :
   A. PREPARE CONCRETE SURFACE BY SANDBLASTING, CHIPPING, OR BY MECHANICAL MEANS TO REMOVE ANY SOFT MATERIAL. SURFACE ROUGHNESS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.
   B. CLEAN METAL SURFACES OF ALL PAINT, OIL, GREASE, LOOSE RUST AND OTHER FOREIGN MATERIAL THAT WILL BE IN CONTACT WITH GROUT.
   C. SET MACHINERY IN POSITION AND WEDGE TO ELEVATION WITH STEEL WEDGES, OR USE CAST-IN LEVELING BOLTS. REMOVE WEDGES AFTER GROUT IS SET AND PACK VOID WITH GROUT.
   D. FORM WITH WATERTIGHT FORMS AT LEAST 2 INCHES HIGHER THAN BOTTOM OF PLATE.
   E. FILL SPACE BETWEEN BOTTOM OF MACHINERY BASE AND ORIGINAL CONCRETE IN ACCORDANCE WITH MANUFACTURER'S REPRESENTATIVE'S TRAINING INSTRUCTIONS.
   F. IF GROUT CANNOT BE PLACED FROM ONE EDGE AND FLOWED TO THE OPPOSITE EDGE, AIR VENTS SHALL BE PROVIDED THROUGH THE PLATE TO PREVENT AIR ENTRAPMENT.
   G. RADIUS ALL CORNERS OF GROUT PAD.
5. STRUCTURAL STEEL:
   A. W-SHAPES SHALL CONFORM TO ASTM A992.
6. THE CONTRACTOR SHALL FIELD VERIFY DIMENSIONS, ELEVATION AND DETAILING OF THE EXISTING STRUCTURES PRIOR TO UNDERTAKING ANY WORK THAT IS AFFECTED BY THE EXISTING STRUCTURE. NOTIFY ENGINEER IF CONDITIONS VARY FROM THAT SHOWN PRIOR TO STARTING WORK.

SHEET KEYNOTES

1. DIESEL ENGINE DRIVE SYSTEM AND ACCESSORIES PER SECTION 40 00 64.
2. DIESEL FUEL STORAGE TANK PER SECTION 43 40 05.
3. FIELD ROUTE FOS/ FOR PIPING BETWEEN DIESEL FUEL STORAGE TANK AND ENGINE CONNECTIONS SEE 4027-600.
4. CONCRETE EQUIPMENT PAD 0330-056 TYPE "A".
5. 1" DIA SS CONCRETE ADHESIVE ANCHORS WITH 6" MIN EMBEDMENT. TYPE HIT RE 500 V3 BY HILTI.
6. VIBRATION ISOLATORS W/ TYPE 304 SST BOLTS BY EQUIPMENT SUPPLIER. PROVIDE FULL BEARING OF ENGINE VIBRATION ISOLATOR ON SUPPORT BEAM. MIN 1 1/4" EDGE DISTANCE FOR BOLT IN SUPPORT BEAM.
7. W8x35 EQUIPMENT SUPPORT BEAM.
8. EXISTING CONCRETE FOUNDATION PEDESTAL.
9. 1 1/2" MIN NONSHRINK GROUT, MASTERFLOW 885 BY BASF BUILDING SYSTEMS.
10. COORDINATE EQUIPMENT ANCHOR SPACING WITH MANUFACTURER.
11. MOUNT EXHAUST SILENCER ABOVE EXISTING WINDOW W/ SILENCER. BOTTOM 7'-6" (MIN) ABOVE EXISTING GRADE.
12. NEW ENGINE DRIVE SHAFT CENTERLINE TO MATCH EXISTING RIGHT ANGLE GEAR DRIVE CENTERLINE.
13. NEW REINFORCED CONCRETE PEDESTAL TOP SEE 0330-056 TYPE "B". MODIFY EXISTING PEDESTAL AS REQUIRED TO ACCOMODATE NEW ENGINE DRIVER/ NEW PEDESTAL TOP.

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN	H POSTROZNY		Z BRYAN	H POSTROZNY	H POSTROZNY		H POSTROZNY

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ch2m.

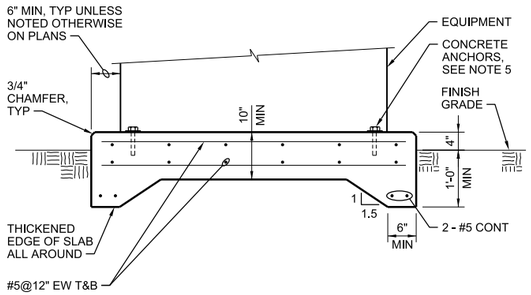
PROCESS MECHANICAL

WELLHOUSE NO. 2
PLAN AND SECTION

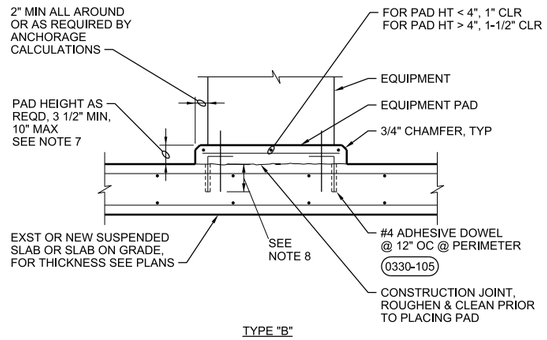
AS NOTED
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2016
PROJ	654039
DWG	14
SHEET	14 of 16

BID DOCUMENTS



TYPE "A"



TYPE "B"

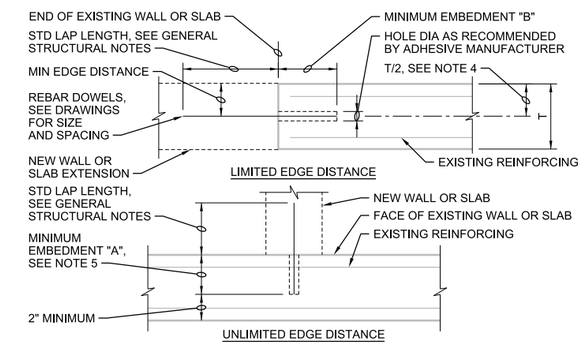
NOTES:

1. PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE PLANS OR AS INDICATED BY THE MANUFACTURER AND APPROVED BY THE ENGINEER.
2. THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AND AS APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A TEMPLATE OR OTHER ACCEPTABLE MEANS, MATCHING THE BASE PLATE, WHILE PAD IS BEING PLACED.
3. EQUIPMENT BASES SHALL BE INSTALLED LEVEL UNLESS INDICATED OTHERWISE.
4. WEDGES, SHIMS, OR LEVELING NUTS SHALL BE USED TO SUPPORT THE BASE WHILE THE GROUT IS PLACED. WEDGES OR SHIMS SHALL BE REMOVED AFTER GROUT IS SET AND PACK VOID WITH GROUT.
5. WHEN ANCHORAGE OF EQUIPMENT TO PAD IS REQUIRED, USE CONCRETE ANCHORS SPECIFIED.
6. CONCRETE PADS FOR ELECTRICAL EQUIPMENT SHALL BE 3 1/2" HIGH UNLESS NOTED OTHERWISE.
7. FOR PAD HEIGHT >10" AND <18" PROVIDE #5 REINFORCEMENT IN LIEU OF #4 REINF SHOWN.
8. SPECIFIED CONCRETE ANCHOR DEPTH INTO EXISTING SLAB.

CONCRETE EQUIPMENT PAD

NTS

0330-056



DOWEL SIZE	MINIMUM EDGE DISTANCE	MINIMUM EMBEDMENT "A"	MINIMUM EMBEDMENT "B"
#3	2 1/2"	5"	8"
#4	3 1/2"	7"	11"
#5	4"	8"	13"
#6	5"	10 1/2"	16"
#7	6"	12 1/2"	20"
#8	7"	14"	22"
#9	7 1/2"	15"	24"

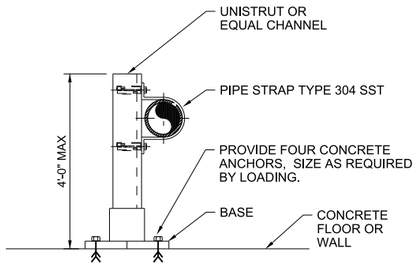
NOTES:

1. CONFORM TO REQUIREMENTS OF SPECIFICATION SECTION 03 63 00, CONCRETE DOWELING.
2. FOLLOW ADHESIVE MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION.
3. USE MINIMUM EMBEDMENTS SHOWN, EXCEPT USE MANUFACTURER'S MINIMUM RECOMMENDED EMBEDMENT IF GREATER.
4. LOCATE DOWELS CENTERED IN WALL OR SLAB UNLESS OTHERWISE NOTED ON DRAWINGS. WHERE 2 ROWS OF DOWELS INDICATED, STAGGER SPACING & LOCATE ALTERNATING DOWELS AT MINIMUM EDGE DISTANCE FROM OPPOSITE FACES.
5. PROVIDE MINIMUM EMBEDMENT "A" SHOWN IN TABLE UNLESS SHORTER EMBEDMENT DEPTH IS CALLED OUT ON DRAWINGS.

ADHESIVE DOWEL

NTS

0330-105



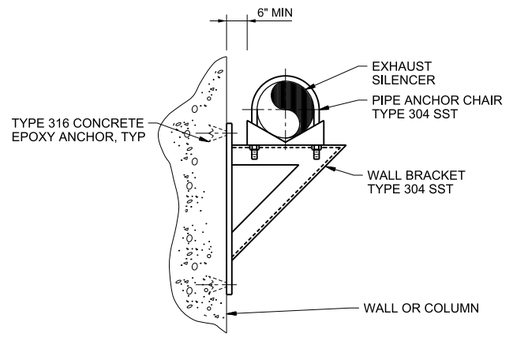
NOTES:

1. FOR MATERIALS OF CONSTRUCTION SEE SPECIFICATIONS SECTION 40 05 15.

PIPE SUPPORT - FLOOR MOUNTED

NTS

4005-495A



NOTES:

1. WALL BRACKET SHALL BE MEDIUM OR HEAVY DUTY DEPENDING ON SILENCER LOAD REQUIREMENTS.

PIPE SUPPORT - WALL MOUNTED MEDIUM

NTS

4005-508

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD
REVISION		H POSTROZNY	Z BRYAN	H POSTROZNY	H POSTROZNY	H POSTROZNY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

PROCESS MECHANICAL
WELLHOUSE NO. 2 DETAILS

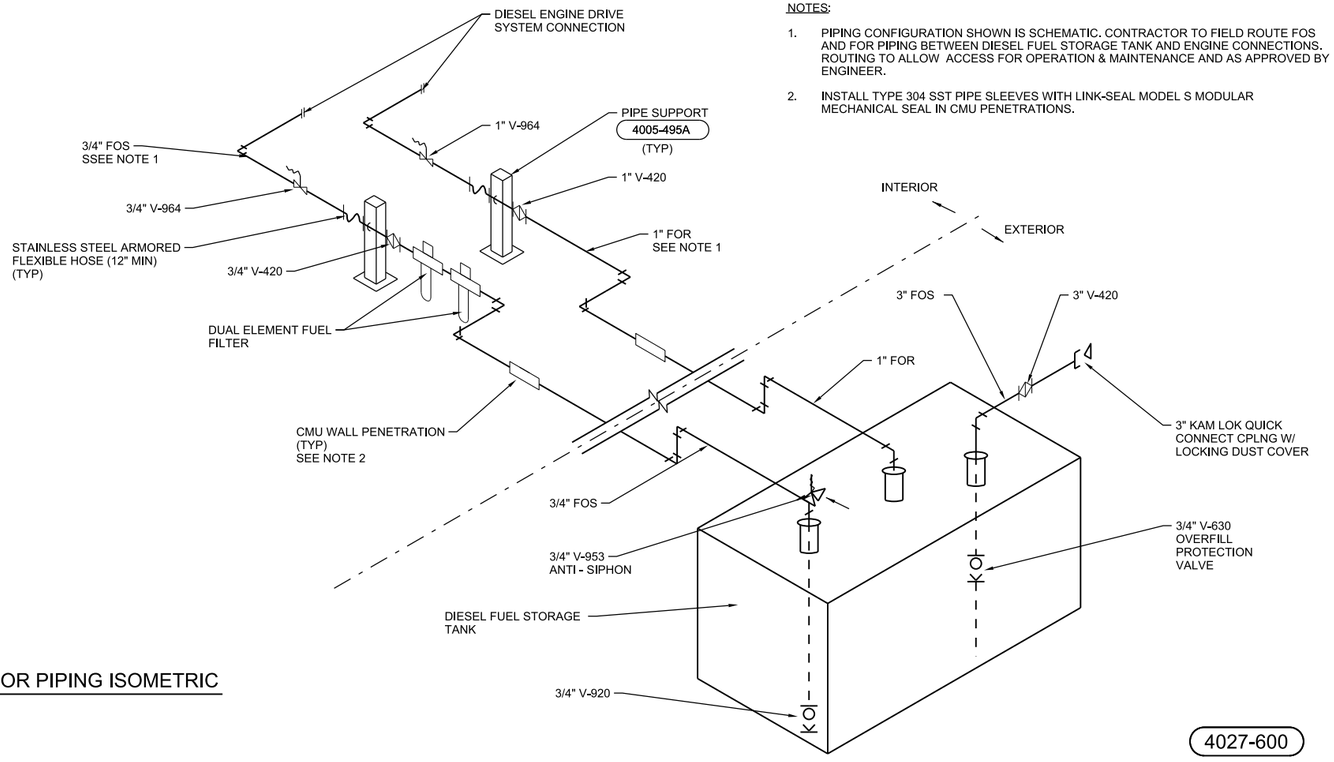
AS NOTED
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2016
PROJ	654039
DWG	15
SHEET	15 of 16

BID DOCUMENTS

NOTES:

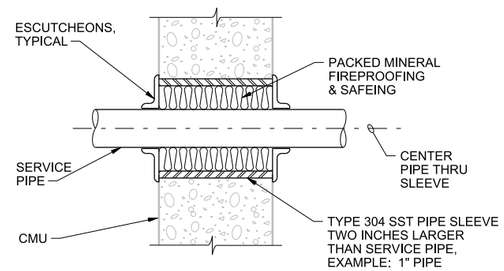
1. PIPING CONFIGURATION SHOWN IS SCHEMATIC. CONTRACTOR TO FIELD ROUTE FOS AND FOR PIPING BETWEEN DIESEL FUEL STORAGE TANK AND ENGINE CONNECTIONS. ROUTING TO ALLOW ACCESS FOR OPERATION & MAINTENANCE AND AS APPROVED BY ENGINEER.
2. INSTALL TYPE 304 SST PIPE SLEEVES WITH LINK-SEAL MODEL S MODULAR MECHANICAL SEAL IN CMU PENETRATIONS.



FOS/ FOR PIPING ISOMETRIC

NTS

4027-600



PIPE SLEEVE WITH FIREPROOFING

NTS

4027-619

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		H POSTROZNY	Z BRYAN	H POSTROZNY	APVD	H POSTROZNY	

NAVARRE BEACH WELLHOUSE NO. 2
ELECTRICAL UPGRADES
SANTA ROSA COUNTY (FL) COMMISSION
SANTA ROSA COUNTY, FL

ch2m.

PROCESS MECHANICAL
WELLHOUSE NO. 2
DETAILS

AS NOTED
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2016
PROJ	654039
DWG	16
SHEET	16 of 16

BID DOCUMENTS

SANTA ROSA COUNTY
PROCUREMENT DEPARTMENT

6495 Caroline Street, Suite J| Milton, Florida 32570

DAVID KING
Procurement Officer
davidk@santarosa.fl.gov

TO: Plan-holders

FROM: Dave King
Procurement Officer

DATE: July 21, 2016

REF: ADDENDUM #1 to BID #16-052 Wellhouse NO.2 Electrical Upgrade

PROJECT ADDENDUM #1

A Pre-bid meeting was conducted on Tuesday, July 12, 2016, at the Navarre Beach Utilities Department. A copy of the agenda is attached. The salient items discussed are summarized as additions/clarifications and are to be incorporated into the project scope of work. Additionally, any changes, additions, and/or deletions are hereby made a part of the Contract Documents for the construction of Navarre Beach Wellhouse No. 2 Electrical Upgrades dated June 2016 as fully and completely as if the same were fully set forth therein:

Statement:	Delete Section 40 00 64, Diesel Engine Generator Sets and Control Panel , of Part 3 SPECIFICATIONS, and replace in its entirety with the attached Section 40 00 64, Diesel Engine Drive System dated July 21, 2016.
Statement:	The existing fuel tank for the existing back-up engine, which is propane, is the property of the County's propane supplier. It will need to be returned to the propane supplier.
Statement:	The sworn statements included in the bid documents must be executed and included with the other proposal contents listed in the Pre-bid agenda. Include sworn statements for subs as well.
Statement:	At least one addendum will be issued, which will include these meeting notes.
Statement:	There is not an operating generator onsite. Any backup power would need to be provided by the contractor.
Statement:	Questions should be forwarded to the County by July 22, 2016 to provide sufficient time to send out an addendum, if necessary.
Question:	Do the maximum panel dimensions specified in Section 26 05 04B, Basic Electrical Materials and Methods for the Well Pump Panel include an air conditioner in the panel if required?
Answer:	No, the dimensions do not include an air conditioner.
Question:	Is there an existing generator onsite for use during construction?
Answer:	There is not an operating generator onsite. Any backup power would need to be provided by the contractor.

SANTA ROSA COUNTY
PROCUREMENT DEPARTMENT

6495 Caroline Street, Suite J| Milton, Florida 32570

DAVID KING
Procurement Officer
davidk@santarosa.fl.gov

This Addendum Number 1 is furnished to all known prospective Proposers. Please sign and return one copy of this Addendum, with original signature, with your proposal as an acknowledgement of your having received same. Bid Forms submitted without acknowledgement or without this Addendum will be considered in nonconformance. You may photocopy for your records.

SIGNED: _____

COMPANY: _____

End of ADDENDUM #1.

SECTION 40 00 64
DIESEL ENGINE DRIVE SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Work necessary to furnish, install, connect, and test one completely factory-assembled standby rated engine drive system including exhaust system with exhaust silencer, freestanding engine control panel equipment, and all related accessory items and appurtenances identified herein and shown on the Contract Drawings.

1.02 SYSTEM RESPONSIBILITY

A. The diesel engine manufacturer shall be responsible for supplying the engine drive system as well as all related drive system accessories and appurtenances including the mechanical PTO clutch assembly, drive-shaft with torsionally soft shaft coupling, engine control panel (ECP) shown on the Contract Drawings and specified herein.

B. The Contractor shall be responsible for the installation of the diesel engine drive system including all accessory and related items as described herein and shown on the Contract Drawings for a complete, fully operational system. The Contractor shall be further responsible for installation of all incidental materials, not specifically shown on the Contract Drawings and required for the complete system as specified and shown.

1.03 GENERAL SYSTEM DESCRIPTION

A. The engine driver system shall be comprised of a complete operating system to manually start the engine drive system and operate a vertical turbine well pump upon loss of utility electrical service.

B. Engine shall be designed to operate an engine manufacturer supplied drive-shaft with torsionally soft shaft coupling through a mechanical power take off (PTO) clutch assembly. Output shaft in turn to drive an existing vertical turbine water well pump through an existing right angle gear drive.

C. The new engine drive shall be a totally assembled package unit supplied with spring type vibration isolators as recommended by the engine manufacturer. The engine/base assembly and the drive-shaft assembly shall be free of harmful critical speeds and torsional vibrations within the specified operating range of speed and capacity.

D. The diesel engine drive system shall consist of diesel engine, battery system, control system, unit instrumentation, and related accessories as specified herein.

E. The fully integrated mechanical and electrical components that constitute this system shall be designed so as to enable a fully manual system that can be started, governed, and protected with safety shutdown provisions for low oil pressure, high water or oil temperature, overspeed, low fuel level, and other indicated conditions.

1.04 SUPPLEMENTAL INFORMATION

A. Information on the existing driven equipment consisting of right angle gear drive and the vertical turbine pump is provided at the end of this section in Supplement 1, “Operational and Maintenance Manual” Data for Navarre Beach Well #2 Pump, Angle Drive and Controller at the end of this section.

1.05 SUBMITTALS

A. Submittals shall include the following specific information:

1. Shop Drawings:
   a. Complete performance data of the specific engine proposed. Rating shall be at ambient conditions as specified in service conditions. Major engine loads including jacket water circulation pumping, lubrication oil pumping, inlet air losses, and exhaust gas back pressure losses are to be included to allow determination of net output horsepower and torque rating. Indicate net engine shaft horsepower, output torque, and specific fuel consumption in gallon/hour versus HP output.
   b. Dimensional, outline Drawings showing the general arrangement, weight, and construction of the engine and all accessories.
   c. Dimensional, general arrangement Drawings, control system description, schematics and logic diagrams, detailing the construction and instrumentation arrangement of local engine control panel (ECP). One line, side section, front elevation, bill-of-materials, and schematic diagrams of the engine control cabinets.
   d. Control system description, schematic/wiring diagrams, all external signal interfaces for the ECP, wall mounted within the Wellhouse Pump Room.
   e. Catalog cuts of all major equipment items, accessories, appurtenances and instrumentation and control items and a bill-of-materials of miscellaneous equipment.

f. Complete electrical elementary control and connection diagrams covering the electrical devices and functions provided on the engine and in the ECP. All diagrams shall be in accordance with NEMA ICS 1-101.

g. Noise projections and supporting calculations for the engine shall be supplied. Projections shall be for a 5-foot contour around engine corrected to free field conditions and shall include (referenced to 0.00002 Newton/sq.m):
   1) An "A" weighted projection on the specified contour (dBA).
   2) Spectral noise projections at 325, 63, 125, 250, 500, 1,000, 2,000, 4,000, and 8,000 Hertz on the same contour.

h. A detailed torsional analysis report describing the engine mass elastic model. Vibration amplitude projections shall be included for all critical speeds as existing between 80 and 110 percent of the specified operational speed range.

i. Modified 3 mass calculations on torsionally soft coupling/drive-shaft manufacturer’s letterhead verifying coupling furnished attenuates dynamic vibrations over the design speed range of the engine. Calculations to be signed and sealed by a Professional Engineer.

j. A fuel air exhaust mass balance and heat balance for the engine at rated operation. Radiant and convective jacket heat losses and lubrication oil cooling loads are to be included. Provide information herein for the exhaust silencer to be supplied under this Contract.

k. Complete list of spare parts which the supplier recommends be kept on hand.

l. Written installation instructions and prestartup servicing instructions.

m. Information, including costs, for 3-year and 5-year extended warranties and inspection service contracts.

n. Cooling radiator/fan performance including static pressure restriction.

o. Complete 8-hour course outline and presentation materials for client training by the ECP manufacturer in the use, programming and troubleshooting of the engine controller.

2. Operation and Maintenance Manuals:
   a. Shop Drawing information as specified.
   b. Provide complete detailed information on how to operate the equipment during startup, sustained operation, test conditions, shutdown, and emergency and fault conditions.
   c. Provide information and data necessary for lubrication, tolerance adjustment, calibration, and other necessary servicing.
   d. Copies of all tests reports made on engine.
   e. Description of parts and service availability.

f. Certification, copies of analyses, or test reports demonstrating appropriate vibration analysis and design in all modes.
g. Certified Factory Test Report.
h. Manufacturer’s Certificate of Performance.
i. Manufacturer’s Certificate of Proper Installation.
j. See additional requirements in as specified in Division 1, General Requirements.

1.06 WARRANTY/MAINTENANCE AGREEMENT

A. A complete engine package including control equipment shall be covered by the system manufacturer for a period of 2 years after acceptance of the system by the Owner. This warranty shall cover all materials provided, labor, and miscellaneous disposal items. Warrantee/Maintenance Agreement shall include quarterly maintenance checks, and a yearly preventive maintenance checks. The Bid price shall include the comprehensive Warranty/Maintenance Agreement for a period of 2 years.

B. The system manufacturer shall provide complete contract information to the Owner for separate purchase (outside of this project) of extended warranties of either 3 or 5 years duration.

1.07 EXPERIENCE

A. A complete, engine package including accessory items shall be the product of one manufacturer, hereinafter referred to as the "Manufacturer." Manufacturer shall have been regularly engaged in the production of complete diesel engine drive systems for at least 10 years. All components shall have been designed to achieve optimum physical and performance compatibility with each other and prototype tested to prove integrated design capability. The complete system shall have been factory fabricated, assembled, and production tested.

1.08 PARTS AND SERVICE

A. A local factory parts depot from which parts may be obtained in necessary quantities at any time during the day or night, and a parts and service facility offering complete servicing including preventative maintenance service contracts shall be maintained by the system manufacturer. The parts depot and the parts and service facility shall be located within 75 miles of the point of installation.

PART 2 PRODUCTS

2.01 DIESEL ENGINE MANUFACTURERS/PRODUCTS

A. The diesel engine and engine control panels shall be the product of the following manufacturer:

1. Caterpillar; Industrial Engine Series C4.4 ACERT engine employing Tier 4 Stage IV technology.
2. Or Engineer approved equal.

2.02 GENERAL

A. The Contractor shall provide products as specified on the Drawings and/or in the Specifications, or an Engineer approved equal.

B. Unless otherwise indicated, provide all first quality, new materials and equipment, free from any defects, in first-class condition, and suitable for the space provided. Provide materials and equipment approved by UL wherever standards have been established by the agency.

C. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

D. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications.

2.03 SERVICE CONDITIONS

A. Service Conditions are as follows:

1. Environment: Coastal marine environment (Gulf of Mexico)—corrosive environment.
2. Altitude: 10 feet above mcan sea level.
3. Atmospheric Pressure: 14.7 psia.
4. Ambient Temperature, Maximum: 105 degrees F.
5. Ambient Temperature, Minimum: 20 degree F.
6. Relative Humidity: 40 to 100 percent, high humidity.

2.04 DIESEL ENGINE PERFORMANCE REQUIREMENTS

A. Engine Drive System Performance:

Service Requirements	Standby/Intermittent service.
Rated Capacity	60 HP (minimum) required from the engine at the output shaft at the specified nominal operating speed plus power required by any engine mounted accessories.
Minimum Operating Speed	1,700 RPM.
Nominal Operating Speed	1,800 RPM.
Characteristics of the existing vertical turbine pump and right angle gear load to be driven by the engine are described in Supplement 1 to this Specification.	
Site Ambient Conditions: The site characteristics are as described in paragraph SERVICE CONDITIONS.	

B. General Arrangement Description/Performance Requirements:

1. Engine, as shown and specified, is to be used as the prime mover for the existing vertical turbine pump in the event of electrical power supply loss. Connect the engine shaft and its PTO mechanical clutch assembly to the existing right angle gear drive shaft by means of an intermediate drive-shaft containing a torsionally soft flex coupling.
2. Engine drive system manufacturer to coordinate among the manufacturers of the diesel engine, gear reducer, and the pump manufacturer to ensure compatibility/coordination of components including, but not limited to, proper fit of engine and reducer shafts, interaction of major components, and control of safety and alarm signals.
3. Supply diesel fuel to the engine by means of an engine mounted supply pump from outside fuel storage tank.
4. Use a manufacturer supplied cooling system to maintain engine and lubricating oil temperatures at the operating temperatures recommended by the manufacturer. Furnish a complete starting system along with necessary accessories for engine startup.
5. Provide engine with a completely independent lubrication system with an engine-driven primary pump.

C. The engine shall be designed to meet Tier 2 emissions requirements. The submittal shall include detailed literature that specifically indicates that the proposed engine is certified to meet Tier 2 limits.

2.05 DIESEL ENGINE

A. Engine:

1. The engine shall be general purpose, stationary, water-cooled four-cycle, in-line-type compression-ignition diesel and shall be capable of starting solely from heat of compression, and employing a 24-volt electric starting system with dual starters. The engine shall be turbocharged designed for fast response high power as increased torque capabilities.
2. The engine shall be equipped with all engine mounted sensing devices necessary to accomplish functions listed in other paragraphs of this section. Engine speed to be controlled by hydraulic actuators which position fuel supply to engine in proportion to an electrical signal received from and developed by a master electronic control unit.
3. The engine shall be equipped with a mechanical overspeed shutdown device which will positively and internally return the fuel pump rack to the no fuel position and also shall be equipped with a drive mechanism to drive a centrifugal switch which shall be set to electrically shutdown the engine before the mechanical overspeed device engages. The mechanical shutdown system shall also seal off the combustion air inlet when activated.
4. Engine to be designed to use Diesel Fuel oil No. 2 (domestic burner oil) of the ultra-low sulfur variety as the combustion fuel. Engine systems requiring premium fuel will not be considered.

B. Starting System/Batteries:

1. A set of 24-volt cranking batteries shall be furnished for each starter motor on the engine. The batteries provided shall be 4D Caterpillar Maintenance Free Batteries designed for engine cranking an engine of this frame size and providing for a minimum of four 10-second cranking periods at 20 degrees F, without being recharged. The cells shall be floor mounted in a freestanding battery box. Each set of engine cranking batteries shall be capable of supplying 24V dc power to the ECP for powering the control devices, relays, and other ancillary equipment located within the control panel. The PLC logic shall select the best of the various batteries as a power source.
2. Batteries/charging system shall be furnished with all interconnecting jumpers for cell-to-cell connections and from cells to starters on the engine. All cell-to-cell conductors shall be tinned-copper. They shall have factory applied crimped lugs and 600V THW or MTW insulation. Cell to charger/engine cables shall be Size 4/0 welding cable, minimum.

3. An automatic battery charger shall be furnished for each set of batteries. The charger shall operate from a 20A, 120-volt single-phase supply and have a 20-amp output, minimum. The charger shall be sized to fully charge each battery within 8 hours. SCR based charger designs are not acceptable. Charger shall be solid state, current-limiting design with float-equalize feature and timer. It shall also have the following features and alarms:
   a. dc cranking disconnect relay.
   b. ac and dc circuit breakers.
   c. High battery volts alarm.
   d. Low battery volts alarm.
   e. Loss of ac alarm.
   f. Battery ground alarm.
   g. Panel-type dc voltmeter and ammeter.
4. Alarms in charger shall have a relay output from one dry Form C contact, rated 10 amps. The alarm signals shall be relayed to the switchgear for annunciation locally. Additionally, the alarm signals shall also be relayed to the associated plant control system.
5. Chargers shall be mounted on the frame of the engine near the starting batteries.

C. Jacket Water Heaters: Provide engine-mounted thermal circulation tank-type immersion water heaters incorporating thermostatic control and contactors. Heaters shall be 1KW, 120V, single-phase, magnetic contactor and shall be disconnected during engine operation. The contactor shall be mounted in the engine control panel. Jacket water heaters shall maintain engine water temperature at 120 degrees F with an ambient temperature of 50 degrees F.

D. Fuel Pump (Engine Mounted) and Accessories:

1. An engine fuel supply pump driven off the engine shall be provided to pump fuel from an adjacent above grade fuel storage tank. This pump shall be suitable for operation with up to a 10-foot maximum diesel fuel No. 2 suction lift.
2. Filter: A minimum of one duplex filter with a trans-flow change-over valve shall be supplied. The filter shall have inlet and outlet connections plainly marked. An indicating differential pressure gauge shall be provided to measure pressure across the filter. Filter to be located on the inlet side of the fuel pump and be capable of filtering out particles down to 25 micron size without excessive headloss across the unit.
3. Strainer: A full flow strainer of the replaceable cartridge type shall be provided between the engine and the fuel tank, upstream of the duplex filter. An indicating differential pressure gauge shall be provided with taps upstream and downstream of the strainer. The strainer cartridge shall be capable of filtering out particles down to 125 micron size.

4. Safety Bypass Valve: A safety bypass valve shall be provided next to the pump isolation valve to prevent the buildup of excessive pressures if the discharge line or fuel pump filters become clogged. Bypass shall protect the fuel piping from over-pressurizing and relieve at an appropriate engine manufacturer selected setpoint. The bypass valve relief line shall return the fuel to the outside bulk fuel storage tank.
5. Fuel connections to the engine shall be with flexible Type 304 stainless steel armored hose suitable for the purpose at least 12 inches long.
6. The Contractor will be responsible for providing and installing all diesel fuel needed for system testing. The Contractor shall also be responsible for refilling the fuel storage tank upon completion of the engine testing. The Owner will only be responsible for any fuel usage after successful completion of all system testing and acceptance of the equipment.

E. Cooling System:

1. Engine shall have its own cooling system, be of the closed type and operate automatically while the engine is running.
2. The cooling system shall have an engine-driven water pump, fin-tube radiator and an automatic temperature regulating valve. The maximum temperature rise of the coolant across each engine shall not exceed the engine manufacturer's recommendation.
3. The engine cooling system shall be arranged to prevent rust and minimize formation of scale deposits within the engine. System to circulate jacket-coolant through the engine at the temperature and flow rate recommended by the engine manufacturer. Coolant shall be an ethylene-glycol water mixture with a concentration sufficient for freeze protection at the minimum outdoor temperature specified. Maximum temperature rise of the coolant to be no more than that recommended by the engine manufacturer.
4. Coolant Pumps: Engine-driven jacket water pumps shall be of the centrifugal type. Secondary pumps shall be electric motor driven and have automatic controllers. The pump shall be a bronze fitted, single stage type with removable seal rings and stuffing box and properly sized for the intended purpose.
5. Radiator: Engine radiator is to be sized to limit the maximum allowable temperature rise on the coolant across the engine to that recommended by the equipment manufacturer for the maximum outdoor design temperature and site elevation. Radiator materials of construction are to be fully corrosion resistant and suitable for service in the ambient conditions specified. Radiator may be factory coated with corrosive resistant film provided that corrective measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via over-sizing or other compensating methods. Internal surfaces shall be compatible with liquid fluid coolant used. Radiators shall be the pressure type incorporating a pressure valve, vacuum valve, and a

radiator cap. Radiator caps to provide for pressure relief prior to removal. The radiator and the entire cooling system is to be capable of withstanding a minimum pressure of 7 psig. Radiator elements shall be protected with a strong grille or screen guard. Radiators shall have at least two tapped holes. One tapped hole in the radiator shall be equipped with a drain cock; the rest shall be plugged.

6. Thermostatic Control Valve: Provide a modulating type, thermostatic control valve in the coolant system to maintain the engine coolant temperature within the manufacturer's specified operating range.
7. Temperature Sensors: Engine is to be equipped with coolant temperature sensors. Temperature sensors shall provide signals for pre-high and high coolant temperature indication and alarms. Additionally, engine shall be equipped with coolant temperature systems for both the jacket water system and the intercooler system when the engine is turbocharged.

F. Lubricating System:

1. Engine lube-oil system shall of the pressurized engine-driven pump type with system pressure adjustable and regulated as recommended by the engine manufacturer. The lube-oil pump is to draw oil from the oil pan through a mesh intake strainer and force it through a lubricating oil cooler and a single or duplex full-flow strainer into the engine. Pump shall be protected by a relief valve to bypass the oil into sump. A portion of the oil from the sump is to be bypassed through a lubricating oil filter and back into the engine oil pan. Lubricating oil temperature shall be regulated by means of an automatic temperature regulator that controls the amount of bypass oil around the cooler. The system is to be readily accessible for service such as draining or refilling. System also shall permit the addition of oil and have oil-level indication with the unit operating.
2. Pump Filters: Provide one full-flow, duplex, 80 micron filter for each pump. Filter to be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. Provide an indicating differential pressure gauge across the filter.
3. Lube-Oil Sensors: Engine shall be equipped with lube-oil temperature and pressure sensors. Temperature sensors to provide signals for pre-high and high lube-oil indication and alarms. Pressure sensors are to be located downstream of the filters and provide signals for pre-low and low lube-oil indication and alarms.
4. Lubricating Oil Strainer: A full-flow, oil strainer shall be furnished in-line, ahead of the engine. The strainer shall be as recommended by the engine manufacturer and configured to allow easy removal of the sludge.

G. Exhaust System:

1. System shall consist of a super critical grade sound attenuating exhaust silencer, metal flex connector, elbows, piping, insulated wall thimble, and mounting hardware. Contractor shall furnish and install all required supports, hangers, clamps for mounting the silencer and exhaust piping for a fully operational system as indicated on Contract Drawings.
2. Complete system, including exhaust silencer and exhaust piping, and exhaust piping shall be wrapped in 1-1/2 inches of insulation. Insulation specified in Section 40 42 00, Breeching and Stack Insulation.
3. Exhaust Silencer shall be sized to ensure back-pressure does not exceed the maximum limitation specified by the engine manufacturer.
4. Metal Flex Connector: A flexible metallic connector shall be furnished to minimize vibration and accommodate thermal expansion/contraction. Size and type as recommended by the engine manufacturer. Connector shall be of Type 316 stainless steel.
5. Diesel exhaust piping (flowstream designation “DE”) shall be Type 316 stainless steel as specified in section 40 27 00, Process Piping – General.
6. Flexible Sections and Expansion Joints: A flexible section shall be provided at the engine with an expansion joint at the exhaust silencer. Flexible sections and expansion joints to be flange end style connections. Flexible sections shall be multiple-ply Type 316 stainless steel expansion bellows type with standard 1.5 inch allowable axial expansion. Elements in the flexible sections shall be capable of absorbing vibration from the engine and compensate for thermal expansion and contraction.
7. Insulated Wall Thimble: Exhaust shall pass through the CMU building wall by utilizing an insulated thimble constructed in conformance with NFPA 37 and 110. Thimble shall be of welded construction, consisting of an inner and outer sleeve separated by vented separators constructed to minimize the conduction of heat from the inner to the outer sleeve. The exhaust pipe shall fit within the inner sleeve and insulation material. The thimble shall include a support collar and exterior flashing on the opening surface, welded to the outer sleeve of the thimble. Furnish a rain collar to clamp on the exhaust pipe and over the thimble, to prevent the entrance of rain into the thimble. Include a mitered tail piece on the exhaust piping with a screen on terminal to prevent entrance of birds and insects.
8. Silencer Type: A super extreme grade noise attenuating silencer for use where ambient noise levels are extremely low and a high degree of silencing is required. Features compressed acoustical fiberglass inserted between the double shell. Provides 300 to 400 degrees (F) degree reduction in surface skin temperature.
    a. Minimum sound attenuation: 32 to 42 dBA.

9. Manufacturer/Products; Exhaust system components shall be the products of:
   a. GT Exhaust Systems Inc.; Model A-201-6103 silencer.
   b. Or Engineer approved equal.

H. Air Intake System: The engine air intake shall be equipped with a dry type air cleaner with filter service indicator.

I. Personnel Safety Devices:

1. Insulate, fully enclose, guard, or otherwise fit with other types of safety devices all exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, or parts that may be a hazard to operating personnel. Install the safety devices so that proper operation of the equipment is not impaired.
2. Safety guards for the right angle gear drive to intermediate shaft to PTO mechanical clutch area shall be fabricated from Type 304 stainless steel flattened expanded metal grating with reinforcing structural framework of 1/4-inch minimum thickness stainless steel shapes and plates.

2.06 MECHANICAL POWER TAKEOFF CLUTCH

A. Engine system manufacturer to furnish and install mechanical power takeoff (PTO) manual/clutch assembly mounted on the diesel engine drive. Clutch manufacturer to coordinate the bell housing size/dimensions/SAE number with the engine manufacturer.

B. PTO clutch assembly to be rated for a torque of 500 lb. feet.

C. Manufacturer/Products:

1. PEC Manufacturing Inc.; Model
   C01-11-2AZ (SAE 2) or
   C01-11-3AZ (SAE 3).
2. Or Engineer approved equal.

2.07 TORSIONALLY SOFT DRIVE COUPLING/DRIVE-SHAFT

A. Engine system manufacturer to furnish and install a torsionally soft drive coupling and driveshaft between the existing right angle gear drive-shaft and the diesel engine mounted PTO mechanical clutch assembly. Coupling and drive-shaft assembly shall be provided complete with companion flange and all related fasteners.

B. Coupling manufacturer to verify-bore and keyway dimension against right angle gear drive and PTO mechanical clutch output shafts.

C. Coupling manufacturer to provide modified 3 mass calculations verifying coupling selection attenuates dynamic vibration over the design speed range of the engine. Calculations to be signed and sealed by a Professional Engineer (mechanical engineering specialty).

D. Coupling manufacturer to field coordinate the final drive-shaft length based upon the final engine layout/installation.

E. Manufacturer's Products:

Torsionally soft drive coupling and drive-shaft shall be the products of:

1. Reich USA Corporation; Model Coupling AC-VSK.25.NN.F1W/1550 drive-shaft combination.
2. Or Engineer approved equal.

2.08 SIGHT FLOW INDICATORS

A. Indicators shall be provided as part of the fuel oil supply and return lines. Indicator shall be constructed of ASTM B62 bronze alloy and be provided with threaded end connections. Indicator shall include an internal Delrin rotating propeller to provide visual flow indication. Indicator housing shall include a tempered glass observation port for viewing the rotating propeller. Indicators shall have Buna-N seals.

B. Sigh flow indicator size to match adjacent FOS/FOR piping size as shown on the Drawings.

C. Manufacturers/Products:

1. OPW Engineered Systems; VISI-FLO Series; Model 1431D.
2. Or Engineer approved equal.

2.09 ENGINE CONTROL PANEL

A. Engine Control Panel (ECP) shall be of the general purpose electronic microprocessor type with manual/auto throttling control capabilities.

B. Enclosures: ECP enclosure shall be designed for the application and environment, conforming to NEMA ICS 6. Enclosure shall be freestanding type, fabricated of powder coated carbon steel with keyed locking mechanism.

C. Parameters Monitored/Alarm Annunciated:

1. Aside from pre-programmed, general purpose engine controller features, controller shall provide the following functionality related to measurement of engine operating parameters and status/alarm signals annunciated and displayed at the panel.
   a. Coolant-fluid temperature display (degrees F.).
   b. Coolant-fluid pressure indicator (psi).
   c. Lubricating-oil pressure indicator (psi).
   d. Lubricating-oil inlet temperature display (degrees F.).
   e. Red emergency stop (push-button or switch)
   f. Run-time meter.
   g. Tachometer display.
   h. Engine start-stop switch.
   i. Start-attempt indicator light.
   j. Engine crank counter.
   k. Engine fuel pressure indicator (psi).
   l. Engine overspeed indication (overspeed indication point as recommended by the engine manufacturer/shutdown engine.
   m. High lube-oil temperature indication/shutdown engine.
   n. Low lube-oil pressure indication/shutdown engine.
   o. High coolant fluid outlet temperature indication/shutdown engine.
   p. Failure to start within the specified time indication/problem.
2. Manufacturer/Products:
   a. Murphy/ENOVATION Inc.; MurphyLink Series ML2000 Panel with MIH and I/O Harnesses, fuel pressure and coolant pressure transducers, and panel programming.
   b. Or Engineer approved equal.

2.10 STRUCTURAL BASE

A. A base for the engine's mounting to the existing concrete pedestal shall be provided as shown on the Drawings. Base to be constructed of high strength structural steel and designed to rigidly support the engine, ensure permanent alignment of all rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment is maintained during normal operation. The base shall withstand and mitigate the effects of synchronous vibration of the engine and pump.

2.11 VIBRATION ISOLATORS

A. The engine shall be mounted to carbon steel structural shapes which are in turn anchored to an existing concrete pedestal. The engine shall be mounted on Korfund Series L vibration isolators. Vibration isolators shall be sized by the isolator manufacturer and shall be such to limit the maximum vibration transmissibility to 10 percent.

2.12 ENGINE TORSIONAL VIBRATION

A. The complete engine system shall be so designed, constructed, and installed as to be free from objectionable vibration in any mode.

2.13 FACTORY PAINT

A. Each complete engine set, including the control cabinet shall be given a factory-applied primer and two finish coats of the manufacturer's premium grade heat-resistant engine paint suitable for long term service in a coastal marine environment. The color shall be as selected by the manufacturer. All areas damaged during shipment shall be touched up after installation.

2.14 SPECIAL TOOLS

A. A set of specialty tools necessary for routine maintenance of the equipment shall be furnished. Included shall be a hydrometer and two-pronged battery voltmeter.

2.15 SPARE PARTS

A. The following spare parts for each engine shall be furnished as part of the base bid:

1. One set fuel oil filter element and gaskets.
2. One lubricating oil filter element and gaskets.
3. Two air cleaner filter element.
4. One set V-belts for pump drives.
5. One set of cooling fan belt drives (if applicable).

PART 3 EXECUTION

3.01 ENGINE DRIVE SYSTEM INSTALLATION

A. The engine drive system and related accessories shall be transported and installed at the site by the Contractor in accordance with manufacturer’s written installation instructions.

3.02 EXHAUST PIPING INSTALLATION

A. Horizontal sections of the exhaust piping shall be sloped downward away from the engine to a condensate trap and drain valve. Changes in direction are to be made utilizing long radius fittings.

B. Exhaust piping, mufflers, and silencers shall be insulated and protective covered as specified in Section 40 42 00, Breeching and Stack Insulation. Insulation jacket shall be secured with not less than 0.375-inch width Type 316 stainless steel bands spaced no farther apart than 8 inches on center. Jackets on horizontal lines shall be installed so that the longitudinal seams are on the bottom side of the pipe. The seams of the jacket for the vertical lines shall be placed on the off-weather side of the pipe. On vertical lines, the circumferential seams of the jacket shall overlap so that the lower edge of each jacket overlaps the upper edge of the jacket below.

3.03 TESTS

A. Factory Test: The engine drive set shall be tested at the manufacturer's plant before shipment. The test shall consist of a steady load run of the durations listed below at each applied load rating:

1. 25 percent applied load for 1 hour.
2. 50 percent applied load for 1 hour.
3. 75 percent applied load for 1 hour.
4. 100 percent applied load for 3 hours.

B. Field Test:

1. An in-place static alignment check of all rotating components shall be made prior to first startup, after units are secured in-place and all final connections are made.
2. At a time when the engine system is complete and the raw water well can be operated from the standby source, the engine shall be given load and operational tests. The units shall be operated at full load for at least 2 hours. In addition, a 2-hour Performance Acceptance Test (PAT) shall be performed. During this test, the engine shall be operated continuously for a minimum period of 2 hours. The above tests shall be performed during normal working hours. The tests shall be coordinated with the Owner. During the tests, the manufacturer shall record all available parameters from the operating units (i.e. diesel fuel usage, output H, oil pressure, engine coolant temperature, ambient air temperature, etc.) at 15-minute intervals. The recorded information shall be documented and submitted to the Owner and Engineer. All specified functional requirements shall be verified by actual tests. Complete records shall be kept throughout the tests, including water temperature, oil pressure, ambient air temperature, etc. Operational tests shall show that the system operates as specified, and shall include verification of preliminary alarm and shutdown functions, and check of other operational options available to the operator.
3. Demonstrate engine safety shutdowns and performance results.

4. A vibration analysis shall be performed after all other tests have been completed and after a minimum of 24 hours running time has been accumulated on the engine. Required dynamic balancing shall be performed at this time to bring the running unit within the tolerance specified.
5. Tests shall be conducted by an authorized representative of the manufacturer of the engine manufacturer. Costs of this representative shall be included in the Bid for this equipment. At least 10 working days' notice of beginning of test shall be given to the Owner to allow witnessing of the tests. Required instrumentation not included in the system equipment shall be provided by the supplier. Upon completion of the tests, final adjustments and alignment check shall be made to the equipment, fuel, and oil filters shall be replaced, belt drive tensions checked, and the proper operation of all equipment demonstrated to the Contractor and the Engineer. The Owner shall be instructed in the maintenance and operation of the equipment.

3.04 MANUFACTURERS' SERVICES

A. Manufacturer's Onsite Services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Revisiting the site as required to correct problems and until installation and operation are acceptable to Contractor.
4. Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.
5. Assistance during functional and performance testing, and facility startup and evaluation.
6. Training of Owner's personnel in the operation and maintenance of respective product as required.
7. Additional requirements may be specified elsewhere.

B. Manufacturer's Certificate of Proper Installation:

1. A Manufacturer's Certificate of Proper Installation form shall be completed and signed by the equipment manufacturer's representative.
2. Such form shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

C. Onsite Training:

1. Contractor/engine system manufacturer in conjunction with the ECP manufacturer shall conduct onsite training course for the Owner's operating staff at a place and time designated by the Engineer/Owner.
2. The Contractor/engine system manufacturer portion of the course presentation shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements addressed in the O&M manuals. Additionally, course shall include demonstrations and instruction in all routine maintenance operations including oil change, oil filter change, air filter change, etc.
3. The ECP manufacturer's portion of the course shall cover the use, programming and troubleshooting of the specific engine controller panel/system furnished.
4. The training period shall consist of a total of 8 hours each of normal working time for the engine system manufacturer and the ECP manufacturer commencing after the engine drive system is functionally completed, but prior to final acceptance.
5. Contractor to have the training session professionally videotaped by a business/service acceptable to the Owner. Contractor to submit three CD copies of the entire training session to the Owner within 7 days of course completion.
6. Contractor to coordinate the proposed date for conducting the onsite training course with Owner. Submittal of the agenda of instruction/course outline, name and qualifications of proposed videotaping business to be provided in writing not less than 30 days prior to proposed date of training.
7. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component).
8. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Division 1, General Requirements.
9. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
10. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

D. Field Engineer: The Contractor in conjunction with the engine drive system manufacturer shall furnish a qualified engineer to supervise the complete installation of the engine drive system and all related component assemblies, assist in performance of the onsite tests, and instruct personnel regarding operational and maintenance features of the equipment. Submit statement of qualification as a submittal documenting that the field engineer proposed is qualified to perform the functions.

E. Operation and Maintenance Manual: Submit an Operation and Maintenance Manual for the diesel engine system detailing startup and operating procedures, lubrication instructions, installation and alignment procedures, routine maintenance requirements and procedures, complete detailed procedures for disassembly and reassembly of the engine, parts list for all parts detailed, assembly plans of the engine showing all parts, suppliers for all parts, settings and adjustment for protective devices, and a list of all tools, handling devices, and spare parts furnished.

F. Onsite Services:

1. Present at site or classroom designated by Owner, the minimum person-days listed below, travel time excluded:
   a. 1 person-day for installation assistance and inspection.
   b. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
   c. 1 person-day for classroom onsite training by Contractor/engine system manufacturer.
   d. 1 person-day for classroom onsite training by ECP manufacturer.
   e. 1 person-day for facility startup.

3.05 SUPPLEMENTS

A. The supplements listed below, following "END OF SECTION," are part of this Specification.

1. Supplement 1, "Operational and Maintenance Manual" Data for Navarre Beach Well #2 Pump, Angle Drive and Controller.

END OF SECTION

BULLETIN 250

Layne

Vertical Turbine Pumps for Water Wells

NAVARRE BEACH WELL #2
OPERATIONAL AND MAINTENANCE MANUALS
Pump, Angle Drive & Controller

SINGER

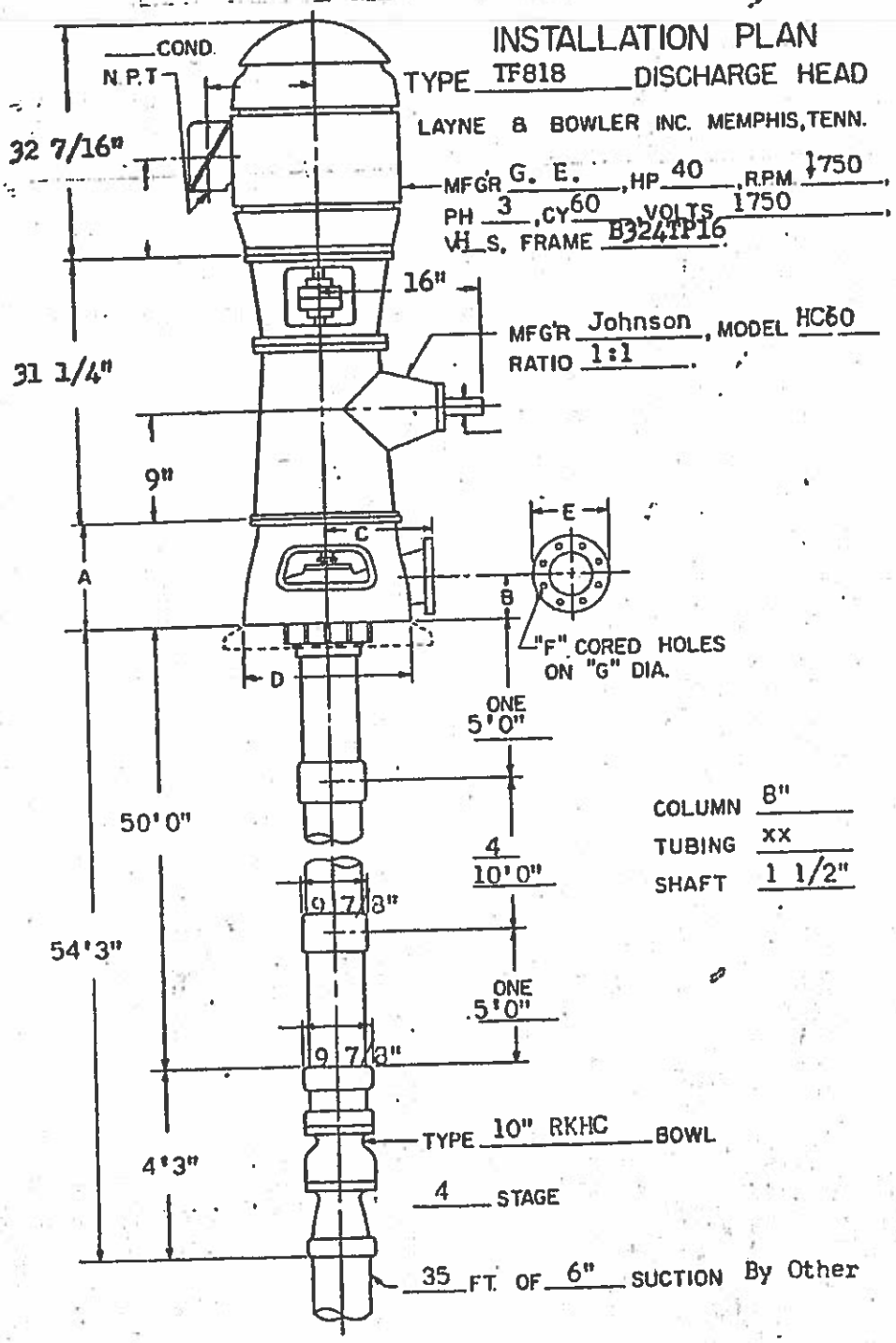
WORLD'S MOST COMPLETE WATER SERVICE ORGANIZATION Layne

40 00 64 SUPPLEMENT-1

INSTALLATION PLAN

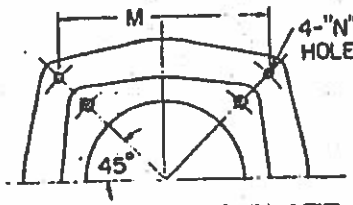
TYPE TF818 DISCHARGE HEAD

LAYNE & BOWLER INC. MEMPHIS, TENN.



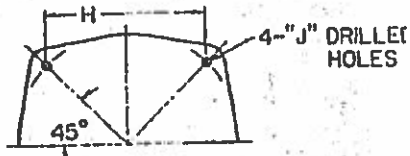
COLUMN 8"
TUBING XX
SHAFT 1 1/2"

USE THESE DIMENSIONS ONLY WHEN CERTIFIED BY FACTORY

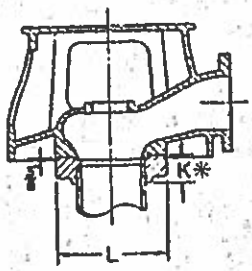


HOLES IN BASE PLATE

BASE PLATE



HOLES IN BASE OF HEAD



SECTION THRU HEAD

* FOR COLUMN SETTINGS OF 200' OR GREATER, "K"=

CUSTOMER: Santa Rosa County Beach Administration
LOCATION: Navarre Beach, Florida (Plant No. 2)
FOR APPROVAL
CERTIFIED:

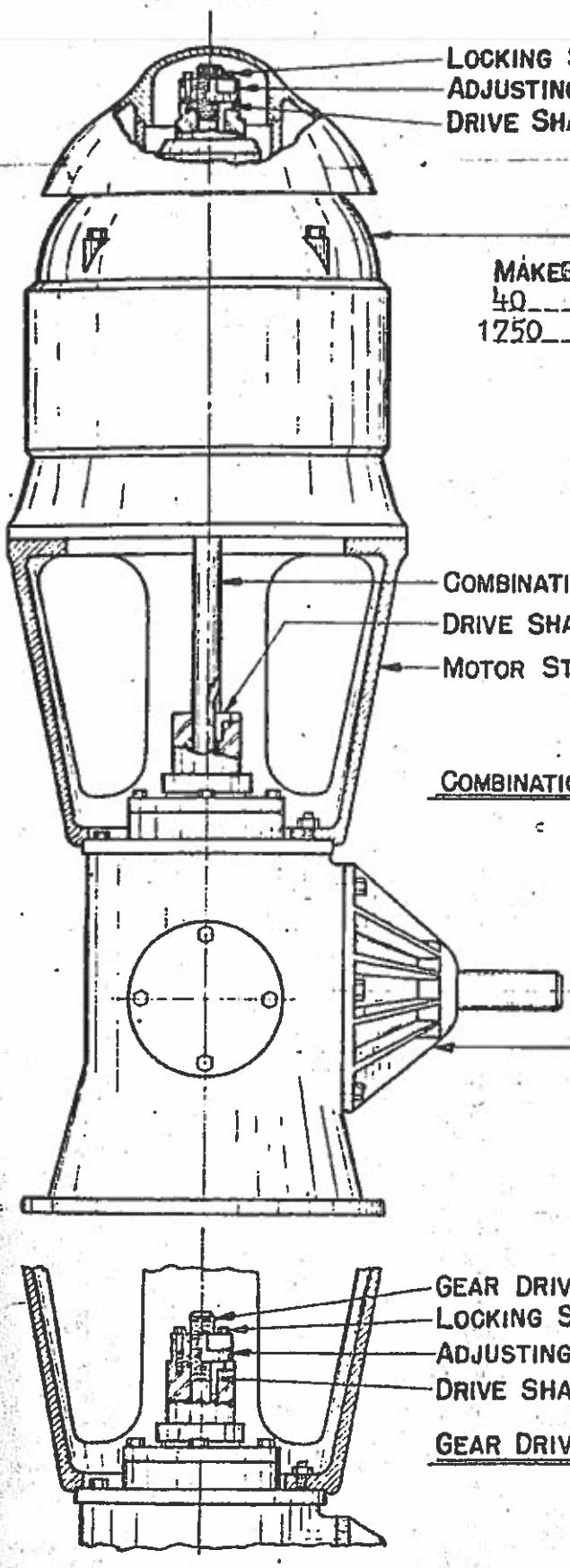
YOUR NO: 001474
OUR NO: 73D-4823
PUMP NO: 74677
DATE: August 29 1973

G.P.M. 500
T.D.H. 139
R.P.M. 1750
B.H.P.

HEAD	A	B	C	D	E	F	G	H	J	K*	L	M	N	P	R	S
TF413	13	6	11	18	9	8-3/4	7 1/8	14 1/8	1 15/16	2 13/16	10	16 13/16	7/8	21	2	17
TF613	14	6	11	18	11	8-7/8	9 1/2	14 1/8	1 15/16	2 7/8	11	16 13/16	7/8	21	2	17
TF418	13	6	14 1/2	23	9	8-3/4	7 1/2	17 5/16	1 15/16	2 13/16	10	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF618	15	6	14 1/2	23	11	8-7/8	9 1/2	17 5/16	1 15/16	2 7/8	12-1/2	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF818	18	7 3/32	14 1/2	23	13 1/2	8-7/8	11 1/2	17 5/16	1 15/16	3 1/16	13 1/2	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF1018	18	8 1/8	14 1/2	23	16	12-1	14 1/2	17 5/16	1 15/16	3 1/16	16	20 1/2	7/8	26 1/2	2 3/4	21 3/4
TF1218	20	9 5/8	16 1/2	26	19	12-1	17	19 5/8	1 15/16	3 1/16	19	23 11/16	7/8	32	3 1/4	24

HEAD	A	B	C	D	E	F	G	H	J	K*	L	M	N	P	R
TF625	15	8 1/8	18 1/4	31	11	8-7/8	9 1/2	23 11/16	1 15/16	2 7/8	12 1/2	29	1	38	3 5/8
TF825	20	8 1/8	18 1/4	31	13 1/2	8-7/8	11 1/2	23 11/16	1 15/16	3 1/16	13 1/2	29	1	38	3 5/8
TF1025	20	8 1/8	18 1/4	31	16	12-1	14 1/2	23 11/16	1 15/16	3 1/16	16	29	1	38	3 5/8
TF1225	21	9 1/8	18 1/4	31	19	12-1	17	23 11/16	1 15/16	3 1/16	19	29	1	38	3 5/8
TF1225I	21	9 1/8	18 1/4	31	19	12-1	17	23 11/16	1 15/16	4 1/16	21	29	1	38	3 5/8
TF1425	21	10 3/8	18 1/4	31	21	12-1 1/2	18 3/4	23 11/16	1 15/16	4 7/16	21	29	1	38	3 5/8
TF1227	24 1/2	9 1/8	21	36	19	12-1	17	27 1/8	1 15/16	3 1/16	19	33 3/8	1	43	4 1/2

PBO 178



MOTOR

MAKE G.E. FRAME NO. B324TP16
40 H.P. 1750 R.P.M.
1250 VOLTS 3 PHASE 60 CYCLES

COMBINATION DRIVE WITH SOLID SHAFT

GEAR DRIVE

MAKE Johnson
TYPE 1:1 FRAME NO. HC60

GEAR DRIVE WITH SEPARATE SHAFT

COMBINATION GEAR DRIVE AND HOLLOW SHAFT MOTOR
USING SOLID COMBINATION SHAFT & SEPARATE GEAR SHAFT

CURVE NO. PT1815.1

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
LOWER	4.5	1
LOWER	3.0	2
LOWER	1.5	3
LOWER	0.6	4

NOTE: ANY CHANGE IN EFFICIENCY CHANGES EITHER THE HEAD OR HORSE POWER IN PROPORTION.

LAYNE & BOWLER, INC.
Memphis, Tenn.

10" RKHC
1750 R P M

SINGLE STAGE LABORATOR
HEAD & HORSE POWER
THRUST "K" = 6.0

5RK171

A – 7 5/8" DIA.
B – 7 1/4" DIA.
C – 6 7/8" DIA.

HEAD IN FEET

HORSE POWER

HEAD CAPACITY

HORSE POWER

U. S. GALLONS PER MINUTE

Approved

Approved as Corrected

Revise and Resubmit

Date:

By:

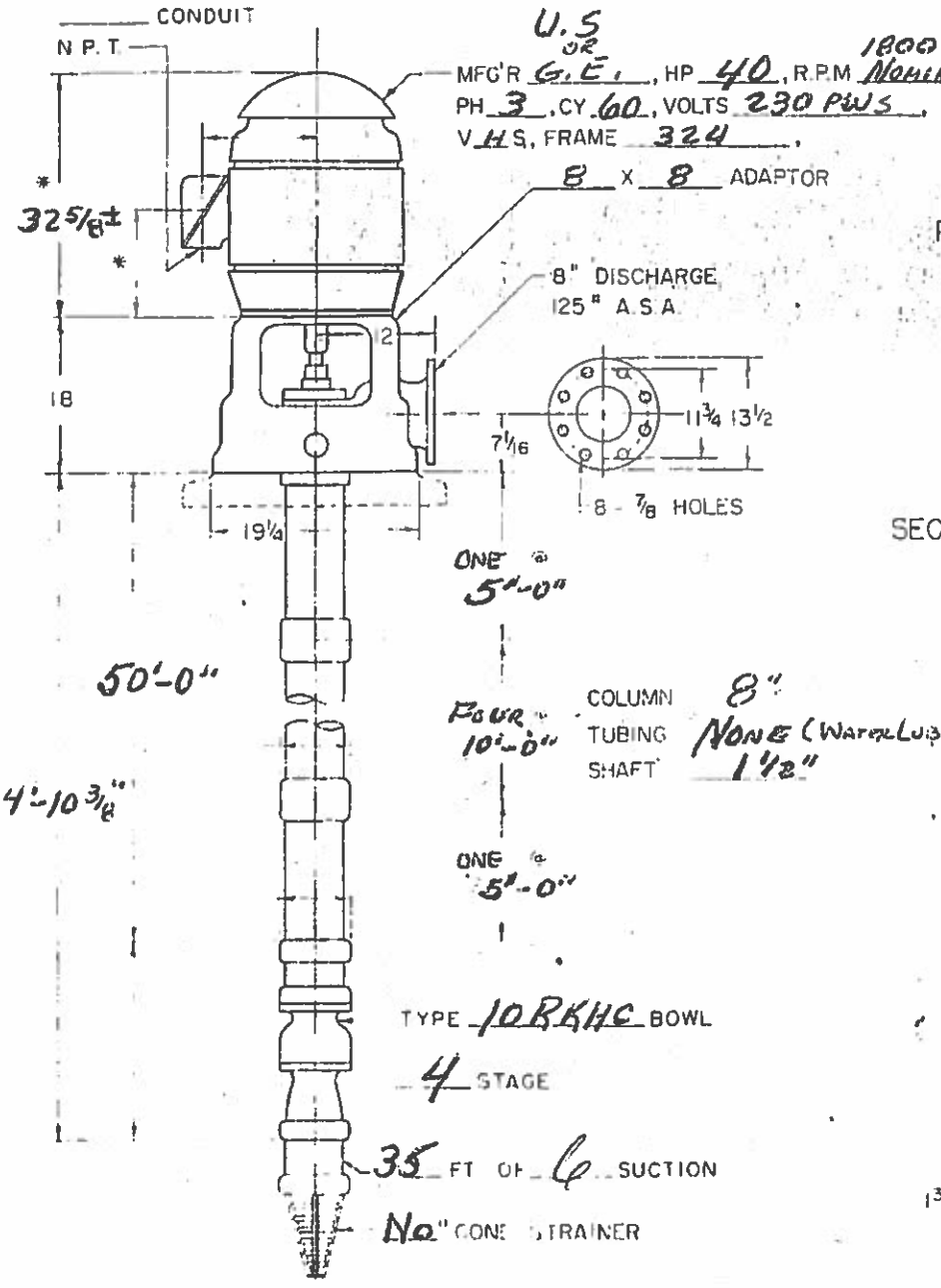
"Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication processes or to techniques of construction, and for coordination of the work of all trades."

ASKERVILLE DONOVAN ENGINEERS, INC.
P.O. BOX 260
GULFSTREAM
ONE STAGE

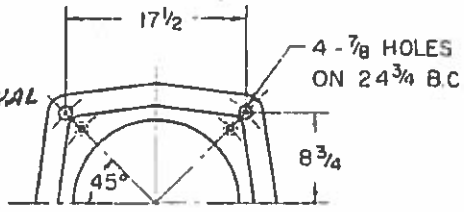
PRINTED

INSTALLATION PLAN
TYPE RF 816 DISCHARGE HEAD

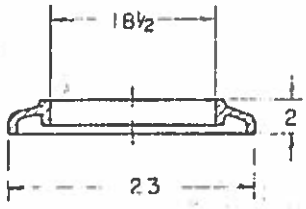
LAYNE & BOWLER, INC. MEMPHIS, TENNESSEE



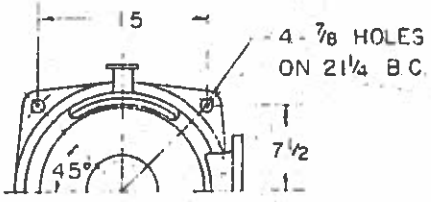
USE THESE DIMENSIONS ONLY
WHEN CERTIFIED BY FACTORY



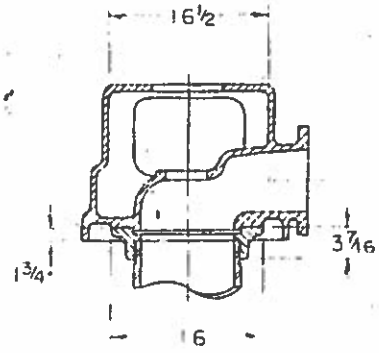
PLAN OF BASE PLATE



SECTION THRU BASE PLATE



PLAN OF HEAD



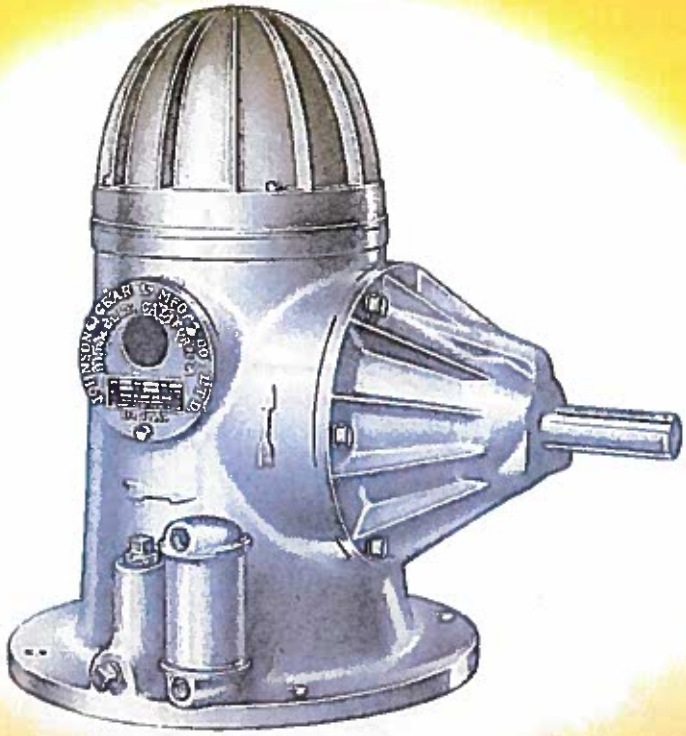
SECTION THRU ELL

500 gpm @ 139' TDH, 1750 rpm, 31.5 BHP

CUSTOMER: Santa Rosa County Beach Admin.	YOUR NO:	G.P.M: 500
LOCATION: Navarre Beach Water Plant No. 2	OUR NO:	T.D.H: 139
FOR APPROVAL: L	PUMP NO:	R.P.M: 1750
CERTIFIED:	DATE:	B.H.P: 31.5

PBO 144

CATALOG 36



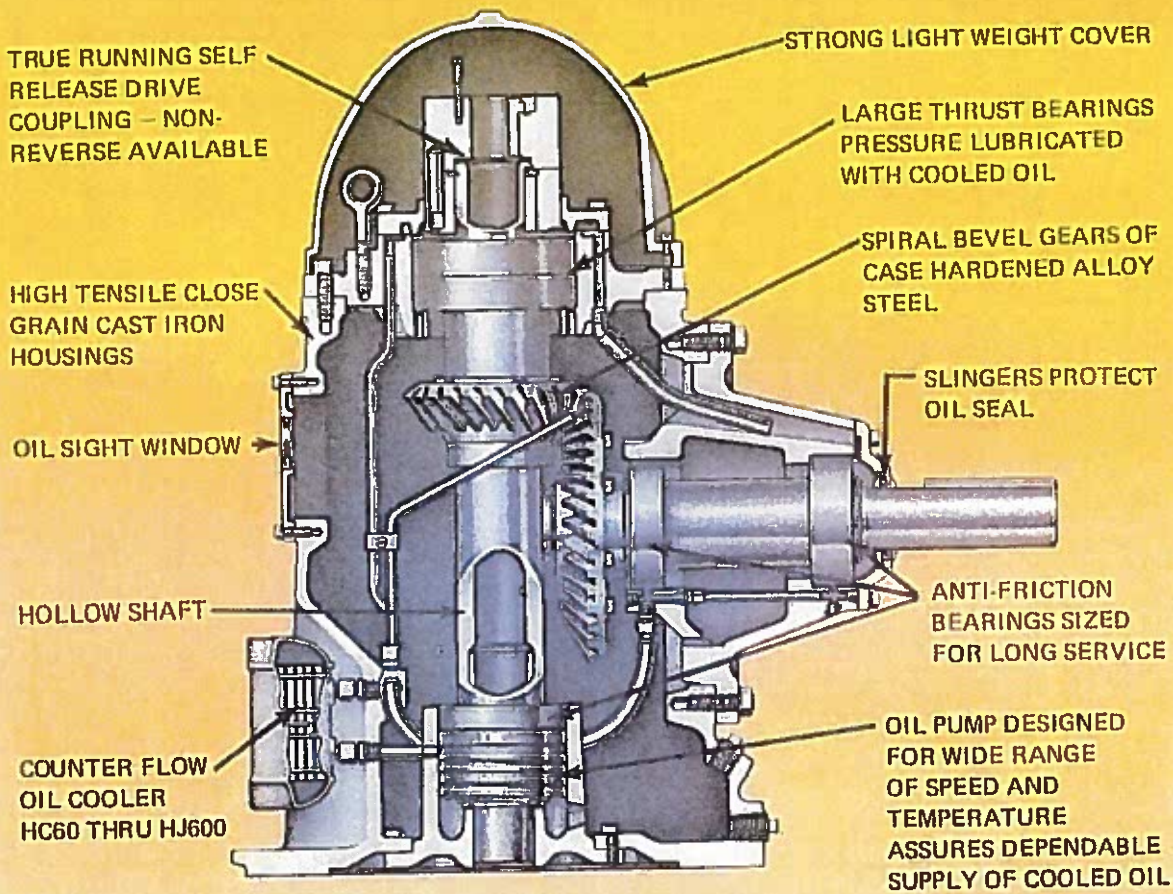
JOHNSON

Right angle TURBINE PUMP DRIVE

JOHNSON GEAR & MANUFACTURING CO., LTD.

CATALOG 36

FOR DEPENDABLE LONG LIFE, LOW OPERATING COST AND HIGH EFFICIENCY



JOHNSON *Right angle* GEAR DRIVE

SALIENT FEATURES

MATERIALS OF HIGHEST QUALITY emphasizing wide use of heat-treated and strain-relieved alloys to insure strength and dimensional stability.

DESIGN of vertical and horizontal members facilitates bench assembly of gears and bearings which are pressed in place, insuring exact and permanent positioning.

SPIRAL BEVEL GEARS of case hardened alloy steel lapped in pairs, quiet in operation.

LUBRICATION—Force feed of cooled oil to bearings and gears by positive oil pump.

TEMPERATURE—Special consideration has been given to heat dissipation and operation in the most efficient temperature range. Adequately sized housings have supplementary cooling fins on small air-cooled units, and auxiliary water cooling is provided for the large sizes.

WORLD-WIDE ACCEPTANCE in recognition of dependable safe service and economy of operation and maintenance.

OIL COOLER—Counterflow marine type with connections arranged vertically to permit water to drain in areas where freezing weather occurs. Normally self-cleaning, even with sandy water. Externally replaceable without disassembly of gear drive.

SELECTED PRECISION BALL BEARINGS used throughout to retain gears in exact position for maximum life and quietness in operation.

EFFICIENT—Maximum amount of usable power transmitted to pump.

WEATHERPROOF housing impervious to climatic conditions.

FACTORY TESTED at service RPM prior to shipment and provided with instruction manual.

EXPERIENCE—Pioneers in development of right angle gear drives for turbine pumps. Each unit a product of nearly 65 years' experience in the manufacture of quality gearing.

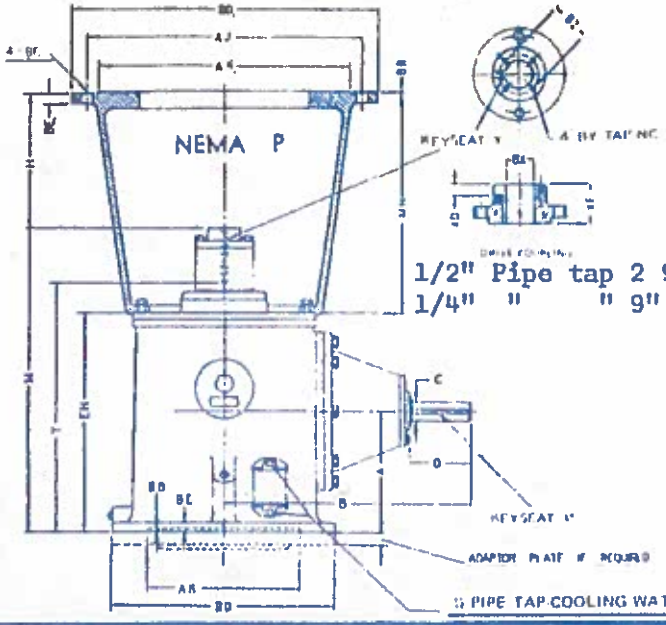
TABLE 2

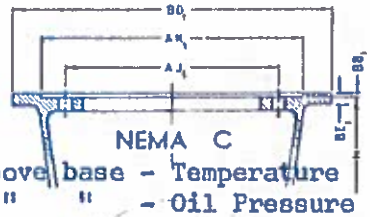
MODEL	Vert. Shaft R.P.M.	H.P.	DOWNTHRUST CAPACITY		HORIZONTAL SHAFT R.P.M. — SPEED INCREASING RATIOS — DRIVER : DRIVEN							
			Std.	Hvy.	1:2	4:7	2:3	3:4	4:5	5:6	10:11	1:1
HA 15	1160	11	2200		580	668	773	870				1160
	1460	13	2100		730	841	973	1095				1460
	1760	15	2000		880	1013	1173	1320				1760
	3460	25	1650		1730	1992	2307	2595				3460
HB 40 12" BASE	1160	30	4400		580	667	773	870		960		1160
	1460	35	4200		730	840	973	1095		1208		1460
	1760	40	4000		880	1012	1173	1320		1457		1760
	2960	46	3500		1480	1702	1973	2220		2450		2960
HB 40	1160	30	4400		580	667	773	870		960		1160
	1460	35	4200		730	840	973	1095		1208		1460
	1760	40	4000		880	1012	1173	1320		1457		1760
	3460	50	3370		1730	1990	2307	2595		2863		3460
HC 60	860	34	6000		430	494	573	645		712		860
	1160	43	5500		580	667	773	870		960		1160
	1460	52	5200		730	840	973	1095		1208		1460
	1760	60	5000		880	1012	1173	1320		1457		1760
HD 90	860	55	8300	10700	430	491	573	645	693	712	777	860
	1160	70	7700	9900	580	663	773	870	935	960	1048	1160
	1460	80	7300	9400	730	834	973	1095	1177	1208	1319	1460
	1760	90	7000	9000	880	1006	1173	1320	1419	1457	1590	1760
HE 150	580	65	10400	15700	290	330	387	431	467	480	529	580
	860	88	9400	14300	430	489	573	639	693	712	784	860
	1160	110	8800	13300	580	660	773	862	934	960	1058	1160
	1460	130	8300	12500	730	830	973	1085	1176	1208	1331	1460
	1760	150	8000	12000	880	1001	1173	1367	1418	1457	1605	1760
HF 200	580	93	12500	16500	284	330	387	435	467	481	529	580
	860	121	11400	14800	422	489	573	645	693	713	784	860
	1160	150	10500	13800	569	660	773	870	934	961	1058	1160
	1460	180	9900	13000	716	830	973	1095	1175	1210	1331	1460
	1760	200	9500	12500	863	1001	1173	1320	1417	1458	1605	1760
HG 250	580	123	14500	19800	284	330	387	435	467	481	529	580
	860	160	13000	17900	421	489	573	645	693	713	784	860
	1160	200	12200	16700	568	660	773	870	934	961	1058	1160
	1460	230	11500	15700	715	830	973	1095	1175	1210	1331	1460
	1760	250	11000	15000	862	1001	1173	1320	1417	1458	1605	1760
HH 350	580	150	17100	21000	284	333	391	432	461	481	530	580
	860	200	15500	19000	421	494	579	640	684	713	786	860
	1160	255	14400	17800	568	666	782	863	923	962	1061	1160
	1460	305	13600	16700	715	838	984	1087	1161	1211	1335	1460
	1760	350	13000	16000	862	1010	1186	1310	1400	1460	1609	1760
HH 425	580	195	19700	26000		333	391	432	461	481	530	580
	860	255	17900	24000		494	579	640	684	713	786	860
	1160	315	16600	22000		666	782	863	923	962	1061	1160
	1460	375	15700	21000		838	984	1087	1161	1211	1335	1460
	1760	425	15000	20000		1010	1186	1310	1400	1460	1609	1760
HI 500	580	230	19700	26000	284	333	391	432		481		580
	860	300	17900	24000	422	494	579	640		713		860
	1160	370	16600	22000	569	666	782	863		962		1160
	1460	440	15700	21000	716	838	984	1087		1211		1460
	1760	500	15000	20000	863	1010	1186	1310		1460		1760
HJ 600	580	278	21000	27000	284	330	391	432		486		580
	860	365	19000	25000	422	489	579	640		720		860
	1160	445	17800	23000	569	660	781	864		971		1160
	1460	530	16700	22000	716	830	983	1087		1222		1460
	1760	600	16000	21000	863	1000	1185	1310		1473		1760

JOHNSON GEAR & MANUFACTURING CO., Ltd.

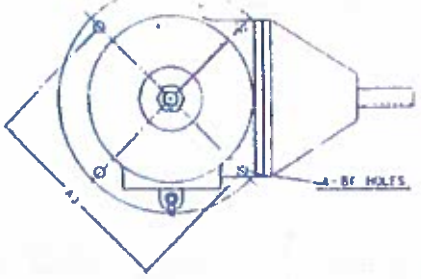
Customer . . SINGER-Layne Central Division . . . . . Order No. . 001473 . . . . . .
Customer's Reference . . "001473-P17902-100-Navarre" . . . . . .
Serial No. . 47366 . . . . . Model . . HC60 . . . . . Ratio . . 1:1 . . . . . Rotation Fig. . 1 . .
Approved by . . . PS . . . . . Date . 8/30/73 . . . . . Drive Coupling "BX" . . 1 1/2" . . . . . Type . . SR . . . . . .

NEMA P MOTOR STAND





1/2" Pipe tap 2 9/16" above base - Temperature
1/4" " " 9" " " - Oil Pressure



½ PIPE TAP COOLING WATER FOR MODEL HC60 AND UP

DIMENSIONS OF JOHNSON COMBINATION RIGHT ANGLE GEAR DRIVES TABLE 2

Model	A	B	C	D	EH	H	M	BE	BD	AJ	AK	BB	BF	Keyseat X
HA15	6 1/8	13	1 1/8	2 1/4	10 1/8		16	5/8	10	9 1/8	8 1/4	3/16	7/16	1/4 x 1/8 x 2 1/2
HB40(12)	9	16	1 1/2	3 1/2	15 1/4		22 1/4	3/4	12	9 1/8	8 1/4	3/16	7/16	3/8 x 3/16 x 3
HB40	9	16	1 1/2	3 1/2	15 1/4		22 1/4	3/4	16 1/2	14 3/4	13 1/2	3/16	11/16	3/8 x 3/16 x 3
XXX HC60	9	16	1 1/2	3 1/2	15 1/4	9"	22 1/4	3/4	16 1/2	14 3/4	13 1/2	3/16	11/16	3/8 x 3/16 x 3
HD90	11 1/8	17 1/2	2	3 1/2	19 5/8		26 1/4	1	16 1/2	14 3/4	13 1/2	3/16	11/16	1/2 x 1/4 x 3
HE150	13 1/4	20 1/2	2 5/16	4 3/4	23 1/8		31 1/4	1	20	14 3/4	13 1/2	3/16	11/16	5/8 x 3/16 x 4
HF200	15	24	2 3/4	5 1/2	26 3/8		36	1 1/8	20	14 3/4	13 1/2	3/16	11/16	5/8 x 3/16 x 5
HG250	16 1/2	29	2 3/4	5 1/2	29 7/8		40 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	5/8 x 3/16 x 5
HH350	16 1/2	30	3	5 3/4	29 7/8		41 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	3/4 x 3/8 x 5
HH425	16 1/2	31	3 1/2	6 1/4	29 7/8		41 1/4	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	7/8 x 7/16 x 5 1/4
HI500	16 1/2	33	3 3/4	7 1/2	31 7/8		45 3/8	1 1/4	24 1/2	*22	13 1/2	3/8	*15/16	7/8 x 7/16 x 5 1/4
HJ600	19	36	4	7 1/2	37		48 3/4	1 1/2	30 1/2	26	22	3/8	15/16	1 x 1/2 x 7

*Also 5/8-11 Tap on 14¾ AJ 1" Deep

MAX. DRIVE COUPLING AND KEYSEAT

Model	XF	XD	BX Fig. 1 & 4	BX Fig. 2 & 3	BY	BZ	T	Y
HA15	1 1/8	5/16	3/4	5/8	10-32	1 3/8	12 1/4	3/16 x 3/32 x 5/16
HB40	2 1/8	9/16	1 1/2	1 1/4	1/4-20	2 1/8	17 3/4	3/8 x 3/16 x 6 1/2
XXX HC60	2 1/8	5/16	1 1/2	XXX	1/4-20	2 1/8	17 3/4	3/8 x 3/16 x 6 1/2
HD90	2 1/8	5/16	1 1/2	1 1/2	1/4-20	2 1/8	22 1/8	3/8 x 3/16 x 6 1/2
HE150	2 1/8	9/16	1 15/16	1 3/4	1/4-20	2 1/2	26 1/2	1/2 x 1/4 x 7
HF200	2 5/8	11/16	2	2	1/4-20	2 1/2	30	1/2 x 1/4 x 8
HG250	3	11/16	2 1/16	2 1/16	3/8-16	3 1/4	34	1/2 x 1/4 x 9
HH350	3 1/4	13/16	2 7/16	2 7/16	3/8-16	3 1/4	34	5/8 x 5/16 x 10
HH425	3 1/4	13/16	2 7/16	2 7/16	3/8-16	3 1/4	35	5/8 x 5/16 x 11
HI500	4	13/16	2 11/16	2 11/16	1/2 16	3 3/4	39 1/2	5/8 x 5/16 x 12
HJ600	4	15/16	3 3/16	3 3/16	3/8-16	4 1/2	39 1/2	3/4 x 3/8 x 12

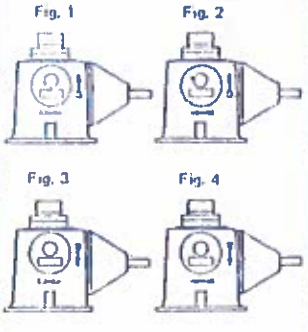
MOTOR STAND

MH	16"
BD1	16 1/2
AJ1	14 3/4
AK1	13 1/2
BB1	1/8
BF1	5/8-11
BE1	5/8

SPEC. DRIVE COUPLING

BX	
Y	
BY	
BZ	
XD	

ROTATION DIAGRAM



Tolerances: Drive Shaft "C" plus .000 minus .001; Base Rabbet "AK" plus .002 plus .005; Coupling Bore "BX" plus .0005 plus .0015; Motor Stand Rabbet "AK1" plus .000 minus .005 — Unfinished cast surfaces subject to normal variation.

BERKELEY, CALIFORNIA 94710, U. S. A.

ND-88509

Navarre Beach Wellhouse No. 2 Electrical Upgrades

PREPARED BY: Joe Klaus/CH2M

PROJECT: 654039.03.36

MEETING DATE: July 12, 2016

MEETING TIME: 10:00 a.m.

LOCATION: Navarre Beach Utilities Administration Office

Attendee Sign In and Overview of Agenda

Introductions

Santa Rosa County/Navarre Beach Utilities

- Roger Blaylock – Director of NBU
- Terry Wallace – Supervisor of Utilities
- Buddy Stephens– Chief Operator
- Dave King – Procurement Manager

CH2M HILL Engineers

- Joe Klaus – Project Manager

Overview of Project

- Major Components
    - Replacement of Electrical Equipment in Wellhouse and Under Elevated Tank
    - Backup Engine
    - Diesel Fuel Storage Tank

Construction Details

Sequencing Constraints

- The following existing equipment are considered critical and shall remain operational during the upgrades. Provide back-up power as necessary.
    - Fairpoint Water Main Valve.
    - Orthophosphate Feed Pump.
    - Caustic Feed Pump.
    - Elevated Tank Valve.
    - Building Lights.
- The following equipment are considered semi-critical and shall not be taken out of service more than one time and shall not be out of service for more than 72 continuous hours during that event.
    - Well Pump.

  - Chlorine Booster Pump.
  - Gas chlorination equipment.
  - SCADA.

- The following equipment are considered non-critical and shall not be taken out of service more than one time and shall not be out of service for more than 7 consecutive days during that event.
  - Diesel engine.
  - Fuel storage tank.

Available Information on Existing Equipment and Wiring

- See Section 26 05 02, Basic Electrical Requirements
- Modifications to engine pad

Details of Bid Submittal

- Location – Santa Rosa County Procurement Department, 6495 Caroline Street, Suite J, Milton, FL. Suite M is an alternate delivery location.
- Date and Time - August 1, 2016 @ 9:00 a.m.
- Original (labeled), six hard copies, and "searchable" pdf of proposal package
- Bids sealed and clearly labeled "**BID# 16-052 Navarre Beach Wellhouse No. 2 Electrical Upgrades**".
- Include in Bid Package:
  - Proposal – on Contractor's letterhead
  - Certified Check or Bond (5% of Bid)
  - Applicable licenses
  - Project references
  - Bidder qualifications

Addenda

- Email or send any questions by C.O.B., July 22, 2016
- At least one addendum will be issued to current plan holders, including notes from this meeting

Estimated Project Schedule

- Bid Opening – August 1, 2016
- Notice of Award – August 26, 2016
- Enter into contract and furnish Performance and Payment Bonds within 10 days of notice
- Notice To Proceed/Preconstruction Conference – Mid September, 2016
- Substantial Completion (180 days) – February, 2017
- Final Completion (210 days) – March, 2017

Questions and General Discussion

Wellhouse Site Visit