

SMALL DIAMETER FORCE MAIN SPECIFICATIONS

SECTION 0 - GENERAL REQUIREMENTS

PART 1 - GENERAL OVERVIEW

1.01 Definitions – For the purposes of these Small Diameter Force Main Specifications ("Specifications"), the following definitions shall apply:

A. "HSE" shall mean Hamilton Southeastern Utilities, Inc., the public utility which provides sanitary sewer service to the project and is the Employer. HSE's address is 11901 Lakeside Drive, Fishers, Indiana 46038, and HSE's phone number is (317) 577-2300.

B. "ENGINEER" shall mean the engineer for HSE, which is Sanitary Management & Engineering Company, Inc. ("SM&E") and its duly engineers. SM&E's inspector shall be the ENGINEER's representative during construction of the PROJECT. SM&E's address is 11901 Lakeside Drive, Fishers, Indiana 46038, and SM&E's phone number is (317) 577-1150.

C. "SUBSOURCES" shall mean those signatories identified as SUBSOURCES under a Special Contract for Extension of Sewer Mains and Facilities with HSE through which the PROJECT is being undertaken. SUBSOURCES is generally the Owner under a construction contract. This definition is intended to include all employees and/or agents acting in the interest of the SUBSOURCES.

D. "CONTRACTOR" shall mean any construction contractor approved by HSE to construct, install, maintain, repair and remove public or PRIVATE (as hereafter defined) SANITARY SEWER FACILITIES (as hereafter defined) within the HSE service area. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the CONTRACTOR or the SUBSOURCES.

E. "DESIGN ENGINEER" shall mean the engineer leading the CONSTRUCTION PLANS (as hereafter defined), as approved to the ENGINEER for HSE and the RECORD DRAWING ENGINEER, both of whom are also defined under these SPECIFICATIONS. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the DESIGN ENGINEER or the DESIGN ENGINEER's COMPANY.

F. "RECORD DRAWING ENGINEER" shall mean the professional who will certify the record drawings, as approved to the ENGINEER for HSE and the DESIGN ENGINEER, both of whom are also defined under these SPECIFICATIONS. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the RECORD DRAWING ENGINEER or the RECORD DRAWING ENGINEER's COMPANY.

G. "PROJECT" shall mean any SANITARY SEWER FACILITIES constructed under a distinct set of contract documents and shall include all work necessary for the COMPLETE (as hereafter defined) and operational installation of all SANITARY SEWER FACILITIES and appurtenances in conformity with the HSE approved CONSTRUCTION PLANS and the standards, specifications and details of HSE.

H. "SANITARY SEWER FACILITIES" shall mean any lift station, wet well and valves, lift & septic tanks, station piping, force mains, pipes, air/vacuum release manholes, clean-out manholes, manholes, flow monitoring/meeting manholes, clean-outs, grease traps, grit traps, oil/water separators, neutralization tanks, wyes, laterals, valves and man boxes, submersible pumps and controls, control panel, alarm devices, lift system, electrical wire in conduit from wet well to control panel, vents, slide rolls and hoist system, wet well and valve vault access doors, fittings, thrust blocks, odor control, asphalt access doors, fencing and any other appurtenances which convey or process sanitary sewage.

I. "CONVEYED" with regards to SANITARY SEWER FACILITIES shall mean PROJECTS for which HSE has received title.

J. "PRIVATE" with regards to PROJECTS shall mean PROJECTS from which sewage flows into HSE's SANITARY SEWER FACILITIES, but for which title for the SANITARY SEWER FACILITIES is not to be CONVEYED to HSE.

K. "COMPLETED" with regards to PROJECTS shall mean any PROJECTS which are acceptable to construction, tested and through which customer service has been authorized by HSE, but for which HSE has not yet initiated construction of applicable permits have been obtained from and approved by all affected government agencies and public utilities. Copies of the permits must be submitted to ENGINEER for review.

L. "CONSTRUCTION PLANS" shall mean primary plans, secondary plans, sets of construction drawings, architectural plans, shop drawings, landscaping plans, record drawings, easements, deeds, covenants and restrictions, contract documents and any other documentation to be submitted for the PROJECT under these SPECIFICATIONS and HSE's "Design Specifications for Sanitary Sewer Facilities". CONSTRUCTION PLANS must meet the applicable standards in effect at the time the documents are submitted.

M. "COMPLETION DOCUMENTATION" shall mean record drawings and other documentation to be submitted under HSE's "Sanitary Sewer Completion Specifications". COMPLETION DOCUMENTATION must meet the applicable standards in effect at the time the documents are submitted.

1.02 Purpose The purpose of these SPECIFICATIONS is to define the standards for engineering design, construction specifications and construction practices related to the PROJECT which will allow for the orderly and proper installation of SANITARY SEWER FACILITIES constructed within HSE's service area.

1.03 Applicability These SPECIFICATIONS are applicable for all public and PRIVATE SANITARY SEWER FACILITIES which will be constructed to HSE's sanitary sewer system. This includes PRIVATE PROJECTS which will not initially be connected to HSE's sanitary sewer system but at some future date may be connected to the system.

1.04 Liability and Costs for PROJECT No direction, field directive or other instruction contemplated by these SPECIFICATIONS and/or conducted by others shall incur any liability, charge or cost to HSE, ENGINEER or ENGINEER'S SPECIFICATIONS.

1.05 Standards, Specifications and Details A. HSE's Gravity Sanitary Sewer Details sheet, Gravity Sanitary Sewer Specifications sheet, Common Force Main Details sheet, Grinder Pump Details sheet, Standards for Design and Construction of Boreholes, Master Plans, Design Specifications for Sanitary Sewer Facilities and Sanitary Sewer Completion Specifications are integral parts of these SPECIFICATIONS. The CONTRACTOR should become familiar with these documents prior to construction of any SANITARY SEWER FACILITIES within HSE's service area.

B. These SPECIFICATIONS, HSE's Common Force Main Details sheet, Grinder Pump Details sheet and Design Specifications for Sanitary Sewer Facilities are complementary in nature and should not be interpreted in isolation. Each of these documents shall be read in conjunction with the others.

C. These SPECIFICATIONS and HSE's Common Force Main Details sheet, Grinder Pump Details sheet, Master Plan and other standards, specifications and details are subject to revision at any time prior to the start of construction of the PROJECT. These documents are also subject to revision at any time during construction when the ENGINEER's opinion, those revisions materially effect the maintenance, operation or life of the PROJECT. All such revised documents must replace the corresponding documents in the CONSTRUCTION PLANS and/or the RECORD DRAWING ENGINEER's copies. D. HSE reserves the right to modify or waive any of these SPECIFICATIONS and/or its Master Plan and other standards, specifications and details in its best interest.

E. These SPECIFICATIONS are intended to define the construction requirements of SANITARY SEWER FACILITIES constructed and operated under typical conditions in HSE's service area. Depending on field conditions and the composition and characteristics of the sanitary sewer flow, different or unusual conditions may occur which cannot be anticipated in a document of this nature. ENGINEER may impose additional or special construction requirements under these circumstances.

1.06 Drawing Discrepancies and Omissions A. Prior to the start of construction, the CONTRACTOR must notify ENGINEER of any conflicts between the CONSTRUCTION PLANS, any supplemental information supplied by HSE and/or these SPECIFICATIONS. Resolution of any such conflict will be at the ENGINEER's sole discretion.

B. Any items which are not covered in these SPECIFICATIONS, the CONSTRUCTION PLANS or HSE's other standards, specifications and details, but are required for construction of this PROJECT, must be approved by ENGINEER prior to installation and must be made a part of this contract.

C. PROJECT construction practices are not described, but in the ENGINEER's opinion, will affect the quality of construction or long term maintainability of the SANITARY SEWER FACILITIES, then the ENGINEER must approve any construction practices proposed by the CONTRACTOR.

1.07 Governing Laws, Codes and Regulations A. Construction practices must meet all applicable laws, codes or regulations and be in accordance with the requirements of all governmental agencies and public utilities having jurisdiction.

B. These SPECIFICATIONS shall not be considered as a substitute, nor shall supersede any state or federal law, code or regulation related to the PROJECT. In the event of a conflict between any state or federal law, code or regulation governing the PROJECT and these SPECIFICATIONS, the more stringent requirement will apply.

C. All persons on site must abide by all Indiana Occupational Safety and Health Administration ("OSHA") standards including but not limited to "General Construction Practices" and "Trench Safety Standards".

1.08 Notices All notices required by these SPECIFICATIONS must be given to both HSE and ENGINEER at their respective business offices.

PART 2 - GENERAL CONSTRUCTION REQUIREMENTS

2.01 General These SPECIFICATIONS cover all work necessary for the installation of SANITARY SEWER FACILITIES and other appurtenances to convey sewage from the pumps to the receiving sewer in an acceptable and operable manner.

B. CONTRACTOR must provide all necessary work to install the SANITARY SEWER FACILITIES in a COMPLETE manner in accordance with the CONSTRUCTION PLANS. C. All pumps, pipe, fittings, valves and appurtenances must be the size, type, classification and grade shown on the CONSTRUCTION PLANS and must meet all requirements of these SPECIFICATIONS.

D. CONTRACTOR must not substitute materials which differ from the approved CONSTRUCTION PLANS unless approved by ENGINEER.

E. All pipe, fittings and all pipe references to pipe diameter on the CONSTRUCTION PLANS or in these SPECIFICATIONS are intended to be nominal size or diameter and must be interpreted as such.

F. If a material type is shown on the CONSTRUCTION PLANS, the material type must describe a general category of materials meeting these SPECIFICATIONS.

2.02 Submittals A. CONTRACTOR must submit only one model number or type per item for approval. Multiple submittals of model number or type for a single item will be cause for rejection of the shop drawing.

B. Before delivery of products to the site (for standard yard stocked items) or before fabrication (for items which are not standard yard stocked items), CONTRACTOR must provide submittals to the ENGINEER. Submittals must be submitted to the ENGINEER and thoroughly reviewed by CONTRACTOR and certified to meet these SPECIFICATIONS (with all exceptions explicitly indicated) prior to submission to ENGINEER.

C. Shop drawings with performance data, field measurements, details of fabrication, including details of installation and physical characteristics for mechanical products, including valves, controls, pumps, etc.

D. Shop drawings for each and other electrical wiring. System head curve plotted with the proposed pump curve.

1. The plot must also indicate the pump efficiency, including capacity and reflect the motor service factor.

2. Efficiency and other performance data must be based on performance with an uncoated impeller. Attempts to improve reported efficiency by coating impeller will not be accepted.

F. Catalog cuts with product data, including details of manufacture, for all manufactured items in the interest of the SUBSOURCES.

G. Manufacturer's recommendations on all materials and methods of installation.

H. Warrant of warranty from manufacturing and installation defects for a period of (1) years and pumps for a period of (2) years and parts for a period of (3) years.

I. Successful operation date will be the first day of the initial thirty (30) day period where pump station and system functioned without failure due to defects in workmanship or materials.

J. The warranty must be provided by the contractor with tanks to remain water tight and structurally sound for a period of three (3) years from date of manufacture and for at least two (2) years after delivery to the site. The warranty must include any joints and fittings installed by the manufacturer and others installed according to the manufacturer's recommendations.

K. Operation and maintenance instructions for all mechanical and electrical equipment. L. If the SANITARY SEWER FACILITIES are to be CONVEYED, then CONTRACTOR must provide HSE with copies of all contracts, invoices, statements, material lists, payment requests and all other related documentation to the construction cost of the PROJECT. The above documents must be provided monthly, unless otherwise determined by HSE.

K. Submit any other items required by the ENGINEER.

2.03 Initiation of Construction A. CONSTRUCTION PLAN approval will be an authorization to proceed with construction of the PROJECT, however, it shall not be construed as authorization to violate, cancel or aside any of HSE's requirements or the laws, codes, regulations and permit processes of governmental agencies or public entities. Approval will be evidenced by an "Approved Hamilton Southeastern Utilities, Inc." stamp on the CONSTRUCTION PLANS.

B. CONSTRUCTION PLAN approval will be valid for a period of six (6) months from the date of the approval stamp. Extensions of this time limit may be requested from ENGINEER if extenuating circumstances exist. ENGINEER's decision regarding time extensions will be final.

C. Prior to initiation of construction, DESIGN ENGINEER must receive formal written approval from ENGINEER. At this time, DESIGN ENGINEER must supply ENGINEER with five (5) complete sets of CONSTRUCTION PLANS for distribution to the ENGINEER'S inspectors and CONTRACTOR.

D. CONTRACTOR will be permitted to initiate construction until the CONSTRUCTION PLANS are formally approved and the SUBSOURCES has entered into all necessary agreements and authorizations with, and all required fees have been paid to, HSE.

E. CONTRACTOR will not be permitted to initiate construction of applicable permits have been obtained from and approved by all affected government agencies and public utilities. Copies of the permits must be submitted to ENGINEER for review.

F. CONTRACTOR will not be permitted to initiate construction until all off-site easements have been reviewed, approved and recorded by ENGINEER.

G. The pipe layers and foreman (superintendents) assigned to the PROJECT must be approved by HSE prior to the start of construction.

H. Notice must be provided to ENGINEER twenty-one (21) days prior to the initiation of construction.

I. A pre-construction meeting is required between the ENGINEER and CONTRACTOR prior to the initiation of construction. The pre-construction meeting must be completed no more than fourteen (14) days prior to the start of construction.

2.04 Continuity of Construction A. Once construction has commenced, the PROJECT must be COMPLETED promptly and in a timely manner as directed by the ENGINEER.

B. CONTRACTOR can not discontinue work on the PROJECT, except for weather delays, without written approval from the ENGINEER and in this case no sanitary sewer facilities including wet wells, lift & septic tanks, valves and man boxes, submersible pumps, clean-out manholes, flow monitoring/meeting manholes, clean-outs, grease traps, grit traps, oil/water separators, neutralization tanks, etc. ("MANHOLES") can be left open and incomplete.

2.05 Confined Space Entry All persons, including but not limited to SUBSOURCES, CONTRACTORS, sub-contractors, DESIGN ENGINEERS, RECORD DRAWING ENGINEERS and surveyors must abide by HSE's Permit Procedures for Manhole Entry and Entry into Trenches or the most recent OSHA confined space entry standards, which ever is more stringent.

2.06 Cleanliness A. The PROJECT site must, at all times, be kept free of trash, rubbish, unsightly materials and other nuisances.

B. All streets, alleys, pavement, parkways and private property must be thoroughly cleaned each day of all surplus materials, debris and refuse of all products by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Spills, holes and pipe tongs must be patched.

C. Keep stored products safe from damage or deterioration in accordance with manufacturer's recommendations. Keep the interior of products free from dirt or foreign matter. Drain and store products in a manner that will protect them from damage by freezing. Store electronic and electrical products in a manner that will protect them from damage by rain, wind and weather. Do not store products under the manufacturer's requirements. Store gaskets and other products affected by sunlight in a cool location out of direct sunlight. Gaskets must not come in contact with petroleum products.

E. Promptly remove damaged or defective products from the PROJECT site. Replace damaged or defective products with acceptable products.

F. The CONTRACTOR is responsible for verifying that the materials are free of defects and are the proper type, classification, grade, etc. complying with the CONSTRUCTION PLANS and/or HSE's standards, specifications and details.

2.07 Product Delivery, Handling and Storage A. The CONTRACTOR is responsible for the delivery, storage and handling of products.

B. Deliver products with manufacturer's tags and labels intact.

C. Handle products in accordance with manufacturer's recommendations and in accordance with the applicable laws, codes and regulations of the state and local jurisdictions.

D. Do not drop products. Do not skid or roll products on or against other products. Spills, holes and pipe tongs must be patched.

E. Keep stored products safe from damage or deterioration in accordance with manufacturer's recommendations. Keep the interior of products free from dirt or foreign matter. Drain and store products in a manner that will protect them from damage by freezing. Store electronic and electrical products in a manner that will protect them from damage by rain, wind and weather. Do not store products under the manufacturer's requirements. Store gaskets and other products affected by sunlight in a cool location out of direct sunlight. Gaskets must not come in contact with petroleum products.

5. Infiltration into the structure.

6. The internal diameter of the structure must not vary more than one (1) percent from the nominal diameter.

7. Not clearly marked data of date manufacturer, trade name, size designation, ASTM number, etc. Having any visible steel bars or wire mesh along inside or outside surface of the structure.

8. Evidence of patching.

10.2 Relation to Wells and Water Supplies A. The structure must be installed (10) feet horizontally from any existing or proposed water main. The distance is to be measured edge to edge. Should specific conditions prevent this separation, the CONTRACTOR must notify the ENGINEER for alternate instructions.

B. Whenever the force main crosses a water main, it should be laid at least eighteen (18) inches below the main.

C. Sewer/water supply separations and pipe classifications must conform with the latest edition of the Indiana State Board of Health's ("OSHA") "On-Site Water Supply and Wastewater Disposal for Public and Commercial Establishments" - Bulletin 5.13.

2.11 Utilities A. All existing utility systems that conflict with the construction of the PROJECT, which can be temporarily removed and replaced, must be accomplished at the expense of the CONTRACTOR. Work must be done by the respective utility unless the utility approved in writing that the CONTRACTOR can do the work.

B. Permanent Relocation of Utilities 1. Except as otherwise noted on the CONSTRUCTION PLANS, it is the responsibility of the CONTRACTOR to move or pay for moving all utility appurtenances, including but not limited to, water mains, gas lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, lift and traffic standards, cable wyes, signals, etc. located in the public right-of-way or private easement which would permanently interfere with the PROJECT.

2. If the CONTRACTOR has determined that the CONTRACTOR has considered his bid all of the permanent and temporary utility appurtenances shown or otherwise indicated on the CONSTRUCTION PLANS. It is also understood and agreed that no additional work will be required for any utility relocation or relocation of any utility appurtenances by the CONTRACTOR due to any interference from said utility appurtenances or the operation of moving them either by the respective utility company or the CONTRACTOR.

C. The CONTRACTOR must provide, at CONTRACTOR's expense, all electrical and gas service connections (including trenching and laying) and telephone service required for the PROJECT. The PROJECT IS COMPLETED.

2.12 Installation Service The manufacturer of any SANITARY SEWER FACILITIES may be required to provide installation advice on bedding, haunching and backfill to the CONTRACTOR's work force. The CONTRACTOR will determine the need for these services based on the experience of the CONTRACTOR's work force or field conditions encountered during construction.

2.13 Product Installation A. Install all products in strict accordance with manufacturer's recommendations and these SPECIFICATIONS. B. Bring all conflicts between the manufacturer's recommendations and these SPECIFICATIONS to the attention of ENGINEER and obtain direction from ENGINEER as to the resolution of any conflict in installation directives.

2.14 As-Built Record Set A. CONTRACTOR must maintain, during the course of the PROJECT, an up-to-date plan set which accurately reflects the actual, as-built dimensions, materials of construction, horizontal and vertical location, vertical elevation and other relevant information necessary to develop a set of as-built record drawings in accordance with HSE's "Sanitary Sewer Completion Specifications".

B. As-built horizontal locations and vertical elevations are required on all fittings, manholes, valves, tees, wyes and adapters, the force main (at a maximum separation of 500 feet) and MANHOLES (including initially installed lift & septic tanks and grinder pump stations).

C. Failure to provide as-built information as specified in HSE's "Sanitary Sewer Completion Specifications" may require excavation by the CONTRACTOR to obtain this information.

2.15 Completion Documentation A. HSE's "Sanitary Sewer Completion Specifications" specify the requirements which must be met prior to the time the PROJECT is placed into service.

B. CONTRACTOR and RECORD DRAWING ENGINEER must provide to HSE and ENGINEER in CONSTRUCTION PLAN approval, the necessary COMPLETION DOCUMENTATION for the PROJECT, including record drawings and a punch list. At the time of approval, ENGINEER will provide a Record Drawing Notification to the SUBSOURCES and RECORD DRAWING ENGINEER. COMPLETION DOCUMENTATION, including record drawings in a digital file format, must be submitted to ENGINEER within thirty (30) days of the date of this notification.

C. If the COMPLETION DOCUMENTATION has not been provided within sixty (60) days of the date of this notification, HSE will procure the services necessary to generate or otherwise complete the record drawings and other COMPLETION DOCUMENTATION at SUBSOURCES's expense.

D. RECORD DRAWING ENGINEER must also submit Sanitary Sewer Record Drawing Information sheets or field notes for all MANHOLES that have not been previously completed. These sheets must be submitted to ENGINEER within fourteen (14) days of the Record Drawing Notification.

D. CONTRACTOR must complete all outstanding items detailed in ENGINEER's correspondence and supply all necessary information (including, construction cost, materials used, etc.) to the ENGINEER. The final information must be submitted to ENGINEER within thirty (30) days. CONTRACTOR must also provide timely responses to RECORD DRAWING ENGINEER for questions associated with constructed conditions including, pipe sizes, pipe types, horizontal location of concrete encasement/capping and borses, water tight castings, fittings, manufacturer and model number, valve description (gate, ball, etc.) and operator type (key or nut), etc.

E. If a Manhole top of casting is adjusted after as-builtting, then the CONTRACTOR must supply ENGINEER with a new measure down from the flow line to the top of casting. If the measure down is not provided by ENGINEER, then the CONTRACTOR must pay ENGINEER, at their current rate, for all time required obtained this information.

2.16 Inspection and Reimbursement A. Full time inspection by ENGINEER is required for all repairs, maintenance or construction to SANITARY SEWER FACILITIES. ENGINEER must approve, in writing, all methods of repair to SANITARY SEWER FACILITIES as recommended by the CONTRACTOR and manufacturer. Failure to comply will be grounds for removal from the HSE approved contractor list.

B. If, for any reason, construction work is delayed or cancelled, CONTRACTOR must notify ENGINEER's inspector assigned to the PROJECT and ENGINEER's chief inspector at least one (1) hour prior to the normal scheduled start time of the work. If the work is delayed or cancelled, CONTRACTOR will be charged \$50.00 for failure to notify ENGINEER's inspector at least one (1) hour prior to the normal scheduled start time of the work. The above rates are subject to change without notice.

C. CONTRACTOR must pay ENGINEER for all inspector's overtime costs. CONTRACTORS will be charged overtime costs at the rate of \$28.00 per hour prior to 7:00 a.m. and after 7:00 p.m. on weekdays and all day on Saturdays. The hourly rate for Sunday and holidays will be \$60.00 per hour. The above rates are subject to change without notice.

D. CONTRACTOR must pay ENGINEER for all inspector's overtime costs. CONTRACTORS will be charged overtime costs at the rate of \$28.00 per hour prior to 7:00 a.m. and after 7:00 p.m. on weekdays and all day on Saturdays. The hourly rate for Sunday and holidays will be \$60.00 per hour. The above rates are subject to change without notice.

E. The ENGINEER's decision on field changes or construction practices is final. Failure to comply is grounds for removal from the HSE approved contractor list.

PART 3 - TESTING, PUNCH LISTS AND CLEANING

3.01 General Testing Requirements A. All testing must be conducted at the CONTRACTOR's expense in the presence of the ENGINEER.

B. Notification must be provided at least five (5) days prior to any testing.

C. At HSE's option, HSE or their agent may perform all testing of SANITARY SEWER FACILITIES within the HSE service area. CONTRACTOR must reimburse HSE or its agent for HSE's current hourly rate for testing.

D. All testing (except manhole vacuum testing) must be conducted after the final backfill and must be in and undisturbed for at least thirty (30) days and after all other utilities have been installed. All concrete thrust blocks must have been in place for a period of at least ten (10) days prior to testing.

E. At the ENGINEER's testing, by the CONTRACTOR, the CONTRACTOR must be required, based upon weather conditions (adequate precipitation to allow for adequate settlement, etc.). Also, testing may be delayed or additional testing may be required due to the installation of site improvements (including but not limited to fencing, signage, landscaping, site lighting and other subsurface improvements).

F. If the SUBSOURCES requires sanitary sewer service prior to final testing, a preliminary test may be performed, however, SUBSOURCES must be, in writing, a guarantee that all cleaning and testing will be performed per the CONSTRUCTION PLANS and HSE's then current standards, specifications and details.

3.02 Force Main Testing A. Perform hydrostatic pressure tests on all force mains.

B. The hydrostatic pressure test must conform to ANSI/AWWA C600 and C605 specifications except as modified by these SPECIFICATIONS.

C. Conduct test at pressure of at least one hundred (100) psi or one and an half (1 1/2) times the operating pressure, whichever is greater.

I. CONTRACTOR must furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on pumps.

J. CONTRACTOR is responsible for any damages caused by failure of the joints.

K. Refill and replace all pipe not meeting the leakage or pressure requirements.

L. Repeat hydrostatic pressure test as necessary.

M. After location of leaks and repair or replacements of defective joints, pipe or fittings.

N. After location of leaks and repair or replacements of defective joints, pipe or fittings.

O. After location of leaks and repair or replacements of defective joints, pipe or fittings.

P. After location of leaks and repair or replacements of defective joints, pipe or fittings.

Q. After location of leaks and repair or replacements of defective joints, pipe or fittings.

R. After location of leaks and repair or replacements of defective joints, pipe or fittings.

S. After location of leaks and repair or replacements of defective joints, pipe or fittings.

T. After location of leaks and repair or replacements of defective joints, pipe or fittings.

U. After location of leaks and repair or replacements of defective joints, pipe or fittings.

V. After location of leaks and repair or replacements of defective joints, pipe or fittings.

W. After location of leaks and repair or replacements of defective joints, pipe or fittings.

X. After location of leaks and repair or replacements of defective joints, pipe or fittings.

Y. After location of leaks and repair or replacements of defective joints, pipe or fittings.

Z. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AA. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AB. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AC. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AD. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AE. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AF. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AG. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AH. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AI. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AJ. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AK. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AL. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AM. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AN. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AO. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AP. After location of leaks and repair or replacements of defective joints, pipe or fittings.

AQ. After location of leaks and repair or replacements of defective joints, pipe or fittings.

6. The pipe and fittings for horizontal directional drilling must be a minimum DR of 9.

7. Pipes and fittings used in open cut installations must be a minimum of DR 11.

8. Joints A. Each product to be incorporated into the PROJECT must be handled into its position, placed and supported only in such manner and by such means as the ENGINEER occupies.

B. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

C. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

D. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

E. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

F. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

G. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

H. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

I. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

J. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

K. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

L. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

M. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

N. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

O. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

P. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

Q. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

R. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

S. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

T. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

U. The butt fusion process should be used to join sections of PE pipe into continuous lengths. Avoidable stress concentrations must be avoided.

V. The butt



D. CONTRACTOR must notify ENGINEER at least twenty-four (24) hours prior to any construction of storm sewers that may affect previously constructed SANITARY SEWER FACILITIES. Storm sewers laid parallel to SANITARY SEWER FACILITIES must maintain a minimum horizontal separation (measured from the outer spring line of each pipe) of ten (10) feet.

#### 2.08 Existing Utilities, Structure, Property, Etc.

A. All improvements, including but not limited to poles, trees, fences, sewer, gas, water or other pipes, wires, conduits and manholes, railroad tracks, buildings, structures, property, etc., along the route of the SANITARY SEWER FACILITIES must be supported and protected from damage by the CONTRACTOR.

B. Movable items such as mail boxes can be temporarily relocated during construction, provided their function is maintained. Unless otherwise shown in the CONSTRUCTION PLANS, place movable items at their original location immediately after backfilling is finished. Any movable items damaged during construction must be replaced by an item of equal or better quality.

C. The CONTRACTOR must proceed with caution in the excavation and preparation of trenches so that the exact location of underground utilities and structures, both known and unknown, can be determined. The CONTRACTOR is responsible for the repair of utilities and structures when broken or otherwise damaged.

D. The CONTRACTOR must make explorations and excavations whenever, in the opinion of the ENGINEER, it is necessary to determine the location of any underground structures.

E. Whenever pipes or conduits cross the trench, the CONTRACTOR must support said pipes and conduits without touching them from and without interrupting their service. The manner of supporting such pipes, etc., is subject to approval by the owner of the pipe or conduit.

F. When utility lines have to be removed or relocated for the PROJECT, the CONTRACTOR must notify the ENGINEER and utility line owner in ample time for the necessary measures to be taken to prevent interruption of the utility's service.

G. The CONTRACTOR must conduct the work so that no equipment, material or debris will be placed or allowed to fall upon private property in the vicinity of the PROJECT unless the CONTRACTOR has first obtained the property owner's written consent and provided a copy of the consent to the ENGINEER.

H. All excavated material must be piled in a manner that will avoid obstructing side walks, driveways and thoroughfares. Hydrants under pressure, water pit covers, valve boxes, curb stop boxes, fire and police call boxes or other utility controls must be left undisturbed and accessible during the PROJECT. CONTRACTOR must prevent runoff from stored piles of excavated material from entering ditches, gutters, valleys or storm sewers.

#### 2.09 Excavating

A. De-watering.

1. The CONTRACTOR must provide, install and operate sufficient trenches, sumps, pumps, hoses, piping, well points, etc., to depress and maintain the groundwater level below the base of the excavation until all SANITARY SEWER FACILITIES are COMPLETED. Provide sufficient dikes and de-watering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property or damage to the environment. Water disposal must be in compliance with the regulations of the Environmental Protection Agency (EPA), Indiana Department of Environmental Management (IDEM), Soil Conservation Service (SCS) and of all other applicable agencies.

2. CONTRACTOR must prevent all water from entering the SANITARY SEWER FACILITIES. In the event any water enters COMPLETED SANITARY SEWER FACILITIES, the CONTRACTOR is responsible to HSE for the costs of sewage treatment, electrical power, equipment repairs, incidental damages, cleaning and any other costs or expenses related to such entry. In addition, CONTRACTOR shall pay HSE damages of \$1000 per occurrence.

3. Operate de-watering equipment ahead of pipe laying or to keep the water level below the excavation until structures are secured by backfill.

4. CONTRACTOR must, at ENGINEER'S discretion, provide de-watering equipment, shoring or other construction practices deemed necessary by ENGINEER.

5. All wells (existing, non-pipeline and de-watering) must be drilled, cased and abandoned in accordance with the requirements of the ENGINEER, the Indiana Administrative Code and the Indiana Department of Natural Resources, Groundwater Section, Hamilton County Health Department and all other governmental agencies and public entities having jurisdiction.

6. As directed by the ENGINEER, CONTRACTOR must maintain the well casing in-place for all SANITARY SEWER FACILITIES, which will be extended in the future.

#### 3.0 Trenching

1. All excavation work must incorporate safety measures that comply with all applicable OSHA regulations and these SPECIFICATIONS. In the event of a conflict, the more stringent requirement will apply.

2. Trench, boulder and other surface encumbrances, located so as to create a hazard to employees involved in excavation work in the vicinity thereof at any time during operations, must be removed or made safe before excavating is begun.

3. Unless otherwise directed by the ENGINEER, do not excavate more than seventy-five (75) feet of trench in advance of the installed pipe. Unless otherwise directed, excavate the trench within six (6) inches of full depth for a distance of at least thirty (30) feet.

4. CONTRACTOR must provide slope side walls (provide that the bottom four (4) feet of trench will not be sloped), shoring, shoring or trench boxes as safety measures for all excavations in accordance with all applicable OSHA regulations. CONTRACTOR is responsible for the determination of the angle of repose of the soil in which the shoring is to be done. Except for areas where solid rock occurs for line shoring or pre-shoring or where shoring, shoring or trench boxes are to be used, excavate all slopes to beyond the angle of repose, but not steeper than a one (1) foot rise to each foot (5:1) soil horizontality.

5. Slope, shoring and boxes of all excavations must meet accepted engineering requirements by design, including, but not limited to, rock bolting, wire meshing or other equally effective means. One special attention to slopes that could be adversely affected by weather or moisture content.

6. Flatten the excavation sides when an excavation has water conditions, slurry materials, loose boulders and areas where erosion may occur and side slopes appear.

7. A competent CONTRACTOR's representative, as defined under OSHA regulations, must inspect excavations and approve trench safety measures for the excavation after every rain event or other hazard increasing excavation.

8. Do not store excavated or other material nearer than ten (10) feet from the edge of any excavation. Store and retain materials so as to prevent materials from falling or sliding back into the excavation. Install substantial steel wall or barricade when stable equipment is utilized or allowed adjacent to excavation.

9. Minimize the amount of excavation around MANHOLES.

10. The design of the pipe and MANHOLES are predicated upon the width of trench as specified by the manufacturer and these SPECIFICATIONS, the more efficient of which will apply. If the specified trench width is exceeded, then the CONTRACTOR is responsible for the provision and installation, at his own expense, of all remedial measures required by the ENGINEER.

11. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to ensure acceptable atmospheric conditions. Provide adequate ventilation from alternate sources of oxygen when flammable gases may be present. Emergency rescue equipment, such as breathing apparatus, a safety harness and air basket stretcher, must be readily available where adverse atmospheric conditions are likely to develop or excavation.

12. Provide walkways or bridges with guardrails where employees or equipment are required or permitted to cross over excavations.

13. Provide ladders where employees are required to be in excavations four (4) feet deep or more. Ladders must extend from the floor of the excavation to at least three (3) feet above the top of the excavation. Locate ladders to provide means of exit without more than twenty-five (25) feet of lateral travel.

14. Provide adequate barriers and physically protect all excavations. Barricade or cover all wells, pits, shafts and other excavations. Install temporary wells, pits, shafts and similar excavations upon termination of operation and similar operations.

#### 4.0 Backfilling

1. Backfilling must meet the requirements of ANSI/AWWA C205 unless otherwise specified in these SPECIFICATIONS.

2. Do not backfill trenches and excavations until all utilities have been inspected by the ENGINEER and until all underground utilities and piping systems are installed in accordance with the requirements of the respective utility company. These SPECIFICATIONS and the CONSTRUCTION PLANS.

3. Place and tamp bedding and backfill in a manner that will not damage the pipe, pipe coating, wrapping or encasement.

4. CONTRACTOR must insure that all install trench bottom material is replaced with suitable material and all voids are filled prior to placement of the pipe embedment material. Excess dry backfill material without viable fines or must not be accepted.

5. When used in these SPECIFICATIONS, the term "clean backfill" shall mean any backfill material of any type which is free of roots, brush, sticks, debris, junk, rocks, children, broken concrete or brick, large lumps of dirt, frozen materials, stones, etc., greater than six (6) inches in their largest dimensions, but more than fifteen (15) percent of the rocks or lumps can be larger than two and a half (2.5) inches in their largest diameter.

6. All job excavated materials which are used for trench backfill above pipe embedment and which are to be compacted by any method except settlement by water, must be "clean backfill". The material must be of such composition that it can be compacted to ninety (90) percent relative compaction by the compaction method used and with water added, if needed, to bring it to optimum moisture content.

7. Material excavated from an open trench can be used for backfilling from the pipe to six (6) inches below finished grade provided it meets the requirements of "clean backfill" and providing a different type of backfill material has not been specified or shown on the CONSTRUCTION PLANS. Where excavated material is used for backfilling and there is a deficiency due to the rejection of a spot thereof, the CONTRACTOR, upon direction of the ENGINEER, must remove the rejected material from the site and furnish an additional quantity of "clean backfill" at his own expense.

8. Excavated material must be placed immediately after the hand backfill. Such backfilling can be done from the top of the trench by mechanical means or directly from backfill by depositing the backfill in a slope equal to the angle of repose of the material and allowing it to flow progressively forward in such a manner as to prevent the formation of voids. The earth backfill must be compacted to at least ninety-five (95) percent relative compaction or rounded six (6) inches for settlement.

9. In no case must backfill be dropped from such height or in such volume that its impact damages SANITARY SEWER FACILITIES. The ENGINEER reserves the right to regulate and control the manner of depositing such backfill, but in any case, the CONTRACTOR will be held liable for damage to the SANITARY SEWER FACILITIES.

10. Settling of backfill by bleeding or puddling will not be permitted.

11. Excess trench material must be neatly graded over the trench in a timely manner after the pipe is installed. This material must be mounded over the trench with a crown height of no more than six (6) inches, (between to existing grade, until final settlement has occurred and the trench is ready for grading and cleanup. An exception to this would be trenches in traveled pathways. Any excess must be heaped, graded and removed or stored off the CONTRACTOR.

12. After settlement of backfill and immediately before restoration of finished grade, grade and remove excess earth in unproved areas. Remove to a depth of six (6) inches below finished grade. Place six (6) inches of topsoil over entire area to be restored.

#### 2.10 Restoration

A. This section pertains to the restoration of the PROJECT after completion of the work.

B. Restoration of improvements in public and private property must be in-kind and acceptable to the owner.

C. Restoration of road surfaces, drainage work and other similar improvements must be in accordance with the direction of the government agency or public utility having jurisdiction.

D. All required areas disturbed or damaged during construction must be re-vegetated with a stand of grass. Agricultural areas and areas currently under construction do not require re-vegetation.

E. Backfills, fills and embankments must be brought to a sub-grade level six (6) inches above finished grade. When sub-grades have settled, deposit and spread fine raked topsoil ready for seeding to a finished depth of at least six (6) inches.

F. Commercial fertilizer, 6-12-12 or equal, must be uniformly spread at the rate of thirty-five (35) pounds per one thousand (1,000) square feet over the topsoil by a mechanical spreader at least forty-eight (48) hours before seeding and mixed into the soil for a depth of two (2) inches.

G. A grass seed mixture composed of thirty-five (35) parts Kentucky Blue Grass, thirty (30) parts Perennial Ryegrass, thirty (30) parts Kentucky 31 Fescue and no more than five (5) parts inert matter must be sown on the disturbed area at a rate of three (3) pounds per one thousand (1,000) square feet. Seeding must be done only between April 1 and June 1 or August 15 and October 15.

H. Seeded areas must be mulched with straw, hay, wood chippings fiber or cone fiber. Straw or hay must be applied at a rate of two and a half (2.5) tons per acre. Wood chippings or cone fiber mulch must be applied at a rate of one thousand (1,000) pounds per acre. On special areas of high water concentration, unstable soils or sloped surfaces, manufactured mulch materials such as soil retention blankets, erosion control netting or others may be required by ENGINEER. Manufactured mulch materials must be installed according to the manufacturer's recommendations.

I. The seeded areas must be thoroughly watered with a fine spray to prevent wash or the seed. Areas must be maintained and protected as directed by ENGINEER. A satisfactory stand of grass at least one (1) inch in height without bare spots will be required.

J. Within three (3) months after PROJECT Completion, the CONTRACTOR must correct defective work, such as settled areas, uneven road surfaces, bare spots in grass coverage, erosion and gullies.

#### 2.11 Valves and Valve Boxes

A. Install valves with stems vertical.

B. Tighen all valve glands as valves are installed; add additional gland packing, if required; and again tighten glands after valves are placed in operation and brought up to operating pressure. Replace any gland packing which is deteriorated or in unsatisfactory condition.

C. Coated balls and nuts must be 3/4 inch stainless steel.

D. Moving surfaces of major parts.

E. Modified and fitted nuts O-rings for water tight seals.

F. Machining and fitting must permit sealing by automatic compression of O-rings in two places for contact on four surfaces.

G. Tolerances must allow replacement of any part without additional machining to ensure seal.

H. Pump Motor Cable

1. Furnish cable with following wires:

a. Three (3) conductor wires and one (1) ground wire for three phase or two (2) conductor wires and one (1) ground wire for single phase.

b. Control cable.

c. High temperature alarm wire, one (1) per phase.

d. Wire Size

e. Conductor and ground wire must meet minimum size per NEC.

#### SECTION 2 - PUMP STATION EQUIPMENT

##### PART 1 - PRODUCTS

###### 1.01 Submersible Pump

A. The pumps must be capable of handling raw sewage typical of domestic wastes.

B. Pumps must be easily removable for inspection or service, requiring no bolts, nuts or other fasteners to be disconnected.

C. Capable of continuous submergence under water without loss of water tight integrity to a depth of twenty-five (25) feet.

###### 2.0 Motors

A. Major parts, including stator coating, oil casting, sliding bracket and valve must be cast iron, Class 25-30 with smooth surfaces devoid of flow holes and irregularities.

B. Protect surfaces in contact with sewage with two (2) part corrosion resistant epoxy finish.

C. Coated balls and nuts must be 3/4 inch stainless steel.

D. Moving surfaces of major parts.

E. Modified and fitted nuts O-rings for water tight seals.

F. Machining and fitting must permit sealing by automatic compression of O-rings in two places for contact on four surfaces.

G. Tolerances must allow replacement of any part without additional machining to ensure seal.

H. Pump Motor Cable

1. Furnish cable with following wires:

a. Three (3) conductor wires and one (1) ground wire for three phase or two (2) conductor wires and one (1) ground wire for single phase.

b. Control cable.

c. High temperature alarm wire, one (1) per phase.

d. Wire Size

e. Conductor and ground wire must meet minimum size per NEC.

a. Allow for three (3) percent voltage drop.

b. Heavy duty, flexible cable for submerged service in hazardous locations.

c. Pump Motor - Oil Filled

1. Description

a. Three phase or single phase with motor and pump furnished as an integral unit.

b. Motor frame and end shields must be corrosion resistant cast iron with stainless steel hardware and shaft.

c. Static seals for moisture endurance O-ring type.

d. Cable Entry

a. Threaded entrance in top and ball, to permit installation of armored covering or conduit.

b. Electrical leads primarily sealed with a molded neoprene compression grommet.

c. Secondary materials used provided by cast epoxy material, encapsulating splice connectors in motor end ball.

d. Ratings

a. Motor bearings must be pre-lubricated at factory with a minimum 8-10 life of fifteen thousand (15,000) hours.

b. Motor rated thermally to NEMA 40-124.2.

c. Motor internal pressure capability must be two hundred (200) psi.

d. Automatic must thermal overload protection for single phase motor and external magnetic controller and overload protection for three phase.

e. Cooling system must be adequately designed with thermal relators integral to tank housing, cast in one unit.

f. Pump shaft must be stainless steel per AISI 431.

g. Shaft seals

1. Carbon and ceramic.

2. Operation and Maintenance: Require neither maintenance nor adjustment, but easily inspected and replaceable.

3. Capable of twenty-four (24) hour operation without damage to motor or seals.

K. Impeller

1. Non-dragging bronze vortice impeller.

2. Dynamically balanced rotor.

3. Slip fit to shaft and key driven with non-corroding fasteners.

4. Wear ring must be cast polymer material with neoprene seals additive, or equal.

L. For grinder pumps, the unit must be located on section of pump impeller, discharging directly into the suction line. There must be no exposed shafting between the impeller and outlet to the pump opening of ground sumps. Both stationary and rotating cultures must be made of hardened and ground stainless steel.

M. Grinder pumps must not be installed on common force main systems.

N. Effluent pumps must be Zeller Pump Company model #65 or ENGINEER approved equal.

###### 1.02 Station Piping

A. Designed for operating pressure of up to one hundred fifty (150) psi and a temperature of one hundred (100) degrees Fahrenheit.

B. The materials must be schedule 40 galvanized or as indicated on the shop drawings.

C. All joints must be screwed or flanged per ANSI/ASME C115/C12.15.

D. Fittings must be schedule 40 galvanized.

E. Flanges must be 250# ductile iron per ANSI/ASME C115/C12.15.

F. All gaskets must be ring type.

G. All bolts and nuts must be machine bolts with hex nuts, regular series, Grade B, carbon plated.

H. Valves

1. The valve shutoff valve must be a PVC true union ball type shutoff valve with teflon seats. A handle actuator must be supplied for ease of operation.

2. During check valves at heavy duty spring loaded or rubber gasket check valve check with cast iron body. It must be an integral part of the discharge end assembly and must fit with the pump assembly. The valve design must allow for operation when negative heads, of up to five (5) feet, are encountered. The valve must be designed to operate at full pressure in the sewer system created by the pumps. A flat cast stainless steel seating, internally molded into the Buna N rubber gasket must be furnished in order to prevent collection of debris in the gasket area. All fasteners must be stainless steel.

###### 1.03 Pump Discharge Sump System

A. The pump discharge and system must permit removal and installation of pump without entering the wet well.

B. The pump discharge connection must be bolted to the discharge piping with a double O-ring seal for vertical removal.

###### 1.04 Level Control System and High Water Alarm System

A. Flood Switches

1. Furnish float switch assemblies - mercury type switch and in polyethylene or polypropylene housing with an adequate amount of cable based on the wet well depth (not less than fifteen (15) feet).

B. Junction Box

1. Furnish junction box for installation in wet well.

2. Conform to specifications for NEMA Type 1 standards for occasional submergence.

The cover must be fastened to the junction box by means of a totally corrosion resistant latching. Cord gyps must make an effective seal around the wire and to the junction box. The interior of the enclosure must be of adequate size to accommodate the wires and connections required to operate the pump. Conduit segments between the controls and junction box must be sealed to prevent gas entering the electrical panel.

C. High Water Alarm and Alarm Silence

1. Furnish separate float switch assembly, signal relay and alarm silence relay for high water alarm function. Signal relay must complete twelve (12) volt DC circuit for external alarm device. Electrical or mechanical indicator. Signal on top of control panel, must indicate high wet well water exists. Signal relay must maintain alarm signal until wet well has been lowered and circuit has been manually reset.

2. Alarm silence switch must be provided to permit maintenance personnel to de-energize external alarm device while corrective actions are underway. After clearing alarm device, manual reset of the signal relay must provide automatic reset of alarm silence relay.

###### 1.05 Electrical Equipment

A. Control Panel

1. All enclosures must be weather proof NEMA Type 4X, molded of glass reinforced polyester resin flammability rating in color must meet UL 94V-0 of single piece construction.

2. The cover must be attached with a stainless steel piano hinges. The cover must be lockable by means of two (2) high quality combination stainless steel dials and padlock keys.

3. The enclosures must be listed to cover wiring and components mounted on back panel; with push buttons, hand-off-automatic (H/O/A) switches and control functions, run lights, any meters, running time meters and instrumentation.

4. Back panel must be sized to mount starters, control equipment and instrumentation.

5. Stainless steel, continuous vertical hinge to provide one hundred fifty-five (165) degree swing.

6. Three point latching device with water tight key lock.

7. Pilot lights: Run - green; Call - amber; Fail - red.

8. Disposed time meters must be wired to each motor starter to indicate total running time in hours and tenths of minutes.

9. N/A/VA or (2) position switch.

10. Grounding

1. Entire installation to be grounded in accordance with requirements of NEC.

2. Equipment grounding must be provided for, but not limited to, the following items; panel enclosure, motor frames, receptacles, junction boxes, etc.

3. Ground must be insulated wire aluminum, green color coded, secured to code books.

4. Battery Backups

1. All options of SUBSCEBER or battery cover.

2. Twelve (12) volt DC lithium ion batteries with automatic one hundred twenty (120) volt charging system.

3. Provide eight (8) hour continuous operation of alarm light and horn.

4. Mount inside control panel.

E. Alarm Appliances

1. Alarm signal must be initiated by float control system high level signal or, at option of SUBSCEBER or battery cover, by alarm.

2. Supply one (1) twelve (12) volt DC weatherproof exterior alarm flasher in wet-light fixture with red globe, conduit box and mounting hardware. Alarm light and mounting fixture must be designed to permit mounting to prevent rain water from standing or collecting in guarded area of fixture between base and globe.

3. All option of SUBSCEBER or battery cover, provide power failure relay with normally open contacts for hookup on alarm line to be de-energized with contacts closed when power is restored in interrupted.

F. Conduit must be rigid-steel heavy wall type. Full weight mild steel pipe of standard pipe dimensions; threaded, hot dip galvanized, standard.

G. Circuit Breaker Usage

Minimum Type of Service Load Rating Amps

150/250 volt 15-100

H. Fuses: Rated one-tenth (1/10) to six hundred (600) amperes, six hundred (600) volts AC or less must be UL listed and Class RK1, current-limiting time delay with 200,000 ampere RMS interrupting rating as manufactured by Buss model MDA or equal. Buss Low Peak: Goid Shock Arrest; Trip-11, or equal. All fuse sizes greater than sixty (60) amperes to be air blast.

I. Wire and Cable (Up to six hundred (600) volts)

1. Except where otherwise noted in these SPECIFICATIONS, insulation must be selected according to thermosetting or thermoplastic type rated six hundred (600) volts, as approved by ENGINEER.

2. Conductors must be solid drawn copper, each strand individually tinned or coated with approved alloy.

3. Conductors #10 and smaller

a. Use threaded conductors for feed connections to motors and all locations where vibration or movement is present.

b. Use solid conductors for all other locations.

4. Use double braid, stranded conductors #8 and larger.

5. Minimum wire size: General - #12; over one hundred (100) feet - #10; over one hundred fifty (150) feet - #8; Control - #14.

6. Types and uses (seventy-five (75) or ninety (90) degrees Celsius) - unless otherwise specified or indicated on shop drawings.

a. Feeder and service entrance conductors: XHHW

b. Power circuits above forty (40) amperes; THHN (#8 and larger).

c. Branch circuits, low voltage, THHN or THHN-2, THHN (#12 and #10).

d. Control (#14) THHN or XHHW

7. Main and feeder cables must be wire tagged in all bays, wire ways and wiring gutters of panels. Tags must be of frame identifying cable number, 1 & 8 type NEC or equal.

8. Cable terminals and connectors (for copper conductors only)

1. Conductor sizes #8 and smaller, to include compression/insulator type terminals, splices and wire joints.

a. For terminals (knives, bars, disconnects): Thomas & Betts; Stans; Bundy Hydrat; Buchanan Press-Sure, or equal.

b. For wire joints (split-nut): Thomas & Betts; Stans; Bundy Hydrat; Buchanan Press-Sure, or equal.

c. Conductor sizes larger than #8, to include mechanical set screw or split ball type connectors.

a. For mechanical or set-screw type connectors: Thomas & Betts; Lull; Bundy O-Mag; Penn Union EZ, or equal.

b. For split-ball type connectors: Thomas & Betts; Bundy Hydrat; Penn Union; or equal.

c. For mechanical or set-screw type connectors: Thomas & Betts; Bundy Hydrat; Penn Union; or equal.

d. For anti-welding compound: Thomas & Betts; Bundy Hydrat; Penn Union; or equal.

9. At a minimum, tanks must contain sufficient ultraviolet light inhibitor such that if the tank were stored outside for two (