

# ENVIRONMENTAL SERVICES DEPARTMENT

## Standard Guidelines for Design and Construction of Commercial and Residential Sanitary Sewer Pumping Stations

Adopted August 8, 2006



JEFFERSON COUNTY COMMISSION

# **Jefferson County, Alabama Environmental Services Department**

## **Standard Guidelines for Design and Construction of Commercial and Residential Sanitary Sewer Pumping Stations**

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\* **For Specifications and Details, refer to Standards of Construction of Commercial and Residential Sanitary Sewer Systems.**

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\* **For Specifications and Details, refer to Standards of Construction of Commercial and Residential Sanitary Sewer Systems.**

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# **Section 1.00**

## **Policies and Procedures**

### **1.0100 Purpose**

**1.0101** The purpose of this document is to assemble in one volume the Policies, Procedures, Design Criteria, and Specifications for Construction of Sanitary Sewer Pumping Stations in Jefferson County, AL. These Standard Guidelines have been developed to protect the public health, safety, and welfare, and to promote uniformity in the development of the sanitary sewer system. The Standard Guidelines are for projects constructed by others and dedicated to the County sewer system. They are not to be confused with the Jefferson County Standard Contract Construction Sanitary Sewer Specifications used for County construction projects.

**1.0102** This document is available from Jefferson County Environmental Services Department to provide a consistent procedure for an Owner/Developer to follow to obtain sewer service for a proposed land development. Approved pumping stations and sewer system extensions shall be constructed and paid for by the Owner/Developer. No sewer system extension shall be constructed without approval and inspection by the Environmental Service Department. On completion of construction and acceptance by the County, such sewer system extensions, including pumping stations, shall become the property of the County. The Owner/Developer shall work with an Engineer experienced in pumping station design and construction. These Standard Guidelines provide the procedures, design standards and construction specifications to insure the pumping station will be approved by the Environmental Services Department and accepted for operation and maintenance.

**1.0103** Minimizing the quantities of infiltration and inflow (I/I) that enter the sewer system and minimizing sanitary sewer overflows is essential to the long term goals of the Environmental Services Department. Federal and State regulations require that all water entering the system receive treatment in accordance with State permits before being discharged into streams and tributaries. A major objective of these Standard Guidelines is to minimize sources of infiltration and inflow.

**1.0104** Construction of pumping stations in accordance with the Standard Guidelines contained in this document shall:

- A. Minimize overflows.
- B. Increase dependability.
- C. Provide a safe working environment.

- D. Provide pumping during power outages.
- E. Provide ease of maintenance.

## **1.0200 Applicability and Jurisdiction**

**1.0201** All sanitary sewer pumping facilities that connect to the Jefferson County Sanitary Sewer System shall be designed in accordance with all criteria established herein. All materials, construction, and testing of such facilities shall be in accordance with all Sections of this document, regardless of whether such facilities will be dedicated to the County, and shall be subject to inspection by the County as deemed necessary to insure compliance with the requirements contained herein.

## **1.0300 Contractor Prequalification**

**1.0301** All sanitary sewer facilities that connect to the Jefferson County Sanitary Sewer System shall be constructed by a prequalified contractor. Prequalification forms and information are available at the Environmental Services Department. Construction of sanitary sewer facilities by a contractor who has not been prequalified shall be approved by the County prior to the start of construction.

## **1.0400 Proposed Pumping Stations**

**1.0401** Commercial and residential property Owners/Developers may propose to construct a pumping station and force main sewer to transport wastewater from residential or commercial developments in Jefferson County to the Jefferson County Sanitary Sewer System. Because of the continuous costs of maintenance, operation, and utilities, installation of a pumping station will be considered as a last alternative to provide sewer service, only after all options for gravity sewers have been investigated. Before beginning a design, a Preliminary Report shall be submitted to the County listing reasons and justifications for proposing the construction of a pumping station. Pumping stations that connect to the County sewer system shall be designed and constructed according to all criteria established herein. The existing gravity sewer, force main, or pump station that the proposed pumping station is to pump to must have adequate capacity to handle the additional flow. This determination is at the sole discretion of the County. Since criteria may require designing a station adequate to serve properties outside the project limits to accommodate future connections, Owners/Developers must determine from construction cost estimates the economic feasibility of the project. See Section 2.00 for Design Guidelines for Sanitary Sewer Pumping Stations.

## **1.0500 Amendments**

**1.0501** These Standard Guidelines are subject to change, and interested parties are advised to verify with the Jefferson County Environmental Services Department that they are using the latest version of the published document. Changes to these Standard Guidelines will be made as needed by the Director of ESD. A list of all changes made to this document will be maintained by ESD and will be made available upon request. When this document is reprinted, all changes made prior to the reprinting date will be included in the reprinted document.

## **1.0600 Alternate Construction Methods**

**1.0601** These Guidelines represent the approved construction practices and procedures for construction of sanitary sewer pumping stations. Any element of design or construction not covered by this document must be submitted to and approved by the Jefferson County Environmental Services Department prior to construction.

**1.0602** The provisions of these Guidelines are not intended to prevent the use of any method of construction not specifically prescribed by the Guidelines, provided any such alternative has been approved and its use authorized by the Director. The Director shall approve any such alternate provided he finds that, for the purpose intended, the alternate is at least equivalent to that prescribed by these Guidelines in quality, strength, effectiveness, durability, safety, and satisfies the objective set out in paragraph 1.0102. The Director shall require that sufficient evidence or proof be submitted to substantiate any claim that may be made regarding the alternate.

## **1.0700 Definitions**

**1.0701** Wherever the words or phrases defined or pronouns used in their place occur in these Standard Guidelines, or any document or instrument herein referenced or to which these Standard Guidelines apply, the intent and meaning shall be construed and interpreted as defined in this document. Words not defined below shall have the meaning in Webster's Collegiate Dictionary, current edition.

**1.0702** ABBREVIATIONS: The following organizations are referred to in these Guidelines by abbreviations of their titles:

- |    |        |  |
|----|--------|--|
| A. | AA     | Aluminum Association   |
| B. | AASHTO | American Association of State Highway and Transportation Officials |
| C. | ACI    | American Concrete Institute  |

D.	ADEM	Alabama Department of Environmental Management
E.	AHAM	Association of Home Appliance Manufacturers
F.	AISI	American Iron and Steel Institute
G.	ALDOT	State of Alabama Department of Transportation
H.	AMCA	Air Movement and Control Association International, Inc.
I.	ANSI	American National Standards Institute
J.	ANSI/MSS	Manufacturers Standardization Society
K.	ASA	American Standards Association
L.	ASME	American Society of Mechanical Engineers
M.	ASTM	American Society for Testing and Materials
N.	AWPA	American Wood Preservers' Association
O.	AWS	American Welding Society
P.	AWWA	American Water Works Association
Q.	CBM	Certified Ballast Manufacturers Association
R.	CRSI	Concrete Reinforcing Steel Institute
S.	DHI	Door and Hardware Institute
T.	EPA	U.S. Environmental Protection Agency
U.	ICC	International Code Council
V.	IEEE	International Electrical and Electronic Engineers
W.	IES	Illuminating Engineering Society
X.	IMIAC	International Masonry Industry All-Weather Council
Y.	ISO	International Organization for Standardization
Z.	ISO/EN	International Organization for Standardization/English Version
AA.	JIC	Joint Industrial Council
BB.	NAAMM	National Association of Architectural Metal Manufacturers
CC.	NEMA	National Electrical Manufacturers Association
DD.	NFPA	National Fire Protection Association
EE.	NFPA	National Forest Products Association
FF.	NIST	National Institute of Science and Technology
GG.	NMTBA	National Machine Tool Builders Association
HH.	OSHA	Occupational Safety and Health Administration
II.	SAH	Society of Architectural Historians
JJ.	SDI	Steel Door Institute
KK.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
LL.	SPIB	Southern Pine Inspection Bureau
MM.	SSPC	Steel Structures Painting Council
NN.	UL	Underwriters Laboratory
OO.	USGS	United States Geologic Survey

The following acronyms are referred to in these Guidelines by abbreviations of their names or descriptions:

1.	AC	Alternating Current
2.	ADA	American Disability Act
3.	AHC	Architectural Hardware Consultant
4.	ASJ	All Service Jacket
5.	ATS	Automatic Transfer Switch
6.	AWG	American Wire Gauge
7.	BEP	Best Efficiency Point
8.	CCA	Chromated Copper Arsenate
9.	CFM	Cubic Feet per Minute
10.	CFR	Code of Federal Regulations
11.	CMU	Concrete Masonry Units
12.	DC	Direct Current
13.	DFT	Dry Film Thickness
14.	DIN	Deutsh Industries Norm
15.	DIP	Ductile Iron Pipe
16.	DTM	Direct To Metal
17.	EMI	Electromagnetic Interference
18.	FOB	Free On Board
19.	FPT	Fire Protection Technologies
20.	FRP	Fiberglass Reinforced Plastic
21.	FS	Federal Specifications
22.	GDT	Gas-filled Discharge Tube
23.	GFI	Ground Fault Interrupters
24.	GPH	Gallons Per Hour
25.	GPM	Gallons Per Minute
26.	HD	Heavy Duty
27.	HID	High Intensity Discharge (ballast)
28.	HM	Hollow Metal (door)
29.	IC	Integrated Circuit
30.	IMC	Intermediate Metal Conduits
31.	I/O	Input/Output
32.	ISOFR	Isophthalic Fire Retardant
33.	kA	Kilo-Ampere
34.	kHz	Kilo-Hertz
35.	kV	Kilo-Volt
36.	kWH	Kilo-Watt Hour
37.	LED	Light Emitting Diode
38.	LPG	Liquid Petroleum Gas
39.	LVDT	Linear Variable Differential Transformer

40.	mA	milliampere
41.	MOV	Metal Oxide Varistor
42.	MPH	Miles Per Hour
43.	MTW	Machine Tool Wire
44.	NCMA	National Concrete Masonry Association
45.	NEC	National Electric Code
46.	NPSHA	Net Positive Suction Head Available
47.	NPSHR	Net Positive Suction Head Required
48.	NPT	National Pipe Thread
49.	NRP	Non Removable Pins
50.	NRV	Non Return Valve
51.	PM	Preventive Maintenance
52.	Poly VB	Poly Vapor Barrier
53.	POTW	Publicly Owned Treatment Works
54.	PSF	Pounds per square foot
55.	PSIG	Pounds per Square Inch Gauge
56.	PVC	Polyvinyl Chloride
57.	RFI	Radio Frequency Interface
58.	RMS	Root Mean Square
59.	SCADA	Supervisory Control And Data Acquisition
60.	SHC	System Head Curve
61.	SJI	Steel Joint Institute
62.	SPD	Surge/Transient Protection Device
63.	SS	Stainless Steel
64.	SSU	Seconds Saybolt Universal
65.	TDH	Total Dynamic Head
66.	TEFC	Totally Enclosed Fan Cooled
67.	TEFC/S	Totally Enclosed Fan Cooled/Submersible
68.	THW	Thermoplastic (insulation), <b>H</b> = 75 Deg. C, <b>Moisture</b> (resistant), <b>Wire</b>
69.	UEC	Ultrasonic Electrode Cleaners
70.	UPC	Universal Product Code
71.	UV	Ultraviolet
72.	VFD	Variable Frequency Drive
73.	VOC	Volatile Organic Compound
74.	WC	Water Column
75.	WTF	Wet Film Thickness

**1.0703** AS-CONSTRUCTED DRAWINGS: Construction drawings that have been revised based on field surveys of the constructed sewers and other data to show changes made during construction.

- 1.0704** BACKFILL: Soil, rock or other material used to replace, or the act of replacing, soil or rock material removed during excavation and construction.
- 1.0705** CONTRACTOR: The person, firm or corporation with whom the Owner has entered into a written agreement, with attached approved project documents, covering the work to be performed.
- 1.0706** COUNTY: Environmental Services Department (ESD) of Jefferson County, Alabama.
- 1.0707** COUNTY SEWER CONSTRUCTION INSPECTOR: An authorized representative of the Sewer Construction Office of the Environmental Services Department of Jefferson County, Alabama assigned to observe the construction of main sewers, and in some cases the service line from the main sewer to the property line, and advise the Director of the conformance with these Standard Guidelines.
- 1.0708** COUNTY SEWER SERVICE INSPECTOR: An authorized representative of the Sewer Permitting and Inspections Office of the Environmental Services Department of Jefferson County, Alabama assigned to observe the construction of all new service lines, repairs to existing service lines, connections, and disconnections, and advise the Environmental Services Director of the conformance with these Standard Guidelines.
- 1.0709** COUNTY REPRESENTATIVE: An authorized representative of the Environmental Services Department of Jefferson County, Alabama assigned to review proposed sewer system Drawings, coordinate required procedures for approval, and advise the Director of the conformance with these Standard Guidelines.
- 1.0710** DESIGN ENGINEER: The engineer of record who performs detailed design of the sanitary sewer facilities and prepares Drawings and Specifications to be submitted to the County for approval.
- 1.0711** DIRECTOR: Director of the Environmental Services Department of Jefferson County, Alabama or his authorized agent.
- 1.0712** DRAWINGS: The official construction drawings or exact reproduction thereof which show and describe the work to be done.
- 1.0713** EQUIPMENT: All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.
- 1.0714** FILL: A soil or broken rock material or embankment used to provide the bulk required to raise the elevation of an area.

- 1.0715** FORCE MAIN: A pressurized sewer line intended to carry wastewater from a sewer pumping facility to the point where it can flow by gravity.
- 1.0716** INFILTRATION/ INFLOW (I/I): Infiltration shall mean the water entering a sewer system and service connections from the ground, through such means as, but not limited to, broken or cracked pipe, defective pipe joints, improper connections, manhole walls etc. Inflow shall mean the water discharged into a sewer system including service connections, from such sources as, but not limited to, roof leaders, cellars, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, cross connections from storm sewers, surface runoff, etc. The term Infiltration/ Inflow (I/I) shall mean the total quantity of water from both infiltration and inflow without distinguishing the source.
- 1.0717** LABORATORY: The official testing laboratories of the County or such other laboratories as may be designated by the County.
- 1.0718** MAIN SEWER: A pipe or conduit eight (8) inches or larger intended to carry wastewater that is located in a public easement or right-of way. In other documents and publications, the smaller (8 or 10 inch) main sewers may be referred to as “lateral” sewers, “collector” sewers, and “public” sewers. However the basic criteria is the same; any sewer that is 8" in diameter or larger is a main sewer.
- 1.0719** MANHOLE: A junction structure from the surface of the ground to the sewer that allows for changes in direction or grade and that is large enough to enable access for inspection and maintenance.
- 1.0720** MATERIALS: Any substance specified for use in the Work and its appurtenances.
- 1.0721** OR APPROVED EQUIVALENT: Wherever a particular process, material, device, detail, or part is specified herein, followed by these words or by similar or equivalent expressions, such words or expressions shall be understood to mean and permit the use of another process, material, device, detail, or part that the Director shall determine is fully equal in suitability, quality, durability, performance, and in all other respects, to the process, material, device, detail, or part herein specified for such use, and is approved for such use in the work. The decision of whether a particular process, material, device, detail or part is considered equal or not is the sole discretion of the Director.
- 1.0722** OWNER: The term “Owner” shall mean the company, organization, developer or municipality who intends to design and construct the proposed sanitary sewer facilities or improvements. The terms “Developer”, “Owner/Developer” and “Owner” shall be used interchangeably.



- 1.0723** PLANS: The DRAWINGS
- 1.0724** PLUMBING INSPECTOR: An authorized representative of the Inspection Services Department of Jefferson County, Alabama or other municipality assigned to observe the installation of the internal plumbing of a building.
- 1.0725** PRE-QUALIFICATION: All work to be connected to the Jefferson County Sanitary Sewer System shall be constructed by pre-qualified Contractors that have received pre-qualification approval from Jefferson County Environmental Services Department for the various classifications of projects.
- 1.0726** SANITARY SEWER: A sewer intended to carry wastewater.
- 1.0727** SANITARY SEWER SYSTEM: All gravity sewer lines, manholes, force mains, pumping stations, and appurtenances that convey wastewater to the County's wastewater treatment plants.
- 1.0728** SERVICE LINE: Any sanitary sewer line or conduit located outside the building structure that connects the building's plumbing to the main sewer. The service line is usually 4 inches and sometimes 6 inches in diameter, but no larger.
- 1.0729** SHALL: "Shall" is mandatory; "may" is permissive.
- 1.0730** SPECIFICATIONS: A part of the contract documents containing the written directions, provisions, and requirements for completing the work. Standards for specifying materials or testing which are cited in this document by reference shall have the same force and effect as if set out in full in these Guidelines.
- 1.0731** STATE: The State of Alabama.
- 1.0732** STATION: A specific point on the centerline of a sewer main or on the survey baseline designating some specific distance from the point of origin. Stations are numbered in terms of one hundred linear feet measured horizontally.
- 1.07233** STORM SEWER: A pipeline intended to carry rainfall, surface runoff and/or subsurface waters. There is a distinct difference between storm sewers and sanitary sewers. Storm sewers exclude flow from domestic wastewater and industrial waste.
- 1.0734** STORM WATER: Rain water or any sort of runoff that does not come from sanitary sewers.

- 1.0735** STUB OUT: A portion of the service line extended from the main sewer and then capped or dedicated for later use.
- 1.0736** STRUCTURES: Facilities such as bridges, culverts, catch basins, inlets, retaining walls, cribbing, water lines, underdrains, electrical ducts, manholes, lighting fixtures and poles, transformers, flexible and rigid pavements, buildings, vaults, and other manmade features that may be encountered in the work and not otherwise classified herein.
- 1.0737** TAP: The actual connection or opening in the main sewer to allow the wastewater from the service line to enter the main sewer.
- 1.0738** WASTEWATER: Any liquids containing waste matter, originating from residences, commercial buildings, institutions, and industrial establishments together with any extraneous water that may be present, whether treated or untreated, which is discharged into or permitted to enter the County maintained sanitary infrastructure.

**1.0800 Standard Reference Specifications**

- 1.0801** All standard Specifications referenced throughout these Standard Guidelines are to be taken as the latest revision available.
- 1.0802** The following is a partially inclusive list of national standard Specifications referenced in these Standard Guidelines:

**ANSI/AWWA**

- C104/A21.3 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- C110/A21.10 Ductile-Iron and Gray-Iron Fittings for Water, 3 inch through 48 inch
- C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- C150/A21.50 Thickness Design of Ductile-Iron Pipe
- C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast for Water
- C153/A21.53 Ductile-Iron Compact Fittings for Water Service
- C115 Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
- C500 Metal-Seated Gate Valves for Water Supply Service

C502	Dry-Barrel Fire Hydrants
C504	Rubber Seated Butterfly Valves
C507	Ball Valves, 6 inch through 48 inch
C509	Resilient-Seated Gate Valves for Water Supply Service
C600	Installation of Ductile Iron Water Mains and Their Appurtenances
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch
C907	Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 inch through 12 inch

## **ASTM**

A27	Steel Castings, Carbon, for General Application
A36	Carbon Structural Steel
A48	Gray Iron Castings
A53	Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
A82	Steel Wire, Plain, for Concrete Reinforcement
A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A185	Steel Welded Wire Reinforcement, Plain, for Concrete
A197	Cupola Malleable Iron
A276	Stainless Steel Bars and Shapes

A283	Low and Intermediate Tensile Strength Carbon Steel Plates
A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A392	Zinc-Coated Steel Chain-Link Fence Fabric
A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A576	Steel Bars, Carbon, Hot-Wrought, Special Quality
A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
A875	Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process
B108	Aluminum-Alloy Permanent Mold Castings
B209	Aluminum and Aluminum-Alloy Sheet and Plate
B211	Aluminum and Aluminum-Alloy Bar, Rod, and Wire
B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
C31	Making and Curing Concrete Test Specimens in the Field
C32	Sewer and Manhole Brick (Made From Clay or Shale)
C33	Concrete Aggregates
C34	Structural Clay Load-Bearing Wall Tile
C39	Comprehensive Strength of Cylindrical Concrete Specimens
C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C55	Concrete Brick
C56	Structural Clay Non-Load-Bearing Tile
C62	Building Brick (Solid Masonry Units made From Clay or Shale)
C73	Calcium Silicate Brick (Sand-Lime Brick)
C76	Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C90	Loadbearing Concrete Masonry Units
C91	Masonry Cement
C94	Ready-Mixed Concrete
C126	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
C129	Nonloadbearing Concrete Masonry Units
C144	Aggregate for Masonry Mortar
C150	Portland Cement
C171	Sheet Materials for Curing Concrete
C172	Sampling Freshly Mixed Concrete
C216	Facing Brick (Solid Masonry Units Made from Clay or Shale)
C260	Air-Entraining Admixtures for Concrete
C270	Mortar for Unit Masonry
C309	Liquid Membrane-Forming Compounds for Curing Concrete
C330	Lightweight Aggregates for Structural Concrete

C404	Aggregates for Masonry Grout
C443	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C476	Grout for Masonry
C478	Precast Reinforced Concrete Manhole Sections
C494	Chemical Admixtures for Concrete
C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C652	Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C881	Epoxy-Resin-Base Bonding Systems for Concrete
C923	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
C948	Dry and Wet Bulk Density, Water Adsorption, and Apparent Porosity of Thin Sections of Glass-Fiber Reinforced Concrete
D225	Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules
D448	Sizes of Aggregate for Road and Bridge Construction
D698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbs/ft <sup>3</sup> )
D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft <sup>3</sup> )
D1599	Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
D1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D1752	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint

Fillers for Concrete Paving and Structural Construction

- D1784 Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) CPVC Compounds
- D2178 Asphalt Glass Felt Used in Roofing and Waterproofing
- D2244 Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- D2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- D2434 Permeability of Granular Soils (Constant Head)
- D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D2822 Asphalt Roof Cement
- D2863 Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
- D3018 Class A Asphalt Shingles Surfaced with Mineral Granules
- D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- E84 Surface Burning Characteristics of Building Materials
- E154 Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F610 Evaluating the Quality of Molded (Poly Vinyl) Chloride (PVC) Plastic Pipe Fittings by the Heat Reversion Technique
- F959 Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
- F1083 Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

**1.0803** The following is a list of other publications referenced in these Standard Guidelines:

- A. Jefferson County Environmental Services Department (ESD) Publications
  1. Jefferson County ESD Standard Specifications for Sanitary Sewer Service Lines and Connections (Adopted November 10, 1999)
  2. Jefferson County ESD Standards for Construction of Commercial and Residential Sanitary Sewer Systems (Adopted November 10, 1999)
  3. Jefferson County ESD Sewer Use/Pretreatment Ordinance (Adopted May 11, 1982, Amended January 1, 2006)
  4. Jefferson County ESD Sewer Extension & Expansion Policy (Adopted November 9, 2004)
  
- B. State of Alabama Department of Transportation (ALDOT) Publications
  1. Alabama Manual on Uniform Traffic Control Devices
  2. Standard Specifications for Highway Construction
  3. Utility Manual
  
- C. Occupational Safety and Health Administration (OSHA) Publications
  1. Safety
  
- D. American Railway Engineering and Maintenance of Way Association (AREMA)
  1. Specifications for Pipeline

**1.0804** Any reference in the ANSI/AWWA or ASTM standards or specifications to “Owner” or “Purchaser” is to be interpreted as “The County”.

**1.0900 Use of Standard Guidelines, Construction Drawings Review and Approval Process**

**1.0901** The Environmental Services Department, as a department of Jefferson County, AL, operates and maintains the County Sanitary Sewer System and must regulate all proposed additions or changes to the system in order to carry out and accomplish the purpose defined in Section 1.0100. Prior approval of any project affecting the sewer system is required. Construction Drawings and Specifications shall be prepared for all new sewers, pumping stations and other facilities to be built and connected to the County Sanitary Sewer System. In the event that a project is to be built that crosses existing sewers or encroaches on County easements, drawings must be submitted to the County for approval.



- 1.0902** The Owner/Developer shall obtain the services of a Professional Engineer registered in the State of Alabama and experienced in the design of wastewater pumping stations to provide Engineering Design Services. The Design Engineer shall follow the Design Guidelines of Section 2.00 to develop required Reports and Drawings for the proposed pumping station. The Design Engineer shall select the recommended Specification paragraphs included in Section 3.00 Construction Specifications that apply to his project and incorporate them into his project specifications. The Design Engineer shall develop other Specification sections as required and submit them to the County for approval. Electronic copies of Specifications and Standard Drawings are available from the Sewer Plans Review Office. If changes are made to the recommended Standard Guideline Section 3.00 specification paragraphs, the Design Engineer shall note the changes and submit the changes to the County for approval.
- 1.0903** Before beginning design, the Owner or the Owner's Design Engineer shall submit for review and approval a Preliminary Report regarding the proposed pumping station to the Jefferson County Environmental Services Department at the Sewer Plans Review Office. If the report is to be sent by mail, the proper mailing address can be obtained from ESD.
- 1.0904** The Construction Drawings for all sanitary sewer facilities that will connect to the County Sanitary Sewer System or wastewater treatment plants shall be prepared in accordance with requirements of Section 2.0300 and submitted to the Environmental Services Department for approval.
- 1.0905** The Owner or the Owner's Design Engineer shall submit two (2) sets of Pumping Station/Force Main Construction Drawings [with the Final Report attached], Specifications, and one copy of the complete development (subdivision, apartment complex, office complex, etc.) Drawings, to the Jefferson County Environmental Services Department at the Sewer Plans Review Office. If the Drawings are to be sent by mail, the proper mailing address can be obtained from ESD.
- 1.0906** The County Representative will review the Drawings and Specifications submitted and, if necessary, the County will return one (1) set of markup drawings to the Design Engineer for revision and resubmittal.
- 1.0907** The Design Engineer will provide the corrected set of original Drawings and Specifications to the County Representative.
- 1.0908** All main sewers 8" and larger and force mains must be located in sanitary sewer easements dedicated to the County in accordance with Section 2.0400. Easement deeds shall be required for all easements in commercial developments and residential developments that are not dedicated by record Maps. Minimum easement width is twenty

(20) feet, ten (10) feet each side of the sewer centerline. The Owner's Design Engineer shall submit one (1) copy of all required deeds for review, prior to executing.

- 1.0909** A \$10,000 deposit to guarantee submittal of "As-Constructed Drawings", Equipment Warranties, and Operation and Maintenance (O&M) Manuals shall be required before Sewer Pumping Station Construction Drawings are approved. See Section 1.1101.
- 1.0910** The Owner or Design Engineer shall submit the original executed deeds and right-of-way accommodation permits to the Sewer Plans Review Office of the Jefferson County Environmental Services Department. If the deeds/permits are to be sent by mail, the proper mailing address can be obtained from ESD. Deeds will be reviewed by the County Representative and, if acceptable, recorded in Probate Court. The County will not accept deeds recorded by others.
- 1.0911** Upon approval of the Sewer Pumping Station Construction Drawings, the Director will sign all sheets and return them to the Design Engineer. The signature of the Director of Environmental Services indicates review of Construction Drawings for conformance with the "Standard Guidelines for Design of Commercial and Residential Sanitary Sewer Pumping Stations" has been completed.
- 1.0912** The Approval of Sewer Pumping Station Construction Drawings is valid for a period of 180 days. If construction has not begun at the end of 180 Calendar days the approval is void and the Drawings shall be resubmitted for review and approval prior to starting construction. Drawings representing projects for which construction has not begun within 180 days of approval are void unless they bear an updated stamp of approval.
- 1.0913** The Owner/Developer shall obtain services of the Design Engineer to periodically inspect the project construction, review submittals for materials and equipment, and to develop As-Constructed Drawings including revisions made to the Drawings during construction. The Design Engineer shall participate in the final inspection and compile operations and maintenance data to submit to the County.

## **1.1000 Final Project Acceptance**

- 1.1001** The Environmental Services Department will make periodic inspections of the projects while they are under construction. The County will not issue a notice of acceptance for the project until a successful field final inspection, including required testing, has been performed. All work shall be complete and in accordance with these Standard Guidelines. All easements must be deeded correctly and a final set of As-Constructed Drawings submitted. The final decision on the acceptance of the sewer facility shall be made by the Environmental Services Director.

## **1.1100 As-Constructed Drawings, Equipment Warranties, Operation and Maintenance (O&M) Manuals**

- 1.1101** Prior to approval of Construction Drawings, a refundable deposit is required to guarantee submittal of the As-Constructed Drawing(s), Equipment Warranties and Operation and Maintenance (O&M) Manuals. Deposits must be a banking institution cashier's check (referred to by some banking institutions as an Official Check). No personal or company checks shall be accepted. The parties on the check must be reflected as follows: "Jefferson County Treasurer or, (relative party)" (both parties to be separated strictly by the word or). Should there be any questions as to the reflection of all parties on the check, consult with the Environmental Services Department, Sewer Plans Review Office. If check is to be sent by mail, the proper mailing address can be obtained from ESD. The amount of deposit shall be \$10,000.00. In the event the Owner/Developer does not submit As-Constructed Drawings, Equipment Warranties, and Operation and Maintenance (O&M) Manuals, clear written notice of failure to submit will be given, after which the County will use the deposit amount to assure required documents are properly prepared.
- 1.1102** Upon completion of construction, the Design Engineer shall have the project surveyed by a Professional Land Surveyor registered in the State of Alabama to locate the constructed facilities on the As-Constructed Drawing(s). With information from the survey and from construction records, the Design Engineer or Surveyor will make revisions to the approved Construction Drawings, in accordance with Section 2.2000, to accurately show the actual facilities that were installed.
- 1.1103** Project completion documents including final As-Constructed Drawings, Equipment Warranties, and Operation and Maintenance (O&M) Manuals shall be submitted for acceptance at the Environmental Services Department, Sewer Plans Review Office. The County shall require a letter from the Owner/Developer confirming that the As-Constructed Drawings, Equipment Warranties, and Operation and Maintenance (O&M) Manuals have been delivered to the County before the deposit is released.

## **1.1200 Inspection Policy**

- 1.1201** The intent and desire of the County is that all sanitary sewer facilities be constructed in such a manner and under such supervision and inspection that the County shall be assured that acceptable materials are used, specified equipment installed and that appropriate construction standards are observed.
- 1.1202** The Contractor shall be responsible for contacting the Sewer Engineering Construction Office 24-hours prior to beginning work.

- 1.1203** The Design Engineer shall submit two (2) copies of the approved Drawings and Specifications for use by the Environmental Services Inspector. The Design Engineer shall also submit two (2) copies of all approved submittals for equipment and materials for use by the Environmental Services Sewer Construction Inspector. Any variance from approved materials and equipment shall be approved by the Environmental Services Director, or his representative, prior to purchase or installation.
- 1.1204** The County Sewer Construction Inspector may inspect any aspect of the work to ensure conformance with plans and specifications.
- 1.1205** The County Sewer Construction Inspector shall witness all testing of pumping and related equipment before the facility is released for use and/or accepted by the County.
- 1.1206** The County Sewer Construction Inspector shall require that a factory representative be present during any equipment testing operations. Factory representative shall start equipment.
- 1.1207** The Contractor shall be responsible for establishing and paying for temporary or permanent electrical service to be used during testing operations.
- 1.1300 Enforcement Policy**
- 1.1301** When an inspection report indicates the work does not meet the requirements of these Standard Guidelines, the County will advise the Owner/Developer that the work being completed is at risk of not being accepted.
- 1.1302** The County reserves the right to withhold future permits if the work is not brought up to the requirements of the Standard Guidelines.
- 1.1400 Miscellaneous**
- 1.1401** All proposed sanitary sewer facilities, even those not specifically covered herein, shall be submitted to the County for its approval. The County Environmental Services Director shall be consulted before commencing development of construction drawings, regarding specific design requirements for any non-routine sewer facilities including, but not limited to, pumping stations, manholes deeper than twenty feet, tunnels, bores, creek crossings, siphons, and any other unique sanitary sewer facility.

## **1.1500 Permits**

### **1.1501 ALDOT**

For any sanitary sewer facilities proposed to be installed within State highway right-of-way, the Alabama Department of Transportation (ALDOT) requires a Right-of-way Accommodation Permit. The Design Engineer or Owner/Developer shall prepare, for the County to execute, all required Right-of-Way Accommodation Permits. Currently the State requires that the County, rather than any private party or Owner/Developer, submit the application for permit agreement. The project Owner/Developer must enter into an agreement with the County accepting responsibilities imposed by the State. (This requires County Commission Action.) The Owner/Developer is responsible for performing all duties imposed on the County by the State. The County's involvement in the process is strictly limited to the submittal of the application. The Design Engineer and/or Owner/Developer is responsible for the accuracy of all information conveyed on the permit application. Further the County is not responsible for the State revoking an Accommodation Agreement after it has been issued. Any inquiries concerning this matter should be directed to the Environmental Services Department, Sewer Plans Review Office.

### **1.1502 Railroads**

In the event a proposed sanitary sewer facility is to be located within existing railroad right-of-way, the Design Engineer or Owner/Developer must contact said railroad. The Owner/Developer may be required to file for a permit as well as enter into an agreement with the railroad that details all duties that are imposed on the Owner/Developer by said railroad. All documents between Owner/Developer and railroad shall be included with the sewer construction drawings at the time they are submitted for County review and approval. An Owner/Developer should be advised that approval of sewer construction drawings can be delayed and/or denied if any language in the documents between the Owner/Developer and the railroad is found to restrict the County's ability to properly maintain and operate said proposed sanitary sewer facilities, or if the language contains any indemnification or hold harmless clauses the County will be prohibited from entering into. Any costs such as crossing fees imposed by the railroad shall be paid by the Owner/Developer.

### **1.1503 Utilities**

In the event a proposed sanitary sewer facility is to be located within existing utility right-of-way, the Design Engineer or Owner/Developer is required to contact said utility. The Owner/Developer may be required to file for a permit as well as enter into an agreement with the utility that details all duties that may be imposed on the Owner/Developer by said

utility. All agreement documents between Owner/Developer and utility are to be included with the sewer construction drawings at the time they are submitted for County review and approval. The Owner/Developer should be advised that approval of sewer construction drawings can be delayed and/or denied if any language in the documents between the Owner/Developer and the utility is found to restrict the County's ability to properly maintain and operate said proposed sanitary sewer facilities, or if the language contains any indemnification or hold harmless clauses the County will be prohibited from entering into. Any costs imposed by the utility shall be paid by the Owner/Developer.

## **1.1600 Ownership**

**1.1601** Upon completion of the work including, but not limited to, sewer main extensions, pumping stations, and other approved facilities, and their acceptance by Jefferson County, such work shall become the property of the County. The persons paying the cost of constructing such facilities shall execute any written instrument requested by the County to provide evidence of the County's title to the facility. In consideration of such facility being transferred to the County, the County shall incorporate said facilities as an integral part of the County sewer system and shall furnish sewer service access in accordance with the County's rules, regulations, and rate schedules, subject always to such limitation as may exist because of the size, elevation and capacity of such sewer mains, pumping stations and other facilities.

## **Section 2.00**

### **Design Guidelines for Sanitary Sewer Pumping Stations**

#### **2.0100 General**

- 2.0101** These Design Guidelines for Sanitary Sewer Pumping Stations are for residential or commercial sewer projects located within Jefferson County, AL where existing gravity sewers are not available for direct discharge, where sewers may not be extended to serve the subject property, or where drainage topography flows into another County. Commercial and Residential Owners may propose to construct a pumping station and force main sewer to transport the wastewater to the Jefferson County Sanitary Sewer System. Because of the continuous costs of maintenance, operation and utilities, installation of a pump station will be considered only as a last alternative to provide sewer service to the proposed area. Before beginning a design, a Preliminary Report shall be submitted to the County listing reasons or justification behind proposing the construction of a pumping station. Pumping stations that connect to the County sanitary sewer system shall be dedicated thereto, and shall be designed and constructed according to all criteria established herein. Since criteria may require designing a station adequate to serve properties outside the project limit to accommodate future connections, the Owner/Developer must decide from construction cost estimates the economic feasibility of the project.
- 2.0102** Jefferson County will assume operation and maintenance of approved pumping stations, therefore the pumping station and force main must be located, sized, and constructed to serve the entire sewer drainage area. Any pumping station that does not serve the entire sewer drainage area must be approved by ESD prior to beginning design of the pumping station.
- 2.0103** In situations where a facility must be constructed to serve areas outside of the proposed development, the Owner/Developer may contact the County to determine if County participation may be available. County or Municipal participation in a project shall require bidding the work in accordance with Alabama State Law. County participation will be in accordance with the County's Sewer Extension and Expansion Policy.
- 2.0104** The Owner/ Developer shall obtain the services of a Professional Engineer, registered in the State of Alabama, and experienced in the design of wastewater pumping stations to provide Engineering Design services. The Design Engineer shall perform periodic construction inspection to assure compliance with specifications and design.
- 2.0105** The Design Engineer must be knowledgeable of the minimum design standards, laws and

regulations relating to the project. The Design Engineer shall obtain County approval of project Drawings and Specifications before issuing documents for construction.

**2.0106** The Owner/Developer shall contract with a General Contractor, having previous experience and qualifications for the type/classification of work to be performed and licensed in the State of Alabama, to construct the project according to the Drawings and Specifications. Contractor shall also be pre-qualified by ESD. The Contractor or Design Engineer will be responsible for coordinating inspections of the work required by the County for final acceptance. The Owner/Developer will contract with the Design Engineer to review and approve shop drawings and submittals supplied by the Contractor. Equipment and materials differing from the County approved specification item shall be submitted to the County for approval before returning the submittals to the Contractor. Two (2) copies of each approved final submittal shall be furnished to the County's designated representative.

**2.0107** Minimum standards for wastewater pump station design specified herein represent good minimum design practice and ensure uniformity throughout the County sewer system.

## **2.0200 Preliminary Report and Final Report**

**2.0201** Before beginning design of a sanitary sewer pumping station, the Owner shall submit a Preliminary Report for the County's approval. Preliminary reports shall be submitted to the Sewer Plans Review Office and shall contain the following information:

- A. The Owner's name, address, and telephone numbers.
- B. The Design Engineer's name, address, and telephone number and a list of qualifications with design of similar projects.
- C. A map with a minimum of the detail typical of a 7.5 minute U.S.G.S. topographic map of the area extending to the limit of the topographic drainage area of the property to be served.
- D. The Township, Range and Section.
- E. An outline of the boundary of the property being served.
- F. Location of existing sewers, the proposed pump station, force main and connection to existing sewer.
- G. Justification that the property cannot be served by gravity sewers and that construction of a pumping station is necessary.



- H. Reasons Owner wishes to provide sewer service to property.
- I. Information on type of property development, estimates of flow quantity, future development, and capacity of receiving sewer to carry proposed flow.
- J. Initial and ultimate sewer flows including average daily and peak daily flows.
- K. Location of existing utilities to serve the requirements of a pumping station. The County requires 480V, 3 phase, 60Hz electric power service and potable water service. The County requires natural gas service, where available. See Section 2.1743 for alternative fuel supply.

**2.0202** When authorized to proceed with designing a pumping station, the Design Engineer shall develop a Final Report to include all the above information and the following design calculations. The Final Report shall be attached to the Drawings submitted for approval.

- A. Design Calculations
  - 1. Flow calculations
  - 2. Performance Pump Curves with system head curve plotted to indicate operating point. The impeller size for the performance curve should be indicated. Operating points shall be indicated for both initial and ultimate conditions. Include criteria used in performing the calculations.
  - 3. Schematic of wet well
    - a. Size
    - b. Operating levels
  - 4. Sizing of Force Main indicating minimum velocities.
  - 5. Locations of air/vacuum and check valves.
  - 6. Adequacy of utility service for natural gas fuel, pressure and quantity at maximum rated output (if required).
  - 7. Buoyancy calculations for Structures for prevention of uplift. See Section 2.1602.
- B. Evaluation of Receiving Sewers
  - 1. Submit an evaluation of the receiving capacity of the downstream sewer system including pumping stations.
    - a. Compile information from As-Constructed records of the existing system.
    - b. Evaluate initial and future conditions for all key downstream sewer reaches, manholes, pump stations and force mains.
    - c. Submit calculations indicating all required changes in operating characteristics of existing pumping stations, equipment, wet wells and force mains.

## 2.0300 Contents of Construction Drawings

2.0301 Sewer Pumping Station Construction Drawings shall be prepared under the direct supervision of a Professional Engineer registered in Alabama and stamped, signed and dated by said registered engineer. Construction Drawings submitted for approval shall contain the following items.

- A. A Land Tie stamped, sealed and dated by a Professional Land Surveyor registered in Alabama shall show the location of the center line or manhole of sanitary sewer in relation to section line, quarter section line, or quarter-quarter section line using two verified monuments and labeled as applicable. Ties made within platted subdivisions may be made to lot lines when the Land Surveyor deems that this is the best and most reproducible tie that can be made. Properties that rely on meets and bounds descriptions should be tied in a manner similar to their deed calls. Direct ties should be made whenever possible. The Land Tie shown on Standard Drawing SD1 shall be used as an example (See Standards for Construction of Commercial and Residential Sanitary Sewer Systems). Alignment and property surveys required for right-of-way acquisitions shall meet the requirements of the Rules as outlined in the **Standards for Surveying in the State of Alabama**. Closure data for both Horizontal and Vertical Control shall be submitted to the Sewer Plans Review Office for review and verification.
- B. Each Drawing sheet shall contain the name of the project, and the name(s), address, and telephone numbers of the Owner/ Developer(s), and the name of the Design Engineer.
- C. Drawings shall be prepared using standard drafting practice on 24"x 36" sheets. Sewer drawings shall be on 24"x 36" half plan/profile sheets. The profile grid shall have 1"=50' (H) and 1"=10' (V) scales.
- D. Drafting media for initial submittal of drawings shall be 4 mil polyester drafting film, premium bond paper or tracing paper of reproducible quality.
- E. Preliminary Drawings shall be in reproducible black, blue-black ink or pencil. Final Drawings submitted for approval shall be in permanent ink only.
- F. The minimum text height shall be 0.1 inch and text shall be legible.
- G. Pumping Station plans, sections and elevations shall be drawn to the scale of 1/4 in. = 1 ft. if practical. If other scales are more prudent or applicable, they shall be so indicated on the drawing. Adequate sections and details shall be

shown to clearly indicate required dimensions and elevations. Plan and profile of proposed sewer system shall be on the same sheet, drawn at 1"=50' (H) and 1"=10' (V) scales. Grades shall be shown in percent (%) and indicated between each manhole. Both invert and existing profile elevations shall be indicated at every 50 ft. station. The flow line elevation of each line entering and exiting a manhole shall also be shown.

- H. Sheets shall be properly numbered, indicating "Sheet \_\_\_\_\_ of \_\_\_\_\_".
- I. All symbols shall conform to the standard symbols indicated on Standard Drawings No. SD3, SD4, SD5 and SD6. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems for Standard Drawings.
- J. Standard Detail Sheet(s) shall be included in the project Drawings and shall be in prepared accordance with the Standard Drawings attached in the Appendix herein.
- K. Stationing for both the plan and profile views shall commence at the left of the sheet at the lowest point of the sewer and continue upstream to the right across the sheet. A maximum of 1,200 linear feet of sewer may be shown on each sheet.
- L. Standard Notes as shown on Standard Drawing SD2 in Standards for Construction of Commercial and Residential Sanitary Sewer Systems shall be shown on at least one of the Plan/Profile Drawings.
- M. Pipe material shall be shown between each manhole and where a pipe material change occurs. Concrete collars, if required, shall be shown on the Drawings.
- N. County reference number, station location, size, direction of flow, and pipe material of all existing sewers shall be indicated on the Drawings.
- O. Direction of flow for each proposed sewer line shall be shown.
- P. Horizontal station location of all manholes, deflection angles at manholes, distance between manholes, angles to existing sewers and other system features shall also be shown.
- Q. North arrows shall be indicated on site plans and on each sewer sheet.
- R. An Alabama registered Professional Engineer's seal, signature and date shall be affixed to each sheet. An Alabama Registered Land Surveyor's seal and

signature shall be affixed to each sheet that indicates right-of-way or property boundaries.

- S. Temporary Bench Mark elevation based on U.S.G.S. Datum shall be shown and properly identified on the appropriate sheet.
- T. All topographic features, both existing and proposed shall be shown. Examples include, but are not limited to, storm sewers, drainage ditches, creeks, utilities, etc. In profile, the existing ground shall be shown as a dashed line, and the proposed ground shall be shown as a solid line.
- U. All property lines, subdivision block and lot numbers, rights-of-way, and required or utilized easements shall be shown. All sanitary sewer easements, both those to be dedicated by record map and those to be dedicated by recorded deed shall be shown. Easements dedicated by plat shall contain the following statement on the plat: "Easements for sanitary sewer lines, if not previously dedicated to Jefferson County, AL it's successors and assigns, are for construction and access in the installation and maintenance of sanitary sewers and their appurtenances only".
- V. Section information (quarter section, township, and range) shall be shown on each sheet near the title block.
- W. Streets shall be shown and named or numbered.
- X. Service lines and connections shall be shown and stationed. The Drawings shall require that the Contractor furnish the Design Engineer a videotape survey of the constructed sewer.
- Y. Location of air/vacuum valves, check valves, and cleanouts shall be shown and stationed.

## **2.0400 Easements, Right-of -Way and Property Deed Descriptions**

**2.0401** Easements and/or property required for gravity sewers, force mains, and pumping stations which will not be transferred to the County by record map must be described and deeded to the County. Easements for residential construction can be transferred by record map. Easements not within the boundary of said record map shall be transferred by deed to the County. Commercial and apartment property shall have deeded easements and cannot be transferred by record map. Property descriptions shall be prepared utilizing field surveys (completed by a Professional Land Surveyor registered in Alabama) of the land tie, properties being transferred, and the project sewer alignment.

**2.0402** Deeds shall be prepared on Jefferson County standard deed forms, copies of which may be obtained from the Sewer Plans Review Office. The project name shall be indicated on the front top left of the deed, and the preparer's name and address shall be indicated on the front top right of the deed.

**2.0403** Property descriptions shall locate the property by commencing with a monumented land tie as required in paragraph 2.0301 A. It shall then traverse from the land tie to the centerline of the project sewer alignment, then along with the centerline sewer alignment to the point of beginning of the property being described, then along with the centerline sewer alignment to the point ending the property being described. Strip deeds for right-of-way and easements shall indicate the property being described relative to the sewer centerline alignment by indicating the right-of-way width and offset from the centerline. The minimum easement width is twenty (20) feet, ten (10) feet each side of the sewer centerline. Property parcels for facility sites shall continue with the above sewer alignment and then with a closed traverse around the boundary of the parcel. Where lines are curved, the significant elements of the curve shall be described.

**2.0404** Dimensions for descriptions shall be formatted as follows:

- A. Distances shall be horizontal, indicated in feet to two decimal places.
- B. Angles shall be in degrees, minutes, and seconds to the nearest second. Angles shall be indicated as deflecting to the left or right (i.e., deflection angle, delta angle, exterior angle) from the direction of the previous course. Azimuths and bearings will not be accepted as angular measurements.
- C. Area shall be shown in acres to two decimal places.

**2.0500 General Design Criteria**

**2.0501** All Residential and Commercial sanitary sewer facilities shall be designed in accordance with these Standard Guidelines.

**2.0502** Design flows shall be calculated based on the guidelines of paragraph 2.0600.

**2.0503** Unless otherwise approved by the County, the system Total Dynamic Head (TDH) for wastewater force mains shall be limited to 100 feet of head. Total Dynamic Suction Head shall be less than 18 feet. On a case-by-case basis, depending on site conditions and pipe material, C-Factors of 120 to 140 shall be used to determine dynamic head losses.

**2.0504** The NPSHR shall be calculated at 1.2 times the manufacturer's recommendations when

based on clean water. The NPSHA shall be 10% higher than 1.2 times the manufacturer's recommendation when based on clean water.

**2.0505** Pumping into an existing forcemain or existing pumping station wet well will not be allowed unless specifically approved by the County.

**2.0506** Building designs shall comply with all local regulations, building codes, subdivision covenants, subdivision review committee requirements, etc.

## **2.0600 Quantity of Sanitary Sewage**

**2.0601** The County provides sewer service access to carry wastewater to a treatment facility for treatment. In the interest of keeping this volume to a minimum, all waters not requiring treatment at a publicly owned treatment works (POTW) must be excluded from the sewer system. Therefore, connections of roof, yard, and foundation drains to the sanitary sewer system are strictly prohibited.

**2.0602** The required sewer capacity must be determined from careful analysis of the present and probable future quantities of domestic, commercial, institutional, and industrial wastewater.

**2.0603** Developments having sewer systems and anticipating future growth in upper reaches of the entire sewer drainage area must develop a long range plan for the installation of sewer facilities. The plan must consider the entire sewer drainage area for sewer extension/expansion projects.

**2.0604** Sanitary sewers shall be designed to carry the flow from the estimated ultimate tributary population.

**2.0605** Estimated design flows shall be determined and submitted to the Environmental Services Department for approval as follows:

- A. Average Daily Flows shall be calculated using the following criteria:
  - 1. Not less than 100 gallons per person per day calculated for single family residential areas at 7 persons per acre and in apartment complexes at 17 units per acre, 3.5 persons per unit.
  - 2. Average sewer flows from institutional, commercial and industrial establishments shall be determined from a study of similar establishments and submitted to the County for review and subsequent approval. Commercial volume of flow shall be computed on the basis of 20 people per acre and 50 gal. per person over a 16 hour period.
  - 3. Allowance shall be made for vacant lots and property in consideration

of existing development patterns, trends, and engineering judgement.

- B. Gravity sewers shall be designed using Kutter's approximation of Manning's formula to flow  $\frac{1}{2}$  full at peak flow. The peak flow shall be calculated by applying a peaking factor of 3 to the Average Daily Flows.

## **2.0700 Pumping Station Classifications**

**2.0701 Small Wastewater Pumping Stations; Less than 200 GPM** - Small pumping stations to serve areas where the peak flow is less than 200 GPM shall require a minimum of two pumps of the submersible or submersible chopper type. All pumps shall have a minimum capacity of 100 GPM and pass a minimum 3" solid, unless approved by the County on a case-by-case basis. Pumps proposed to serve facilities such as hospitals, nursing homes, jails etc. that typically discharge higher solids material shall be the chopper type. Wet wells shall be precast concrete meeting the requirements of Section 3.0240. A standby engine driven generator set shall be provided. It shall be equipped with a sound attenuating enclosure as approved by the County. At locations where natural gas service is available, the County shall require standby generator/pump engines to be natural gas fueled; otherwise liquefied petroleum gas (LPG) or diesel fueled engines may be approved on a case-by-case basis. Fuel system storage tanks shall provide a minimum of three days running requirement and comply with all regulations for storage of fuel.

**2.0702 Intermediate Wastewater Pumping Stations; 200 GPM to 600 GPM** - Intermediate pumping stations, to serve residential subdivisions, apartment complexes, commercial developments, or small industries require a prepackaged/factory built station with a minimum of two pumps of the flooded suction type or self-priming suction lift type. Prepackaged flooded suction stations shall be located underground. Prepackaged suction lift stations will be located in a masonry building as approved by the County. On a case-by-case basis the County may consider prepackaged suction lift stations with an above ground enclosure. Submersible pumps, that are located in the wet well, are prohibited for pumping stations when flows exceed 200 GPM. From information in the Preliminary Report, the County will decide if sewage grinder equipment will be required. Even if grinders are not required in the original construction, wet wells for intermediate size stations shall be designed to allow for future installation. A standby engine driven generator set shall be provided. It shall be equipped with a sound attenuating enclosure as approved by the County. As an option to a standby generator, a built in engine may be provided for standby service. At locations where natural gas service is available, the County shall require standby generator/pump engines to be natural gas fueled, otherwise, petroleum gas (LPG) or diesel fueled engines may be approved on a case-by-case basis. Fuel system storage tanks shall provide a minimum of three days running requirement, and comply with all regulations for storage of fuel.

- 2.0703 Large Wastewater Pumping Stations; over 600 GPM** - Larger wastewater pumping stations, over 600 GPM, require County approval on a case-by-case basis.
- 2.0704** Only pumping stations utilizing 480Volt 3 Phase current will be approved. Where 480 Volt power service is not available from the local electric utility, the County may approve 208 Volt 3 Phase or 240 Volt 3 Phase equipment on a case-by-case basis. Where served by Alabama Power Company; engineers may contact the Industrial Accounts Manager [Telephone No. 205-226-1031].
- 2.0800 Pumping Station Site**
- 2.0801** Site selection for the station will involve a comprehensive study of the entire area to be served. Careful attention should be given to future growth because the location of the pump station will often determine the overall development of the area.
- 2.0802** Topography - A study of downstream topography must be made to decide if constructing a gravity sewer can eliminate the station.
- 2.0803** A study of elevations involved will determine required station finished grades and depths to prevent flood damage or flotation of structure. Finished grade elevations of all pumping station appurtenances, including the access road, must be above the 100-yr. flood stage. All stations must be designed to withstand flotation. Station overflow pipes are prohibited.
- 2.0804** Where stations are proposed near developed areas, the building appearance must be similar to that of adjacent buildings. All stations shall be protected against vandalism by constructing fencing. On a case-by-case basis, the County may require privacy type walls or fencing. See Standard Drawings SD4000, SD4006 and SD4007.
- 2.0805** Utility service shall be provided for proposed equipment including 480 volt, 3 phase power service and potable water. Natural gas shall be provided if available.
- 2.0806** Standby generators or engine driven pumps shall be provided to insure continued operation.
- 2.0807** The size and layout of the site shall be approved by the County as adequate for equipment access. The site layout shall provide a turn around for maintenance vehicles. The minimum size site of 0.1 acres of usable area shall be provided.
- 2.0808** Careful attention in design shall be given to controlling odors and noise. Noise control and suppression shall be required.



- 2.0809** Provide a permanent asphalt paved access road with dedicated right-of-way to the pumping station site. Design criteria for the road shall meet the requirements of the standard specifications of the governing body in which the road is located. The minimum pavement width shall be 14 feet and the maximum grade shall be 15%. The site layout shall provide a turn around for maintenance vehicles. Any exception must be approved by the County in writing on a case-by-case basis.
- 2.0810** The station site and access road shall be surveyed by a Professional Land Surveyor registered in Alabama and designed by a Professional Engineer registered in Alabama. Property shall be recorded and dedicated for the facility.
- 2.0811** Provide automatic dusk to dawn site lighting with manual switch for nighttime maintenance.
- 2.0812** Provide freeze protected 1" hose connections for cleaning.
- 2.0813** Provide that the site be grassed and landscaped to an appearance similar to adjacent property.
- 2.0900 Pumping Station Capacity**
- 2.0901** Capacity shall be determined by a comprehensive study of the sewer drainage area being served. Requirements for determining present and future wastewater quantities are covered in Section 2.0600 of these Standard Guidelines.
- 2.0902** Pumping Station structures and piping shall be designed to accommodate initial flow as well as the full flow capacity of the incoming gravity sewer. Effects of initial minimum flow conditions shall be estimated to ensure that retention of sewage in wet well will not create a nuisance and that pumping equipment will not operate too infrequently. Allowances shall be made so that additional or larger pumps may be installed later as required.
- 2.0903** Initial pump equipment shall be designed to pump the peak flow utilizing only one (1) pump. The second pump shall be for standby purposes only, but shall alternate with the first pump.
- 2.0904** Station capacity shall be adequate to meet the maximum rate of flow. The existing gravity sewer, force main, or pump station that the proposed pumping station is to pump to must have adequate capacity to handle the additional flow. This determination is at the sole discretion of the County. Discharge directly to another force main or pumping station wet well shall be prohibited unless specifically approved by the County.

**2.0905** To minimize operating expense, pumping equipment shall be selected to perform at maximum efficiencies under average flow conditions.

**2.1000 Wet Well Design**

**2.1001** Pumping station wet well shall be precast concrete with stainless steel manhole joint straps in accordance with Section 3.0240.

**2.1002** The selection of proper wet well storage capacity is critical because it affects the length of time liquid will be retained in the station and the frequency of operation of the pumping equipment.

**2.1003** The shape of the wet well and the detention capacity provided will be such that deposition of solids is reduced and sewage does not become septic. The cycle of operation for each pump will not be less than that recommended by the pump manufacturer and, to prevent septicity, the maximum retention time in a wet well shall not average more than 30 minutes. Pump run time shall not be less than that recommended by the pump manufacturer.

**2.1004** The bottom of the wet well will slope a minimum of 1:1 to the distance of one pipe diameter from the pump inlet.

**2.1005** The pump inlet pipe shall be horizontal where practical so that an inflatable plug can be installed if required for maintenance.

**2.1006** Provide a minimum of 2 feet freeboard from the high water alarm level to the invert of the incoming sewer.

**2.1007** Provide isolation valves on both the incoming gravity sewer to the wet well and the discharge force main. The valves shall be located in manholes and installed with an extension stem extending to within approximately two feet of the manhole cover.

**2.1008** Provide adequate access to the wet well for cleaning, inspection, and to allow for future installation of sewage grinding equipment.

**2.1009** Provide vent piping to allow entrance and exit of air as the liquid in the wet well rises and falls.

**2.1010** Provide anchoring weight adequate to prevent flotation of structures.

**2.1011** On a case-by-case basis, sewage grinders may be required. From information in the Preliminary Report regarding the type of service area, the County will decide on the need

for grinding equipment to be installed. If not required with the original construction, the structure of all wet wells and appurtenances shall be designed to accommodate future installation of grinder equipment or submersible chopper pumps. Also see Section 2.0701, 2.0702, 2.1008, and 2.1103.

**2.1012** Provide corrosion protection coating over the entire surface of the wet well per Section 3.0918 C.3.

**2.1013** Miscellaneous metals located in the wet well, including guide rails, pipe hangers equipment mounts, cables, chains, etc. shall be stainless steel.

**2.1014** For emergency pump connection provide a 6" DIP suction pipe with 4" quick connect fitting and cap.

**2.1100 Pumping Equipment**

**2.1101** Where practical, the Design Engineer shall propose Factory Built Pumping Stations with, at a minimum, the features and accessories specified in Section 3.1100, Equipment. The manufacturers named in Section 3.1100 shall manufacture pumping equipment. Unless otherwise approved, all above ground equipment shall be located in a masonry building as approved by the County.

**2.1102** A minimum of two pumps are required.

**2.1103** Submersible pumps installed in wet wells shall be centrifugal or chopper type selected for range of head and capacity. All pumps shall have a minimum capacity of 100 GPM and pass a minimum 3" solid or be chopper type pump. Pumps serving facilities such as hospitals, nursing homes, jails, etc. that are known to discharge high solids waste shall be the chopper type.

**2.1104** Due to difficulty of maintenance and high repair costs, submersible pumping stations will be approved by the County only for capacity requirements of less than 200 GPM.

**2.1105** Self-priming pumps shall be horizontal, self-priming, non-clog sewage pumps designed so the rotating element can be withdrawn without disturbing the suction or discharge piping. Pumps shall be capable of repriming without benefit of a suction check valve and with an empty suction leg when operating at the rated speed.

**2.1106** Flooded suction pumps 4" and larger will be the standard non-clog centrifugal type capable of handling raw sewage, a minimum three inch solid and selected for range of head and capacity. Submersible type non-clog pumps installed in dry pit will be required at locations prone to flooding of the station.

- 2.1107 Pump casing shall be cast iron unless special application such as grit or corrosive flow requires other material.
- 2.1108 Pump impellers shall be constructed of cast ductile iron.
- 2.1109 Pump shall have hard metal wear rings between stationary and rotating parts.
- 2.1110 Pump seals shall be a redundant sealing system, an outboard seal and a completely independent inboard seal; Silicon, or Tungsten Carbide. Seals shall be available from more than one source. Seals shall either be oil lubricated or be pressured and lubricated by water taken from the pump volute and passed through a filter that will screen out solids larger than 50 microns.
- 2.1111 Pump bearings may be sealed/shielded (permanently lubricated) or open (regreasable with anti leak lubrication ports) with a minimum B10 life of 40,000 hours.
- 2.1112 Pump Selection.
- A. The number of pumps to be installed in a station will depend largely on the station capacity and range of flow. A minimum of two pumps is required in any station. In a two pump station each pump shall be capable of pumping the peak flow.
  - B. Pump stations near treatment works shall be designed with consideration for the adverse effect of sudden or wide ranging variations in flow.
  - C. Pumps shall operate within  $\pm 10\%$  of the Best Efficiency Point (BEP), as determined by the intersection of the pump performance curve and the System Head Curve (SHC) under all operating conditions.
  - D. Provide a manufacturer's pump curve and system curve for pumps selected.
- 2.1113 The project Owner shall require equipment suppliers/manufacturers to transfer equipment warranties to Jefferson County.
- 2.1200 Standby Engine Driven Pumps**
- 2.1201 As an option to providing engine driven standby power generators for standby pumping capacity in event of power failure, an engine driven self-priming pump may be installed. Where natural gas is available, engine driven pumps shall be fueled with natural gas; otherwise, diesel fueled or LPG engines may be considered on a case-by-case basis.

- 2.1202** Standby pumps will be in addition to the required electric powered pumps with pumping capacity equal to the peak flow.
- 2.1203** The pumps shall be skid mounted for permanent installation complete with low voltage controls and starting system.
- 2.1204** Standby pumps shall be heavy-duty fully automatic self-priming type, capable of handling 3 inch solids in effluent containing high proportions of solids and unscreened sewage. The pump shall be fitted with a fully automatic priming system capable of priming at the station elevations. The pump shall be capable of running completely dry for unlimited periods of time.
- 2.1205** Pump and piping system shall provide for winterizing freeze protection.
- 2.1206** Engine will be natural gas, propane gas, or diesel fueled as approved, complete with oil and air filtration, and 12 volt electric start equipment. The engine shall be supplied complete with oil pressure, water and temperature gauges, tachometer and hour meter.
- 2.1207** The engine shall be equipped with automatic safety shut down and low oil pressure, water, and high temperature alarms.
- 2.1208** Standby pump controls shall start pump on a high water level sensor and stop pump at low water level. Provide a contact in the control panel to transmit a pump run alarm.
- 2.1300 Pump Drives**
- 2.1301** Except when provided for standby pumping capacity, pump drives shall be electric motors of the constant speed, squirrel cage type selected for proposed pumps, and shall be the appropriate horsepower and speed.
- 2.1302** Provide drive shaft or pulley configuration required by the station and pump type selected.
- 2.1303** Pump motors shall be sized such that they shall not overload at any point on the pump curve. Motors shall have a 1.15 service factor. The service factor will be reserved for the Owner's protection.
- 2.1304** The motors shall be fitted with heavy-duty lifting eyes, each capable of supporting the entire weight of the motor.

## **2.1400 Valves and Station Piping**

### **2.1410 Piping**

**2.1411** Pump station piping will be sized so that velocity will be not less than 2 feet per second (fps) or exceed 4 fps. in the suction line and 8 fps. in the discharge piping. Minimum piping size shall be 4" diameter.

**2.1412** Reducers on the suction side of the pump shall be eccentric and installed with the top flat to prevent entrapment of air in the suction line.

**2.1413** Fittings shall be flanged Ductile Iron in accordance with ANSI/AWWA C110/A 21.10 and C115/A21.15 Standards. Flexibility is essential in laying out flanged piping. Provide flexible couplings so that tolerances in piping may be taken up in flexible joints.

**2.1414** Since solids settle in vertical risers, pump discharge piping shall not connect into the station header pipe from the bottom.

**2.1415** To assure that no undue strains are induced to piping, proper hangers and supports shall be provided. Particular attention must be paid to proper blocking and pipe restraint where hub end or flexible joints are used.

**2.1416** Provide ports for drain valves to be installed at all low points and air release valves to be installed at high points in piping.

**2.1417** Wall Penetrations shall require modular seals with wall sleeves. Provide Link-Seal Modular Seals with the manufacturer's recommended sleeves at all wall penetrations.

### **2.1420 Valves**

**2.1421** Station valves shall be located in a dry vault or manhole.

**2.1422** Flow isolation valves in prepackaged pumping stations shall be standard valves of the manufacturer that meet minimum requirements of gate valves AWWA C500 or C509 or eccentric plug valves AWWA C507 and C504.

**2.1423** Yard valves and valves in constructed vaults shall be eccentric plug valves meeting AWWA C507 and C504.

**2.1424** Check Valves shall be the cushioned gravity swing type equipped with levers, weights, and air cushion chamber adjustable for controlling closure. Unless otherwise approved, check valves should be installed in horizontal runs. Excessive surges due to water

hammer shall be prevented.

**2.1425** A combination Sewage Air Release/Vacuum Valve, installed in a manhole vault is required at all high points in the hydraulic profile.

## **2.1500 Force Mains**

**2.1501** Force mains deliver wastewater discharged from a pumping station to a discharge that is generally a higher point in the sewer system. The size of the force main shall be determined only after a comparative study of construction and pumping costs for several practical sizes. Velocities in pipe larger than 4 inches shall be 2 fps. minimum and 8 fps maximum.

**2.1502** Force main alignment and grade shall generally be straight reaches utilizing manufactured fittings to change direction when required. Utilize maximum bend angles of 45 degrees. No ninety degree fittings will be allowed. Deflecting joints to accomplish changes in direction will not be allowed unless otherwise approved by the County.

**2.1503** Cleanouts shall be installed in both upstream and downstream directions, at all low points and a maximum of 400 feet apart. See Standard Drawing SD2080. The top of all cleanouts shall be placed a minimum of 4 inches below grade and shall be marked.

**2.1504** Combination sewage air/ vacuum release valves shall be installed at all high points along the force main, at changes in downward slope and other points as recommended by the manufacturer or as required by the County. A maintenance valve assembly shall be installed at low points in the pipe profile to allow pumping the pipe capacity into storage containers for pipeline maintenance. See Standard Drawing SD2071.

**2.1505** Force mains shall be constructed and tested in accordance with Section 3.0230 of these Specifications.

**2.1506** Selection of pumping equipment shall consider force main requirements to transport flow from the station wet well to the receiving sewer including flow rate, flow velocity, length of main, bends in main, equivalent length, pipe material, pressure class, coefficient of friction, elevations, head losses, surge pressures, working pressure, high points in main and placement of air release valves.

- 2.1507**
- A. All Force Mains shall be 4" minimum diameter Thickness Class 52 Ductile Iron Pipe, or AWWA C900 Class 150, DR18, PVC Pipe.
  - B. All fittings shall be Ductile Iron, or PVC of the same size and pressure rating as the pipe.

- C. Force mains crossing storm drains, creeks, or ditches shall be ductile iron pipe. If a force main is running parallel to a storm drain, ductile iron shall also be used.
- D. Force mains that are to be constructed with less than 30 inches of cover shall be submitted to the County for approval on a case-by-case basis and shall be ductile iron pipe.
- E. In areas that have been filled and the proposed force main will be within the fill, ductile iron pipe with restrained joints shall be used.
- F. All sewers requiring concrete bedding or encasement shall be ductile iron.
- G. All carrier pipes installed in a bore or tunnel shall be ductile iron.
- H. All sanitary sewers located in mobile home parks shall be ductile iron pipe.

**2.1508** All force main sewers shall be stenciled to identify “Force Main Sewer”. PVC force mains shall be installed with identifying locator tape.

**2.1509** Unless otherwise required by the right-of-way accommodation Permit, pressure sanitary sewers shall have a minimum of 30 inches of cover in non-traffic areas and 36 inches in paved areas subject to vehicular traffic. Force mains shall be designed in profile on straight grades to generally parallel the ground surface and minimize high or low points. Manufactured fittings shall be used to change grade.

**2.1510** Separation between sanitary sewers and water mains shall be 10 ft. horizontally, or 24 inches vertically below, measured between the outside diameters of the pipes. If running parallel with a water line the sewer line shall be ductile iron.

**2.1600 Buildings and Enclosures**

**2.1601** Prepackaged or factory built pumping stations are available in several basic types that may be above ground, or underground. Common types provide complete system enclosure for pumps, motors, controls, valves, piping and appurtenances. Flooded suction type underground stations shall be enclosed in a corrosion protected steel tank. Unless otherwise approved, all above ground equipment will be housed in a built in place, stand alone building meeting County requirements. Suction lift type stations will be above ground requiring equipment to be housed in a built in place building. On a case-by-case basis the County may consider proposed suction lift stations housed in FRP buildings secured to a concrete slab, or the recessed type with only a cover extending above grade.



- 2.1602** All underground structures associated with the pump stations shall be designed to support the weight of a service vehicle parked over them as well as the soil over the structure. The structure shall be designed to resist the up-lift of external water pressure. The Owner shall furnish Jefferson County structural design calculations, certified and stamped by a Professional Engineer registered in Alabama.
- 2.1603** Wet wells for prepackaged pump stations shall generally be watertight precast concrete manhole sections of the required diameter meeting requirements of ASTM C478 unless otherwise approved by the County. Separate, recessed valve pits shall be constructed of reinforced or precast concrete. Depending on the type of station, Aluminum access hatches, and ladders shall be provided. Guide rails for submersible pumps shall be stainless steel.
- 2.1604** Above ground facility equipment shall be located in a building structure of masonry construction on a reinforced concrete slab. On a case-by-case basis, the County may consider equipment housed in an FRP enclosure. The building or enclosure shall be insulated for noise control. Where in developed areas, the building will be finished and landscaped similarly to nearby buildings. Buildings shall be constructed in accordance with all applicable building codes and zoning regulations.
- 2.1605** Minimum design criteria for pump station structures and buildings shall be as specified in Section 3.00 for Site Work, Concrete Work, Masonry, Metals, Carpentry, Thermal and Moisture Protection, Doors and Windows, Finishes, Specialties, Equipment, Conveying Systems, Mechanical and Electrical.
- 2.1606** Required appurtenances shall include lights, fan, dehumidification equipment, doors or hatch, ladder, maintenance lift, pumps, sump pump, motors, and pump controls. Cathodic protection in the form of sacrificial anodes shall be provided for the outside steel shell when recessed underground.
- 2.1700    **Electrical Equipment****
- 2.1701** Basic requirements for electrical equipment at pumping stations are adequacy, reliability, and safety.
- 2.1702** The electrical system for pump stations shall provide the following principal functions:
1.       Motor starting and service protection.
  2.       Branch circuit protection.
  3.       Level sensing.
  4.       Control Circuitry.
  5.       Station monitoring and communication.
  6.       Standby power generation and system transfer.

7. Lightning and surge protection.

- 2.1703** All work shall be done in strict accordance with all requirements of all local applicable codes, or ordinances, public utility companies, National Electrical Safety Code, and the latest edition of the National Electric Code with interim amendments thereto.
- 2.1704** All Materials shall conform to the latest issue of all applicable standards as established by NEMA, NFPA, and the National Board of Fire Underwriters Laboratories.
- 2.1705** The Owner shall require the Electrical Contractor to furnish County with a certificate of final inspection from the inspecting authority.
- 2.1706** The County requires that 480V, 3 phase, 60 Hz power service be provided to proposed pumping stations. Selection of electrical equipment will be coordinated with this requirement. Special approval must be granted for 208V, 3 phase or 240V, 3 phase Service. Single phase service for pump motors and controls will not be allowed, unless approved by the County. If single phase service is allowed, a Variable Frequency Drives (VFD) system shall be provided. (See Section 3.1690)
- 2.1707** An Overload Protection device shall disconnect the motors before excessive heat can be generated.
- 2.1708** Full Voltage type motor starting equipment is preferred. Other starting methods will be considered on a case-by-case basis.
- 2.1709** All Wiring shall be labeled for identification.
- 2.1730** **Control System**
- 2.1731** Provide an automatic control system to start and stop the pump units, standby power generators, associated valves and accessories after initiation of push button stations or automatic sensory devices. Control equipment also includes apparatus and accessory devices for starting, stopping, regulating, and protecting pump motors and other equipment. Automatic sequence controls based on liquid levels should be designed with sufficient well or reservoir capacity to prevent the starting and stopping of equipment more than the maximum recommended by the manufacturer.
- 2.1732** Provide a transducer system or a bubbler system with stainless steel piping to detect primary switching points required for control. The system shall be backed up by a system of floats to send a signal for all pumps to run at a high level mark. The float system shall be classified to be “intrinsically safe”. Materials shall be of the highest quality and the floats shall be mounted to prevent tangling and to be serviced at the operating floor level.

Provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the transducer and float control wires. The backup float system shall reset to the automatic primary system when pumps cut off at low level.

- 2.1733** Logic systems receive input from the level control system and convert this information to start/stop signals for the pumps. This may include timers to prevent simultaneous starting of pumps, to manually select lead and lag pumps, automatic sequencer to equalize the operating time on all pumps, timers which control pump fail detectors, etc.
- 2.1734**
- A. A red emergency flashing alarm light shall be provided above the control panel or on the outside of the building (if applicable).
  - B. Provide control system contacts for a local alarm and dry contacts as required for future connection to county monitoring equipment.
  - C. Provide the following monitoring capabilities to indicate alarm for:
    - 1. Pump malfunctions including pump failure, pump overheating, motor overload, motor overheating, and bearing overheating.
    - 2. High level or low level in wet well.
    - 3. Flooding of the station.
    - 4. Power failure.
    - 5. Intrusion into the station.
- 2.1735** Provide a lightning surge/transient protection system containing surge/transient protection devices on all services entering the station controls with cabled connections to/from other devices external to the main system.
- 2.1740** **Standby Engine Generator Set**
- 2.1741** Dependability of equipment and power supply is mandatory in pumping stations because failure can cause considerable damage and sewage overflows. To provide dependability for electric pump drives, a standby engine driven generator set that is sufficient to supply power for the station shall be required. Generator shall be sized to supply power for all loads in the pump station including the sewage grinder equipment.
- 2.1742** Typically a generator set installation will include the generator set equipment, a masonry building, fuel system, automatic transfer switch, cooling system, exhaust system and other accessories required for a fully automatic system. On a case-by-case basis, a weatherproof enclosure may be considered in lieu of the requirement for a masonry building.

**2.1743** Where natural gas service is available, the engine and fuel system for standby power shall be natural gas. Propane gas or diesel fuel systems may be considered on a case-by-case basis, but only when natural gas service is not available.

**2.1750 Conduit**

**2.1751** All power conductors will be installed in conduit as follows:

- A. Rigid steel conduit will be used in all cases at the building exterior or other areas exposed to moisture or danger of mechanical damage.
- B. Rigid steel conduit will be used in all hazardous areas.
- C. Where possible, conduit will be installed exposed and not embedded in structural concrete. Nonmetallic conduits (Schedule 40 PVC) will be used for branch circuits and feeders where below grade, or in concrete slabs on grade. Nonmetallic will convert to rigid metal conduit before leaving ground level slabs on grade.

**2.1760 Conductors and Cable, 600 Volts and Below**

**2.1761** Conductors and cable shall be copper and conform to the following:

- A. Conductors shall have current carrying capacities and insulation temperature rating per NEC with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.
- B. #12 thru #10, General Use: Conductors shall be solid with nylon jacket PVC insulation type THHN-THWN and must meet UL standard VW-1 Flame Test.
- C. Feeders and General Use: Conductors #8 and larger, and any size to motors, shall be stranded with cross-linked polyethylene insulation type RHW 167°F (75°C), RHW-2 194°F (90°C), or THHN.
- D. Control wire shall be #14, 19 strand, with .015 inch polyvinyl chloride insulation, .004 inch nylon jacket, type THHN-THWN, rated 194°F (90°C).

**2.1800 Appurtenances**

**2.1801** Meters and Gauges - Pumping stations shall have indicating gauges which show station suction and header discharge pressures. Pumping stations larger than 600 gpm shall have a flow meter that shows and records the discharge from the station. Flow meters shall be

installed in an external vault with bypass piping, valving, sump pump or backflow prevented drain, entrance hatch and high water alarm. Design criteria for meter size shall be 3 inch for flows less than 260 gpm, 4 inch for flows between 260 and 599 gpm, and 6 inch for flows between 600 gpm and 1080 gpm. The meter shall be located in a straight section of the discharge piping a minimum of three diameters upstream and two diameters downstream from a fitting or valve.

- 2.1802** Water Supply - Provide potable water to the station site for cleaning. Isolate the public water system by installing backflow preventer devices.
- 2.1803** Gas supply - Provide natural gas service to the station in sufficient quantity as fuel for the standby engine or generator at the maximum rated output.
- 2.1804** When propane gas or diesel fuel is approved as fuel for standby engines, provide a storage tank of sufficient size for three (3) days running requirement. Fuel tanks shall be the above ground type installed in a recessed containment structure. LPG tanks shall be ASTM standard pressure tanks. Tanks and system shall meet all regulations, Federal, State and Local, for storing the proposed fuel.
- 2.1805** Equip underground pump stations with a maintenance lift to lift equipment from the lower compartments.
- 2.1806** Fencing - All stations and station facilities shall be fenced to prevent against vandalism or hazard to persons who may come in contact with electrical equipment. On a case-by-case basis, the County may require privacy walls or fencing. See Standard Drawings SD4000, SD4006 and SD4007.
- 2.1807** Landscaping - The station will be landscaped as necessary to make the facility fit with surrounding area.
- 2.1808** Building Drainage - Adequate floor drains will be placed in sumps or gutters to drain the station. Sump pumps are required to remove drainage from the dry pit. Provide a built-in-trap in all building floor drains.
- 2.1809** Heating and Ventilation - Provide adequate automatic heating facilities to prevent freezing in cold weather. Proper ventilation is required in both wet wells and dry areas. There should be no interconnection between these areas. Ventilation should be positive and supply fresh air to the lowest floor level. Ventilation must also be provided to dissipate the heat from electric motors, especially in hot weather. Provide a dehumidifier in all underground and recessed pumping stations.
- 2.1810** Emergency Connections - Provide a 6 inch pump suction pipe with 4 inch Quick Connect

fitting and cap at the station wet well. Provide a shut off valve and 6 inch pump discharge Quick Connection with cap in the flow meter vault or valve vault. These connections are to provide a means to connect engine driven emergency pumping equipment to the station.

- 2.1811** Safety Features - Provide safety features to meet all OSHA requirements. Railings are required at all manholes or openings where there are differences in levels or a danger of an operator falling. Provide guards on and around mechanical equipment where operators might come in contact with electrical equipment, belt drives, gears, chain drives, rotating shafts or other moving parts. Provide rubber mats in front of electrical equipment to reduce shock hazards. Wiring and devices in hazardous areas shall be rated explosion proof. All wiring and receptacles shall be grounded. Provide cages and safety climb devices on ladders. Fire extinguishers of proper types shall be provided.

## **2.1900 Engineering Construction Services**

- 2.1901** The Design Engineer shall review and approve shop drawings and submittals supplied by the Contractor during construction of the project. Equipment and materials differing from the County approved specification item shall be submitted to the County for approval before returning the submittals to the Contractor. Two (2) copies of each approved final submittal shall be furnished to the County's designated representative.

- 2.1902** The Design Engineer shall review and approve Material Testing Reports supplied by the Contractor during construction of the project. Two (2) copies of each approved report shall be furnished to the County's designated representative.

- 2.1903** The Design Engineer shall review and approve Operation and Maintenance (O&M) Manuals supplied by the manufacturer. Three (3) copies of each approved manual shall be furnished to the County's designated representative.

- 2.1904** The Design Engineer shall observe start up services by the equipment manufacturer's representative. The Design Engineer shall coordinate the start up service for county operators to observe and receive training. Two (2) copies of each approved start up report shall be furnished to the County's designated representative.

- 2.1905** The Design Engineer shall review equipment warranties furnished by the equipment manufacturer. Two (2) copies of each warranty shall be furnished to the County. Equipment warranties shall be transferred to Jefferson County.

## **2.2000 As-Constructed Drawings**

- 2.2001** Upon Completion of construction, a field survey shall be performed to locate the

constructed facilities.

- 2.2002** As-Constructed Drawings shall reflect all changes made to the approved Construction Drawings and should accurately show the actual sewer Pumping Station facilities that were installed.
- 2.2003** In general the As-Constructed Drawings shall have the same format and information, excluding notes, etc., required on the approved Construction Drawings in Section 2.0300.
- 2.2004** As-Constructed Drawings shall be on 4 mil polyester drafting film with matte finish on both sides, 24"x 36"half plan/profile sheets with permanent black ink. The profile grid shall have 1"=50' (H) and 1"=10' (V) scales.
- 2.2005** Pumping Station plans, sections and elevations shall be drawn to the scale of 1/4 in. = 1 ft. if practical. Scales shall be indicated on the drawing. Adequate sections and details shall be shown to clearly indicate required dimensions and elevations. Plan and profile of constructed sewer system shall be on the same sheet, drawn at 1"=50' (H) and 1"=10' (V) scales. Grades shall be shown in percent (%) and indicated at every 50 ft. station with both invert and existing profile elevations. The flow line elevation of each line entering and exiting a manhole shall also be shown.
- 2.2006** The following note shall be indicated on the property site plat of the drawings and on each plan profile drawing.

I (Printed Name) certify that this is a true and accurate site plan and profile map as field surveyed after construction.

Signature

Alabama Professional Engineer or Land  
Surveyor Registration Number

## **Section 3.00**

# **Construction Specifications for Sanitary Sewer Pumping Stations**

### **3.0200 Site Work**

#### **3.0210 Site Preparation**

**3.0211** Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.0100.

#### **3.0220 Earthwork**

##### **3.0221** Excavation

Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.0200.

##### **3.0222** Fills and Embankments

- A. Fills and embankments shall be constructed of rolled or compacted earth conforming to these specifications and to the lines and grades shown on the Drawings.
- B. The area to be occupied by the embankment shall be stripped of all surface material to a depth of not less than 6 inches and this material shall be removed and stockpiled for reuse as topsoil. The surface thus exposed shall then be machine-graded to planes suitable for embankment foundations. Any materials such as large stones or stumps found embedded in the exposed surface that would interfere with proper compaction and consolidation of the starting layers of embankment shall also be removed. Any material thus removed from the embankment area which is unsuitable for embankment construction shall be disposed of in a suitable manner and shall not be used in the Work.
- C. Material used for embankment construction shall consist of a mixture of the available soils subject to the requirements of these specifications and approval of the County. It shall be entirely free of brush, stumps, heavy sods, heavy growth of grass and other organic matter and shall not contain any stones larger than 6 inches in greatest dimension. Material shall be placed in the embankment in successive layers of not more than 8 inches



in loose depth and then rolled and compacted as specified herein. Starting layers shall begin at the lowest points in the fill. All starting layers shall be carefully placed and compacted in such manner as will provide a complete bond between the compacted fill and the natural ground on which it rests so as to prevent the development of planes of weakness. Successive layers shall be approximately horizontal after compaction, and shall be sloped slightly to the outside edge of the fill to provide proper drainage while the work is in progress. Material for successive layers may be dumped onto preceding layers, but it shall then be spread, by the use of blade graders, bulldozers or similar equipment, so that when properly compacted it will form a layer of uniform thickness over the entire preceding layers.

- D. The material shall be distributed and mixed in each layer so that all parts of the finished embankment will be a uniform composite mixture of all of the available soils, and will be free of lenses, pockets, streaks or layers which differ materially in texture or density from adjoining layers. No pockets or clusters of stones shall be permitted to form in the completed work.
- E. The optimum water content and the maximum density produced by proper compaction of the available soils shall be pre-determined by the Design Engineer and shall govern the compaction operations throughout the progress of the work. The theoretical maximum density shall be arrived at in the manner prescribed in current version of ASTM D698. Material containing too much moisture, or which is frozen, shall not be placed in the embankment. Its placement may be delayed until it has dried out to the proper moisture content, or it may be thoroughly mixed with a drier material to obtain the desired water content. Material with insufficient moisture shall be wetted before compaction. Adequate equipment for furnishing and sprinkling water shall be kept available at all times during the progress of the Work.
- F. After the material has been properly spread in layers, it shall then be compacted by rolling with tractor sheep's foot roller or other types of tamping rollers until all parts of the layer have been compacted to a minimum of 95% Standard Proctor maximum dry density. In no case shall material for a following layer be placed until rolling operations have continued long enough to produce the required density. Earth moving equipment may be routed over the work to assist in compaction.
- G. The slopes and the top of the fill shall be carefully trimmed so that after making proper allowance for shrinkage they will conform to the slopes and dimensions called for on the Drawings. No material shall be left on the outside surfaces of the fill which is at a steeper slope than that shown on the Drawings.

- H. The number, type, size and operating conditions of all equipment used in the Work shall be suitable for the work to be performed. Any unsuitable or inadequate equipment shall be replaced.

**3.0223** Structural Backfill

- A. Backfill for pipeline trenches shall be placed in accordance with Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 3.0300 and 3.0600. Backfill to replace excavation for other structures shall be placed as follows.
- B. All forms, debris, foreign material, etc., shall be removed prior to backfilling.
- C. Moisture density determinations shall be performed for each soil type to provide data for quality control. The moisture content at the time of compaction shall be within 2% above or below optimum moisture content.
- D. Material used for backfilling shall be suitable job excavated material subject to the approval of the Design Engineer or as indicated on the plans. It shall be entirely free of large clods, brush, stumps, heavy sods or growths of grass, and other organic matter and shall not contain any stones larger than 6 inches in greatest dimension. The material shall be soil with plasticity index less than 25, and have a maximum dry density greater than 100 pcf.
- E. The dry, fine material shall be placed in 8 inch loose layers and compacted to a minimum of 95% Standard Proctor maximum dry density. The upper 24 inches of fill under pavements, as well as all fill under structures, shall be compacted to 98% Standard Proctor maximum dry density, in accordance with ASTM D698.
- F. Structural backfill under proposed structures and under existing pavements shall consist of ASTM D448, No. 57 or No. 67 crushed stone.
- G. In place density tests should be performed at every 8-inch vertical lift and every 2500 square feet horizontally. An experienced geotechnical engineering technician under the direction of the Design Engineer shall observe the fill operations and perform sufficient in-place density tests.
- H. Compaction shall be accomplished by appropriate mechanical means, subject to approval by the Design Engineer.

- 3.0224** Pipe Bedding
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.0300.
- 3.0225** Special Slope Protection
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.2000.
- 3.0230 Pipe Construction**
- 3.0231** Pipe Materials
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 4.00.
- 3.0232** Pipe Installation
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 3.0400.
- 3.0233** Joint Installation
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.0500.
- 3.0234** Backfilling Trenches
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Paragraph 3.0600.
- 3.0235** Pipe Testing
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 5.0100.
- 3.0240 Precast Concrete Manholes and Pumping Station Wet Wells**
- 3.0241** Installation
- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 3.1200.

- B. Precast concrete wet well sections shall be anchored with stainless steel joint straps and bolts. See Standard Drawing SD1515.

**3.0242** Precast Concrete Manhole Material

- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Sections 4.0700 and 4.0800.

**3.0243** Manhole Testing

- A. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 5.0140.

**3.0250 Chain Link Fence and Gates**

**3.0251** General

- A. Description
  1. Furnish and install all galvanized or PVC coated chain link fencing, including, but not limited to, fence fabric, posts, rails, gates, barbed wire, fittings and accessories, where shown on the Drawings or specified.
  2. On a case-by-case basis, treated wood privacy fence or masonry privacy walls may be shown on the Drawings. Refer to Standard Drawings SD4000, SD4006, SD4007 or the combination of each shown on the Project Drawings. Treated wood fencing shall meet requirements of Section 3.0600.
- B. Quality Assurance
  1. Installer must have experience in installations of similar size and scope. Installer must be approved by the fencing material manufacturer.
  2. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications and be approved by the County.
    - a. USX Corp. - Cyclone Fence
    - b. Anchor Fence Company
    - c. Or approved equivalent
- C. Submittals
  1. Submit product data and samples as follows:
    - a. Submit manufacturer's product data for fence system proposed. Identify applicable materials, sizes, coatings, etc.

- b. Submit two (2) samples (12" x 12") of each type of fence fabric required.
- c. Submit color chart for PVC coating for color selection by Owner, in consultation with the County, if applicable.

**3.0252 Products**

**A. Galvanized Fencing**

- 1. Chain link fabric shall be galvanized steel wire conforming to ASTM A392, Class 2 (2.0 oz. per SF of surface area). Fabric shall be woven from 9 gage (Coated size) wire in 2" mesh. Fabric 72" high or more shall be knuckled at one selvage and twisted and barbed at the other.
- 2. Posts shall be either roll-formed C-Sections or schedule 40 galvanized steel pipe.
  - a. Line posts shall be C-sections of steel per ASTM A1011, Grade 45, 1.875" x 1.625", with bending strength of 247 lb. under 6' cantilever load, continuously coated with 2.0 oz. GALFAN alloy per ASTM A875; or 2-3/8"OD galvanized steel pipe, with bending strength of 201 lb. under 6' cantilever load, with 2.0 oz hot dipped zinc per ASTM F1083.
  - b. Terminal Posts shall be C-Sections, 3.5" x 3.5", with minimum bending strength of 486 lb. under 6' cantilever load, coated with 2.0 oz. hot-dipped zinc per ASTM A123; or 2-7/8" OD galvanized steel pipe, with bending strength of 381 lb. under 6' cantilever load, with 2.0 oz. hot-dipped zinc per ASTM F1083.
  - c. Gateposts shall be galvanized steel posts per the following schedule:

Leaf Width	Post Size	Minimum Unit Wt.
0 to 6'	C, 3-1/2" x 3-1/2"	4.85
	or 2-7/8" OD	5.79
6' to 13'	4" OD	9.10
13' to 18'	6-5/8" OD	18.97
Over 18'	8-5/8 OD	28.55

- 3. Top Brace Rails shall be either 1-5/8" x 1-1/4" channel shaped rail or 1.66" OD galvanized steel pipe. Channels shall have vertical bending strength of 237 lb. on a 10' continuous span, coated with

2.0 oz. GALFAN alloy per ASTM A875. Pipe shall have vertical bending strength of 201 lb. on 10' continuous span, coated with 2.0 oz. hot-dipped zinc per ASTM F1083. Top rail couplings, 6" minimum in length shall be spaced at maximum 21' centers.

4. Barbed Wire shall be aluminum-coated double strand 12-1/2 gauge twisted wire with 14 gauge 4-point round aluminum barbs spaced on approximately 5" centers, per ASTM A121.
5. Fittings shall be pressed steel or malleable iron, hot-dip galvanized per ASTM A153. Tie wires shall be 11 gage galvanized steel.
6. Gates shall be fabricated from 1.90" OD galvanized steel pipe with welded or riveted corners. Provide braces and truss rods as required to prevent sagging.
  - a. Hitches shall be pressed steel or malleable iron, one pair per leaf.
  - b. Latches shall be forked-type for double gates, with padlock eye to permit operation from either side of gate.
  - c. Provide keepers for each leaf over 5'-0" wide, to hold gate in full open position.

B. PVC Coated Fencing

1. Where fencing is designated as "PVC Coated", all fabric, posts, arms, rails, barbed wire and fittings shall be coated with PVC of the color selected by the Owner, in consultation with the County.
2. PVC coating on fabric and barbed wire shall be minimum 7 mils, over a 0.30 oz. zinc substrate, with minimum 1,290 lb. breaking strength.
3. All posts and rails to be PVC Coated shall be treated with 2.0 oz. GALFAN alloy. PVC coating shall be 10 to 15 mil thermal fusion coating.
4. All material shall be of the same sizes and strengths as specified for galvanized fencing.

**3.0253** Execution

A. Installation

1. General:
  - a. Do not begin prior to completion of final grading. Drill holes for post footings in firm, undisturbed or compacted soil. Holes for all gate, end, corner, pull posts and all other type posts shall have a minimum diameter of 12 inches. Excavate hole depths a minimum of 6 inches deeper than a post bottom, with bottom of all type posts set no less than 30 inches below surface when in firm, undisturbed soil. Excavate deeper as required for adequate support in soft and loose soils and for posts with heavy lateral loads.

- b. Place concrete around posts in a continuous pour. Tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
  - c. Trowel finish tops of footings and slope or dome to direct water away from posts. Extend footings for gateposts to the underside of bottom hinge. Set keepers, stops, sleeves and other accessories into concrete as required.
  - d. C-section line posts may be mechanically driven to a depth of 3'-0", instead of concrete set.
2. Post Spacing: Posts shall be spaced not more than 10 feet on centers.
  3. Fence Height: Fence height shall be 6' to top of fabric, 7' to top of barbed wire, unless shown or specified otherwise.
  4. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
  5. Tension Wire: Install tension wires before stretching fabric and tie to each post with ties or clips.
  6. Fabric: Leave approximately 2 inches between finished grade and bottom selvage, except where bottom of fabric extends into concrete. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.
  7. Stretcher Bars: Thread through fabric and secure to posts with metal bands spaced not over 15 inches o.c.
  8. Barbed Wire: Install 3 parallel wires on each extension arm on security side of fence, unless otherwise shown. Pull wire taut.
  9. Gates: Install gates plumb, level and secure for full opening without interference. Install ground set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.
  10. Tie Wires: Use U-shape clip or wire, securely fastened around pipe to which attached, clasping pipe and fabric firmly. Bend ends of wire to minimize hazard to persons or clothing.
  11. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side.

B. Cleanup

1. All surplus fencing materials and debris resulting from installation of the fencing shall be carefully collected and promptly removed from the site.

### **3.0260 Pavement and Paving Replacement**

#### **3.0261 General**

- A. Performance Requirements
  - 1. Paving: designed for movement of trucks up to 60,000 lbs.
- B. Quality Assurance
  - 1. The Contractor shall perform Work in accordance with the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.
  - 2. The mixing plant shall conform to ALDOT Standard Specifications for Highway Construction, latest edition.
  - 3. The Contractor shall obtain materials from the same source throughout.
- C. Regulatory Requirements
  - 1. Conform to applicable code for paving work on public property.
- D. Environmental Requirements
  - 1. The Contractor shall not place asphalt when base surface temperature is less than 40°F (4.4°C), or surface is wet or frozen.
- E. Temporary Roadway Paving Repairs
  - 1. Temporary cold or permanent hot asphalt patching shall be required for both transverse and longitudinal roadway cuts upon completing backfilling requirements at the end of each day's work, if the road is to be opened for local traffic.
- F. Protection
  - 1. Immediately after placement, the contractor shall protect pavement from mechanical injury for 7 days.

#### **3.0262 Products**

- A. Flexible Pavement
  - 1. The bituminous material furnished shall be of approved quality and shall meet the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction for the kind of material furnished. The material furnished shall show a uniform test. Where more than one grade of material is permitted for any item of work, the Design Engineer shall specify the grade desired. In all cases, the Design Engineer shall specify the consistency limits for the grade of material shown on the Plans



and/or Bid Proposal Form. The Contractor may, without extra compensation, supply bituminous material containing approved additives for producing non-stripping characteristics. For such materials, an adjustment in the total bitumen requirements of this section shall be made as deemed necessary.

2. Asphalt cement supplied under this section shall be prepared by the refining of asphaltic petroleum of the four (4) basic viscosity grades of asphalt cement used in pavement construction. The refined asphalt cement shall be homogeneous, free of water, shall not foam when heated at 347°F (175°C), and shall conform to the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction.
3. Shipping temperature of the asphalt from the refinery shall not exceed 360°F (182.2°C). The material shall be maintained within the specific temperature range during application. The temperature ranges covered in the Alabama Department of Transportation Standard Specifications for Highway Construction, Section 401, shall apply.
4. Cutback asphalt supplied under this section shall be made from asphalt cement base and naphtha solvent, so proportioned and mixed that the finished product shall be homogeneous and conform to the requirements of AASHTO Designation M81 for rapid curing cutback and AASHTO M82 for medium curing cutback.
5. Emulsified asphalt supplied under this section shall be a homogeneous emulsification of asphalt and shall show no separation of asphalt or objectionable change in viscosity within 3 months after delivery. Separation at anytime caused by freezing or contamination shall be cause for rejection. Emulsified asphalt shall conform to the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction.
6. Tar supplied under this section shall be produced from suitable gashouse, coke-oven, and/or water-gas tars. The grades of tar specified shall conform to the requirements established by the Alabama Department of Transportation Standard Specifications for Highway Construction.

B. Rigid Pavement

1. Concrete and reinforcing bars (where required) for rigid pavement shall conform to the requirements of Section 3.0310, Cast-In-Place Concrete. Concrete for pavement shall be Class A.

- C. Curb and Gutter
  - 1. Concrete for curb, curb and gutter, or valley gutter shall be Class A. Concrete shall conform to the requirements of Section 3.0310, Cast-In-Place Concrete.
- D. Sidewalks
  - 1. Concrete for sidewalks shall be Class A conforming to the requirements of Section 3.0310, Cast-In-Place Concrete.
- E. Driveways
  - 1. Concrete for driveways shall be Class A conforming to the requirements of Section 3.0310, Cast-In-Place Concrete.

**3.0263** Execution

- A. Pavement and Pavement Replacement
  - 1. The Contractor shall place all pavements following the guidelines established by the Alabama Department of Transportation and other authorities having jurisdiction.
  - 2. Where chert, gravel, slag, or other unpaved street or driveway surfaces are removed or damaged, they shall be replaced with the same type of materials that were removed as an incidental part of the Work. Unpaved drives shall be topped with gravel.
  - 3. In replacing pavements and unpaved surfaces, the materials used and the construction methods shall comply with the applicable requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction.
  - 4. All concrete pavement replaced shall not be less than 4 inches thick or equal to the original if greater than 4 inches.
  - 5. Existing pavements replaced shall be of the same type of construction as was removed, except that no asphalt surface replaced shall be less than three inches thick consisting of binder and seal coat. Wearing surfaces shall be slag sealed in accordance with the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction.

**3.0270 Fuel Utility or Storage System**

**3.0271** General

- A. When engine driven equipment is installed, furnish a complete fuel system sized to provide a minimum 3 days running requirement.
- B. Where natural gas service is available, and equipment is to be natural gas

fueled, contract with the utility company to install the required service line, riser, regulator and meter.

**3.0272** Double Walled Steel, Above Ground Type Diesel Fuel Storage Tank

- A. Where diesel fueled equipment has been approved, furnish and install a complete diesel fuel system to the equipment including a double walled tank, piping, valves, and day tank.
- B. The tank shall be installed on reinforced concrete saddles and located in a secondary containment structure recessed below the ground surface of adequate volume to hold the entire fuel content plus 10% in accordance with current EPA regulations. Protection against overfill spill shall be provided. The tank shall be in conformance with Underwriters Laboratory (UL) Scope 142. Corrosion protection shall be provided for all underground steel piping which services the tank.
- C. The following companies manufacture acceptable above ground double wall diesel fuel storage tanks. This list is not exclusive, but other companies must comply with the specification and be approved by the County.
  - 1. Brown-Minneapolis Tank
  - 2. ConVault, Mid-Atlantic, Inc.
  - 3. Or approved equivalent

**3.0273** Steel Liquefied Petroleum Gas Storage Tank

- A. Where LPG fueled equipment has been approved, furnish and install a complete LPG fuel system to the equipment including required steel storage tank, piping, valves and regulators. The system shall meet all Federal, State and local code requirements for LPG installations.
- B. The tank shall be an ASME container assembly listed for underground installation installed per LPG Pamphlet 58. The tank shall be supported on reinforced concrete saddles and located in a vented secondary containment structure recessed below the ground surface.

**3.0280** **Miscellaneous**

**3.0281** No structure shall be constructed over or immediately adjacent to a gas pipeline or gas facility, or within the gas line easement. Gas pipelines shall not pass through manholes or other sewer structures. When sanitary sewer lines cross over gas lines, the minimum cover shall be as specified by the owner of the gas line. (Cover is the vertical distance between the outside top and outside bottom of the two pipelines.)

This cover space shall be carefully backfilled with thoroughly compacted crushed stone.

**3.0282** In the event the sewer crosses, runs parallel to or alongside any highway, county road, city street, or railroad rights-of-way, the Contractor shall obtain a utility permit from the governing body affected. A copy of said permit or agreement shall be submitted to the County before commencement of construction.

**3.0283** Where the work requires special stream or railroad crossings or any other extraordinary conditions, or where alternate types of construction are used that are not covered by these Specifications, the materials and construction methods shall be as shown on the Drawings and specified by the Design Engineer and approved by the County.

**3.0284** After the sewer pumping station is installed and backfilled and a sufficient amount of time has elapsed for backfill to settle, the disturbed area shall be machined to a smooth surface matching the adjacent or adjoining ground surfaces and the ground profile on the Drawings. A vegetation cover approved by the County shall be established for erosion control.

**3.0285** An access road is required into the site meeting the minimum standard specifications of the governing body in which the road is located. The minimum pavement width shall be 14 feet and the maximum grade shall be 15%; see section 2.0809.

### **3.0300 Concrete Work**

#### **3.0310 Cast-in-Place Concrete**

##### **3.0311 Description**

A. The Work under this section includes, but is not limited to the following:

1. Preparation
2. Joints
3. Installation of Embedded Items
4. Concrete Placement
5. Patching
6. Defective Concrete
7. Field Testing Concrete

B Design, the material, and workmanship shall be in accordance with Specifications and the current edition of the following standards, unless otherwise modified on the Drawings or in the Specifications:

1. ACI 347 - Recommended Practice for Concrete Formwork
2. ACI 318 - Building Code Requirements for Reinforced Concrete

3. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures
4. ACI 301 - Specifications for Structural Concrete for Buildings
5. ACI 305R - Hot Weather Concreting
6. ACI 306R - Cold Weather Concreting
7. ACI 308 - Standard Practice for Curing Concrete
8. ACI 211.1 - Recommended Practice for Selecting Proportions for Normal Weight Concrete
9. ACI 503.1 - Standard Specifications for Bonding Plastic Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive
10. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
11. ASTM C33 - Concrete Aggregates
12. ASTM C94 - Ready-Mixed Concrete
13. ASTM C150 - Portland Cement
14. ASTM C260 - Air Entraining Admixtures for Concrete
15. ASTM C330 - Light Weight Aggregates for Structural Concrete
16. ASTM C494 - Chemical Admixtures for Concrete
17. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
18. ASTM C948 - Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber Reinforced Concrete
19. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type)
20. ASTM D6690 – Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
21. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
22. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
23. CRSI - Recommended Practice for Placing Reinforcing Steel.

C. Ready Mix concrete shall be either Class A or Class B in accordance with ASTM C94. Usually, Class A concrete shall be reinforced concrete cast-in-place in forms and shall be used for building structures, pipe collars, footings, piers, head walls, manholes, and similar structures; Class B concrete shall be plain concrete and shall be used for trench bottom stabilization, pipe protection, anchors, massive sections and similar work.

**3.0312** Quality Assurance

- A. The Contractor shall perform Work in accordance with ACI 301 and ACI 318.
- B. The Contractor shall maintain one copy of contract documents on site.
- C. The Contractor shall acquire cement and aggregates from the same source for all work performed.
- D. The Contractor shall conform to ACI 305R when concreting during hot weather.
- E. The Contractor shall conform to ACI 306R when concreting during cold weather.
- F. Testing Laboratory Services:
  - 1. The Owner/Developer shall employ and pay for the services of an independent geotechnical testing laboratory to perform specific services and necessary tests as outlined below:
    - a. All mix design shall be proportioned in accordance with Section 4.3 of ACI 318. Mix designs must be approved by the Design Engineer prior to placing the initial concrete at the job site. During concrete placement an independent geotechnical laboratory technician shall make a set of four test cylinders for each 50 cubic yards, or fraction thereof, of each concrete pour placed each day. The independent geotechnical laboratory technician shall break a cylinder from each set on the 7th, 14th (if required), and 28th day.
    - b. During concrete placement an independent geotechnical laboratory technician shall make all concrete cylinders and perform a slump test at the point where concrete is placed into the forms.
- G. Tolerances:
  - 1. The Contractor shall ensure that cured concrete meets the following tolerances:

a.	Variations from plumb	±3/8-in. per 10 ft. but not more than 1 inch total
b.	Variations from level	±3/8-in. per 10 ft. but not more than ½ inch total
c.	Variations from horizontal	±3/8-in. per 10 ft. but not more than ½ inch total

- d. Variations in size and locations of openings or sleeves ±1/4-inch
- e. Reinforcing steel placement ±3/8-inch

**3.0313** Submittals

- A. The Contractor shall submit the following product data.
  - 1. Submit concrete mix design including the following:
    - a. Break down of material content per cubic yard of concrete.
    - b. Show dry weight of cement.
    - c. Show saturated surface-dried weights of fine and coarse aggregate.
    - d. Show weight of water.
    - e. List quantities, types, and names of admixtures.
  - 2. Submit trial mix laboratory reports.
  - 3. Submit product data on each admixture proposed.
  - 4. Submit certification of aggregate quality. Include statement from an independent laboratory that aggregates used are not reactive.

**3.0314** Storage

- A. The Contractor shall store cement at the site in an approved manner to prevent absorption of moisture or contamination.
- B. The Contractor shall store aggregates at the site in an approved manner to prevent inclusion of foreign materials in the concrete.
- C. The Contractor shall store admixtures in an approved manner to prevent contamination, evaporation, or damage. The Contractor shall protect liquid admixtures from freezing and from harmful temperature ranges.

**3.0315** Qualifications for Ready-mix Concrete Manufacturer

- A. Concrete shall be manufactured and delivered to the project site by a ready-mix manufacturer experienced in ready-mix concrete.

**3.0316** Job Conditions

- A. The Contractor shall follow methods outlined in ACI 306R if concrete is to be placed when the atmospheric temperature is expected to be less than 40°F (4.4°C).

- B. Calcium chloride will not be approved as an accelerating admixture during cold weather construction.
- C. The Contractor shall follow methods outlined in ACI 305R if concrete is to be placed when the atmospheric temperature is expected to exceed 90°F (32.2°C).
- D. Manufacturer's written recommendations shall be strictly followed in regard to atmospheric temperature limitations during application of epoxy or acrylic polymer modified concrete materials.

### **3.0320 Products**

#### **3.0321 General**

- A. Class A concrete shall be formed reinforced concrete having a 28-day minimum compressive strength of 4000 pounds per square inch. Class A concrete shall be cast-in-place in forms for foundations, pipe collars, footings, piers, sidewalks, curb and gutter, headwalls, manhole, monolithic sewer, and similar structures.
- B. Class B concrete shall be non-formed, non-reinforced concrete having a 28-day minimum compressive strength of 3000 pounds per square inch. Class B concrete shall be used for trench bottom stabilization, pipe protection encasement, pipe collars, anchors, massive sections, and similar work.
- C. Other classes, types, or design for cast-in-place concrete may be specified in the Plans and Specifications, or approved by the Design Engineer, as circumstances require.
- D. Concrete ingredients shall be selected, proportioned, and mixed to produce a workable, homogeneous concrete.
- E. Concrete components shall conform to the minimum requirements of this section.

#### **3.0322 Concrete Materials**

- A. Portland Cement shall conform to the following:
  - 1. All water bearing structures shall conform to ACI 350 Code requirements for Environmental Engineering Concrete Structures and Commentary, and ASTM C150, Type V including optional tables. Tri-calcium Aluminate shall not exceed 5%.



2. Non-water-bearing structures shall conform to the requirements of ASTM C150, Type I.
  3. The Contractor shall use one brand of cement throughout the project unless otherwise acceptable to the Design Engineer.
- B. Fly Ash used shall be Type F, and shall conform to the requirements of ASTM C618.
- C. Normal weight aggregates shall conform to the requirements of ASTM C33 and as specified in this section. The Contractor shall provide aggregates from a single source for exposed concrete.
1. For exterior exposed surfaces, the Contractor shall not use fine or coarse aggregates containing spall causing deleterious substances.
  2. Local aggregates not in compliance with the soundness and durability requirements of ASTM C33 shall not be used except with prior written approval of the Design Engineer, and provided it can be shown by special testing or a record of past performance that these aggregates produce concrete of adequate strength and durability. Aggregate soundness testing for fine and coarse aggregates shall be in accordance with ASTM C88 using a sodium sulfate solution.
- D. Fine aggregates shall conform to the requirements of ASTM C33. The content of material passing a number 200 sieve shall not exceed 4%. The Contractor shall use only clean, sharp, natural sand.
- E. Coarse aggregates shall be crushed limestone conforming to the requirements of ASTM C33. Crushed limestone for coarse aggregate shall consist of uncoated particles of sound, durable rock of uniform quality containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Content of material passing a number 200 sieve shall not exceed 0.5 percent. No surface, yellow or soft stone shall be permitted. The specific gravity of the stone shall not be less than 2.56.
- F. Water shall be clean and potable.
- G. The Contractor shall provide concrete admixtures which contain not more than 0.1 percent chloride ions.
1. Water-reducing admixture shall conform to requirements of ASTM C494, Type A.
  2. Air-entraining admixture shall conform to requirements of ASTM C260, and shall be certified by manufacturer to be compatible with other required admixtures.

3. High-range water-reducing admixture (Super Plasticizer) shall conform to requirements of ASTM C494, Type F or Type G.
4. Water-reducing, accelerating admixture shall conform to requirements of ASTM C494, Type E.
5. Water-reducing, retarding admixture shall conform to requirements of ASTM C494, Type D.

### 3.0323 Related Materials

- A. Granular Base: The Contractor shall provide evenly graded mixture of fine and coarse aggregates with maximum particle size of 1" to provide, when compacted, a smooth and even surface below slabs on grade. Granular base shall be 6" thick.
- B. Sand Cushion: The Contractor shall provide 2" of clean, manufactured or natural sand between the granular base and the vapor barrier. Sand used in concrete shall be natural sand consisting of clean, hard, durable, uncoated grains. Sands containing lignite are not acceptable for exposed architectural concrete.
- C. Vapor Retarder: The Contractor shall provide vapor retarder cover over prepared base material below slabs on grade. The Contractor shall use only materials that are resistant to deterioration when tested in accordance with ASTM E154. Vapor retarder shall consist of a Polyethylene sheet not less than 10 mils thick.
- D. Absorptive Cover: The Contractor shall provide burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2, where required.
- E. Moisture-Retaining Cover: The Contractor shall provide one of the following complying with ASTM C171 for curing concrete, where required:
  1. Waterproof paper
  2. Polyethylene-coated burlap
- F. Liquid Membrane-Forming Curing Compound: The Contractor shall provide liquid-type membrane-forming curing compound complying with ASTM C309, Type I, Class A where required. Moisture loss shall not exceed 0.055gr. /sq. cm. when applied at 200 sq. ft./gal.
- G. Water-Based Acrylic Membrane Curing Compound: The Contractor shall provide water-based acrylic membrane curing compound conforming to ASTM C309, Type I, Class B.

- H. Bonding Compound: Bonding compound shall be polyvinyl acetate or acrylic base.
- I. Epoxy Adhesive: The Contractor shall provide epoxy adhesive conforming to ASTM C881 two component material suitable for use on dry or damp surfaces. The Contractor shall provide material Type, Grade, and Class to suit project requirements.
- J. Sealer: The Contractor shall provide sealer conforming to the Ashford formula as manufactured by Curecrete Chemical Company, Inc., or approved equivalent.
- K. Forms: Forms shall be new material at project start. Undamaged forms, meeting the requirements of allowable tolerances, may be reused with approval from the Design Engineer. Forms shall be constructed of steel, or finished lumber true to line, and grade, mortar tight, free from irregularities, and holes. They shall be of sufficient strength to avoid displacement, and held together with approved form clamps. Forms shall be coated with a non-staining mineral oil, or other Design Engineer approved release agent. Forms shall be removed after the cured concrete has gained sufficient strength, and generally within 24 to 72 hours after placing concrete, but shall not be removed until inspected and approved by the Design Engineer, or his agent.
- L. Waterstops: Waterstops for expansion and contraction joints shall be the flat type, 9 inches in length and 3/8" thick PVC, 3-bulb continuous, as manufactured by Greenstreak, Inc., or approved equivalent.

### **3.0324 Proportioning And Design of Mixes**

- A. Concrete mix design shall be submitted to the Design Engineer for approval.
- B. An independent testing laboratory acceptable to the Design Engineer for preparing and reporting proposed mix designs shall prepare design mixes for each type and strength of concrete by laboratory trial batch methods as specified in ACI 301.
- C. Design mixes shall provide normal weight, air-entrained concrete with the following properties, as indicated on the Plans, per ASTM C94.
  - 1. Cement: Type V ASTM C150 including optional tables. Tricalcium Aluminate for all water bearing structures and surfaces shall not exceed 5%. Type I may be used for non-water bearing structures.
  - 2. Admixtures:

- a. Air entraining shall conform to ASTM C260.
- b. Pozzolans shall conform to ASTM C618.
- c. Admixtures other than air-entraining agents and pozzolans shall be used only when authorized in writing by the Design Engineer.
- 3. Coarse Aggregate shall be Number 57, conforming to ASTM C33.
- 4. Fine Aggregate shall conform to ASTM C33.
- 5. Slump shall be between 3 and 5 inches.
- 6. Air content shall be  $6\% \pm 1\%$  conforming to ASTM C94.
- 7. Mix Proportioning: One Cubic Yard
 

	Class A	Class B
a. Minimum 28 day compressive strength (psi)	4000	3000
b. Cement per cubic yard Concrete (lbs)		
1. Minimum	517	423
2. Maximum	N/A	517
c. Pozzolan (fly ash) (lbs/cubic yard)	100	N/A
d. Volume of water per cu. ft. of cement -maximum (Gal)	*	7.5
*Water to cement ratio for all water bearing structures and surfaces shall be in the range of 0.45 to 0.48.		
e. Amount of air entrained in fresh mix	5-7%	0

**3.0325** Concrete Mixing

- A. Ready-mix concrete shall comply with requirements of ASTM C94, and as specified.
- B. Mix concrete only in quantities for immediate use.
- C. Do not retemper or use set concrete.

**3.0326** Reinforcing Material for Cast-in-Place Concrete

- A. Reinforcing bars shall conform to the requirements of ASTM A615 or A706. Reinforcing bars shall be grade 60 deformed bars, or as specified on the Plans.
- B. Welded wire fabric, or cold-drawn wire for concrete reinforcement shall conform to the requirements of ASTM A185 or ASTM A82, respectively.

**3.0327** Grout

- A. Grout shall consist of a mixture of water and cement, or water, and one part cement to two parts mortar sand, by volume. The water may be adjusted to produce a mixture suitable for job conditions, as approved by the Design Engineer.

**3.0328** Non-Shrink, Non-Metallic Grout

- A. Non-Shrink, non-metallic grout shall be provided as a high-strength mortar or grout which does not shrink in the plastic state, maintains its dimensions in a hardened state, for the purpose of bonding permanently to a clean metal base plate and concrete substrate.
- B. Non-Shrink, non-metallic grout shall be pre-mixed, non-metallic, non-corrosive, non-staining grout containing the selected sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, in full compliance with ASTM C1107, having consistency suitable for application in Jefferson County, Alabama, from manufacturer approved by the Design Engineer.

**3.0330 Execution**

**3.0331** Preparation

- A. The Contractor shall prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's written instructions.
- B. In locations where new concrete is doweled to existing work, the Contractor shall drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- C. The Contractor shall coordinate the placement of joint devices with erection of concrete formwork, and placement of form accessories.
- D. The Contractor shall coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.
- E. The Contractor shall not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. The Contractor shall apply form-coating material in compliance with manufacturer's written instructions.

- F. The Contractor shall coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

**3.0332** Joints

- A. The Contractor shall locate and install construction joints as indicated or, if not indicated, so as not to impair strength and appearance of the structure, as acceptable to the Design Engineer.
- B. The Contractor shall provide keyways in construction joints for walls, slabs, and between walls and footings as shown on the Drawings and details.
- C. The Contractor shall place construction joints perpendicular to main reinforcement. The Contractor shall continue reinforcement across construction joints except as otherwise indicated. The Contractor shall not continue reinforcement through sides of strip placements.
- D. The Contractor shall use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. The Contractor shall provide waterstops in construction joints as indicated. The Contractor shall install waterstops to form continuous diaphragm in each joint. The Contractor shall make provisions to support and protect exposed waterstops during progress of Work. The Contractor shall field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.
- F. The Contractor shall construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as equipment bases and elsewhere as indicated.
- G. The Contractor shall provide premolded joint filler and cold applied joint sealant component in all expansion and contraction joints. See Standard Drawings SD4023 and SD4024.

**3.0333** Installation of Embedded Items

- A. The Contractor shall set and build into the Work anchorage devices and other embedded items required for other Work that is attached to or supported by cast-in-place concrete. The Contractor shall use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. The Contractor shall set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished

surfaces. The Contractor shall provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

- C. All exposed formed concrete edges shall have 3/4" chamfer unless otherwise noted.

### **3.0334 Concrete Placement**

- A. Prior to placing an order for concrete, the Contractor shall inspect and complete form work installation, reinforcing steel, and items to be embedded or cast in. The Contractor shall notify other crafts to permit installation of their work; and cooperate with other trades in setting such work. In addition to other equipment required for placement, the Contractor shall provide standby vibrators (minimum of two (2) units) during all concrete placement.
- B. The Contractor shall comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- C. The Contractor shall deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, the Contractor shall provide construction joints as herein specified. The Contractor shall deposit concrete to avoid segregation at its final location.
- D. The concrete shall be placed in such a manner to produce solid concrete free of honeycomb, and sand streaks. Concrete shall not be allowed to drop freely a distance greater than 5 feet. Concrete shall be compacted with mechanical vibrating equipment supplemented by hand spading, and tamping. It shall be placed upon clean, damp surfaces, free from standing water. Concrete which has contained its water content for more than 45 minutes shall not be placed unless the Design Engineer approves a variance. Freshly placed concrete shall be protected from heavy rain, flowing water, or other injurious conditions, and shall not be allowed to become dry from the time it is placed until the expiration of the 21-day curing period.
- E. The Contractor shall be required to have all necessary equipment and supplies on site before starting a pour, including two standby vibrators, concrete buckets, pumps, cranes, and curing compounds as applicable.
- F. The Contractor shall deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, the Contractor shall place each

layer while the preceding layer is still plastic, to avoid cold joints. When placing concrete, use of aluminum pipe or other aluminum conveying devices will not be permitted. Maximum height of concrete free fall shall not exceed 5 feet. The Contractor shall use placement devices such as chutes, pouring spouts, and pumps as required.

1. The Contractor shall consolidate placed concrete by hand held mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. The Contractor shall use equipment and procedures for consolidation of concrete in accordance with ACI 309. Form vibrators are prohibited.
2. The Contractor shall not use vibrators to transport concrete inside forms. The Contractor shall insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. The Contractor shall place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. The Contractor shall not insert vibrators into lower layers of concrete that have begun to set. At each insertion, the Contractor shall limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. The Contractor shall deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. The Contractor shall consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. The Contractor shall bring slab surfaces to correct level with straightedge and strike off. The Contractor shall use bull floats prior to beginning finishing operations.
3. The Contractor shall maintain reinforcing in proper position during concrete placement.

H. The Contractor shall protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures in accordance with provisions of ACI 306R.

I. When air temperatures has fallen to or is expected to fall below 40°F (4°C), the Contractor shall uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 80°F (27°C) at point of placement.

1. The Contractor shall not use frozen materials or materials containing ice or snow, or place concrete on frozen subgrade or on subgrade containing frozen materials.



2. The Contractor shall not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
  3. The Contractor shall maintain the concrete at a temperature of not less than 50°F (10°C) and not more than 90°F (32°C) for a period not less than 72 hours.
- J. When hot weather conditions exist that would seriously impair quality and strength of concrete, the Contractor shall place concrete in compliance with ACI 305R and as herein specified.
1. The Contractor shall cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C).
- K. All permanently exposed concrete work inside and outside shall be thoroughly rubbed with Carborundum stones to remove form marks and other defects, and produce a smooth, uniform finish, no sooner than 24 hours, nor later than 72 hours after placement of the concrete. In lieu of rubbing the unfinished concrete, the Contractor may seal the concrete with a sealing compound approved by the Design Engineer.
- L. After concrete has been placed, it shall be protected against the loss of moisture, and from damage from other adjacent construction operations. The concrete shall be kept wet until forms have been removed. After forms have been removed, the concrete shall be rubbed as specified, and then wetted, and tightly covered with polyethylene film, or other approved curing material for a period of 21-days in accordance with ASTM C309 for curing concrete. It shall be the responsibility of the Contractor to maintain moisture in the concrete during the specified curing period.

**3.0335** Patching

- A. The Contractor shall allow the Design Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb, or embedded debris in concrete is not acceptable. The Contractor shall notify the Design Engineer upon discovery of excessive honeycomb.
- C. The Contractor shall patch imperfections as directed by the Design Engineer.

**3.0336** Defective Concrete

- A. Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements shall be considered defective.

- B. The Contractor shall repair, or replace defective concrete as directed by the Design Engineer.
- C. The Contractor shall not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of the Design Engineer for each individual area.

**3.0337** Field Testing Concrete

- A. **Strength Tests During the Work:** The Owner/Developer's contracted Testing Laboratory shall make four concrete test cylinders for each 50 cubic yards poured, or for each day's pour, whichever amount of concrete is smaller. Cylinders shall be made, and tested in accordance with ASTM C31, ASTM C172, and ASTM C39. The standard age of the test shall be 28 days. The first cylinder shall be broken at 7 days. If the 7-day break exceeds the specified strength, then no further tests shall be made until the 28th day. If the 7-day break does not meet the specified strength, then the second cylinder shall be tested at the 14th day. In either event, the remaining cylinder(s) shall be tested at the 28th day. When the test cylinders fail to conform to the compressive strength requirements, the Design Engineer shall have the right to order a change in the concrete mix for the remaining portions of the Work.
- B. **Test of Hardened Concrete in, or Removed From the Structure:** When the results of the strength tests of the control specimens indicate the concrete as placed does not meet specification requirements, or where there is other evidence that the quality of the concrete is below specification requirements, core-boring tests shall be made in conformance with ASTM C42. Core specimens shall be tested by the Owner/Developer's Testing Laboratory. All deficiencies shall be corrected; or, if the Contractor elects, he may submit a proposal, for approval, that load tests be made. If the proposal is approved, the load test shall be made by the Contractor, and the test results evaluated by the Design Engineer and the County. If any concrete shows evidence of failure during the load test, or fails the core test as evaluated, the deficiency shall be corrected. Any deficiency shall be corrected in a manner approved by the County.
- C. **During the concrete placement, the Owner/Developer's Testing Laboratory shall be responsible for making the test cylinders including furnishing the molds, storing cylinders in a moist, or saturated condition, and testing at the Laboratory's test facility. Copies of all test results shall be furnished to the Design Engineer, County, and the Contractor.**

## **3.0400 Masonry**

### **3.0410 Mortar and Grout**

#### **3.0412** References - Latest Edition

- A. ASTM C91 - Masonry Cement
- B. ASTM C144 - Aggregate for Masonry Mortar
- C. ASTM C150 - Portland Cement
- D. ASTM C270 - Mortar for Unit Masonry
- E. ASTM C476 - Grout for Masonry
- F. ASTM C404 - Aggregates for Masonry Grout
- G. ACI 530/ASCE 5 - Building Code Requirements for Masonry Structures
- H. ACI 530.1/ASCE 6 - Building Code Specifications for Masonry Structures
- I. IMIAC - International Masonry Industry All-Weather Council

#### **3.0413** Submittals

- A. Submit product data as specified.  
Submit manufacturer's product data for each type of mortar required.
- B. Submit the following product data:
  - 1. Submit masonry grout mix design.
    - a. Break down material content per cubic yard of grout.
    - b. Show dry weight of cement.
    - c. Show saturated, surface-dried weights of fine and coarse aggregate.
    - d. Show weight of water.
    - e. List quantities, types, and names of admixtures.
  - 2. Submit trial mix laboratory reports.
  - 3. Submit product data on each admixture proposed.
  - 4. Submit certification of aggregate quality. Include statement for an independent lab that aggregates used are not reactive.

**3.0414** Quality Control

- A. Sampling and testing: ASTM C1019 for strength and slump.
- B. Frequency: 3 samples for each 5,000 sq. ft. of masonry for strength, 1 test each batch for slump. Slump shall be between 8" and 11" in accordance with ASTM C476.
- C. Use of concrete cylinder molds for grout samples is prohibited. Samples shall be prepared in accordance with ASTM C1019.

**3.0415** Materials

- A. Portland Cement: ASTM C150, normal type I; gray color.
- B. Masonry Cement: ASTM C91, water repellent; for general use.
- C. Mortar Aggregate: ASTM C144, standard masonry type; clean, dry; protected against dampness, freezing, and foreign matter.
- D. Water: Clean and potable.
- E. Grout Aggregate: ASTM C404; Maximum coarse aggregate size 1/2 inch.

**3.0416** Mixes

- A. Mortar for Load Bearing Walls: ASTM C270, Type S.
- B. Mortar for Non-Load Bearing Walls and Partitions: ASTM C270, Type N.
- C. Pointing Mortar: ASTM C270, Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
- D. Grout for Masonry Walls, reinforced and non-reinforced: Proportioned to have compressive strength equal to or greater than the compressive strength of the masonry, but not less than 2,000 psi.

**3.0420** Unit Masonry System

**3.0421** Section Includes

- A. Concrete masonry and brick units.
- B. Reinforcement, anchorage, and accessories.

### **3.0422** References

- A. ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement
- B. ASTM C34 - Structural Clay Load-Bearing Wall Tile
- C. ASTM C55 - Concrete Brick
- D. ASTM C56 - Structural Clay Non-Load Bearing Tile
- E. ASTM C126 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
- F. ASTM C216 - Facing Brick (Solid Masonry Units made from Clay or Shale)
- G. ASTM C62 - Building Brick (Solid Masonry Units made from Clay or Shale)
- H. ASTM C90 - Hollow Loadbearing Concrete Masonry Units
- I. ASTM C129 - Nonloadbearing Concrete Masonry Units
- J. UL - Underwriters' Laboratories

### **3.0423** Submittals

- A. Submit product data:
  - 1. Submit product data and test reports for each type and size of concrete masonry unit, brick, and/or structural tile applicable.
  - 2. Submit product data for each type of masonry accessory required, such as Joint Reinforcement, Dovetail Anchors, Wall Ties, Flashing, Control Joints, etc. Specify sizes, finishes, options, etc. on data sheets.
- B. Submit a minimum of four samples of each type of face brick required on the project to illustrate extremes of color and texture ranges.

### **3.0424** Concrete Masonry Units

- A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type II - Nonmoisture- Controlled; normal weight.
- B. Solid Load Bearing Block Units: ASTM C90, Grade N, Type II - Nonmoisture- Controlled; normal weight.

- C. Hollow Non Load Bearing Block Units: ASTM C129, Type II - Nonmoisture- Controlled; normal weight.
- D. Concrete Brick Units: ASTM C55, Grade N, S, Type II - Nonmoisture- Controlled; of same Grade, Type, and Weight as block units.
- E. Masonry Units: Nominal modular size of 8 x 8 x 16 inches. Provide special units for 90-degree corners, bond beams, lintels and bullnosed corners.
- F. Specified minimum compressive stress:  $f_m = 2,000$  psi, minimum
- G. Acoustical Concrete Masonry Units: Acoustical Concrete Masonry Units shall be 8" x 16" nominal face size. They shall be 8" deep and have sound absorptive features as well as straight through cavities to accommodate vertical reinforcing where required. Units shall meet other specified requirements of Concrete Masonry Units and shall be Proudfoot, "SoundBlox" Type RF; Type RSC/RF, or Trenwyth Industries Acousta-Wal Type IIRF, or approved equivalent.
- H. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications and be approved by the County.
  1. Grasselli Concrete Products
  2. Superock Block Co.
  3. Sherman Industries, Inc.
  4. Proudfoot SoundBlox
  5. Trenwyth Industries, Inc.
  6. Or approved equivalent

**3.0425** Brick Units

- A. Face Brick: ASTM C216, color as selected by Owner (match existing brick in size, texture and color if applicable).
- B. Building Brick: ASTM C62, Solid Units.
- C. Hollow Facing and Building Brick: ASTM C652, Grade SW, Type HBS; color as selected by Owner.
- D. Sand-Lime Face Brick: ASTM C73, Grade SW.
- E. Brick Masonry Units: Nominal modular size of 2-1/4 x 3-3/4 x 8 inches. Provide special units for 90-degree corners, lintels and exposed solid edges at sillwork.

F. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications and be approved by the County.

1. Bickerstaff Clay Products
2. Or approved equivalent

**3.0426 Reinforcement and Anchorage**

- A. Single Wythe Joint Reinforcement: Truss type; hot dip galvanized after fabrication; cold-drawn steel conforming to ASTM A82, No. 9 gage side rods with No. 9 gage cross ties; manufactured by Dur-O-Wall or approved equivalent.
- B. Reinforcing Steel: ASTM A615, Grade 60 of sizes shown on Drawings. Deformed billet, unprotected finish.
- C. Corrugated Formed Sheet Metal Wall Ties: 1-1/2" x 8" inch size by 16 gage thick, galvanized steel finish.
- D. Lintel Blocks: Concrete with reinforcing.

**3.0500 Metals**

**3.0510 Miscellaneous Metals**

**3.0511** The Work under this section includes but is not limited to furnishing and installing all iron, steel, stainless steel, aluminum shapes, fabrications, castings or items not specifically covered by other sections.

**3.0512 Submittals**

- A. Submit shop drawings as specified.
1. Submit complete layout, erection and fabrication drawings for each shop-fabricated item.
  2. Show all dimensions needed to fabricate, locate, and erect each item, and dimensions required to coordinate with other work and trades.
- B. Submit product data as specified.
1. Submit product data for all "bought-out" items furnished under this Section.
  2. List locations, quantities, sizes, and reference drawings for each item.

### **3.0513** Project Conditions

Field Measurements: Check actual locations of construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delays of work.

### **3.0514** Quality Assurance

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code D1.1". Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

### **3.0520** Products

#### **3.0521** Iron Castings

- A. Castings shall be of the type, size, weight and dimensions as shown on the Drawings.
- B. Cast Iron shall conform to ASTM A48 Class 30B.
  - 1. Castings shall be sound, smooth, clean and free from blisters and other defects. No plugging of defective castings will be permitted.
  - 2. All unfinished edges shall be neatly cast with suitable round corners and all inside angles shall have ample fillets.
  - 3. Surfaces shall be finished to such smoothness and accuracy of dimension as to insure good workmanship when assembled. All castings shall be annealed to remove internal stress before being machined.
  - 4. All castings shall have the mark number and heat number cast on them.
  - 5. All parts called for on the Drawings as galvanized shall be coated to conform to the requirements of ASTM A123 Standard Specification.
- C. Malleable Iron Castings shall conform to ASTM A197.
  - 1. Castings shall be free from cracks, blowholes, mold pulls, risers, fins or other imperfections that may impair serviceability. The surface of the castings shall be reasonably smooth and free of fused sand and dross.



2. Tolerances shall be accepted foundry standards not to exceed plus/minus 1/16 inch per linear foot of major dimension. The seating surfaces of cover and grating shall be machined to insure a continuous fit.
  3. Castings shall have asphalt dip coatings. Coatings shall be smooth, tough and non-tacky.
- D. Install Casting as follows:
1. Frames and covers shall be of the types and sizes shown on the Drawings. They shall be installed as shown on the Drawings with surfaces accurately set to line and grade unless otherwise shown.
  2. Castings to be embedded in concrete shall be firmly and properly supported until the concrete has been placed around them and hardened.
  3. Casting to be embedded in brick masonry shall be inserted as the work progresses.
  4. Care shall be exercised in bolting castings to prevent misalignment or springing of any of the parts.

### **3.0522** Structural Steel

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Structural Steel Shapes, Plates and bars: ASTM A36, except where other type steel is indicated.
- C. Cold-Formed Steel Tubing: ASTM A500, Grade B.
- D. Hot-Formed Steel Tubing: ASTM A501.
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
- F. Anchor Bolts: ASTM A307, headed type unless otherwise indicated.
- G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers as follows:
1. Quenched and tempered medium-carbon steel bolts, nuts and washers, detailed to provide slip critical connections complying with ASTM A325.
  2. Direct tension indicators, ASTM F959 Type as required. Use on all A325 Bolts.

H. Electrodes for Welding: Comply with AWS Code.

**3.0523** Miscellaneous Steel

- A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A36.
- C. Miscellaneous steel items located in pumping station wet well shall be Type 304 stainless steel.

**3.0524** Structural Aluminum

Material shall be wrought alloy 6063-T6.

**3.0525** Metal Grating

- A. On a case by case basis, the County may require either aluminum or UV coated fiberglass grating to cover openings as shown on Drawings. When metal grating is shown provide aluminum grating as follows.
- B. Provide embedded aluminum angle frames for grating support wherever possible. Where not, provide surface-mounted aluminum angle supports.
- C. Thickness of grating shall be as determined by supplier, but shall be sufficient to limit deflection to 1/240 of span at 150 psf live load. Provide all additional supports required at openings or large spans to limit deflection to the maximum specified.
- D. Openings: All openings for pipes, etc. shall be banded and fabricated in sections of such size that each section may be removed without disassembling the pipes which pass through it.
- E. Aluminum planks and gratings shall have end closure strips.
- F. Acceptable Manufacturers
  1. IKG/Borden
  2. Ohio Gratings, Inc.
  3. Or approved equivalent

- G. Where grating is installed in concrete, it shall be supported by anchored bearing angles on all sides. Bearing angles shall be embedded wherever possible, unless otherwise shown on the Drawings. Bearing angles shall be of the same material as the grating.
1. The width of the horizontal leg of the bearing angles shall be equal to at least twice the depth of the grating it supports.
  2. Completed sections shall be level and true so as to rest firmly on the bearing angles along the entire contact surface. Bearing angles and anchors shall be accurately set to the line and grade shown on the Drawings, leveled and rigidly supported by suitable means until the concrete has been placed around them and has hardened.
  3. Where aluminum angles are to be in contact with concrete, the contact surfaces shall be painted with 2 coats of coal tar epoxy.
  4. Grating anchor clips shall be installed on all sections of grating subject to lateral movement; where adjacent sections of grating bear on a common intermediate support; where any gaps between grating and supports create tripping hazards or cause uncomfortable deflection of grating; or where directed by the Design Engineer. Grating clips shall be designed so as to not create a tripping hazard. A minimum of four clips shall be installed on all applicable grating sections.

**3.0526** Aluminum Handrail System

- A. On a case-by-case basis, the County may require either aluminum or UV coated fiberglass handrails as shown on Drawings.
- B. When fiberglass handrail is shown refer to section 3.0620. When aluminum handrail is shown, design, engineer, fabricate and install the railing system to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component.
1. Handrails:
    - a. Concentrated load of 200 lb applied at any point, non-concurrently, vertically downward or horizontally.
    - b. Uniform load of 50 lb per linear foot applied nonconcurrently, vertically downward or horizontally.
    - c. Concentrated and uniform loads above need not be assumed to act concurrently.
- C. Aluminum members shall be of alloy and temper recommended by the manufacturer for strength, corrosion resistance and application of required finish. Comply with ASTM B221 for aluminum extrusions, ASTM B209

for aluminum-alloy sheet or plate and ASTM B211 for aluminum-alloy bars, rods and wire.

- D. Pipe for aluminum posts and rails shall be a minimum 1-1/2" Schedule 40 (.145" wall) pipe of aluminum alloy 6063-T6. Outside diameter for nominal 1-1/2" pipe shall be 1.900".
- E. Fittings
1. Fittings shall be manufactured of wrought material of the same aluminum alloy composition as the posts and rails.
  2. Tee-fittings and elbows which are fabricated from more than one piece shall be of welded construction with no weld marks visible when the fitting is installed.
  3. All surfaces which mate with pipe or tubing shall be precisely machined and free from burrs.
- F. Mounting
1. Posts shall be attached to surfaces with surface-mount flanges.
  2. Surface-mount flanges shall be top-mount or side-mount as indicated on the drawings.
  3. Mounting flanges shall be designed for the number of anchor bolts required to meet the load requirements of this section.
  4. Mounting flanges on stair stringers shall not exceed the width of the stringer member.
- G. Fasteners
1. All mechanical fasteners used in the assembly of the handrail system shall be manufactured from stainless steel alloys.
  2. Adhesive: 3M Scotch-Weld Epoxy Adhesive, EC-2216 B/A, a two part epoxy compound, shall be used for permanent splice connections.
- H. Toe Plate
1. All handrails shall be furnished with a toe plate wherever any of the following conditions apply:
    - a. A person can pass below the handrail (except at stair stringers).
    - b. A walkway, slab, or accessible area is adjacent to handrail at another walkway or slab and at least 36" below that walkway or slab.
    - c. Wherever machinery or equipment below could be damaged by falling material.
  2. The toe plate shall be sized as shown on Drawings. The toe plate shall be aluminum heavy-duty extruded section with clip attachment to handrail posts as indicated.

- I. Finish
  - 1. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designation of finishes.
  - 2. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
  - 3. Provide Class I clear anodized finish AA M10 C22 A41 (215 R1). All pipe shall be plastic wrapped for finish protection. Plastic wrap shall be removed only after erection.
  
- J. Dissimilar Materials
  - 1. When aluminum system components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with a heavy coat of a proper primer or asphalt paint. See Section 3.0900.
  - 2. When aluminum railing components come in contact with concrete or lime mortar, such exposed aluminum surfaces shall be painted with alkaline-resistant coatings such as heavy-bodied bituminous paint or water-white methacrylate lacquer. See Section 3.0900.
  
- K. Anchors
  - 1. Expansion anchors or embedded hook anchors may be used. Bolt pullout force must meet or exceed that calculated by the handrail system manufacturer to meet the specified design loads.
  
- L. Installation
  - 1. Handrails shall be installed of the sizes and at the locations as shown on the Drawings. Railings shall be rigid and true to lines and grades.
  - 2. Bends, where required, shall be neatly rounded without distorting or otherwise injuring the pipe.
  - 3. Posts shall be installed at 6'-0" horizontally on center, maximum, or less if required by manufacturer to comply with specified load requirements.
  - 4. Posts shall be installed plumb and level.
  - 5. Mounting flanges shall be installed with the required number of anchor bolts to meet the specified load requirements.
  - 6. Aluminum reinforcing bars shall be furnished where indicated or needed in posts. Reinforcing bars shall be 15" solid bar post insert.

**3.0527** Trench Drain Grating

All trench drain grating shown shall be heavy-duty trench frame type "X" and grating, Neenah R-4990, Type A opening, or approved equivalent.

**3.0528** Fasteners

- A. Provide stainless steel fasteners for exterior use or where built into exterior walls. Select fasteners of the type, grade, and class required.
- B. Provide rubber washers to avoid contact between dissimilar metals and as required for providing a watertight seal.

**3.0529** Anchor Bolts

- A. Minimum size: 1/2 inch diameter
- B. Material:
  - 1. Submerged or exposed to weather or wet conditions: Type 304 stainless steel.
  - 2. Equipment anchor bolts: Type 304 stainless steel.
  - 3. Other: stainless steel.
- C. Type: (Contractor's option, unless specifically designated)
  - 1. Cast in place, with sufficient embedment to develop the full tensile strength in accordance with the latest ACI standards.
  - 2. Drill-in expansion anchors: diameter and size as required to achieve required or specified pullout strength.

**3.0530** Stair Nosings

- A. Abrasive aluminum, minimum 3" wide with anchors, by American Abrasives, or equivalent.

**3.0531** Steel Stairs

- A. Steel stairs shall be constructed of structural steel shapes using manufacturer's standard details. Design for 100 psf live load.

**3.0532** Manhole Steps

- A. Manhole and inlet steps shall be made of steel reinforced copolymer polypropylene plastic, model PS-1 PF, as manufactured by M.A. Industries, Inc. They shall be installed at maximum 16" intervals. Manhole steps shall conform to Standard Drawing No. SD1580 with rod and pull out ratings meeting OSHA standards.
- B. Install manhole steps integral with cast-in-place concrete. Anchor and support manhole steps firmly in accordance with manufacturer's written

instructions until concrete has been placed and hardened. Steps shall be 16" O.C. unless otherwise shown on Drawings.

**3.0533** Paint

- A. Paint shall be as specified in Section 3.0900.
- B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

**3.0534** Fabrication, General

- A. Form metal fabrication from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
  - 1. Temperature Change (Range): 100°F (37.8°C).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld corners and seams continuously to comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat head (counter sunk) screws or bolts. Locate joints where least conspicuous.
- H. Provide for anchorage of type indicated and coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- I. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- J. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- K. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- L. Clean, prep and shop prime all ferrous fabricated items as specified in Section 3.0900, Painting.

**3.0535** Miscellaneous Framing and Supports

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete Work.
- B. Fabricate units to sizes, shapes, and profiles indicated. Coordinate dimensions with adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
    - a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch thick x 8 inches long.



**3.0536** Structural Aluminum Ladders and Safety Cages

- A. Structural aluminum ladders and safety cages shall have bolted connections using stainless steel bolts, nuts, and washers.
- B. Ladders and cages shall conform to all applicable OSHA regulations.

**3.0600 Wood and Plastic**

**3.0610 Carpentry Work**

- A. Rough carpentry lumber shall bear visible grade stamp of an agency certified by National Forest Products Association (NFPA).

**3.0611** Reference Standards

- A. ASTM E84, maximum 25 Flame Spread Rating for Lumber AWPA C20 and Plywood AWPA C27.
- B. PS 1 - Construction and Industrial Plywood.
- C. PS 20 - American Softwood Lumber Standard.
- D. NFPA National Forest Products Association National Design Specification for Wood Construction.

**3.0612** Rough Carpentry Materials and Components

- A. Framing lumber shall be Southern Yellow Pine graded in accordance with SPIB standards and grade marked S4S.
- B. Plywood shall be 3/4", SPIB CDX Exterior Grade unless noted otherwise on Drawings.
- C. Nails, Spikes and Staples shall be galvanized for exterior locations, high humidity locations and treated wood, of size and type to suit application, in accordance with Federal Specifications (FS) FF-N-105.

**3.0613** Wood Treatment

- A. Fire Retardant treated wood shall be chemically treated and pressure impregnated; capable of providing a maximum flame spread/fuel contribution/smoke development rating of 25, manufactured by Koppers Company, Inc., Hoover Universal Inc., or approved equivalent.

- B. Wood Preservative shall be Wolmanized (CCA) type, in accordance with Federal Specifications (FS) TT-W-550, manufactured by Koppers Company, Inc. or Hoover Universal, or approved equivalent.

**3.0614** Framing, Furring and Stripping

- A. Erect wood framing, furring, stripping and nailing members true to lines and levels. Do not deviate from true alignment more than 1/4 inch.
- B. Construct members of continuous pieces of longest possible lengths.
- C. Construct and erect required built-up beams, lintels, and diaphragm beams.

**3.0620** **Miscellaneous Fiberglass Reinforced Plastic (FRP)**

**3.0621** On a case by case basis, the County may require Structural Shapes, Handrails, Ladders, Safety Cages, and Grating to be either UV stabilized Fiberglass Reinforced Plastic, or Aluminum. Where FRP is required, furnish miscellaneous fabrications as follows.

**3.0622** The Work under this section includes but is not limited to furnishing and installing all fiberglass shapes, fabrications, castings or items not specifically covered by other sections.

- A. Fiberglass Reinforced Plastic Structural Shapes
- B. Fiberglass Reinforced Plastic Handrail
- C. Fiberglass Reinforced Plastic Ladder and Cages
- D. Fiberglass Reinforced Grating

**3.0623** The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

- A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test Methods
- B. ASTM D638 - Tensile Properties of Plastics
- C. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics
- D. ASTM D2344 - Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

- E. ASTM D495 - High Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation
- F. ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- G. ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
- H. ASTM E84 - Surface Burning Characteristics of Building Materials
- I. ICC International Building Code (IBC)
- J. The Occupational Safety and Health Administration (OSHA)
- K. Code of Federal Regulations (CFR), Volume 29, 39

**3.0624** Submittals

- A. Submit shop drawings as specified.
  - 1. Submit complete layout, erection and fabrication drawings for each shop-fabricated item.
  - 2. Show all dimensions needed to fabricate, locate, and erect each item, and dimensions required to coordinate with other work and trades.
- B. Submit product data as specified.
  - 1. Submit product data for all "bought-out" items furnished under this Section.
  - 2. List locations, quantities, sizes, and reference drawings for each item.
  - 3. Submit the manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems.

**3.0625** Project Conditions

- A. Field Measurements: Check actual dimensions of construction to which fiberglass fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delays of work.

**3.0626** Quality Assurance

- A. Fabricator Qualifications: Firm experienced in successfully producing fiberglass fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

**3.0627** Product Delivery and Storage

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. Storage of Products: All materials shall be carefully handled to protect them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

**3.0628** Manufacturer

- A. The following companies manufacture acceptable Structural Shapes, Handrails, Ladders and Cages and Grating that may be used for design conditions. This list is not exclusive, but other companies must comply with the specification and be approved by the County.
  - 1. Fibergrate Composite Structures Inc.
  - 2. Seasafe Inc.
  - 3. Or approved equivalent

**3.0629** Fiberglass Structural Shapes

- A. All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight for maximum sunlight and chemical resistance. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the specifications and drawings.
- B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

- C. Resins shall be ISOFR, fire retardant isophthalic polyester with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
- E. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with:
  - 1) integral UV inhibitors in the resin and
  - 2) a synthetic surfacing veil to help produce a resin rich surface.
- F. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E84 Tunnel Test.

**3.0630** Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D638	30,000	psi
Tensile Modulus	D638	2.5 x 10 <sup>6</sup>	psi
Flexural Strength	D790	30,000	psi
Flexural Modulus	D790	1.8 x 10 <sup>6</sup>	psi
Flexural Modulus (Full Section)	N/A	2.8 x 10 <sup>6</sup>	psi
Short Beam Shear (Transverse)	D2344	4,500	psi
Shear Modulus (Transverse)	N/A	4.5 x 10 <sup>5</sup>	psi
Coefficient of Thermal Expansion	D696	8.0 x 10 <sup>-6</sup>	in/in/°F
Flame Spread Index	E84	25 or less	N/A

**3.0631** Fabrication

- A. Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.

- B. Sealing: All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the Contractor in accordance with the manufacturer's written instructions.
- C. Hardware: Type 316 stainless steel connection hardware shall be provided.

**3.0632** Fiberglass Handrail System

- A. All posts, and rails are to be structural shapes manufactured by the pultrusion process specified hereinabove. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the Drawings and Specifications.
- B. The system shall must meet the requirements of OSHA 29 CFR 1910.23 and resist without change a 200 lb. loading in all directions. The system shall have top and bottom rails, posts at 6 ft. maximum spacing and kick plate, where required.
- C. Unless specified otherwise, all rails, posts, and kick plates are to be integrally pigmented yellow.
- D. All fasteners used in the railing system are to be Type 316 SS. Rivets shall be Type 18-8 SS.

**3.0633** Handrail Fabrication

- A. The handrail post/rail connection is to be fabricated such that the rails align straight and continuous through the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 6'-0".
- B. Bases of the posts are to be attached according to the drawings and are to be reinforced at the point of maximum leverage.
- C. When required, rails are to be spliced at a distance of 1/4 to 1/3 of the post spacing from the posts using a length of tube bonded and riveted into place using epoxy adhesive and stainless steel fasteners.
- D. All shop fabricated cuts are to be coated with a vinyl ester resin to provide maximum corrosion resistance. Field cuts are to be similarly coated by the contractor in accordance with the manufacturer's written instructions.

### **3.0634 Handrail Performance Requirements**

- A. The completed handrail installation must conform to OSHA specifications and shall meet the following load requirements with a minimum factor of safety of 2.0:
  - 1. Concentrated Load: 200 lb applied in any direction at the top rail.
  - 2. Uniform Load: 50 lb/lf of the top rail in any direction.
  - 3. Loads are not concurrent.

### **3.0635 Fiberglass Ladders and Safety Cages**

- A. All ladder side rails, rungs, ladder mounting brackets and cage straps are to be FRP structural shapes manufactured by the pultrusion process specified hereinabove. Cage hoops and brackets shall be produced by the open molded hand lay-up method. All structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Drawings and Specifications.
- B. Structural members for the ladder side rail and rungs shall be designed by the manufacturer to conform to OSHA 29 CFR 1910.27. The rungs shall be pultruded structural shapes, continuously fluted to provide a non-slip surface. Rungs that are gritted, as a secondary operation, shall not be permitted. Ladder wall and floor mounts shall be fabricated from pultruded angles.
- C. The ladder cage vertical bars shall be pultruded channel shapes to offer protection to workers from exposed hardware. Cage hoops and cage brackets shall be manufactured by the open mold hand lay-up process.
- D. Type 316 stainless steel bolts shall be provided for attaching ladder cage vertical bars to hoops, ladder hoops to brackets, ladder cage brackets to the ladder, and wall brackets to the ladder.
- E. All rungs shall be both mechanically attached to the ladder with stainless steel rivets and chemically bonded with epoxy.
- F. All ladder and cage components are to be integrally pigmented yellow. All wall and floor mount brackets shall be pigmented light gray.
- G. All fasteners used in the ladder system are to be Type 316 SS. Rivets shall be Type 18-8 SS.

### **3.0636** Fabrication

- A. All ladders and cages shall be designed and laid out in strict accordance with OSHA 29 CFR 1910.27.B. and shall conform to all other applicable OSHA regulations.
- B. All rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both epoxy and rivets to provide both a chemical and mechanical lock, respectively.
- C. Ladders shall be fully shop assembled. Ladder cages shall be test assembled and drilled to ensure a proper fit in the field. Ladder cage brackets shall remain attached to the ladder for shipping, but ladder cage components shall be disassembled, packaged, and shipped separately to prevent damage in transit. Cage components shall be bundled with each respective ladder.
- D. The hoop brackets shall be shop attached to the ladder with bolts. The hoops shall be field attached to the hoop brackets.
- E. All cut or machined edges, holes and notches shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts shall be coated similarly by the Contractor in accordance with the manufacturer's written instructions.

### **3.0637** Performance Requirements

- A. The completed ladder and cage system installation shall meet the load requirements set forth in OSHA CFR 29 1910.27. The ladder shall also be capable of supporting an ultimate concentrated vertical load of 1,200 pounds applied at the mid-span of the rung. Manufacturer shall be required to provide supporting test data for rung capacity.

### **3.0638** Installation

- A. Structural fiberglass ladders and safety cages shall have bolted connections using stainless steel bolts, nuts, and washers.
- B. Contractor shall be required to assemble and install ladder in strict accordance with manufacturer's assembly drawing and installation brochure.
- C. Seal cut or drilled surfaces in accordance with manufacturer's written instructions. Follow manufacturer's written instructions when cutting or



drilling fiberglass products or using resin products; provide adequate ventilation.

**3.0639 Reinforced Grating**

- A. Manufacture: Fiberglass Reinforced Grating components conforming to all requirements of OSHA 29 CFR shall be high strength and high stiffness molded or pultruded elements of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be integrally molded or be interlocked and epoxied in place with a two-piece cross rod system to provide a mechanical and chemical lock.
- B. Non-slip surfacing: Grating shall be provided with a quartz grit, bonded and baked to the top surface of the finished grating product.
- C. Fire rating: Grating shall be fire retardant with a tested flame spread rating of 15 or less when tested in accordance with ASTM E84.
- D. Resin system: The resin system used in the manufacture of the grating shall be Vi-Corr vinyl ester, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required, manufactured by Fibergate Composite Structures, Inc. or approved equivalent.
- E. Color: Gray
- F. Depth: Thickness of grating shall be as determined by supplier, but shall be sufficient to limit deflection to 1/240 of span at 150 psf live load. Provide all additional supports required at openings or large spans to limit deflection to the maximum specified.
- G. Mesh Configuration: To be selected by Owner from manufacturer's standard configurations.

**3.0640 Grating Fabrication**

- A. Measurements: Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.

- B. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
- C. Layout: Each grating section shall be readily removable. Manufacturer shall provide openings and holes where located on field verified drawings. Grating supports shall be provided at openings in the grating by the Contractor where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.
- D. Where grating is installed in concrete, it shall be supported by anchored bearing angles on all sides. Bearing angles shall be embedded wherever possible, unless otherwise shown on the Drawings. Bearing angles shall be of the same material as the grating.
  - 1. The width of the horizontal leg of the bearing angles shall be equal to at least twice the depth of the grating it supports.
  - 2. Completed sections shall be level and true so as to rest firmly on the bearing angles along the entire contact surface. Bearing angles and anchors shall be accurately set to the line and grade shown on the Drawings, leveled and rigidly supported by suitable means until the concrete has been placed around them and has hardened.
- E. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's written instructions.
- F. Type 316 stainless steel grating anchor clips shall be installed on all sections of grating subject to lateral movement; where adjacent sections of grating bear on a common intermediate support; where any gaps between grating and supports create tripping hazards or cause uncomfortable deflection of grating; and where directed by the Design Engineer. Grating clips shall be designed so as to not create a tripping hazard. A minimum of four clips shall be installed at maximum spacing of four feet on all grating sections.
- G. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

**3.0641** Installation

- A. Contractor shall install gratings in accordance with manufacturer's assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's written instructions. Follow manufacturer's written instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

**3.0700 Thermal and Moisture Protection**

**3.0710 Flashing and Sheet Metal**

**3.0711** Quality Assurance

- A. Requirements of Regulatory Agencies: Conform to the requirements of Local building code.
- B. Exercise care when working on or about roof surfaces to avoid damaging or puncturing membrane or flexible flashings.

**3.0712** Sheet Metal

- A. Galvanized Steel: Minimum 24 gage of same material and finish as Roof Panels if used on buildings with preformed roofing.

**3.0713** Fabrication

- A. Form sections square true and accurate to size free from distortion and other defects detrimental to appearance of performance.
- B. Backpaint flashings with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

**3.0714** Installation

- A. Cut reglets true to lines and levels. Seal top of reglets with sealant.
- B. Secure flashings in place using specified type fasteners. Use exposed fasteners in locations approved by Design Engineer. Exposed fasteners shall be of same finish as flashings.

- C. Insert metal flashings into reglets to form tight fit. Secure in place. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- D. Apply sealing compound at junction of metal flashings and asphalt felt flashings.
- E. Lock seams and end joints. Fit flashings tight in place. Make corners square, surfaces true and straight in planes and lines accurate to profiles.
- F. Counter-flash mechanical and electrical items projecting through membrane roofing.
- G. Hem exposed edges of flashings on underside 1/2 inch.

### **3.0720 Asphalt Shingle Roofing System**

#### **3.0721 General**

- A. Where asphalt roofing shingles are indicated on the Drawings:
  1. Granular surfaced asphalt shingle roofing
  2. Moisture shedding underlayment, eave, valley and ridge protection
  3. Associated metal flashings
- B. Related Work
  1. 3.0610 Carpentry Work, Framing and Sheathing, Roof sheathing and Framed Openings
  2. 3.0710 Sheet Metal Flashing and Trim
  3. 3.0740 Gutters and Downspouts
- C. References
  1. ASTM D6380 – Asphalt Roll Roofing (Organic Felt)
  2. ASTM D225 - Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules
  3. ASTM D2178 - Asphalt Glass Felt Used in Roofing and Waterproofing
  4. ASTM D2822 - Asphalt Roof Cement
  5. ASTM D3018 - Class A Asphalt Shingles Surfaced with Mineral Granules
  6. ASTM A924 – General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  7. UL 580 - Tests for Uplift Resistance of Roof Assemblies
  8. FS L-P-375 - Plastic Film, Flexible, Vinyl Chloride
- D. Submittals
  1. Submit product data as follows:

- a. Product Data: Provide data indicating material characteristics, performance criteria and limitations.
  - b. Manufacturer's Written Installation Instructions: Indicate preparation required and installation procedures.
- E. Regulatory Requirements
- 1. Conform to applicable code for ASTM D3018 Class A for asphalt shingle types specified.
- F. Environmental Requirements
- 1. Do not install eave edge protection and shingles when ambient temperatures are below 50°F (10°C).
- G. Extra Materials
- 1. Provide 200 square feet of extra shingles.
- H. Guarantee
- 1. Prior to acceptance of Project, the Contractor shall furnish to the County, the manufacturer's warranty on the asphalt shingles for a minimum 20-year period.

**3.0722** Products

- A. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications, with the ICC International Building Code (IBC) and be approved by the County.
- 1. Johns Manville Co.
  - 2. CertainTeed Corp.
  - 3. Elk Corp.
  - 4. Or approved equivalent
- B. Asphalt Shingles
- 1. Asphalt Shingles: Type I organic felt or fiberglass base, mineral granule surfaced type; 235-lb/square standard type; square tab; color selected by Owner/Developer in consultation with the County.
- C. Sheet Materials
- 1. Underlayment: No. 15 unperforated asphalt saturated felts as recommended for use in waterproofing and in construction of built-up roofs.
- D. Accessories
- 1. Nails: Standard round wire shingle type, hot dipped zinc coated steel minimum 13/64 inch head diameter and 0.080 inch shank

diameter, of sufficient length to penetrate 1/4" through underside of roof sheathing.

2. Continuous Ridge Ventilation: .080-250 gage Polypropylene Baffle System with low profile ridge cap.

E. Flashing Materials

1. Sheet Flashings: 26 gage thick steel with minimum 1.25 oz/sq. ft. galvanized coating.
2. Bituminous Paint: Acid and alkali resistant type; black color.
3. Nails: Standard round wire roofing type, hot dipped zinc coated steel; minimum 19/64 inch head diameter and 0.10 inch shank diameter; minimum 7/8 inch long of sufficient length to penetrate through substrate.

F. Flashing Fabrication

1. Form flashings to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water.
2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
3. Hem exposed edges of flashings minimum 1/4 inch on underside.
4. Apply bituminous paint on concealed surfaces of flashings as required.

**3.0723** Execution

A. Examination

1. Verify existing site conditions to assure that storage of materials and installation does not interfere with any other construction work and utility locations or ongoing utility construction.
2. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
3. Verify roof openings are correctly framed prior to installing work of this Section.
4. Verify deck surfaces are dry, free of ridges, warps, or voids.

B. Preparation

1. Fill knotholes and surface cracks with latex filler at areas of bound eave protection.
2. Broom clean deck surfaces under eave protection and underlayment.

C. Installation - Protective Underlayment

1. Place one ply of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 6 inches. Stagger and lap each consecutive layer. Nail in place.

2. Install protective underlayment perpendicular to slope of roof and weather lap minimum 4 inches over eave protection.
3. Weather lap and seal watertight with plastic cement, items projecting through or mounted on roof.

D. Installation - Valley Protection

1. Place one layer of sheet metal flashings, minimum 24 inches wide, centered over open valleys and crimped to guide water. Weather lap joints minimum 2 inches. Nail in place minimum 18 inches o.c., one inch from edges.
2. Apply a 4-inch wide band of lap cement along each edge of first layer and embed ply of roll roofing minimum 36 inches wide, centered. Press into cement to encourage bond and nail in place minimum 18 inches o.c., one inch from edges.

E. Installation - Metal Flashing

1. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
2. Secure in place with nails at 6 inches o.c. Conceal fastenings.
3. Flash and seal work projecting through or mounted on roofing with plastic cement, weather tight.

F. Installation - Asphalt Shingles

1. Install shingles in accordance with manufacturer's written instructions.
2. Place shingles in straight coursing pattern with 5-inch weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.
3. Project first course of shingles 3/4 inch beyond fascia boards.
4. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
5. Cap hips and ridges with individual shingles, maintaining 5-inch weather exposure. Place to avoid exposed nails.
6. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashings.
7. Complete installation to provide weather tight service.

G. Installation - Continuous Ridge Ventilation

1. Install ridge vents in accordance with manufacturer's written instructions.
2. Ridge vents shall be protected from damage or bending.
3. Begin ridge vent flush with fascia board on gable type roofs.
4. Connect ridge vents flush together to maintain a straight and sag free appearance.
5. Shingled ridge cap shall completely cover the ridge vent to become

virtually invisible. See Standard Drawing SD4080.

- H. Protection of Finished Work
  - 1. Cover or otherwise protect finished work of other trades and surfaces during installation. The Contractor shall hold the finished work of other trades free of any damage due to his operations.
  - 2. Do not permit traffic over finished roof surface.

### **3.0730 Metal Roofing System (Aluminum)**

#### **3.0731 General**

- A. Where a metal roofing system is indicated on the Drawings:
  - 1. Provide UL 90 Rated Roof Assembly that has tested in accordance with UL 580 test procedures.
  - 2. The work under this Section includes, but is not limited to:
    - a. Ridges, ridge vents, valleys, eaves, rakes, corners, curbs, miscellaneous flashing, attachment accessories, etc.
  - 3. Metal roofing system shall be furnished and installed on decking as specified. Roofing system shall be complete with roof covering, ridge caps, cell caps (where required), closures, interlocks, fasteners, clips, clamps, anchors, sealing strips, sealant, flashing collars, openings for grounding terminals and conduit, and other accessories as required for the complete system.
  - 4. Related work specified elsewhere:
    - a. Carpentry Work, Section 3.0610.
    - b. Flashing and Sheet Metal, Section 3.0710.
    - c. Joint Sealant, Section 3.0750.
    - d. Gutters and Downspouts, Section 3.0740.
- B. Quality Assurance
  - 1. Manufacturer's Qualifications
    - a. Acceptable manufacturers shall have a maximum of five (5) years of experience in the factory fabrication of metal roof systems.
  - 2. Installer Qualifications
    - a. Three (3) years experience installation of the type of roofing system with successful completion of projects of similar scope.
  - 3. Regulatory Requirements
    - a. Conform to all requirements of the ICC International Building Code (IBC).
- C. Submittals
  - 1. Samples



- a. Submit actual panel sample along with gauge of material sample and color selections. Color shall be selected by the Owner/Developer in consultation with the County.
  - 2. Shop Drawings
    - a. Submit shop drawings showing scaled roof plan (1/4" = 1'-0") and elevations. Show details of all trim and flashing conditions, fastening and anchoring methods, weatherproofing, and penetrations of metal roofing work. Panel fabrication or installation shall not begin until the Design Engineer approves shop drawings.
- D. Guarantee
- 1. Manufacturer's roof panels shall not:
    - a. Crack, blister, peel, flake, check, chip or lose adhesion for three (3) years from date of final acceptance.
    - b. Change in excess of five (5) "delta E" units (per ASTM D2244), or chalk in excess of No. 8 rating (per ASTM D4214) for twenty (20) years from date of final acceptance.
  - 2. Prior to acceptance of the project the Contractor shall furnish to the Owner a warranty bond guaranteeing the workmanship and leak-proof performance of the roofing and trim for a period of twenty years following the acceptance of the project. The warranty shall cover the roofing panels, trim and accessories as a "roofing assembly", and shall include a clause including the performance of the finish coating with respect to resistance to chalking, fading, splitting or peeling within the period of the warranty bond.
- E. Product Delivery, Storage, and Handling
- 1. Materials shall be protected from damage during transit and at the job site. Examine each shipment for damage and completeness before accepting delivery.
  - 2. All materials shall be stored in a manner approved by the manufacturer of the roofing system. The Contractor shall exercise care in transporting, handling and storing the materials. All bundles and cartons shall be handled with care to prevent damage to components, and the manufacturer's specific handling instructions shall be followed. Storage in a warehouse or weather protected area is required. Storage at the job site for an extended period shall not be permitted. Should any of the materials show stains or effects or contact with materials not compatible with the metal or finish, such materials shall be rejected.

**3.0732** Products

- A. The following companies are acceptable manufacturers. This list is not

exclusive, but other companies must comply with all specifications and be approved by the County.

1. Zip Rib by Merchant & Evans
2. Metecno-Morin
3. Imetco
4. Or approved equivalent

B. Materials

1. Roofing shall be aluminum panels 16" wide, not less than 0.040" thickness, and panels shall be furnished in single unbroken lengths extending from ridge to eave, or from wall line to eave, as the case may be. Panels shall be fabricated from aluminum alloy 3004, and shall have factory applied fluorocarbon coating of color as hereinafter specified. The leading edge of each panel shall have a continuous groove in the bulb-rib to provide anti-siphon protection when the hook-rib of the adjacent panel is locked over the bulb-rib so as to form a standing seam approximately 2½" high. Two continuous stiffening ribs, 3/8" high, shall be provided between the upstanding legs of each panel; and stiffening ribs shall be spaced 4" o.c. and approximately 4" from each leg.
2. The roofing system shall be anchored so as to withstand a positive uniform load in accordance with the ICC International Building Code (IBC) by using roofing anchor clips applied to the structure at each panel joint (12" o.c.) and at spacing as required to withstand the load specified hereinabove. Clips shall be concealed type of heavy base barb design and shall be anchored to bulb tees or purlins by means of stainless steel screws set in tapped holes. Clip-to-panel fastening shall be affected by means of stainless steel through bolts. The joint shall be factory sealed (hook-rib side) to prevent entrance of moisture resulting from snow piling. Tops of bulb-tees or purlins shall be covered with 90 lb. smooth roll roofing felt or plastic separator strips to reduce wear on panel legs (edges in contact with supporting bulb-tees or purlins) resulting from thermal movement.
3. Ridge cap assemblies shall be complete with ridge cap of sufficient profile height to allow for flexing of the roof, pan closures, and fasteners with weather tight washers.
4. Flashing shall be fabricated from aluminum alloy 3004, shall have thickness of not less than 0.040", and shall be of finish as specified hereinabove.
5. Soffit covers, when shown on the Drawings, shall be fabricated from aluminum, and shall be same aluminum alloy having thickness and finish as specified for roofing panels.
6. Gutters and downspouts shall be fabricated from aluminum, and shall be of same alloy and finish as specified for soffit and fascia.

7. All fasteners for clips, anchors, closures and accessories shall be stainless steel.
8. All sealants shall be construction grade silicone.
9. Where any aluminum surfaces or aluminum components may be in contact with dissimilar metals, other than stainless steel or zinc, or may be subject to drainage from dissimilar metals, other than stainless steel or zinc, such contact shall be prevented by treatment of the dissimilar metal as follows:
  - a. One coat of zinc-rich primer to dry film thickness of not less than 1.5 mils and two coats of self-leafing aluminum, Koppers Industries or Indurall Coatings Inc., to dry film thickness of not less than 4.0 mils; or
  - b. One coat of bituminous paint, Koppers double-thick or equivalent product of Indurall, to dry film thickness of not less than 8 mils; or
  - c. Isolation strips of neoprene with compatible adhesive or strip of butadiene, self-adhering, or
  - d. Approved equivalent.
10. Where aluminum may be in contact with masonry or concrete, such contact shall be prevented by application of alkali-resistant paint, Koppers or Indurall or approved equivalent, to dry film thickness of not less than 4.0 mils; and, where aluminum may be in contact with wood, the joining surfaces shall be sealed with silicone, or shall be given coat of aluminum-pigmented bituminous paint followed by two coats of metal/masonry paint, Koppers or Indurall or approved equivalent, to dry film thickness of not less than 8.0 mils.
11. All penetrations shall be made, closed, sealed and flashed in manner approved by the roofing manufacturer. Such penetrations may be, but not limited to, those as required for: air terminals for lightning grounding system, conduit, skylights, vents, stacks, etc.
12. Assembly of the roofing system shall be made with concealed anchor clips as specified hereinabove, and the manufacturer of the roofing system shall furnish such anchor clips. No perforations shall be made in the roofing panels except as shown for flashing, closures or trim. Special machine tools furnished by the manufacturer of the roofing system shall be used for closing the interlocking seams of the panels and for forming the pans on ridge panels.
13. Finish of all exposed metal for roofing panels, ridge caps, flashing collars and hoods, base cones for passage of stacks and vents, gutters and downspouts, fascia and trim, soffit panels, etc., shall be a premium fluorocarbon finish. The colors shall be as selected by the Owner in consultation with the County.
14. Provide manufacturer's standard accessories and other miscellaneous materials necessary to complete the work in a professional manner.

**3.0733 Execution**

A. Examination

1. Installation shall not proceed until surfaces are acceptable for the application of the roof system to all parties involved.
2. Installer shall field verify all necessary dimensions prior to fabrication of materials. Fabricate all components in accordance to governing industry standards.

B Installation

1. Entire system shall be installed plumb, level and true to line with no transverse seams.
2. Prevent panels from bending, twisting, abrasion, scratching, denting, etc. Only minor scratches are to be touch-up in the field.
3. Protective masking must be removed immediately prior to when panels are installed.
4. Protect installed roof as required from damage by other trades.
5. Installer shall comply with manufacturer's written installation instructions and shop drawings.

C. Cleanup

1. Leave work areas clean, free from grease, finger marks and stains.
2. Remove all debris, rubbish and unused materials from the jobsite.

**3.0740 Gutters and Downspouts**

**3.0741 Work Included**

- A. Precoated aluminum gutters and downspouts.
- B. Precast concrete splash blocks.

**3.0742** Conform to SMACNA Manual Drawings for nominal sizing of components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

**3.0743 Materials**

- A. The Owner/Developer shall select the color in consultation with the County.
- B. Aluminum Sheet: ASTM B209, .032-inch thick, plain, shop precoated with selected color in 10'-0" lengths with joints lapped.

**3.0744 Fabrication**

- A. Form gutters and downspouts of profiles and sizes indicated.

- B. Field measure site conditions prior to fabricating work.
- C. Fabricate with required connection pieces.
- D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- E. Hem exposed edges of metal.
- F. Seal metal joints.
- G. Fabricate gutter and downspout accessories; seal watertight.

**3.0745** Installation

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's written instructions.
- B. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Apply backing paint to metal back surfaces.
- D. Apply bituminous protective backing on surfaces in contact with dissimilar materials.
- E. Seal metal joints watertight.
- F. Turnout downspouts at splash blocks. Hold in 1" clear of the wall with G.I. straps spaced as required.

**3.0750 Joint Sealants**

**3.0751** Work Included

Cleaning preparation and sealing of all architectural and structural joints as shown and specified.

**3.0752** Sealant Materials

- A. Joint Sealant
  - 1. Joint sealant for both structural joints (expansion joints, isolation joints etc.) and architectural joints (precast panels, windows, doors, louvers, etc.) shall be one-component urethane-based non-sag type.

2. Joint sealant shall be suitable for interior or exterior exposed below-grade or submerged use.
3. Sealant shall be suitable for bridging joints of sizes indicated and required.

B. Backer Rod

1. Backer rod shall be extruded from polyurethane foam.
2. Backer rod shall be of open-cell or closed-cell construction, as sealant type and joint location require. Open-cell rod shall not be used in below grade or submerged applications.
3. Backer rod shall be over-sized for joints as recommended by the rod manufacturer.
4. Sealant shall not bond to backer rod.

C. Bond Breaker

1. Bond breaker shall be compatible with joint sealant.

D. Primer

1. Primer shall be compatible with and of same manufacturer as joint sealant.

**3.0753** Acceptable Manufacturers

- A. Sonneborn Products, Division of Sutton Laboratories, Inc.
- B. Sika Corp.
- C. Or approved equivalent

**3.0754** Inspection

- A. Verify that joint dimensions and physical and environmental conditions are acceptable to receive work of this Section.
- B. Beginning of installation signifies acceptance of above conditions.

**3.0755** Preparation

- A. Clean, prepare and size joints in accordance with manufacturer's written instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant. Clean nonporous surfaces (metal glass porcelain enamel and glazed surfaces of ceramic tile) chemically but do not harm substrate. Prime surfaces when and as recommended in manufacturer's installation instruction.

- B. Examine joint dimensions and size materials to achieve required width/depth ratios for sealant bead.
- C. Use backer rod to achieve required joint depths to allow sealants to perform properly.
- D. Where joint depth does not permit use of backer rod, use bond breaker to prevent three-surface bonding of sealant.
- E. Mask adjacent surfaces as required to protect from sealant application.

**3.0756** Installation

- A. Install sealant in accordance with submitted and approved manufacturer's written instructions.
- B. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
- C. Tool joints concave or as indicated.
- D. Joints shall be installed free of air pockets, foreign embedded matter, ridges, and sags.
- E. Protect joints from foreign material moisture traffic or other potential damage for the curing period recommended by the manufacturer.

**3.0800** Doors

**3.0810** Steel Doors

**3.0811** Work includes non-rated and fire rated steel doors.

**3.0812** References

- A. ANSI/SDI 100 - Standard Steel Doors and Frames.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

**3.0813** Submittals

- A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cutouts for glazing, and finish.
- B. Product Data: Indicate door configurations, location of cutouts for hardware reinforcement.
- C. Manufacturer's Written Installation Instructions: Indicate special installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

**3.0814** Conform to requirements of ANSI/SDI 100 and ANSI/ICC A117.1 – Standard for Accessible and Usable Buildings and Facilities

**3.0815** Regulatory Requirements

- A. Fire Rated Door Construction: Conform to UL 10B.
- B. Installed Door Assembly: Conform to NFPA 80.

**3.0816** Door Manufacturers

- A. Bymoco Metal Fabrication, Inc.
- B. The Ceco Corporation
- C. Magnatrax Corporation
- D. Steelcraft Manufacturing Company
- E. Or approved equivalent

**3.0817** Door Construction

- A. Face: Steel sheet in accordance with ANSI/SDI 100.
- B. Core: Cardboard honeycomb.

**3.0818** Fabrication

- A. Fabricate doors with hardware reinforcement welded in place.



- B. Attach fire rated label to each door unit.
- C. Close top and bottom edge of exterior doors with flush end closure. Seal jambs tight.
- D. Configure exterior doors with special profile to receive recessed weatherstripping.
- E. Finish
  1. Steel Sheet: Galvanized to ASTM A653 Grade 60
  2. Primer: Baked

**3.0819** Installation

- A. Install doors in accordance with ANSI/SDI 100 and DHI.
- B. Coordinate installation of doors with installation of frames and hardware.
- C. Touch-up factory finished doors.

**3.0820 Steel Frames**

**3.0821** Work includes non-rated and fire rated steel frames.

**3.0822** References

- A. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM E2074 - Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- C. NFPA 80 - Fire Doors and Fire Windows.
- D. UL 9 - Fire Tests of Door Assemblies.

**3.0823** Submittals

- A. Shop Drawings: Indicate frame elevations, reinforcement, and finish.
- B. Product Data: Indicate frame configuration, anchor types and spacing, location of cutouts for hardware and reinforcement.
- C. Manufacturer's Written Installation Instructions: Indicate special installation instructions.

- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

**3.0824** Frame Manufacturers

- A. Bymoco Metal Fabrications, Inc.
- B. The Ceco Corporation
- C. Magnatrax Corporation
- D. Steelcraft Manufacturing Company
- E. Or approved equivalent

**3.0825** Fabrication

- A. Fabricate frames as welded unit.
- B. Fabricate frames with hardware reinforcement plates welded in place.
- C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- D. Terminate door stops 6 inches above finished floor. Cut stop at 90-degree angle and close.
- E. Prepare frame for silencers. Provide three single silencers for single doors. Provide two single silencers on frame head at double doors without mullions.
- F. Fabricate frames to suit masonry wall coursing with 4-inch member.
- G. Finish
  - 1. Steel Sheet: Galvanized to ASTM A653
  - 2. Primer: Baked

**3.0826** Installation

- A. Install frames in accordance with ANSI/SDI 100 and DHI.
- B. Coordinate with masonry and wallboard wall construction for anchor placement.
- C. Coordinate installation of frames with installation of hardware and doors.

### **3.0830 Finish Hardware**

#### **3.0831 Work Included**

- A. The Work: Work in this section shall include the furnishing of all items of finish hardware necessary to complete the building.
- B. Finish Hardware: Hardware used in building construction but particularly that used on or in connection with doors, frames, cabinets and other movable members. It also has a finished appearance as well as functional purpose and may be considered as a part of the decorative treatment of a room or building.

**3.0832 Supplier:** A recognized builders' hardware supplier who has been furnishing hardware in the project's vicinity for a period of not less than two (2) years, and who is, or has been in full time employment of, an Architectural Hardware Consultant (AHC) in good standing as certified by the Door and Hardware Institute and who is a direct distributor of the products approved for warranty purposes.

**3.0833 Templates:** The hardware supplier shall provide necessary templates and/or physical hardware to all trades requiring them in order that they may cut, reinforce or otherwise prepare their material or product to receive the hardware item. If physical hardware is required by any manufacturer, the hardware supplier shall ship them such hardware.

#### **3.0834 Warranty**

All hardware shall have a one year limited warranty except door closers which shall have a ten year limited warranty as applicable for the closer specified.

#### **3.0835 Hinges and Pivots**

- A. Template hinges: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template hinges which conform to ANSI Standards whenever applicable.
- B. Hinge pins, except as otherwise indicated, shall be as follows:
  - 1. Steel Hinges: Steel pins.
  - 2. Exterior Doors: Non-removable pins (NRP) or security stud.
  - 3. Out-Swing Corridor Doors: Non-removable pins (NRP), whether specified in the hardware sets or not.
  - 4. Interior Doors: Non-rising pins.

5. Tips: Flat button and matching plus, finished to match leaves, except where hospital tip indicated.
- C. Where projection of door trim is such as to prevent desired degree of opening, the proper hinge width shall be provided to allow the door to clear the trim.
- D. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications and be approved by the County.
  1. Hager Companies
  2. Stanley Works
  3. McKinney Products
  4. Or approved equivalent

**3.0836** Keys and Keying

- A. All lock cylinders shall be master keyed to the County's designated system. Supplier shall submit a detailed key schedule indicating how the Design Engineer and County's instructions have been carried out.
- B. Grade Master keys, Master keys, and other Security Keys shall be transmitted to the County's designated representative. All keys to be stamped "Do Not Duplicate".
- C. Furnish keys in the following quantities:  
4 each - Master keys per door lock set and pad locks
- D. Locksets and Latchsets
  1. Accepted and approved only as follows:
    - a. Corbin 390 Series by Ashley Norton and LCN, or Approved equivalent.
  2. All closers shall be mounted on interior side of rooms.
  3. Only closers with cast iron bodies will be accepted. Aluminum bodies shall not be allowed. All closers shall have full covers.

**3.0837** Installation

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders' Hardware for (Standard Steel Doors and Frames), (Custom Steel Doors and Frames), (Wood Doors and Frames)" by the Door and Hardware Institute (DHI), except if otherwise specifically indicated or to comply with requirements of governing regulations, requirements for the handicapped, or if otherwise directed by the Design Engineer.

- B. Degree of opening for doors with overhead holders, closers, etc., shall be included in the hardware schedule for the Design Engineer's approval.
- C. All hardware shall be installed by tradesmen who are skilled in the installation of commercial grade hardware.
- D. Install each hardware item in compliance with the instructions and recommendations. Securely fasten all parts to be attached. Fit faces or mortised parts snug and flush. Make sure all operating parts move freely and smoothly without binding, sticking or excessive clearance. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted and finished in another way, the hardware shall be removed and stored prior to the painting or finishing. Items shall then be re-installed only when the finishes have been completed on the surface to which the hardware is to be applied.
- E. At exterior doors and elsewhere as indicated, set thresholds, in a bed of sealant as specified in Section 3.0752 to completely fill concealed voids and exclude moisture from every source. Do not plug drain holes or block weeps. Remove excess sealant.
- F. After installation, representative templates, instruction sheets and installation details shall be placed in a file folder to be turned over to the owner when the building is accepted. Included shall be at least five each of any special adjusting and/or installation tools furnished with hardware by the manufacturers.

**3.0838** Adjusting and Cleaning

- A. Adjust and check each operating item of hardware to insure correct operation and function. Units which cannot be adjusted to operate as intended for the application shall be replaced.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to building acceptance or occupancy of a space or area, the installer shall return to the work during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items. Hardware shall be cleaned as necessary to restore correct operation, function and finish. Door control devices shall be adjusted to compensate for final operation of heating and ventilating equipment.

### **3.0839 Protection**

- A. Whenever hardware is located in areas where it may be subject to damage during construction by handling, cleaning, etc., (e.g., painting, cleaning of bricks) it shall be protected and/or removed from its location until the hazardous condition is terminated.

## **3.0900 Finishes**

### **3.0910 Painting**

#### **3.0911 Work Included**

- A. This section covers the painting of all surfaces throughout the project.
- B. The Contractor shall furnish all material, labor and equipment required to prepare surfaces and to complete all painting.

#### **3.0912 Related Documents**

- A. Steel Structures Painting Council (SSPC)
  - 1. SSPC; Good Painting Practice; Volume 1
  - 2. SSPC; Systems and Specifications; Volume 2
  - 3. SSPC SP1; Solvent Cleaning
  - 4. SSPC SP3; Power Tool Cleaning
  - 5. SSPC SP COM; Surface Preparation Commentary
  - 6. SSPC-VIS 1; Visual Standard for Blast Cleaned Steel
  - 7. SSPC SP6; Commercial Blast Standard
  - 8. SSPC-PA COM; Commentary of Paint Application
  - 9. SSPC-PA1; Shop, Field & Maintenance Painting
  - 10. SSPC-PA2; Measurement of Dry Paint Thickness with Magnetic Gages
  - 11. SSPC-PA Guide 3; A Guide to Safety in Paint Application
- B. American Society for Testing and Materials (ASTM)
  - 1. ASTM Standard Paint Tests for Formulated Products and Applied Coatings; Volume 06.02

#### **3.0913 Submittals**

- A. Submit shop drawings as specified.
  - 1. Submit a Painting Schedule similar in format to the schedule in this section.

2. Cross-reference product numbers of all products proposed for each application.
  3. Cross-reference equivalent product specified in schedule.
- B. Submit product data as specified.
1. Submit manufacturer's product data for all products required and listed in the Painting Schedule submitted.
  2. Include product name and number.
  3. List applicable specifications and test standards.
  4. Describe typical uses and restrictions.
  5. List theoretical coverage rates.
  6. Provide manufacturer's preparation/application instructions.
  7. Certify that paint products submitted meet or exceed the requirements of the Specifications.
  8. Submit manufacturers color charts for the Owner to select colors in consultation with the County.

**3.0914 Project Conditions**

- A. General: Air, material, and surface temperatures must be between 50°F (10°C) and 120°F (48.8°C) during application, drying and curing, and metal surfaces must be at least 5°F (-15°C) above the dew point.
- B. Environmental Requirements:
1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
  2. Do not apply finish in areas where dust is being generated.
- C. Regulatory Requirements
1. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.
- D. Protection:
1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

**3.0915 Warranty**

- A. Guarantee all painting work to be free from defective workmanship or materials for one year from date of final acceptance.

**3.0916** Manufacturers

- A. Referenced manufacturer, unless otherwise specified, is The Sherwin-Williams Co., and is named to establish a standard of acceptable quality.
- B. Acceptable Manufacturers:
  - 1. Koppers Company, Inc.
  - 2. Sherwin-Williams Co. (S-W)
  - 3. Or approved equivalent
- C. Other manufacturers furnishing equivalent materials are also acceptable, subject to prior approval by the Design Engineer.

**3.0917** Lead & Chromates

- A. Primers and finish coats must be free of lead and chromate hazards.

**3.0918** Materials

- A. Materials selected for coating systems for all surfaces on this project shall be the product of a single manufacturer. This shall include all shop coats.
- B. Shop Primer
  - Surface Prep: Abrasive Blast to Commercial Blast per SSPC SP6.
  - Primer: Apply one coat S-W Kem Kromik Universal Metal Primer, Brown, B50 NZ6, 3.0 - 4.0 Mils DFT, Spread Rate 204 - 273 Sq Ft./Gal. VOC: 3.45 lbs/gal.
- C. Materials List
  - 1. Non-submerged, masonry and concrete, exterior, above grade walls.
    - Surface Prep: Remove loose mortar, laitance, dust, form release compounds, curing membranes, hardeners, etc.
    - Finish: Apply one coat S-W SherCrete, White, B61 W101; 8.0 - 10.0 Mils Dry Film Thickness, 90 - 100 sq ft/gal, VOC: 2.78 lbs/gal.
    - Color Coat: Apply one coat S-W Exterior Acrylic Flat, A6 Series, 1.4 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 1.2 lbs/gal.
  - 2. Non-submerged, masonry and concrete, exterior, below grade walls.



Surface Prep: Remove loose mortar, laitance, dust, form release compounds, curing membranes, hardeners, etc. Surface must be free of moisture. Fill bug holes and other voids with Kem Kromik Cati-Coat Filler/Sealer.

Finish: Apply one coat S-W Hi-Mil Sher-Tar Epoxy, B69 B40 / B69 V40, 16.0 - 20.0 Mils Dry Film Thickness, 54 - 68 sq ft/gal; VOC: 2.55 lbs/gal.

3. Submerged Masonry and Concrete, including wet wells for wastewater treatment works, pumping stations or other structures.

a. Material:

-100% solids, hard epoxy coating that can be applied to wet or dry substrates.

-Nontoxic.

-0% Volatile Organic Compounds.

-National Sanitary Federation Approved.

b. Manufacturer:

-Raven Lining Systems, Tulsa, OK., Aquatapoxy epoxy coating system.

c. Surface Prep:

-Concrete and mortar shall be thoroughly cured and dry. Remove all contaminants including oils, grease, existing coatings, form release compound, curing compound, sealers, salts and other compounds.

d. Finish:

-Spray apply 20 mil minimum thickness Aquatapoxy epoxy coating. If necessary to ensure no voids or pinholes, apply subsequent topcoat within 12 to 24 hours after the prior coat was applied.

e. Qualifications:

-Application procedures shall conform to the recommendations of the manufacturer.

-The protective coating material must be spray applied by a certified applicator of the Manufacturer.

4. Interior Wood Surfaces: Doors, Trim (Alkyd Semi-Gloss)

Surface Prep: Sand exposed wood, remove dust/contaminants and patch nail holes with wood filler.

Prime Coat: Apply one coat S-W Wall & Wood Primer, B49 WZ2, 1.5 Mils Dry Film Thickness; 400 Sq Ft/Gal; VOC: 3.07 lbs/gal.

1st Coat: Apply one coat S-W ProMar Alkyd Semi-Gloss; B34 Series, 2.1 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 3.16 lbs/gal.

- 2nd Coat: Apply one coat S-W ProMar Alkyd Semi-Gloss; B34 Series, 2.1 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 3.16 lbs/gal.
5. Interior, Concrete Block
- Surface Prep: Remove loose mortar and foreign material. Surfaces must be free of laitance, concrete dust, dirt, and loose cement. Concrete and mortar must be cured at least 30 days at 75°F (23.9°C).
- Primer: Apply one coat S-W Heavy Duty Block Filler, B42 W46, 10.0 - 12.0 Mils Dry Film Thickness, 88 Sq Ft/Gal; VOC: 0.13 lbs/gal.
- 1st Coat: Apply one coat S-W ProMar 200 Interior Latex Flat B30 W200 Series, 1.2 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.44lbs/gal.
- 2nd Coat: Apply one coat S-W ProMar 200 Interior Latex Flat B30 W200 Series, 1.2 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.44 lbs/gal.
6. Interior Gypsum Wallboard:
- a. Latex Flat Finish.
- Surface Prep: Surface must be clean and dry. Taped joints must be sanded smooth and sanding dust removed.
- Prime Coat: Apply one coat S-W ProMar 200 Latex Wall Primer, B28 W200, 1.1 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.71 lbs/gal.
- 1st Coat: Apply one coat S-W ProMar 200 Interior Latex Flat, B30 W200 Series, 1.2 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.44 lbs/gal.
- 2nd Coat: Apply one coat S-W ProMar 200 Interior Latex Flat, B30 W200 Series, 1.2 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.44 lbs/gal.
- b. Gloss Finish.
- Surface Prep: Surface must be clean and dry. Taped joints must be sanded smooth and sanding dust removed.
- Prime Coat: Apply one coat S-W ProMar 200 Latex Wall Primer, B28 W200, 1.1 Mils Dry Film Thickness, 400 Sq Ft/Gal, VOC: 0.71 lbs/gal.

- 1st Coat: Apply one coat S-W Tile Clad High Solids, B62 WZ Series, 4.0 Mils Dry Film Thickness, 225 - 359 Sq Ft/Gal, VOC: 3.12 lbs/gal.
- 2nd Coat: Apply one coat S-W Tile Clad High Solids, B62 WZ Series, 4.0 Mils Dry Film Thickness, 225 - 359 Sq Ft/Gal, VOC: 3.12 lbs/gal.
7. Exterior Wood Surfaces: Including but not limited to Walls, Trim, Soffit; etc.
- Surface Prep: Remove surface contaminants, patch nail holes and imperfections with wood filler or caulk.
- Primer: Apply one coat S-W WeatherPerfect Exterior Alkyd Undercoater, A-100 at 2.2 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 2.80 lbs/gal.
- 1st Coat: Apply one coat S-W Exterior Acrylic Flat, A6 Series, 1.4 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 1.2 lbs/gal.
- 2nd Coat: Apply one coat S-W Exterior Acrylic Flat, A6 Series, 1.4 Mils Dry Film Thickness, 400 Sq Ft/Gal; VOC: 1.2 lbs/gal.
8. Non-submerged Metal: Including but not limited to interior & exterior pumps, motors, piping, handrails, small structural; etc.
- Surface Prep: Solvent Clean per SSPC SP1 and Power Tool Clean rusty areas per SSPC SP3.
- Primer: Apply one coat S-W Kem Kromik Universal Metal Primer, B50 NZ6, 3.0 - 4.0 Mils Dry Film Thickness, 300 Sq Ft/Gal; VOC: 3.5 lbs/gal.
- 1st Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.
- 2nd Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.
9. Non-submerged Metal Exterior: Including but not limited to Tanks, Large Structural; etc.
- Surface Prep: Solvent Clean per SSPC SP1 and Power Tool Clean rusty areas per SSPC SP3.
- Primer: Apply one coat S-W Kem Kromik Universal Metal Primer, B50 NZ6, 3.0 - 4.0 Mils Dry Film Thickness, 300 Sq Ft/Gal; VOC: 3.5 lbs/gal.

- 1st Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.
- 2nd Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.
10. Submerged Metal: Including but not limited to Pipe, Supports, Hangers, Sluice Gates, Valves, Bar Screens; etc. submerged or located below the operating floor where the painted surface would be subject to being wetted by the process water.
- a. Sewage Treatment Works and Other Structures:  
Surface Prep: Abrasive Blast to White Metal per SSPC SP5.  
Primer: None.  
1st Coat: Apply one coat S-W Hi-Mil Sher-Tar Epoxy, B69 B40 / B60 V40 at 8.0 Mils Dry Film Thickness, 136 Sq Ft/Gal; VOC: 2.55 lbs/gal.  
2nd Coat: Apply one coat S-W Hi-Mil Sher-Tar Epoxy, B69 B40 / B60 V40 at 8.0 Mils Dry Film Thickness, 136 Sq Ft/Gal; VOC: 2.55 lbs/gal.
11. Non-ferrous Metal: Including but not limited to Non-Submerged Galvanized, Zinc Coated, Aluminum; etc.  
Surface Prep: Solvent Clean per SSPC Sp1.  
Primer: N/A.  
1st Coat: Apply one coat S-W DTM Acrylic Gloss, B66 W100 Series, 3.0 Mils Dry Film Thickness, 208 Sq Ft/Gal; VOC: 1.72 lbs/gal.  
2nd Coat: Apply one coat S-W DTM Acrylic Gloss, B66 W100 Series, 3.0 Mils Dry Film Thickness, 208 Sq Ft/Gal; VOC: 1.72 lbs/gal.
12. Tar Coated Surfaces Which May Bleed Through Finish Coats  
Surface Prep: Using water and detergent solution remove dirt, dust and other surface contaminants.  
Prime Coat: Apply one coat S-W DTM Acrylic Primer/Finish, B66 W1, 3.0 Mils Dry Film Thickness, 242 Sq Ft/Gal, VOC: 2.08 lbs/gal.  
1st Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.

2nd Coat: Apply one coat S-W Hi-Solids Polyurethane, B65 W300 Series, 3.0 Mils Dry Film Thickness, 346 Sq Ft/Gal., VOC: 2.40 lbs/gal.

**3.0919** Examine substrates and conditions under which painting shall be performed for compliance with requirements for application of paint. Apply primer and finish coats only when environmental conditions are within the parameters established in the Manufacturer's published Technical Data.

**3.0920** Application

- A. Clean surfaces before applying shop primer. Remove grease, oils and other surface contaminants per SSPC SP1, Solvent Cleaning. Schedule cleaning and priming so that dust and other contaminants from the cleaning process shall not fall on wet, freshly primed surfaces.
- B. Apply primer and finishes by air or airless spray to achieve a uniform dry film thickness as specified in Paint Schedule. Applied film must be free of runs, sags, pinholes or holidays. Follow manufacturer's written instructions for equipment and application recommendations.
- C. Brush application is permitted to repair damaged areas, thin spots or skipped areas.
- D. Thickness of the applied film must be constantly monitored to ensure the Dry Film Thickness (DFT) of the cured film is within the parameters specified. The Wet Film Thickness (WFT) must be measured immediately after application with proper gauges to establish that enough material has been applied that when dry will produce the specified dry film. The dry, cured film must be measured using appropriate magnetic film gauges to ascertain that the dry film is within specified limits.
- E. Follow manufacturer's written recommendation for lapsed time and temperature between succeeding coats.

**3.1000 Specialties**

**3.1010 Metal Wall Louvers**

**3.1011** Work Included

- A. Furnish and install completely all louvers of sizes shown or specified, complete with all fasteners and installation hardware necessary.

**3.1012** Submittals

- A. Submit shop drawings as specified.
  - 1. Submit a comprehensive schedule listing each louver furnished. List structure, location, size, model, and other pertinent information for each louver.
  - 2. Show elevation view for each louver.
  - 3. Show specific mounting conditions and details for each louver.
  - 4. Show typical details of construction.
  - 5. List all options, accessories, on non-standard features provided.
  
- B. Submit manufacturer's product data as specified.
  - 1. Submit Free Area, Airflow Resistance, and Water Penetration charts for each model of louver provided. Provide airflow resistance information for all screens.
  - 2. Show typical louver sections and blade configurations.
  - 3. List materials of construction.
  - 4. Describe shop paint/finish system proposed.
  - 5. Submit standard color charts for color selection by Owner/Developer in consultation with the County.
  - 6. Submit manufacturer's written installation instructions.

**3.1013** Warranty

- A. Guarantee louvers to be free from defects in materials and workmanship for one year from date of final acceptance.

**3.1014** Design

- A. Louvers shall be designed to withstand the most current wind loading design values provided or referenced in the ICC International Building Code (IBC) Chapter 16, and ASCE 7.
  
- B. Performance data shall be submitted as specified and shall be licensed to bear the Air Movement and Control Association International, Inc. (AMCA) Certified Ratings Seal.

**3.1015** Fabrication

- A. Louver frames and blades shall be constructed of 16 gage galvanized steel.
  
- B. Assembly of members shall be with stainless steel fasteners or welding.

**3.1016** Finish

- A. Finished after assembly in manufacturer's plant with Kynar 500 System.
- B. The Owner/Developer shall select color from manufacturer's standard colors and submit to the County for approval.

**3.1017** Hardware and Accessories

- A. Provide all mounting hardware and fasteners required for proper installation. Exposed fasteners shall be stainless steel.
- B. Provide insect screens of galvanized steel mesh, removable and replaceable, on all louvers.
- C. Provide operators for adjustable type louvers to automatically open/close when equipment or building requires ventilation. Operators shall function automatically to provide ventilation in the event of a power failure.

**3.1018** Acceptable Products

- A. The following companies are acceptable manufacturers. This list is not exclusive, but other companies must comply with all specifications and be approved by the County.
  - 1. Airolite Co.
  - 2. Airline Products Co.
  - 3. American Warming Co.
  - 4. Or approved equivalent

**3.1019** Installation

- A. Install louvers in openings, level, plumb and true.
- B. Set and tie into flashing to ensure diversion of moisture to exterior.
- C. Install shims between frame and opening edge at anchors to prevent distortion of frame when fasteners are tightened, if applicable.
- D. Seal gaps between opening sides and frame with architectural sealant as specified in Section 3.0750.

## **3.1100 Equipment**

### **3.1110 Factory-Built Flooded Suction Steel Underground Sewage Pumping Station**

#### **3.1110.01 General**

- A. Where shown on the plans, the contractor shall furnish and install one factory built, complete and fully operational underground flooded suction sewage pumping station with all needed equipment factory installed in a welded steel pump chamber with steel entrance tube, maintenance lift and ladder to provide access. The principal items of equipment shall include non-clog sewage pumps, internal piping, valves, control panel with circuit breakers and motor starters, bubbler type primary level control, float type backup level control, lighting, ventilating blower, heater, dehumidifier, sump pump, cathodic protection, alarm condition contacts for connection to future SCADA system and all internal wiring, all as shown on the plans and specified herein.
- B. On a case by case basis, independent of the power service being supplied, the County may require VFD systems for the Factory-Built Flooded Suction Sewage Pumping Stations.
- C. The Pumping Station arrangement shall be suitable for use with a precast concrete wet well structure of the size and location shown on the plans.
- D. The following companies manufacture acceptable flooded suction pump stations that may be selected to meet design conditions. This list is not exclusive, but other companies must comply with these specifications and be approved by the County.
  - 1. Dakota Pump, Inc.
  - 2. Smith and Loveless, Inc.
  - 3. USEMCO, Inc.
  - 4. Or approved equivalent
- E. To insure total quality control, the complete unit shall be designed, fabricated, assembled and tested in house by the station manufacturer.

#### **3.1110.02 Operating Conditions, Sewage Pumps**

- A. The sewage pumping station shall be equipped with at least 2 centrifugal \_\_\_\_\_ inch non-clog sewage pumps. Each pump shall be capable of delivering \_\_\_\_\_ GPM of raw unscreened sewage against a total dynamic



head of \_\_\_\_\_feet. The anticipated operating head range is from \_\_\_\_\_feet minimum to \_\_\_\_\_feet maximum.

- B. All pump openings and passages shall be large enough to permit passage of a sphere 3" in diameter and any trash or stringy material which will pass through an 8" main sewer and a 4" or 6" house or building collection system.
- C. The pump motors shall be of the type specified with a maximum allowable speed of \_\_\_\_\_ RPM. The minimum rated horsepower of each motor shall be \_\_\_\_\_ HP suitable for 480 volt, 3 phase, 60 hertz, \_\_\_\_\_ wire electrical service and shall be non-overloading throughout the entire operating range.

### 3.1110.03 Pump Chamber, Cylindrical Structure

- A. The station shall be built in two major sections consisting of the equipment chamber and the entrance tube. These sections shall be joined at the job site by field welding. The field joint shall be welded following procedures recommended by the station manufacturer. The equipment chamber shall contain all pumps and other equipment and shall be a vertical cylindrical configuration with a minimum inside diameter of 10 feet, and a minimum inside height of \_\_\_\_\_ feet, as shown on the plans. The required diameter shall be adequate to accommodate maintenance lift equipment.
- B. The equipment chamber shall be fabricated of structural grade steel plate and beams that meet or exceed the requirements for ASTM A36. The top and bottom of the chamber shall be a minimum 3/8" thick steel plate reinforced by wide flanged steel beams. The beams shall be continuously welded to the plate so that all the seams between them are sealed against water penetration.
- C. The thickness of the vertical cylinder shall be determined by the structural requirements for the depth of bury shown on the plans, but shall not be less than 3/8". It shall be the responsibility of the station manufacturer to determine the structural requirements based on the external loads specified. Structural calculations shall be provided, certified and stamped by a Professional Engineer registered in Alabama to verify the structural integrity.
- D. The plate forming the top and bottom of the equipment chamber shall be assembled and welded to the vertical wall to form a Tee joint which shall be continuously welded to form a watertight seal.

- E. Lifting eyes shall be incorporated in the top reinforcement beams to facilitate lifting and handling the equipment chamber. Lifting eyes shall also be provided inside the equipment chamber over each pump at an adequate height so a hoist can be used for service work.
- F. A sump pit fabricated of 3/8" steel plate shall be provided to accept the specified sump pump.
- G. Where the suction and discharge lines are designed to pass through the station wall, the manufacturer shall provide steel sleeves welded to the station wall. At locations where pipe sections penetrate the station wall, the manufacturer shall provide a plain-end ductile iron pipe, Class 52 minimum, of the diameter as shown on the plans, through the wall sleeve and terminating outside the station wall. Link-Seal® Mechanical Seals or approved equivalent seals shall be placed around the ductile iron pipe in the station wall sleeve. These plain-end suction and discharge ductile iron pipe sections extended from the station wall shall be connected by the Contractor to the influent and discharge pipe using approved and accepted methods. These connections shall be designed to absorb vibration, distortion in normal settling and maintain a leakproof seal.

#### **3.1110.04 Entrance Tube**

- A. The entrance tube shall be constructed of a minimum 3/8" thick ASTM A36 structural grade steel plate and shall be provided in one or more sections, as required, and the diameter shall be 48" minimum or as shown on the plans to accommodate the maintenance lift.
- B. The entrance tube shall be provided with a ladder designed to meet the loading requirements of OSHA 29 CFR 1910.27.B, in order to provide personnel entrance and exit capabilities to the maintenance lift under normal and emergency operations. The entrance tube shall be provided with a domed steel or fiberglass reinforced plastic cover with an angle iron frame attached to a single, wide span hinge. The cover shall be provided with a suitable drip lip around the edge and shall be fitted with a weatherproof lock of the pin and tumbler type with inside keyless release. The lock shall be self locking upon closing the cover. When the cover is in the full open position, a lock open device shall engage to prevent accidental closing of the cover.
- C. A ventilation duct with inlet vent shall extend from the top of the entrance tube into the station. The inlet vent shall be covered with a screen to exclude rodents and foreign objects.

D. Maintenance Lift

1. The pump station shall be equipped with a maintenance lift manufactured to contribute to the personal safety of the operator and to facilitate access into the station. The lift shall have a minimum capacity of 440 pounds when fully loaded, and shall travel at a minimum rate of 25 feet per minute. The unit shall be equivalent to the manufacturer's standard equipment manufactured by Smith and Loveless, USEMCO or Dakota. It shall be built in accordance with the applicable American National Standards Institute (ANSI) code, and shall meet the requirements of state code, if applicable.
2. The lift shall consist of a car with a welded steel frame that travels on guide rails, equipped with devices to stop travel when obstacles are encountered or if lift begins to fall. The entire hoist system shall be designed to afford a safety factor of eight.
3. The lift car shall have a minimum floor area of four square feet. The lift car shall be enclosed on three sides, with the fourth side having an opening to allow a person to enter and exit the car. The fourth side shall provide a full width opening to allow the car to transport equipment, within design load limitations, as needed for maintenance. This provision would allow the County to move selected equipment in and out of the pump station without having to remove the car first. An operating panel shall contain operating push buttons and an emergency stop button. The floor for the car, and ceiling, if provided, shall be hinged or removable to allow personnel to pass through the car using the hoist way as an exit in case the lift is inoperable. Provision shall be made in the car enclosure to allow personnel to readily climb through the car and to move safely to the emergency ladder.
4. A limit switch shall be mounted above the car as an overhead obstruction switch. An under car obstruction switch shall be mounted on a plate suspended under the car floor such that the switch will open in case the plate strikes an obstruction, causing the car to stop immediately.
5. The car shall have a welded steel frame with guide rollers mounted to receive the machined maintenance lift guide rails. Side sway shall be eliminated by spring mounted ball bearing stabilizing rollers riding on the guide rail. The car shall stop and hold position with its rated load in event of an emergency condition. The slack cable shall also engage a switch circuit to stop the drive motor in case of the slackening of a cable.
6. Special machined elevator guide rails shall be installed to insure a straight controlled movement of the car.

7. The safety circuit shall consist of a main safety relay with normally open contacts in the main operating power circuit. This main relay shall have a holding circuit, activated by a reset button in the car or at the main control panel. Switches shall be wired in series in the main safety relay control circuit, including the following units:
  - a. The overhead obstruction switch on the car.
  - b. The under car obstruction switch (manually reset).
  - c. The slack cable switch (manually reset).
  - d. Car platform switch. (This switch is held closed by the removable floor in the car and prevents the car from being operated when the floor is not completely in place.)
  - e. Upper and lower final limit switches. (These switches are back-up switches to the normal upper and lower terminal switches.)
  - f. The emergency stop button in the car. (This button must be manually pulled out for the car to operate.)
8. The non-operating parts of the lift shall be sandblasted to a white metal and shall receive a 6 mil coating of a two component epoxy coating system. Operating equipment shall receive paint protection compatible with the function of the part.

### **3.1110.05** Welding

- A. All welding shall be in accordance with standard AWS practices, with proper fillet section and continuity to assure a sound, watertight structure. All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. All welds shall be tested with a dye penetrant to assure the watertight integrity of the weld system.

### **3.1110.06** Protective Coating, Painting

- A. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by sandblasting or steel shot blasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding.
- B. Exterior surfaces below grade elevation shall be coated with coatings recommended by the manufacturer and comply with coating procedures approved by the Steel Tank Institute for underground steel tanks. The coating shall be self-priming, chemically cured, and either catalyzed epoxy or polyurethane material. The coating shall have superior adhesion qualities and shall be highly resistant to debonding. The coating shall be applied in a single coat to provide a minimum 6 mil dry film with no runs,

sags or pinholes. Other coating systems recommended by the manufacturer may be approved by the County on a case-by-case basis.

- C. Interior and exterior above grade surfaces shall receive a single coat of epoxy primer followed by a minimum of two coats of hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products or salt solutions. The prime coat shall be applied to a minimum thickness of 1.5 mils. The two finished coats shall be a minimum of 2 mils each coat.
- D. Paint touch-up kits shall be provided with the station for coating field weld joints and damaged areas.
- E. The floor in all working areas within the station shall be protected with heavy dielectric neoprene matting.

### **3.1110.07** Cathodic Protection, Galvanic

- A. The effects of underground corrosion upon the equipment chamber shall be attenuated by means of a cathodic protection system. Protection shall be provided by using sacrificial magnesium anode packs with insulated copper leads, with the size and number of anode packs being as determined and recommended by the pump station manufacturer, and approved by the Design Engineer and the County.
- B. The anodes shall be placed vertically in the ground at intervals around the centerline of the equipment chamber, as recommended by the manufacturer. The anodes shall be located approximately at the vertical midpoint of the equipment chamber and a minimum of five (5) feet out from the structure. A NEMA junction box, type as recommended by the manufacturer, shall be installed either above grade or in the pump chamber. The anode leads shall be wired to a terminal strip in the NEMA junction box.
- C. An anode tester with all controls shall be installed and wired in the NEMA junction box. An ammeter shall be provided to allow current readings to be taken of the current flow to each anode. Adjustable resistors connected in series independently with each anode circuit shall also be provided for current adjustment. The tester shall be equipped with spring loaded "test-normal" switches for each anode.

### 3.1110.08 Pumps and Motors

- A. The pumps shall be vertical, built-together, non-clog sewage pumps of heavy cast iron construction and shall include a vertical motor with the pump impeller mounted directly to the motor shaft. Where design indicates a potential for the station to be flooded, dry pit mounted submersible non-clog pumps may be required on a case-by-case basis.
  
- B. The following companies manufacture acceptable pump models that may be selected for design conditions. This list is not exclusive, but other companies must comply with the specification and be approved by the County.
  - 1. Vertical Non-Clog Sewage Pumps
    - a. Smith and Loveless Inc.
    - b. Fairbanks Morse Pump Corp.
    - c. Or approved equivalent
  - 2. Dry Pit Mounted Submersible Non-Clog Sewage Pumps
    - a. KSB Inc.
    - b. Flygt, ITT Fluid Technology Corporation
    - c. Fairbanks Morse Pump Corp.
    - d. Or approved equivalent
  
- C. Vertical Non-Clog Sewage Pumps
  - 1. The pump volute and suction elbow shall be made of close grain cast iron and shall be constructed so that the rotating element may be removed without dismantling the motor, impeller or backhead, and so that any foreign object may be removed from the pump or suction elbow. The pump shall be designed to permit the removal of the rotating assembly without disturbing the suction or discharge piping.
  - 2. The impeller shall be made of close grained cast iron and shall be of the one-piece, single suction, enclosed, non-clog design. The impeller shall be statically and dynamically balanced, securely keyed and locked to the motor shaft. The pump shall be equipped with 300-350 Brinell hardness stainless steel impeller and casing wear rings. The common pump and motor shaft shall be either solid stainless steel or high strength alloy steel with a minimum tensile strength of 90,000 PSI, of sufficient size to carry the maximum loads imposed and shall have renewable stainless steel shaft sleeves in the seal area.
  - 3. The pump shaft shall be sealed against leakage by a double mechanical seal installed in either a bronze or cast iron housing. The mechanical seal shall be of a double carbon and ceramic construction held in a mating position by a stainless steel spring.

The mechanical seal shall be pressurized and lubricated by water taken from the pump volute and passed through a filter that will screen out solids larger than 50 microns.

4. The pump motors shall be vertical solid shaft, open drip proof ball bearing induction motors. The motors shall be NEMA design B with normal starting torque, a minimum of Class B insulation rated for continuous duty with low starting current and a 1.15 service factor. The motor shall have grease lubricated bearings of sufficient size to carry all pump loads and have a minimum B-10 life of 40,000 hours. Bearing calculations shall be submitted to the County. The motor shall be fitted with heavy lifting eyes or lugs each capable of supporting the entire weight of the motor.
5. The pump's limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.
6. The pumps shall be tested at the manufacturer's plant before shipment. The test shall consist of checking the unit at the specified rated speed, capacity, efficiency, brake horsepower and at such other conditions of head and capacity to properly establish and provide a certified performance curve, submitted to the County prior to installation. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests. The pump testing data, certified results, and performance curve plots shall be included with three Operation and Maintenance (O&M) Manuals and forwarded to the County and the Design Engineer for review.

D. Dry Pit Mounted Submersible Non-Clog Pumps

1. Dry Pit Mounted Submersible Non-Clog Pumps shall be furnished for Flooded Suction Pump Stations where flooding conditions may occur.
2. Dry pit mounted submersible non-clog pumps shall be capable of continuous operation either in the dry mode or completely submerged as may occur during flooding conditions. The pumps submersible electric motor shall be capable of operation at 480 Volts, three (3) phase, 60 Hertz service. The motor shall be supplied with \_\_\_ feet of properly sized electric submersible cable sized in accordance with NEC Standards. Each pump shall be fitted with taps in the pump casing to accommodate pressure gauges and air bleed relief systems. Each pump shall also be fitted with hand-hole cleanouts in both the pump casing and the suction elbow.
3. The pump's design shall allow for the permanent mounting of the pump in the dry well of a wet well / dry well design pump station. The pump shall connect to a permanently mounted suction elbow having a hand-hole cleanout. The motor shall be of TEFC/S

(totally enclosed fan cooled/submersible) design requiring neither a secondary water source nor the pumped media to be circulated inside or around the motor. The pump's design shall further insure that motors cooling shall be accomplished at a constant rate regardless of the varying speed of the main motor as can occur with VFD operation.

4. Major components (pump casing, impeller, intermediate housing, motor housing) shall be of at minimum ASTM A48 Class 35 cast iron with smooth surfaces devoid of blow holes and other irregularities. All exposed fasteners shall be ASTM A962 Type 316 stainless steel. The volute shall be smooth having no internal irregularities, splitters, bearing supports, or braces as these are incompatible in design with the fibrous content of the pumped media.
5. Mating surfaces between components where watertight integrity is critical shall be machined and fitted with Nitrile Rubber or Viton O-rings. Because these are critical passages and flame paths, no secondary sealing compounds, greases, or other devices shall be used.
6. The motor shall be adequately sized and designed so that integrally cast motor cooling fins have sufficient surface area to allow the motor to run continuously in submerged, partially submerged, or completely dry conditions without the need for internal oil circulation systems or cooling jackets which circulate the pumped media or secondary water inside the motor shell.
7. The power cable shall be suitable for the submersible application and sized in accordance with NEC requirements. The cable entry design shall insure that no entry of moisture is possible into the high-voltage motor terminal area even if the cable is damaged or severed below water level to a submerged depth of up to 85 feet.
8. The submersible motor shall be squirrel cage, induction in design, housed in a completely watertight and air filled chamber. The motor shall have at minimum a 1.15 service factor and be suitable for use in Class I, Division 1, Group C & D atmospheres as Explosion Proof. The motor stator shall use at minimum Class F insulation rated for 311°F (155°C). The motors shall be designed, rated, and warranted for continuous operation and capable of at minimum fifteen (15) starts per hour. Temperature monitors shall be embedded in the motor windings for use in conjunction with and supplemental to external motor overload protection. The pump's control shall shut down the pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. The motor shall be supplied with a sensor in the motor's stator cavity which allows a control



- panel mounted relay to indicate any leakage into the motor stator chamber and shut down the pump.
9. Furnish upper and lower bearings as needed to provide a B10 bearing life of at minimum 40,000 hours at anticipated axial and radial loadings. The bearings shall be sealed, shielded, and permanently greased requiring no preventive maintenance to insure proper lubrication. Bearing calculations shall be provided to the County.
  10. Each pump shall be provided with two totally independent mechanical shaft seals, installed in tandem, each with its own independent spring system acting in a common direction. The upper seal shall operate in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from outside of the pump. The lower seals shall be of bellows type with both faces of at minimum Silicon Carbide. The seals shall require neither routine maintenance nor adjustment, and shall be easily inspected and replaced. The seals shall be non-proprietary in design, with replacements available from a source other than the pump manufacturer.
  11. The pump shall be furnished with a monitoring system to signal in the event either the upper or lower mechanical seal leaks. This monitoring system shall be a stainless steel mechanical float switch located in a separate seal leakage collection chamber. This seal leakage monitoring and collection system shall be designed so that no seal leakage is allowed to penetrate into the motor chamber or lower bearing assembly.
  12. Provide a common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. The shaft shall be of solid stainless steel or ASTM A108 Grade 1045 N carbon steel and shall be isolated from the pumped media by a replaceable AISI Type 420 stainless steel shaft sleeve under the lower mechanical seal. Do not use carbon steel as shaft material without using a stainless steel shaft sleeve.
  13. Provide non-clog type impellers, capable of passing at minimum a 3 inch spherical solid. The impeller shall be statically and dynamically balanced. The pump shall be provided with hard metal wear rings on both the casing and impeller. These wear rings shall be of 400 Series stainless steel material having a Brinell hardness of at minimum 300 to insure maximum pump/impeller life and continuing high efficiencies.
  14. The pumps shall be tested at the manufacturer's plant before shipment. The test shall consist of checking the unit at the specified rated speed, capacity, efficiency, brake horsepower and

at such other conditions of head and capacity to properly establish and provide a certified performance curve, submitted to the County prior to installation. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests. The pump testing data, certified results, and performance curve plots shall be included with three Operation and Maintenance (O&M) Manuals and forwarded to the County and the Design Engineer for review.

### **3.1110.09 Pressure Gauges**

- A. Pressure gauges shall be provided to indicate suction and discharge pressure of each pump. The gauges shall have 4-1/2" minimum diameter faces with molded black phenolic case, turret type with snap ring face mounting. The gauge internal construction shall include phosphor bronze bourdon tube with bronze movement and shall be liquid filled. Gauges shall have 1/4" NPT bottom connections and provided with a brass isolation valve, pulsation damper and vent cock.

### **3.1110.10 Motor Control and Protection**

- A. Control Panel
  1. The control equipment shall be mounted within a NEMA type 12 enclosure with hinged door, fabricated of steel and reinforced as required. All circuit breakers, motor starters, reset buttons and pump control switches shall be mounted so they are operable without opening the door. The door shall be secured with a three point locking handle.
  2. The control panel shall conform to the National Electrical Code specifications and shall be UL listed and labeled in accordance with UL Standards No. 508.
  3. The pump motors shall have short circuit and overload protection by means of properly sized motor starters and thermal magnetic molded case circuit breakers shall be provided as disconnect switches and to provide protection against short circuits or grounds of each pump motor. Circuit breakers shall be UL listed and have an interrupting rating as required. The operating mechanism shall allow manual switching and shall indicate when the breaker has tripped.
  4. A wall mounted convenience duplex outlet shall be provided for operation of 115 volt AC devices.
  5. A thermostat controlled heater shall be provided in the control panel to reduce condensation.

B. Across-the-Line Motor Starters

The magnetic across-the-line starters with manual reset shall be provided with melting alloy type overload relays for each phase to assure positive motor protection. Starters shall be minimum NEMA rated size 1.

**3.1110.11** Panel Mounted Distribution Load Center

- A. As part of the station's control panel, an electrical distribution center consisting of thermal magnetic circuit breakers with a minimum capacity of 15 amps, shall be provided for each branch circuit including the following:

Control  
Sump Pump  
Dehumidifier  
Blower  
Heater  
Convenience Receptacles  
Lighting

- B. The circuit breakers shall indicate when the circuit is open and shall have means provided for manual switching. All breakers shall be labeled as to function with permanently attached phenolic nameplates.
- C. Provide Surge/Transient Protection devices on all services per paragraph 3.1320.

**3.1110.12** Duplex Logic System

- A. The sewage pumps shall alternate automatically on the completion of each pumping cycle. One pump shall start as the lead pump and the other pump shall be started if the wet well level continues to rise to the start level for the lag pump. After each operating cycle the lead and lag positions shall alternate. A manual selector switch shall also be provided so that the operator can designate either pump to stay in the lead position continuously. Adjustable time relays shall be provided to prevent simultaneous starting of the pumps after power failure. In case of a malfunction in the primary bubbler type level control system such that high water level is exceeded, a backup mercury float level control shall indicate an alarm and call both pumps to start using a time delay. After reaching a low water level, the pump cycle shall reset to the primary system for normal operation. The alarm light shall remain on until it is manually reset.

### 3.1110.13 Air Bubbler Level Control System (Primary)

- A. To control the operation of the pumps with variations of liquid level in the wet well, an air bubbler system shall be provided, complete with two air compressors, flow indicator, bubbler tube, and a sensitive pressure switch for each pump.
- B. The two air compressors shall be the close-coupled and oil-less type. Each compressor shall have a minimum capacity of 0.2 cubic feet of free air per minute at 10 PSI. It shall incorporate a single phase, 60 cycle, 115 volt, electric motor. A motor driven timer shall be provided to alternate the compressors every five minutes. Wiring and piping for the air compressors shall be configured so that one compressor may be removed without removing the other compressor from service. Connections from the Pump Station Bubbler system to the Wet Well Bubbler Tube shall be 1/2" Type 304 Stainless Steel tubing. The wet well bubbler tube shall be constructed of 3/4" Type 304 Stainless Steel tubing, connecting to the station tubing with a 3/4" X 1/2" X 3/4" Type 304 Stainless Steel tee. The tee shall be furnished with a 3/4" plug at top to allow rodding of the bubbler tube. The bubbler tube shall extend to not less than 2" and not more than 4" above the floor of the wet well. The lower end of the bubbler tube shall be cut at a 45 degree angle and shall be reamed to remove all burrs on the inside and outside of the tube.
- C. The pressure switch shall have sensitive pressure elements and independent high and low adjustment for each pump capable of a minimum differential of 18" of water.
- D. A low pressure diaphragm gauge with a 2-1/2" dial calibrated from 0 to 100 inches of water shall be connected to the air bubbler system to indicate the sewage level in the wet well.
- E. An air flow indicator gauge shall be provided and connected to the air bubbler piping to provide a visual indication of rate of flow in standard cubic feet per hour.
- F. An adjustable pressure switch shall be provided to sense a low air pressure condition. The switch shall be connected in the bubbler supply line, and shall actuate a contact to indicate a low pressure condition. An orifice shall be installed in the supply line, downstream from the switch, in order to maintain adequate back-pressure.

### **3.1110.14** Float Level Control System (Secondary)

- A. Provide an independent backup level control system of UL listed direct acting float switches to control the operation of the pumps with sewage level exceeding primary control high water limit and or primary control low water level in the wet well.
- B. The float shall consist of a chemically resistant polypropylene casing encapsulating a single pole snap action switch which activates when the longitudinal axis of the float is horizontal, and deactivates when the level falls one inch below the actuation elevation.
- C. The float cable shall be of the PVC type STO #18 AWG 41 strand, 600 volt rated conductors. The float switches shall be suspended in the wet well by means of 1/4" stainless steel cables and a plastic coated cast iron weight. The floats shall be secured to the cable by stainless steel fasteners to assure drift free mounting and convenient removal for level adjustment.
- D. Low current isolating switches shall be provided for intrinsically safe switching levels in the wet well. The relay shall be of the solid state design that reduces the current so it is incapable of releasing sufficient energy to ignite explosive gases.
- E. On stations where the control panel is remote to the wet well, provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the float wires. Contractor shall coordinate exact location of float control wire junction box with ESD Pump Station Maintenance office. At the selected junction box location, the Contractor shall core drill required holes and install PVC schedule 40 sleeves for the wires from the floats to the junction box.

### **3.1110.15** Station Monitoring

- A. Fault Detection
  1. Primary High Wet Well Level (Bubbler Control): A pressure switch shall be provided to sense a high level condition in the wet well. The switch shall activate an alarm in event of a high level condition.
  2. Primary Low Wet Well Level (Bubbler Control): A pressure switch shall be provided to sense a low level condition in the wet well. The switch shall activate an alarm in event of a low level condition.
  3. Secondary High Wet Well Level (Float Control): In addition to a bubbler type level control, a direct acting float switch shall be

- provided and installed in the wet well as a backup to sense a high level condition. The float switch shall activate an alarm contact in the event of a high level condition.
4. Secondary Low Wet Well Level (Float Control): In addition to a bubbler type level control, a direct acting float switch shall be provided and installed in the wet well as a backup to sense a low level condition. The float switch shall activate an alarm contact in the event of a low level condition.
  5. Station Flooding: A float actuated switch shall be provided and installed in the pump chamber to detect a flooding condition and shall activate an alarm signal when the level reaches one inch above the chamber floor.
  6. Pump Failure: A limit switch shall be activated by the external arm of the discharge check valve of each pump to detect failure of the pumps to deliver normal operating flow. An auxiliary time delay relay shall be provided to provide an alarm signal and shut pump down when pump fail occurs.
  7. Power Failure: A relay with single pole, double throw contacts shall be provided and installed in the control panel to activate a power failure alarm signal to future SCADA contacts.
  8. Phase Failure: A relay with double pole, double throw contacts shall be provided to monitor and protect against phase loss, under voltage and phase reversal. The relay shall automatically reset when three phase service returns to normal.
  9. Unauthorized Entry: An adjustable timer shall be provided and installed in the control panel to signal an unauthorized entry into the pump station and activate an alarm signal to future SCADA contacts. The timer shall be activated when the entrance cover is in the open position. A key-operated switch shall be provided and located at the inside top of the entrance tube to provide authorized personnel a means to deactivate the alarm before the timer completes its cycle.
  10. Operator Assist Alarm: A momentary contact, manually operated switch shall be mounted on the face of the control panel to activate an alarm in case of an emergency by the operator.
  11. Heat Sensor: The pump motors shall be provided with heat sensors embedded in the motor windings to detect excessive heat. The heat sensors shall be set to trip at 221°F (105°C) and shall automatically reset when the motor cools to a safe temperature. The alarm signal shall be a red light mounted on the control panel front.

B. Alarm Signal Light

Unless otherwise noted, the alarm signal light shall be a 120 volt AC weatherproof light for remote external mounting. The weatherproof fixture shall include a 100 watt red globe with guard.

C. SCADA

1. Provide dry contacts for the following faults for inputs for future SCADA system:
  - a. High wet well level - bubbler and float systems
  - b. Low wet well level - bubbler and float systems
  - c. Station flooding
  - d. Pump failure - any pump
  - e. AC power failure
  - f. Generator Failure
  - g. Unauthorized Station Entry
  - h. Sewage Grinder failure (common – due to overload, Oil, or AC power)

**3.1110.16** Running Time Meter

- A. A running time meter shall be provided for each pump to show the number of hours of operation. The meter shall register in hours and tenths of hours up to 99999.9 hours. It shall be of the non-resettable type with flush mounted dial enclosed in a dust and moisture proof enclosure.

**3.1110.17** Wiring

- A. All wiring shall comply with the National Electric Code and applicable state and local codes. Wiring shall be completely factory installed except for the power lines that run to the control panel continuously from the external disconnect switch, and any wires connecting to any operating devices not mounted in the station.
- B. All wiring within the equipment chamber and outside the control panel shall be run in PVC rigid conduit except for the liquid tight metallic flexible conduit to connect the pump motors. Accessory items such as the sump pump, dehumidifier, etc. with approved manufacturer's U.L. certified cord and plug may be plugged into polarized grounded outlets.
- C. It shall be the responsibility of the local electrical contractor to furnish and install correctly sized service wires from the service pole outside the equipment chamber to the control panel. It shall also be the responsibility

of the electrical contractor to furnish and install, if required, any exterior disconnects or switching mechanisms.

- D. A dry type single-phase power transformer shall be provided to supply power to the station single-phase loads. The transformer shall have a dust tight enclosure and shall be suitable for wall mounting. The transformer shall have Class H insulation and shall be UL approved for indoor applications.

### **3.1110.18** Lights

- A. The equipment chamber shall be well lighted by 2 dual, 40 watt, rapid start fluorescent light fixtures with guards installed within the equipment chamber. Automatic and manual light switches shall be provided and shall be conveniently located at the top of the entrance tube.

### **3.1110.19** Piping

- A. The pump suction lines shall be Class 52 ductile iron pipe which shall terminate in a plain end outside the pumping station. Each pump suction line shall be fitted with a gate valve inside the chamber.
- B. The discharge line from each pump shall be fitted with a check valve and gate valve. The common discharge shall be Class 52 ductile iron pipe which shall terminate in a plain end outside the pumping station chamber.

### **3.1110.20** Gate Valves

- A. Gate valves, sized as shown on the plans, shall be of the resilient wedge type, non-rising stem design. The valve body shall be of high quality cast iron construction. Valves shall have bronze stems with O-ring seals located above the thrust collar. Gates for all valve sizes shall be encapsulated in rubber where exposed to line velocity, be field replaceable and provide a dual seat on the mating body seat. The valve shall meet or exceed AWWA specifications.

### **3.1110.21** Swing Check Valves (Cushioned)

- A. Horizontal cushioned full bodied swing check valves, sized as shown on the plans, shall be installed in the discharge piping of each pump. The valve shall permit flow in one direction only and close tightly without slamming when discharge pressure exceeds the inlet pressure. The valve shall be provided with an outside lever and weight and complete non-corrosive shockless cushion chamber. The cushion chamber shall be



attached to the side of the valve body externally and so constructed with a piston operating in the chamber that will effectively permit the valve to operate without any hammering action. The shock absorption shall be by air and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

- B. The valve body shall be of high quality cast iron construction with a bronze renewable resilient seat ring. The valve disc shall be of cast iron construction suspended from a stainless steel pin which passes through the stuffing box and into the cushion chamber on the outside of the valve.

### **3.1110.22 Sump Pump**

- A. The station shall be provided with an automatically operated submersible sump pump with a vertical close coupled motor.
- B. The pump shall be of high grade cast iron construction. The integral pump and motor shaft shall be furnished with sealed bearings and replaceable mechanical seal to exclude water from the motor housing. The motor shall be thermally protected and of adequate horsepower to meet the operating conditions of 1000 GPH at finished grade.
- C. The sump pump shall discharge through 1-1/4" PVC pipe with two check valves and a gate valve terminating in a steel coupling welded in the chamber wall. An enclosure of heavy mesh shall surround the sump to keep out debris.

### **3.1110.23 Dehumidifier**

- A. A packaged dehumidifier assembly with hermetically sealed Freon refrigeration type compressor, expansion coil, fan and condenser coil shall be furnished to maintain the relative humidity of the air to prevent condensation on the walls. The dehumidifier shall be controlled automatically by an adjustable humidistat located on the dehumidifier, and shall have automatic defrost control, with low temperature cut out.
- B. The dehumidifier shall be housed in a heavy steel enclosure securely fastened to the wall of the station. The condensate shall be drained to the station sump.
- C. The dehumidifier shall have a minimum capacity of 15.5 pints per 24 hours at 80°F (26.7°C) and 68% relative humidity, and be capable of removing 25 pints per 24 hours at 80°F (26.7°C) and 90% relative

humidity. The dehumidifier performance shall be certified by the Association of Home Appliance Manufacturers.

#### **3.1110.24** Ventilation

- A. The ventilation system shall be provided to maintain a fresh air supply in the equipment chamber. The exhaust blower shall be sized and rated to change the air in the equipment chamber 30 times per hour.
- B. The blower shall be of centrifugal squirrel cage design with statically balanced wheel to assure quiet performance and maximum air delivery. The blower shall be located a minimum of 18 inches above the floor and exhaust through a duct sized for efficient air circulation. The exterior port shall be above ground elevation and be protected against weather and foreign matter.
- C. An automatic switch shall turn on the blower and lights when the access cover is opened. A manual control switch shall also be provided near the top of the access tube to operate the blower and lights when the cover is in the closed position.

#### **3.1110.25** Heater

- A. The equipment chamber shall be provided with a wall mounted 1500 Watt electric heater suitable for 120 Volt, single phase service.
- B. The heater shall be of the fan-forced type complete with an integral automatic dial type thermostat, copper anodized aluminum reflector, and safety grill. The heater shall be provided with a UL approved electric cord and 3 prong plug.

#### **3.1110.26** Inspection and Test

Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

#### **3.1110.27** Initial Operation

After the installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the County's operating personnel in the

operation and maintenance of the equipment. Three (3) copies of Operation and Maintenance (O&M) Manuals shall be supplied to the County prior to initial operation.

### **3.1110.28 Spare Parts**

Each pump shall be furnished with one spare impeller trimmed as specified for the flow conditions. Each pump shall be furnished with a spare set of mechanical seals. Two pump volute gaskets and a seal water filter cone shall also be furnished as spares.

### **3.1110.29 Guarantee**

The manufacturer of the pump station shall guarantee for a period of one year from the date station is placed into operation by the factory representative and accepted by the County, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the guarantee period, the manufacturer shall provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded.

## **3.1120 Factory-Built Base Mounted Pump Station with Duplex Self-Priming Pumps, Standby Engine, and Electronic Pressure Switch Level Control.**

### **3.1120.01 General**

- A. The Contractor shall furnish and install one factory-built base mounted automatic pump station with Duplex Self-Priming Pumps, Standby Engine, and Electronic Pressure Switch Level Control. The station shall be manufactured complete with all equipment specified herein. The principal items of equipment shall include two self-priming, horizontal, centrifugal V-belt motor driven sewage pumps, one air cooled standby engine, valves, internal piping, weatherproof motor control center with thermal magnetic circuit breakers, magnetic motor starters, automatic liquid level control systems for normal and standby operation, and internal wiring. Pumps, motors, engine, and piping shall be mounted on a unit base.
- B. The equipment shall be installed in a building as shown and approved on the project Drawings.

- C. On a case-by-case basis the County may approve factory built base mounted self-priming stations with FRP enclosure.
- D. The following company manufactures acceptable self-priming pump stations that may be selected for design conditions. This list is not exclusive, but other companies must comply with these specifications and be approved by the County.
  - 1. Gorman Rupp Company
  - 2. Or approved equivalent

**3.1120.02** Operating Conditions, Sewage Pumps

- A. Each self-priming pump shall have the necessary characteristics and be selected to perform in accordance with the provisions of the paragraph titled "Pumps". See Section 3.1120.05.

**3.1120.03** System Power Characteristics

- A. Electrical power furnished to the site shall be 3 phase, 60 hertz, 480 volts, maintained within plus or minus 10 percent. Control voltage shall not exceed 126 volts.

**3.1120.04** Unit Base

- A. The unit base shall be comprised of structural steel members and reinforcements designed to prevent flexing or warping under operating conditions. Base flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provision for lifting the complete pump station unit during shipping and installation.

**3.1120.05** Pumps

- A. Pumps shall be horizontal, self-priming sewage pumps, specifically designed for pumping raw, unscreened, domestic sanitary sewage. Pumps shall have \_\_\_\_\_ inch suction connection, and \_\_\_\_\_ inch discharge connection. All areas of the pump casing and volute which are exposed to sewage shall be constructed of high grade cast iron.
- B. All openings, internal passages, and internal recirculation ports shall be large enough to permit the passage of a sphere 3 inches in diameter, and any trash or stringy material which can pass through an 8" main sewer and a 4" or 6" house or building collection system.

- C. Each pump must have the necessary characteristics and be properly selected to perform under these operating conditions:
1. Capacity, in GPM \_\_\_\_\_
  2. Total Dynamic Head, in feet \_\_\_\_\_
  3. Total Dynamic Suction Lift, in feet \_\_\_\_\_
  4. Maximum Repriming Lift, in feet \_\_\_\_\_
  5. Minimum TDH, in feet \_\_\_\_\_
  6. Maximum TDH, in feet \_\_\_\_\_
  7. Maximum Static Suction Lift \_\_\_\_\_
  8. Total Discharge Static Head \_\_\_\_\_
- D. Consideration shall be given to the sanitary sewage service anticipated, in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in loss of the suction leg, but also in the siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal with proper installation of air release line free to atmosphere.
- E. In consideration of such occurrence and of the unattended operation anticipated, each pump shall be designed so as to retain adequate liquid in the pump casing to insure unattended automatic repriming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.
- F. Pump must be capable of a reprime lift of \_\_\_\_\_ feet at the selected speed and impeller diameter. Reprime lift is defined as the static height of pump suction centerline above liquid that pump will prime; and delivery within five minutes on liquid remaining in the pump casing after a delivering pump is shut down with the suction check valve removed. Additional standards under which reprime test shall be run are:
1. Piping shall incorporate a discharge check valve downstream from the pump. Check valve size shall be equal (or greater than) the pump discharge diameter.
  2. A ten foot length of one-inch pipe shall be installed between pump and discharge check valve. This line shall be open to atmosphere at all times to duplicate the air displacement rate of a typical pump station fitted with an air release valve.
  3. No restrictions shall be present in pump or suction piping which could serve to restrict the rate of siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a minimum horizontal run of 4.5 feet and one 90-degree ell.
  4. Impeller shall be set at the clearances recommended by the manufacturer in the pump service manual.

5. Reprime lift repeatability shall be demonstrated by five sequential reprime cycles.
  6. Liquid to be used for reprime test shall be water.
- G. Certified reprime performance test data, prepared by the pump manufacturer and certified by a Professional Engineer registered in Alabama, shall be submitted to the Design Engineer prior to shipment.
- H. The pump manufacturer shall demonstrate to the Design Engineer's satisfaction that due consideration has been given to reducing maintenance costs by incorporating the following features:
1. Special Tools: No special tools shall be required for replacement of any components within the pump.
  2. Cover Plate: The pump must be equipped with a removable cover plate, allowing access to pump interior to permit the clearance of stoppages and to provide simple access for service and repairs without removing suction or discharge piping.
  3. Wear Plate and Rotating Assembly: The pump shall be fitted with a replaceable wear plate. Replacement of the wear plate, impeller, seal, and suction check valve shall be accomplished through the removable cover plate. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without removing the pump volute or piping.
  4. Suction Check Valve: Each pump shall incorporate a suction check valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping. Sole function of check valve shall be to eliminate re-priming with each cycle. Pumps requiring suction check valves to prime or reprime shall not be acceptable.
  5. Impeller Clearance Adjustment: Means shall be provided for external adjustment of the clearance between the impeller and wear plate.
- I. The pump impeller shall be two-vaned, semi-open, non-clog, cast in ductile iron with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew.
- J. The pump shaft shall be sealed against leakage by a mechanical seal. Both the stationary sealing member and mated rotating member shall be tungsten titanium carbide alloy. Each of the mating surfaces shall be lapped to a flatness of one-half light band (5.8 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of shock loads that will cause deflection, vibration, and

axial or radial movement of the pump shaft.

- K. The seal shall be lubricated with oil from a separate, oil-filled reservoir. The same oil shall not be used to lubricate both shaft seal and shaft bearings.
- L. The seal shall be warranted for a minimum of four (4) years from the date of shipment. Should the seal fail within the first year, the manufacturer shall be obligated, upon notification, to furnish a new seal, without charge to owner, FOB factory. The cost of replacement seals thereafter shall be on a pro-rata basis as follows:

FAILURE WITHIN	PERCENTAGE OF NEW SEAL PRICE
2 YEARS	25%
3 YEARS	50%
4 YEARS	75%

- M. The pump impeller shaft bearings shall be anti-friction ball or tapered roller bearings, of ample size and proper design to withstand all radial and thrust loads which can reasonably be expected during normal operation. Bearings shall be lubricated from a separate reservoir.
- N. Each pump shall be equipped with a one-piece, cast iron suction spool, flanged on each end. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting of gauges or other instrumentation.
- O. The following company is an acceptable manufacturer of self-priming suction lift pumps. The list is not exclusive. But other companies must comply with all specifications and be approved by the County.
  - 1. Gorman-Rupp Co.
  - 2. Or approved equivalent

**3.1120.06** Valves and Piping

- A. Full flow type swing check valves shall have cast iron body with 125 lb. flanged ends. Valves shall be fitted with an external lever and spring. Bronze body ring shall be threaded into the valve port. Valve clapper shall be cast iron, bronze faced, and shall swing completely clear of waterway when valve is full open. Hinge pin shall be of Type 18-8 stainless steel construction and shall be utilized with bronze bushings and O- ring seals. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without

removing the valve from the line. Valve rating shall be 175 psi water working pressure, 350 psi hydrostatic test pressure.

- B. The discharge header shall include a 3-way plug valve to permit either or both pumps to be isolated from the common discharge header. The plug valve shall be of the non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to ANSI 125 lb. standard. Valve shall be furnished with a drip-tight shutoff plug mounted in a stainless steel bearing, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reset action. The lever shall be equipped with a locking device to hold the plug in the desired position.
- C. Each pump shall be equipped with one automatic air release valve, designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visible indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.
- D. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric-reinforced neoprene or similar inert material. A cleanout port, 3 inches or larger in diameter, shall be provided for ease of inspection, cleanout, and service. Valves shall be field adjustable for varying discharge heads.
- E. Flanged header pipe shall be centrifugally cast ductile-iron, complying with ANSI/AWWA C115/A21.15 Standards. Flanges shall conform to the drilling and facing requirements of ANSI/ASME B16.1 pressure class 125 designation. Fittings shall be produced of ductile-iron and conform to the applicable requirements for ductile-iron fittings specified in ANSI/AWWA C110/A21.10. Pipe barrels and flanges shall have taper pipe thread (NPT) in accordance with ANSI B1.20.1, with thread diameters adapted to ductile-iron pipe standard outside diameters, and suitable thread sealant applied before assembling flange to pipe.
- F. Bolt holes shall be in angular alignment within 1/2 degree between flanges. Flanges shall be faced and a gasket finish applied that shall have concentric grooves a minimum of 0.010 inch deep by approximately 0.030 inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.



### 3.1120.07 Gauge Kit

- A. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Compound gauges shall be graduated -30 to +30 feet water column minimum. Pressure gauges shall be graduated 0 to 140 feet water column minimum.
- B. Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

### 3.1120.08 Drive Unit

- A. The pump motors shall be \_\_\_\_\_ HP horizontal, open drip proof, induction type, with normal starting torque and low starting current characteristics, suitable for 3 phase, 60 hertz, 480 volt, AC electrical current. The motors shall not be overloaded at the design condition or at any head in the operating range as specified.
- B. Each motor shall be in current NEMA design cast iron frame with copper windings. Motor used with pump which has standby engine shall be of double shaft configuration to provide for mounting of centrifugal clutch.
- C. Standby engine shall be a four cylinder, natural gas, or propane fueled air cooled type, and shall have a continuous duty power rating suitable for the horsepower requirements of the pump, after derating to factors set forth herein. Engine shall be cooled by an integral forced air cooling system capable of maintaining safe engine operating temperature under the expected operating loads, and subject to the expected maximum ambient temperatures in the pump station enclosure.
- D. The engine shall be equipped with all controls and components required for manual and automatic operation when used with the engine controls and DC level control system described in these specifications. Such components shall include, but not be limited to the following:
  - 1. 12 volt DC electrical system including starter and alternator.
  - 2. Storage battery, 84 ampere-hour capacity minimum.
  - 3. Elapsed running time meter.
  - 4. Sensors for engine temperature, oil pressure, and overspeed.

5. Muffler designed to limit engine noise to a level acceptable in a residential area.
  6. Switch for manual operation of the starter, mounted on or near the engine.
  7. Alternator ammeter.
  8. Battery charger.
- E. Engine electrical equipment shall be wired to a terminal board on the engine for connection by the contractor to matching terminals in the motor control center.
- F. Because the engine shall be required to operate during emergency situations, the following minimum performance standards shall be used for engine selection:
1. Engine speed shall be controlled by a manually adjustable, governor-controlled throttle which shall maintain the preset speed over the range of expected pumping loads. This speed shall be not less than 1800 rpm to insure adequate cooling, nor more than 2400 rpm so that internal engine wear is held to a minimum. This governed speed shall not be acceptable if it is greater than that speed at which the engine torque and horsepower curves intersect. Engine manufacturer's published performance curves shall be submitted for review to support engine selection.
  2. The engine shall develop approximately 95% of manufacturer's published performance horsepower after a reasonable run-in period.
  3. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance in an ambient temperature of 100°F (37.8°C), which can be reasonably expected in the pump station enclosure in the summer.
  4. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance if installed at elevations more than 1000 feet above sea level.
  5. Engine rating shall be further reduced to conform to engine manufacturer's recommendations for continuous service applications.
- G. Brake horsepower requirements of pump shall not exceed 70% of calculated engine horsepower after derating for power available after run-in, derating for temperature compensation, derating for altitude compensation and derating for continuous service recommendations.

- H. Power shall be transmitted from motors to pumps and from engine to clutch and jackshaft by means of V-belt drive assemblies. The drive assemblies must be selected to establish proper pump speed to meet the specified operating conditions.
- I. Each drive assembly shall have a minimum of two V-belts. In no case shall a single belt drive be acceptable. Each V-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump based on the data developed in accordance with drive calculations. Drive systems with a safety factor of less than 1.5 to 1 shall not be considered sufficient for service intended. Computation of safety factors shall be based on the data developed in accordance with drive calculations.
- J. The pump manufacturer shall submit power transmission calculations which clearly express the following:
  - 1. Ratio of pump speed as related to motor speed.
  - 2. Pitch diameter of driver and driven sheaves.

**3.1120.09 Duplex Logic System**

- A. The sewage pumps shall alternate automatically on the completion of each pumping cycle. One pump shall start as the lead pump and the other pump shall be started if the wet well level continues to rise to the start level for the lag pump. After each operating cycle the lead and lag positions shall alternate. A manual selector switch shall also be provided so that the operator can designate either pump to stay in the lead position continuously. Adjustable time relays shall be provided to prevent simultaneous starting of the pumps after power failure. In case of a malfunction in the primary submersible transducer type level control system such that high water level is exceeded, a backup float level control shall indicate an alarm and call both pumps to start using a time delay. After reaching a low water level, the pump cycle shall reset to the primary system for normal operation. The alarm light shall remain on to be manually reset.

**3.1120.10 Submersible Transducer Level Control System (Primary)**

- A. The primary system to control the operation of the pumps with variations of sewage level in the wet well shall be a submersible level transducer.
- B. The transducer shall be a two wire type and produce a 4-20 mA DC instrumental signal proportional to the liquid level over a factory calibrated range of zero to \_\_\_\_\_ feet of water. It shall be of the head pressure sensing type, suitable for continuous submergence and operation.

The sensor shall be mounted in the wet well at the elevation shown on the plans. The transducer housing shall be fabricated of Type 316 stainless steel and the diaphragm shall be of molded Buna N synthetic rubber. The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure by a sealed breathing system which also houses the upper transmitter assembly.

- C. The transducer assembly shall incorporate a high-accuracy precision linear pressure capsule and linear variable differential transformer (LVDT). The transducer/transmitter shall derive operating power from the 2-wire logs below the 4 mA level. The accuracy of the output signal with respect to the sensed head pressure shall be +/- .5% of the total head pressure range of the transducer pressure element. The transducer shall be factory calibrated to the specified range.
- D. The following company manufactures acceptable liquid level sensing transducers that may be selected for design conditions. This list is not exclusive, but other companies must comply with the specifications and be approved by the County.
  - a. U.S. Filter Control Systems
  - b. Or approved equivalent
- E. Provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the transducer wires. Contractor shall coordinate exact location of transducer control wire junction box with ESD Pump Station Maintenance office. At the selected junction box location, the Contractor shall core drill required holes and install PVC schedule 40 sleeves for the wires from the transducers to the junction box. The junction box used for the transducer control wires may also be used for the float control wires, if both are located in the same vicinity, close enough for only one junction box to be required.

**3.1120.11** Float Level Control System (Secondary)

- A. Provide an independent backup level control system of UL listed direct acting float switches to control the operation of the pumps with sewage level exceeding primary control high water limit and or primary control low water level in the wet well.
- B. The float shall consist of a chemically resistant polypropylene casing encapsulating a single pole snap action switch which activates when the longitudinal axis of the float is horizontal, and deactivates when the level falls one inch below the actuation elevation.

- C. The float cable shall be of the PVC type STO #18 AWG 41 strand, 600 volt rated conductors. The float switches shall be suspended in the wet well by means of 1/4" stainless steel cables and a plastic coated cast iron weight. The floats shall be secured to the cable by stainless steel fasteners to assure drift free mounting and convenient removal for level adjustment.
- D. Low current isolating switches shall be provided for intrinsically safe switching levels in the wet well. The relay shall be of the solid state design that reduces the current so it is incapable of releasing sufficient energy to ignite explosive gases.
- E. Provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the float wires. Contractor shall coordinate exact location of float control wire junction box with ESD Pump Station Maintenance office. At the selected junction box location, the Contractor shall core drill required holes and install PVC schedule 40 sleeves for the wires from the floats to the junction box.

### **3.1120.12 Station Monitoring**

- A. Fault Detection
  1. Primary High Wet Well Level (Transducer Control): Contacts shall be provided to sense a low level condition in the wet well. The transducer assembly shall activate an alarm in event of a high level condition.
  2. Primary Low Wet Well Level (Transducer Control): Contacts shall be provided to sense a low level condition in the wet well. The transducer assembly shall activate an alarm in event of a low level condition.
  3. Secondary High Wet Well Level (Float Control): In addition to a transducer type level control, a direct acting float switch shall be provided and installed in the wet well as a backup to sense a high level condition. The float switch shall activate an alarm contact in the event of a high level condition.
  4. Secondary Low Wet Well Level (Float Control): In addition to a transducer type level control, a direct acting float switch shall be provided and installed in the wet well as a backup to sense a low level condition. The float switch shall activate an alarm contact in the event of a low level condition.
  5. Pump Failure: A limit switch shall be activated by the external arm of the discharge check valve of each pump to detect failure of the pumps to deliver normal operating flow. An auxiliary time

delay relay shall be provided to provide an alarm signal and shut pump down when pump fail occurs.

6. Power Failure: A relay with single pole, double throw contacts shall be provided and installed in the control panel to activate a power failure alarm signal to future SCADA contacts.
7. Phase Failure: A relay with double pole, double throw contacts shall be provided to monitor and protect against phase loss, under voltage and phase reversal. The relay shall automatically reset when three phase service returns to normal.
8. Unauthorized Entry: An adjustable timer shall be provided and installed in the control panel to signal an unauthorized entry into the pump station and activate an alarm signal to future SCADA contacts. The timer shall be activated when the entrance cover is in the open position. A key-operated switch shall be provided and located at the inside top of the entrance tube to provide authorized personnel a means to deactivate the alarm before the timer completes it's cycle.
9. Heat Sensor: The pump motors shall be provided with heat sensors embedded in the motor windings to detect excessive heat. The heat sensors shall be set to trip at 221°F (105°C) and shall automatically reset when the motor cools to a safe temperature. The alarm signal shall be a red light mounted on the control panel front.

#### B. Alarm Signal Light

Unless otherwise specified the alarm signal shall be a 120-volt AC weatherproof light shall be provided for remote mounting. The weatherproof fixture shall include a 100 watt red globe with guard.

#### C. SCADA

1. Provide dry contacts for the following faults for inputs for future SCADA system:
  - a. High wet well level - transducer and float systems
  - b. Low wet well level - transducer and float system
  - c. Pump failure - any pump
  - d. AC power failure
  - e. Engine or Generator failure
  - f. Unauthorized entry
  - g. Sewage grinder failure (common - due to overload, Oil, or AC power)

### 3.1120.13 Engine Control System

- A. The engine control system shall be designed to accomplish the following tasks:
1. Permit the operator to select mode of engine operation, providing manual start and stop of the engine to override the standby level control system and cranking circuit if required.
  2. Crank the engine upon start command from the standby level control system, and stop the engine upon a stop command.
  3. Stop the cranking sequence if the engine fails to start after a reasonable number of attempts, and provide an alarm indication of failure to start.
  4. While the engine is operating, continuously monitor engine speed, temperature, and oil pressure.
  5. Stop the engine for excessive speed, excessive cylinder head temperature, or insufficient oil pressure, and provide an alarm indication of shutdown and its cause.
  6. Maintain the charge on the engine storage battery.
  7. Provide an alarm indication for loss of 12 volt DC power for the standby level control system and engine control system.
- B. Upon operator selection of automatic operation, when the standby level control system provides a start command, the engine control system shall start the engine cranking motor for a short period of time. If the engine does not start, the system shall stop the cranking motor for a short period of time, then resume cranking. Typically, five 10-second cranking periods, each followed by a 10-second reset period, should be considered a reasonable effort to start the engine. When the engine starts, a sensor on the engine or elsewhere in the system shall stop the cranking cycle and reset the cranking circuit for the next start.
- C. If the engine does not start within the preset number of attempts, the cranking circuit shall be de-energized, a failure to start indicator on the control panel shall be illuminated, and an external alarm device shall be energized. Control of the pump with the standby engine shall be returned to the primary level control system.
- D. Once the engine has started normally, the engine control system shall monitor engine speed, cylinder head temperature, and oil pressure. Upon engine failure from any cause, system shall provide an alarm indication, illuminate an indicator, and energize an external alarm device as specified below.

- E. A switch or other device shall be provided and connected to perform as follows:
  - 1. When automatic operation is selected, engine shall start and stop under control of the engine control system.
  - 2. When manual operation is selected, engine cranking motor shall be controlled by a manual push-button or other device on the engine. Once started, engine shall run until off is selected, or engine failure circuit stops engine.
  - 3. Operator can stop engine if it is running, and prevent it from starting during maintenance or repair.
  
- F. Engine failure circuits shall stop the engine, illuminate a labeled indicator on the control panel, and energize an external alarm device for each of the following conditions:
  - 1. Engine speed exceeds maximum overspeed setting.
  - 2. Engine temperature exceeds safe operating temperature as specified by the engine manufacturer.
  - 3. Engine oil pressure falls below engine manufacturer's specified recommendations. System must override or bypass this function during cranking and for several seconds after starting to permit engine to build up oil pressure.
  
- G. Engine control system shall be furnished with one battery charger, designed and connected to operate on 115 volts AC, 60 hertz to maintain the charge on the 12 volt DC storage battery supplied with the engine. Battery charger shall incorporate the following design items:
  - 1. Automatic charge sensing and charging rate adjustment circuit.
  - 2. Integral current limit circuit to limit charging rate to 5 amperes maximum.
  - 3. Charging rate ammeter.
  - 4. Fuse for protection of charging circuit.
  - 5. Manual adjustment of charging rate.Operating power for the engine control system, except the battery charger, shall be provided by the storage battery furnished with the standby engine.

**3.1120.14** Enclosure Construction and Design: For use only where pump station enclosure is indicated on the approved Drawings.

- A. The enclosure is to be square/rectangular with outside dimensions of 16 feet long by 8 feet wide and having a minimum inside height of 8'8" at the roof peak. The enclosure shall be provided with four lifting eyes to ease in handling.



All exterior surfaces of the enclosure shall be of a stucco white/green/brown/gray isophthalic gel coat molded surface, flame retardant (ASTM D2863 rating of 27.5), and shall be provided with ultra-violet inhibitors. All interior surfaces of the enclosure shall be finished in an isophthalic polyester laminate, flame retardant and sealed with a white gel coat.

The pitch of the roof shall be sufficient for good moisture drainage, and shall be designed to withstand minimum roof loads in accordance with the ICC International Building Code (IBC). The enclosure walls and roof shall be fabricated of a composite, consisting of 1/8" thick laminate outside surface, 3/4" thick urafoam polyurethane core, and minimum 3/32" thick inside laminate surface. Marine grade plywood shall be used in place of foam where penetrations are to be made for the purpose of mounting auxiliary equipment. The enclosure shall have a minimum R-10 insulation factor and shall be capable of withstanding the most current wind loading design values provided or referenced in the ICC International Building Code (IBC) Chapter 16, and ASCE 7.

Enclosure door(s) shall be molded of reinforced fiberglass plastic double laminate, with molded gel-coat surfaces same as described for interior and exterior surfaces. Door shall have urafoam polyurethane foam core and marine grade plywood core in areas for mounting of door hardware and shall be completely encapsulated. The door hardware shall consist of (2) stainless steel ball bearing hinges, 3-point closure, handle and lock with anti-lock lever inside. Door shall have an adjustable door positioner and holder, Glynn-Johnson or approved equivalent. Door and hardware shall be mounted to withstand the most current wind loading design values provided or referenced in the ICC International Building Code (IBC) Chapter 16, and ASCE 7.

The enclosure shall have a 4-7/8" internal base flange which shall be fastened by anchors to a concrete foundation or slab.

B. Intake Louvers

The enclosure shall be complete with intake louvers and an exhaust fan to provide adequate ventilation.

The intake louvers shall be completely self contained and shall not require the use of motors, solenoids, or other electrically operated devices.

Intake louvers shall open automatically at 75°F (23.9°C), and close at 60°F (15.5°C). Louver operation shall be the result of the expansion and contraction of wax in an enclosed plunger, which shall drive the louver vanes through a mechanical linkage. The intake louver shall have the actuator mounted out of the flow of the intake air and shall maintain the louver vanes in the open position.

Intake louver vanes and louver frame shall be constructed of anodized aluminum with zinc plated steel actuator mounting and linkage. The louver vanes shall pivot on plastic bearings. Intake louver size shall be 15" wide and 18-7/8" high. Multiple louvers shall be provided to meet air flow requirements.

A shuttered, thermostatically controlled exhaust fan with a minimum capacity of 1600 CFM to change the air in the enclosure once every minute, shall be mounted in one end wall. In the wall approximately opposite to this shall be mounted intake louvers. Both intake and exhaust openings shall be equipped with a screen and cowl suitably designed to prevent the entrance of rain, snow, rocks, insects and foreign material. Fan circuit shall be protected by a thermal magnetic circuit breaker.

C. Lighting

To provide adequate illumination for all areas in the station and the control panel, provide four fluorescent type lighting fixtures, each having two 20-watt fluorescent tubes and separate ballasts. The enclosure shall be provided with a light switch located adjacent to the door opening. Lighting circuit shall be protected by a thermal magnetic circuit breaker.

**3.1120.15** Manufacturer's Responsibilities

- A. The pumps, motors, and controls shall be given an operational test in accordance with the standards of the Hydraulic Institute. Recordings of the test shall substantiate the correct performance of the equipment at the design heat, capacity, suction lift, speed and horsepower as herein specified. The Design Engineer, either he or his representative shall be invited to witness the operational test at the manufacturer's facility or other location designated by the manufacturer.
- B. The manufacturer of the pump station shall be responsible for delivery to the County of three (3) copies of the Operation and Maintenance (O&M) Manuals and the support literature required herein. Installation of the

pump station and related appurtenances shall be performed in accordance with written instructions by the manufacturer.

- C. After the installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the County's operating personnel in the operation and maintenance of the equipment.
- D. The pump station manufacturer shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump station and all equipment supplied by the station manufacturer. Said instructions shall assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained the exact equipment supplied.
- E. These instructions shall be prepared as a systems manual applicable solely to the pump station and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him. However, items of equipment for which the station manufacturer has made mounting or other provisions, but which he has not supplied, may be excluded from these instructions.
- F. The instructions shall include, but not be limited to, the following:
  - 1. Descriptions of, and operating instructions for, each major component of the pump station as supplied.
  - 2. Instructions for operation of the pump station in all intended modes of operation.
  - 3. Instructions for all adjustments, which must be performed at initial startup of the pump station, adjustments, which must be performed after the replacement of level control system components, and adjustments, which must be performed in the course of preventive maintenance as specified by the manufacturer.
  - 4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
  - 5. Service instructions for major components not manufactured by the pump station manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.

6. Electrical schematic diagram of the pump station as supplied, prepared in accordance with NMTBA and JIC standards. Schematics shall show, to the extent of authorized repair, pump motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for electronic equipment, the detail parts of which are not normally repairable by the station operator, need not be included, and shall not be substituted for an overall schematic diagram. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall schematic diagram.
  7. Layout drawing of the pump station as supplied, prepared in accordance with good commercial practice, showing the locations of all pumps, motors, valves and piping.
- G. Operation and maintenance instructions, which are limited to a collection of component manufacturer literature without overall pump station instructions, shall not be acceptable. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and pump stations, and which require the operator to selectively read portions of the instructions, shall not be acceptable.

### **3.1120.16 Spare Parts**

Each pump shall be furnished with one spare impeller trimmed as specified for the flow conditions. Each pump shall be furnished with a spare set of mechanical seals.

### **3.1120.17 Guarantee**

- A. The manufacturer of the pump station shall warrant it to be of quality construction, free from defects in material and workmanship. This warranty shall include specific details described below. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year from station start up and acceptance by County, excepting only those items that are normally consumed in service, such as light bulbs, oil, grease, packing, gaskets, O-rings, etc. The pump station manufacturer shall be solely responsible for the warranty of the station and all components.
- B. Components failing to perform as specified by the Design Engineer or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired or satisfactorily modified by the manufacturer without cost of parts or labor to the Owner.

- C. The warranty shall become effective upon startup by a factory representative and acceptance by the County.

### **3.1130 Submersible Sewage Pumping Station**

#### **3.1130.01 General**

- A. The contractor shall furnish and install a complete, fully operational underground submersible sewage pumping station with valve boxes, controls and all needed equipment to be installed in a precast concrete wet well. The principal items of equipment shall include submersible centrifugal or chopper type sewage pumps, slide away couplings with guide rail system, internal piping, valves, entrance hatches, automatic transducer type level controls, float type backup level control and control panel, all as shown on the plans and specified herein.
- B. Submersible centrifugal and chopper pumps shall have a minimum capacity of 100 gpm unless otherwise approved by the County at the rated head. Chopper pumps shall have the ability to reduce wastewater solids into a fine slurry and pump the slurry through the piping system without plugging. All material normally found in domestic and commercial sewage such as sanitary napkins, disposable diapers, cloth diapers, wash rags, wood, plastic, etc. shall be pumped, both in tests and field applications.
- C. The following companies are acceptable Submersible Pump Manufacturers. The list is not exclusive, but other companies must comply with all specifications and be approved by the County.
  - 1. Submersible Centrifugal Pumps.
    - a. ABS Pumps, Inc.
    - b. KSB, Inc.
    - c. EBARA International Corp.
    - e. Flygt, ITT Fluid Technology
    - f. Or approved equivalent
  - 2. Submersible Chopper Pumps.
    - a. Vaughan Co. Inc.
    - b. Or approved equivalent

#### **3.1130.02 Operating Conditions, Sewage Pumps**

- A. The sewage pumping station shall be equipped with a minimum of two (2) \_\_\_\_\_ inch centrifugal or chopper submersible sewage pumps. Each

pump shall be capable of delivering \_\_\_\_\_GPM of raw unscreened sewage against a total dynamic head of \_\_\_\_\_feet.

- B. The pumps shall be capable of processing any trash or stringy material which will pass through an 8" main sewer and a 4" or 6" house or building collection systems and pumping the slurry through all pump passages, system piping and valves without plugging.
- C. The submersible pump motors shall be of the type specified with a maximum allowable speed of \_\_\_\_\_ RPM. The minimum rated horsepower of each motor shall be \_\_\_\_\_ HP suitable for 480 volt, 3 phase, 60 hertz, \_\_\_\_\_wire electrical service and shall be non-overloading throughout the entire operating range.

### **3.1130.03** Precast Concrete Wet Well

- A. The submersible equipment chamber shall be a Precast Concrete Wet Well as specified in Section 3.0240 with a minimum inside diameter of \_\_\_\_\_ feet, and a minimum inside height of \_\_\_\_\_ feet, as shown on the plans.
- B. The top of the equipment chamber and valve box shall be provided with aluminum hatches with suitable lifting handles and locking hasp. When the cover is in the full open position, a hold open device shall be provided to prevent accidental closing.

### **3.1130.04** Submersible Centrifugal Pumps and Motors

- A. The pumps shall be submersible, non-clog sewage pumps of heavy cast iron construction and shall include pump, vertical submersible motor with the pump impeller mounted on a one piece motor pump shaft. The common pump and motor shaft shall be solid hardened stainless steel supported by heavy duty roller or ball bearings. All fasteners shall be stainless steel.
- B. Submersible pumps shall be capable of passing a 3" minimum solid and a minimum capacity of 100 gpm at \_\_\_\_\_ T.D.H.
- C. Each submersible pump shall be equipped with double mechanical seals. An oil chamber shall separate the pump and motor and provide lubrication for the seals. Seals shall not require routine maintenance or adjustment and shall not be damaged when the pump is run dry. Seal oil inspection shall be achieved without disassembly of the pump. The seal shall not require pumped liquid as a lubricant. An electronic probe shall be provided in the motor housing to detect the leakage of water and activate

an alarm warning light in the control panel.

- D. The motor shall be a vertical submersible type, explosion proof FM approved for Class 1, Division 1, Group D Locations, rated at \_\_\_\_ HP, \_\_\_\_ RPM, 480 Volts, 3 Phase, 60 Hz, with a 1.15 service factor. The motor shall be completely watertight, housed in an air filled chamber and shall have Class F insulation. Small motors less than 2.5 HP may be oil filled per approved manufacturers standard products. Bi-metallic thermal switches shall be embedded in each phase winding to sense high temperature. The control current shall be connected through the bi-metallic switches so the motor is shut down should a high temperature condition exist. The switches shall be self resetting when the motor cools. The power cable shall be rated for an explosion proof environment.
- E. A guide rail system shall be provided which shall permit installation and removal of the pumps without the need for personnel to enter the wet well. The system shall be spark proof design consisting of stainless steel guide rails, cast aluminum guide bracket, cast ductile iron discharge elbow with mounting support, upper guide rail mounting bracket, and intermediate guide brackets every ten feet. The pump discharge connection shall be made automatically when the pump is lowered into operating position and the check valve hydraulic sealing flange shall provide a positive seal engagement.

**3.1130.05** Submersible Chopper Pumps and Motors

- A. The pump casing shall be of semi-concentric design, with the first half of the circumference being cylindrical beginning after the pump outlet, and the remaining circumference spiraling outward to the 125 lb. flanged centerline discharge. The casing shall be ductile-iron with all water passages smooth and free of blowholes and imperfections for good flow characteristics.
- B. The pump impeller shall be semi-open type with pump out vanes to reduce seal area pressure, and to draw lubricant down from the reservoir should leakage occur. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings with a set clearance between the impeller and the cutter bar. The impeller shall be hardened cast alloy steel keyed to the shaft, and shall have no axial adjustments or set screws required.
- C. The cutter bar shall be recessed into the pump bowl with a funnel shaped inlet opening, and shall extend diametrically across entire pump suction

opening. The cutter bar shall be hardened cast alloy steel. The impeller shall be secured to the shaft using a special cutter nut, designed to cut stringy materials and prevent binding. An upper cutter shall be threaded into the casing above the impeller, designed to cut against the pump out vanes and the impeller hub, reducing and removing stringy material from the mechanical seal area.

- D. The seal and bearing housing shall be ductile-iron, and machined with piloted bearing fits for concentricity of all components. Piloted motor mount shall firmly align motor on the bearing housing. Shaft thrust in both directions shall be taken up by two back-to-back mounted single-row angular contact ball bearings with a B-10 life rated for 100,000 hours, lubricated with turbine oil. The mechanical seal shall be fitted with silicon carbide seal faces. The seal shall ride on a stainless steel shaft sleeve, with seal tension set by three set screws. The mechanical seal shall not be single-spring rubber bellows type, which is susceptible to wrapping of stringy materials.
- E. An automatic oil level monitor shall detect the oil level and shut off the motor in event of low oil level. An oil level switch shall be mounted at the top of the wet well, above flood stage, with a hose feeding down to the bearing housing to detect oil level. A sensitive relay shall be included for mounting in the motor control panel.
- F. The pump shafting shall be AISI 4140 heat treated. The submersible motor shall be close coupled directly to the pump through a solid sleeve coupling, which is keyed to the pump and motor shafts.
- G. The submersible electric motor shall be UL/LISTED EXPLOSION PROOF for Class 1, Division 1, Group C and D hazardous locations, rated at \_\_\_ HP, \_\_\_ RPM, 480 Volts, 3 Phase, 60 Hz, with a 1.15 service factor and Class F insulation. The motor shall be equipped with tandem mechanical seals in oil bath and dual moisture sensing probes. Motor shall include two normally closed automatic resetting thermostats connected in series and imbedded in adjoining phases. Motor frame shall be cast iron, and all hardware and shaft shall be stainless steel.
- H. A guide rail system shall be provided which shall permit installation and removal of the pumps without the need for personnel to enter the wet well. The system shall be spark proof design consisting of stainless steel guide rails, cast aluminum guide bracket, cast ductile iron discharge elbow with mounting support, upper guide rail mounting bracket, and intermediate guide brackets every ten feet. The pump discharge connection shall be made automatically when the pump is lowered into operating position and



the check valve hydraulic sealing flange shall provide a positive seal engagement.

### **3.1130.06** Motor Control and Protection

#### A. Control Panel

1. The control equipment shall be mounted and wired within a NEMA type 4X enclosure fabricated of stainless steel, and equipped with a drip shield and door gasket to prevent moisture from entering the panel. The hinged outer door shall be securely held closed with a three point locking handle with provisions for padlocking. All operating controls and indicators shall be mounted through a hinged inner swing dead front door equipped with screw fittings to hold it securely closed. It shall not be necessary to expose any internal components to perform normal operating procedures. A ground duplex outlet shall be provided on the side of the enclosure for 115-volt devices. The enclosure shall be suitable for wall or pole mounting.
2. The control panel shall conform to the National Electrical Code. All wiring shall be neatly installed and run in raceways to prevent interference with any operating devices. All door mounted devices shall be labeled as to functions with permanently attached nameplates and all internal wiring, terminal strips, etc. shall be properly identified for field connections and trouble shooting.
3. The pump motors shall have short circuit and overload protection by means of properly sized motor starters and thermal magnetic molded case circuit breakers shall be provided as disconnect switches and to provide protection against short circuits or grounds of each pump motor. Circuit breakers shall have an interrupting rating of 14,000 amps at 480 volts and shall be UL listed. The operating mechanism shall allow manual switching and shall indicate when the breaker has tripped.
4. The following companies manufacture acceptable types of motor control panels that may be selected for design conditions. This list is not exclusive, but other companies must comply with the specifications and be approved by the County.
  - a. U.S. Filter Control Systems, (Consolidated Autocon)
  - b. Revere Control Systems Inc., Birmingham, AL.
  - c. Control Systems Inc, Jackson MS.
  - d. ABS Pumps Inc.
  - e. KSB Inc.
  - f. EBARA International Corp.
  - g. Flygt, ITT Fluid Technology
  - h. Or approved equivalent

B. Across-the-Line Motor Starters

The magnetic across-the-line starters with manual reset shall be provided with melting alloy type overload relays for each phase to assure positive motor protection. Starters shall be minimum Nema rated size 1.

C. Surge/Transient Protection Devices shall be provided per Section 3.1320.

**3.1130.07 Duplex Logic System**

A. The sewage pumps shall alternate automatically on the completion of each pumping cycle. One pump shall start as the lead pump and the other pump shall be started if the wet well level continues to rise to the start level for the lag pump. After each operating cycle the lead and lag positions shall alternate. A manual selector switch shall also be provided so that the operator can designate either pump to stay in the lead position continuously. Adjustable time relays shall be provided to prevent simultaneous starting of the pumps after power failure. In case of a malfunction in the primary submersible transducer type level control system such that high water level is exceeded, a backup float level control shall indicate an alarm and call both pumps to start using a time delay. After reaching a low water level, the pump cycle shall reset to the primary system for normal operation. The alarm light shall remain on to be manually reset.

**3.1130.08 Submersible Transducer Level Control System (Primary)**

A. The primary system to control the operation of the pumps with variations of sewage level in the wet well shall be a submersible level transducer.

B. The transducer shall be a two wire type and produce a 4-20 mA DC instrumental signal proportional to the liquid level over a factory calibrated range of zero to \_\_\_\_\_ feet of water. It shall be of the head pressure sensing type, suitable for continuous submergence and operation. The sensor shall be mounted in the wet well at the elevation shown on the plans. The transducer housing shall be fabricated of Type 316 stainless steel and the diaphragm shall be of molded Buna N synthetic rubber. The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure by a sealed breathing system which also houses the upper transmitter assembly.

C. The transducer assembly shall incorporate a high-accuracy precision linear pressure capsule and linear variable differential transformer (LVDT). The transducer/transmitter shall derive operating power from the 2-wire logs

below the 4 mA level. The accuracy of the output signal with respect to the sensed head pressure shall be +/- .5% of the total head pressure range of the transducer pressure element. The transducer shall be factory calibrated to the specified range.

- D. The following company manufactures acceptable liquid level sensing transducers that may be selected for design conditions. This list is not exclusive, but other companies must comply with the specifications and be approved by the County.
  - a. U.S. Filter Control Systems
  - b. Or approved equivalent
  
- E. Provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the transducer wires. Contractor shall coordinate exact location of transducer control wire junction box with ESD Pump Station Maintenance office. At the selected junction box location, the Contractor shall core drill required holes and install PVC schedule 40 sleeves for the wires from the transducers to the junction box. The junction box used for the transducer control wires may also be used for the float control wires, if both are located in the same vicinity, close enough for only one junction box to be required.

### **3.1130.09** Float Level Control System (Secondary)

- A. Provide a backup level control system of UL listed, direct acting float switches to control the operation of the pumps with sewage level exceeding primary control high water limit or low water level in the wet well.
  
- B. The float shall consist of a chemical resistant polypropylene casing encapsulating a single pole snap action switch which activates when the longitudinal axis of the float is horizontal, and deactivates when the level falls one inch below the actuation elevation.
  
- C. The float cable shall be of the PVC type STO #18 AWG 41 strand, 600 volt rated conductors. The float switches shall be suspended in the wet well by means of stainless steel cables and a plastic coated cast iron weight. The floats shall be secured to the cable by stainless steel fasteners to assure drift free mounting and convenient removal for level adjustment.
  
- D. Low current isolating switches shall be provided for intrinsically safe switching levels in the wet well. The relay shall be of the solid state

design that reduces the current so it is incapable of releasing sufficient energy to ignite explosive gases.

- E. Provide a stainless steel Nema 4X terminal box with screw down terminals above the top of the wet well for intermediate connection of the float wires. Contractor shall coordinate exact location of float control wire junction box with ESD Pump Station Maintenance office. At the selected junction box location, the Contractor shall core drill required holes and install PVC schedule 40 sleeves for the wires from the floats to the junction box.

### **3.1130.10 Station Monitoring**

#### **A. Fault Detection**

1. Primary High Wet Well Level (Transducer Control): Contacts shall be provided to sense a high level condition in the wet well. The transducer assembly shall activate an alarm in event of a high level condition.
2. Primary Low Wet Well Level (Transducer Control): Contacts shall be provided to sense a low level condition in the wet well. The transducer assembly shall activate an alarm in event of a low level condition.
3. Secondary High Wet Well Level (Float Control): In addition to a transducer type level control, a direct acting float switch shall be provided and installed in the wet well as a backup to sense a high level condition. The float switch shall activate an alarm contact in the event of a high level condition.
4. Secondary Low Wet Well Level (Float Control): In addition to a transducer type level control, a direct acting float switch shall be provided and installed in the wet well as a backup to sense a low level condition. The float switch shall activate an alarm contact in the event of a low level condition.
5. Pump Failure: A limit switch shall be activated by the external arm of the discharge check valve of each pump to detect failure of the pumps to deliver normal operating flow. An auxiliary time delay relay shall be provided to provide an alarm signal and shut pump down when pump fail occurs.
6. Power Failure: A relay with single pole, double throw contacts shall be provided and installed in the control panel to activate a power failure alarm signal to future SCADA contacts.
7. Phase Failure: A relay with double pole, double throw contacts shall be provided to monitor and protect against phase loss, under voltage and phase reversal. The relay shall automatically reset when three phase service returns to normal.

8. Unauthorized Entry: An adjustable timer shall be provided and installed in the control panel to signal an unauthorized entry into the pump station and activate an alarm signal to future SCADA contacts. The timer shall be activated when the entrance cover is in the open position. A key-operated switch shall be provided and located at the inside top of the entrance tube to provide authorized personnel a means to deactivate the alarm before the timer completes its cycle.
9. Heat Sensor: The pump motors shall be provided with heat sensors embedded in the motor windings to detect excessive heat. The heat sensors shall be set to trip at 221°F (105°C) and shall automatically reset when the motor cools to a safe temperature. The alarm signal shall be a red light mounted on the control panel front.

**B. Alarm Signal Light**

Unless otherwise specified the alarm signal shall be a 120-volt AC weatherproof light shall be provided for remote mounting. The weatherproof fixture shall include a 100 watt red globe with guard.

**C. SCADA**

1. Provide dry contacts for the following faults for inputs for future SCADA system:
  - a. High wet well level - transducer and float systems
  - b. Low wet well level - transducer and float system
  - c. Pump failure - any pump
  - d. AC power failure
  - e. Generator failure
  - f. Unauthorized entry

**3.1130.11 Piping**

The pump station piping shall be flanged Class 52 ductile iron pipe. Each discharge line shall be fitted with a gate valve and check valve as specified herein, sized as shown on the plans, and located in a concrete valve box.

**3.1130.12 Valves**

Pump station valves and accessories shall be as shown on the drawings and specified in Section 3.1530 and 3.1540.

### **3.1130.13** Inspection and Test

Pumps shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the pumps shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

### **3.1130.14** Initial Operation

After the installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump equipment and to instruct the owner's and County operating personnel in the operation and maintenance of the equipment. Three (3) copies of Operation and Maintenance (O&M) Manuals shall be supplied to the County prior to initial operation.

### **3.1130.15** Spare Parts

Each pump shall be furnished with one spare impeller trimmed as specified for the flow conditions. Each pump shall be furnished with a spare set of mechanical seals.

### **3.1130.16** Guarantee

The manufacturer of the pumping station equipment shall guarantee for a period of one year from the date station is placed into operation and accepted by the County, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the guarantee period; the manufacturer shall provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded.

## **3.1140 Engine Driven Dry Prime Centrifugal Pumps (Standby Pumping Capacity)**

**3.1140.01** Furnish and install a skid mounted heavy duty, fully automatic self-priming, single stage, end suction, solids handling centrifugal pump. With the standard impeller the pump is capable of handling solids 3 inches in diameter as well as thick sludge, abrasive slurries, sewage etc. The pump shall be capable of capacities equal to the pump station main sewage pumps at same head conditions when equipped with standard impeller.

**3.1140.02** The pump set shall be fitted with a fully automatic priming system capable of priming up to 25 feet static suction lift conditions. The pump shall be capable of running completely dry for unlimited periods of time.

**3.1140.03** The following companies manufacture acceptable standby engine driven centrifugal pumps that may be selected for design. This list is not exclusive, but other companies must comply with these specifications and be approved by the County.

1. Thompson Pump & Manufacturing Co.
2. Godwin Pumps of America, Inc.
3. Gorman Rupp Industries
4. Or approved equivalent

**3.1140.04** Construction

The pump shall be furnished with fully open bladed impeller of cast chromium steel hardened to a minimum of Brinell HB341 hardness test for castings. Pump casing, suction cover, separation tank and replaceable wearplates shall be of close-grained cast iron. The shaft shall be constructed of 1-1/2% nickel content/chromium steel. The pump mechanical seals shall be oil lubricated, with high abrasion resistant solid silicon carbide interfaces, which allow the pump to run continuously dry with no premature failure or damage. The pump shall be supplied complete with an integral ball type non-return valve. Non-return valve body shall be constructed of cast iron and the non-return valve ball and seat shall be made of nitrile rubber. The non-return valve shall have a quick release access cover to facilitate inspection and removal of blockage.

**3.1140.05** Priming System

The pump shall be fully automatic self-priming or shall be fitted with a fully automatic priming system incorporating a compressor and air ejector assembly. The compressor shall be lubricated automatically with oil supplied from the diesel engine and shall be driven by a fixed center non-slip tooth belt from the pump shaft. The priming system shall either not require fail-safe protection float gear or the design shall include an integral type NRV which serves as a check for the Dry Prime System. Vacuum pumps shall not be accepted as equal when used for priming.

**3.1140.06** Coupling

Pump and engine are connected by means of a flexible type coupling of Dodge Powerbase or similar design and secured to the shafts with taper lock bushings.

### 3.1140.07 Controls

- A. The diesel engine shall be equipped with a factory installed microprocessor-based controller designed to start/stop the engine at a signal supplied by high and low level floats. The automatic control shall be mounted on a fabricated steel stand, separate from the pump to eliminate damages due to engine vibration. It shall be furnished with a 25-foot cord and plug to allow it to be operated when required, but be easily removable when manual operation is desired.
- B. Control Specifications
1. Power Input shall be 12VDC nominal.
  2. Sensor Outputs shall have six (6) open collector transistor 125 mA sink; two (2) 5A 24 VDC NO relay contacts.
  3. Reverse Polarity Protection shall have 200 volt peak reverse voltage.
  4. Operating Temperature Range: -20° to 140°F (-28.8° to 60°C).
    - a. Test: Starts engine in automatic mode and runs until switched “off” or emergency shutdown occurs.
    - b. Off: Disconnects all power to control circuits, stops/disables engine from starting and resets shutdown indicators.
    - c. Auto: Automatic start/stop sequencing is initiated by external switches and signals.
  5. Cycle Crank Timer: Five (5) crank attempts, seven (7) seconds each; four (4) rest periods, fifteen (15) seconds each, before overcrank.
  6. Overspeed Trip Point Setting: From 2500 - 9000 Hz.
  7. Crank Disconnect Speed Setting: From 20 - 2500 Hz.
  8. Shutdown Time Delay: fifteen (15) seconds after engine start; locks out low lube oil and high pressure.
  9. Engine Run LED: Comes “on” when crank disconnect occurs.
  10. Shutdown Output: Removes DC output, operates dry relay contacts for engine shutdown.
  11. Start/Stop: See Float Switches Below.
  12. Enclosure: Weatherproof NEMA 3.
  13. Enclosure Coating: Brushed or Powder Coated Stainless Steel
  14. Subpanel Coating: Brushed or Powder Coated Stainless Steel
  15. Float Switches: The control shall be supplied with one-normally open and one-normally-closed narrow angle (10-degree to 20-degree) float switches. The floats shall be constructed with tilt sensation mercury switches enclosed within a polyurethane resin. Each float shall have a minimum 25-ft. waterproof cable wired into the engine controller.



### 3.1140.08 Engine

- A. Engine shall be natural gas fueled, water cooled, with air filtration and 12 volt electric start equipment. Engine shall develop power required to drive pumps at rated capacities. Engine shall be equipped with a low oil pressure - high coolant temperature warning/shutdown system, fuel filter - water separator, electric tachometer/hourmeter, and hand throttle.
- B. Standby engine shall be a four cylinder, natural gas, or propane fueled air cooled type, and shall have a continuous duty power rating suitable for the horsepower requirements of the pump, after derating to factors set forth herein. Engine shall be cooled by an integral forced air cooling system capable of maintaining safe engine operating temperature under the expected operating loads, and subject to the expected maximum ambient temperatures in the pump station enclosure.
- C. The engine shall be equipped with all controls and components required for manual and automatic operation when used with the engine controls and DC level control system described in these specifications. Such components shall include, but not be limited to the following:
  - 1. 12 volt DC electrical system including starter and alternator.
  - 2. Storage battery, 84 ampere-hour capacity minimum.
  - 3. Elapsed running time meter.
  - 4. Sensors for engine temperature, oil pressure, and overspeed.
  - 5. Muffler designed to limit engine noise to a level acceptable in a residential area.
  - 6. Switch for manual operation of the starter, mounted on or near the engine.
  - 7. Alternator ammeter.
  - 8. Battery charger
- D. Engine electrical equipment shall be wired to a terminal board on the engine for connection by the contractor to matching terminals in the motor control center.
- E. Because the engine shall be required to operate during emergency situations, the following minimum performance standards shall be used for engine selection:
  - 1. Engine speed shall be controlled by a manually adjustable, governor-controlled throttle which shall maintain the preset speed over the range of expected pumping loads. This speed shall be not less than 1800 rpm to insure adequate cooling, nor more than 2400 rpm so that internal engine wear is held to a minimum. This governed speed shall not be acceptable if it is greater than that

speed at which the engine torque and horsepower curves intersect. Engine manufacturer's published performance curves shall be submitted for review to support engine selection.

2. The engine shall develop approximately 95% of manufacturer's published performance horsepower after a reasonable run-in period.
  3. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance in an ambient temperature of 100°F (37.8°C), which can be reasonably expected in the pump station enclosure in the summer.
  4. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance if installed at elevations more than 1000 feet above sea level.
  5. Engine rating shall be further reduced to conform to engine manufacturer's recommendations for continuous service applications.
- F. Brake horsepower requirements of pump shall not exceed 70% of calculated engine horsepower after derating for power available after run-in, derating for temperature compensation, derating for altitude compensation and derating for continuous service recommendations.

### **3.1140.09 Engine Control System**

- A. The engine control system shall be designed to accomplish the following tasks:
1. Permit the operator to select mode of engine operation, providing manual start and stop of the engine to override the standby level control system and cranking circuit if required.
  2. Crank the engine upon start command from the standby level control system, and stop the engine upon a stop command.
  3. Stop the cranking sequence if the engine fails to start after a reasonable number of attempts, and provide an alarm indication of failure to start.
  4. While the engine is operating, continuously monitor engine speed, temperature, and oil pressure.
  5. Stop the engine for excessive speed, excessive cylinder head temperature, or insufficient oil pressure, and provide an alarm indication of shutdown and its cause.
  6. Maintain the charge on the engine storage battery.
  7. Provide an alarm indication for loss of 12 volt DC power for the standby level control system and engine control system.

- B. Upon operator selection of automatic operation, when the standby level control system provides a start command, the engine control system shall start the engine cranking motor for a short period of time. If the engine does not start, the system shall stop the cranking motor for a short period of time, then resume cranking. When the engine starts, a sensor on the engine or elsewhere in the system shall stop the cranking cycle and reset the cranking circuit for the next start.
- C. If the engine does not start within the preset number of attempts, the cranking circuit shall be de-energized, a failure to start indicator on the control panel shall be illuminated, and an external alarm device shall be energized. Control of the pump with the standby engine shall be returned to the AC level control system.
- D. Once the engine has started normally, the engine control system shall monitor engine speed, cylinder head temperature, and oil pressure. Upon engine failure from any cause, system shall provide an alarm indication, illuminate an indicator, and energize an external alarm device as specified below.
- E. A switch or other device shall be provided and connected to perform as follows:
  - 1. When automatic operation is selected, engine shall start and stop under control of the engine control system.
  - 2. When manual operation is selected, engine cranking motor shall be controlled by a manual push-button or other device on the engine. Once started, engine shall run until off is selected, or engine failure circuit stops engine.
  - 3. Operator can stop engine if it is running, and prevent it from starting during maintenance or repair.
- F. Engine failure circuits shall stop the engine, illuminate a labeled indicator on the control panel, and energize an external alarm device for each of the following conditions:
  - 1. Engine speed exceeds maximum overspeed setting.
  - 2. Engine temperature exceeds safe operating temperature as specified by the engine manufacturer.
  - 3. Engine oil pressure falls below engine manufacturer's specified recommendations. System must override or bypass this function during cranking and for several seconds after starting to permit engine to build up oil pressure.
- G. Engine control system shall be furnished with one battery charger, designed and connected to operate on 115 volts AC, 60 hertz to maintain

the charge on the 12 volt DC storage battery supplied with the engine. Battery charger shall incorporate the following design items:

1. Automatic charge sensing and charging rate adjustment circuit.
2. Integral current limit circuit to limit charging rate to 5 amperes maximum.
3. Charging rate ammeter.
4. Fuse for protection of charging circuit.
5. Manual adjustment of charging rate.

Operating power for the engine control system, except the battery charger, shall be provided by the storage battery furnished with the standby engine.

### **3.1140.10 Skid Mount**

The pump shall be mounted to a common structural steel skid. The skid shall have a centralized lifting bracket and eye.

## **3.1150 Hydraulic In-Channel Sewage Grinder**

### **3.1150.01 General**

#### **A. Description**

1. Hydraulic In-Channel Sewage Grinders shall be required on a case by case basis as determined by the County. Grinders reduce solids to fine particles to enhance the function and life of downstream wastewater pumps.
2. Each Grinder unit shall be properly designed for a maximum flow of \_\_\_\_\_ gpm, and shall meet the requirements of these specifications.
3. Each Grinder unit installed shall include a support system with guide rails, housing, dual-shaft grinder, hydraulic drive, hydraulic motor, motor controller and electrical controls.

### **3.1150.02 Products**

#### **A. Acceptable Sewage Grinder Unit Types**

Two types of cutter and spacer designs are acceptable to the County, (1) Individual Cutter and Spacer Units and (2) Single Piece Cutter Cartridge Units.

- B. Acceptable Suppliers
  - 1. Individual Cutters and Spacers Grinder Unit(s), and required associated equipment and components shall be supplied by JWC Environmental, or approved equivalent.
  - 2. Single Piece Cutter Cartridges Grinder Unit(s), and required associated equipment and components shall be supplied by Franklin Miller, Inc. or approved equivalent.

- C. Identification

Each unit shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, supplier's name and location.

### 3.1150.03 Grinder Mechanisms

- A. Shafts

For either type of sewage grinder unit specified in Section 3.1150.02, the Grinder shaft design shall be twin parallel shafts, with a 2" minimum shaft diameter, hexagonal configuration, made of AISI 4140 heat treated alloy steel, through-hardened and precision ground for uniformity. The twin shafts shall counter-rotate providing positive feed flow through the grinders and shall intermesh at close clearance to intensively shear and shred solids into fine particles.

- B. Cutters and Spacers

- 1. Individual Cutters and Spacers Grinder Unit  
Individual cutters and spacers shall be minimum AISI 4130 heat treated alloy steel, surface ground for uniformity and through-hardened to a minimum 45-50 Rockwell C scale hardness value. The inside configuration of both the individual cutters and the individual spacers shall be hexagonal so as to fit the shafts with a total clearance NOT to exceed 0.015-inch across the flats to assure positive drive and increase the compressive strength of the spacers. Cutter configuration shall consist of one shaft with individual 5-tooth double-edged cutters and one shaft with individual 11-tooth cam cutters. To maintain particle size, the height of the tooth shall NOT exceed 1/2 inch above the root diameter. Cutter root diameter overlap shall be NOT less than 1/16 inch or greater than 1/4 inch to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.
- 2. Single Piece Cutter Cartridge Grinder Unit

Single piece cutter cartridges shall be AISI 4140 heat treated alloy steel comprising a plurality of 7 tooth cam shaped elements. This one piece element shall be designed for heavy duty cutting. It shall provide easy assembly with no more than \_\_\_\_ elements for a \_\_\_\_ inch chamber. The monolithic cutter cartridge design shall avoid catastrophic cutter stack collapse due to the cracking of one or more cutters. It shall further be designed to reinforce adjacent cutters as well as shafting and shall help prevent shaft scoring.

### 3.1150.04 Hydraulic Power Units

#### A. Hydraulic Motors and Drives

Hydraulic motor and drive systems shall be utilized with component design being as recommended by the manufacturer.

##### 1. Individual Cutters and Spacers Grinder Unit

- a. Individual cutters and spacers design grinder units shall utilize a low speed, high torque, rotary power hydraulic motor that utilizes the hydraulic pressure developed by the hydraulic power unit to provide rotational torque for grinder operation. The hydraulic power pack shall include an oil reservoir with a positive displacement pump driven by a TEFC vertically mounted \_\_\_\_ HP motor.
- b. The hydraulic power unit shall provide hydraulic power to operate and control the grinder and, provide overload protection and quick response to frequent stop-start and severe reversing of the grinder motor.
- c. The entire hydraulic system shall be designed for 3000 psi maximum pressure. At idle load conditions the system operating pressure should be in the 200 to 400 psi range. Continuous operating pressure greater than 2000 psi shall NOT be acceptable. Hydraulic connections between the motor and the power pack shall consist of two 1/2 inch flexible hoses. Each hose shall be rated for 3500 psi.
- d. As solids are encountered, pressure shall be automatically increased on a demand basis to provide the required torque necessary to continue the rotation of the cutters. Should the grinder demand pressure exceed 2850 psi, a pressure switch shall be activated and a 4-way valve shifted. The rotation of the cutters shall instantly reverse for about one-half (1/2) to one (1) revolution or about 1/2 second. At the end of this time, the valve shall be shifted and the cutters shall return to the forward direction.

- e. If the obstruction has been cleared the unit shall continue to operate in the forward direction. If the obstruction has NOT cleared the reversing sequence shall repeat until the torque requirement is reduced or until it has had to repeat the reversing cycle 9 times within a 45 second time span. If 9 reversals have occurred within 45 seconds the controller shall shut down the hydraulic unit, activate an overload relay, and light a Fail indicator.
  - f. The rain resistant hydraulic power unit may be mounted in a remote location as required by design parameters in accordance with the supplier's recommendations.
  - g. On completion of installation, the hydraulic power unit shall be filled with a high quality fluid with a viscosity of approximately 100 to 250 SSU at 100°F (37.8°C) with good chemical stability and anti-foaming properties. The grades of hydraulic fluid shall be in accordance with supplier's recommendations.
  - h. Hydraulic fluid shall be supplied by the Contractor; hydraulic fluid is NOT supplied by the grinder manufacturer.
2. Single Piece Cutter Cartridge Grinder Unit
- a. Single piece cutter cartridge design grinder units shall utilize a hydraulic drive system consisting of a power pack, a hydraulic motor coupled to the unit and associated hoses, connectors, and pipes as required.
  - b. The power pack consists of an oil reservoir with a positive displacement pump driven by a \_\_\_\_\_HP TEFC electric motor operating at 230/460 volts, 3 phase, 60 hertz. The power pack shall have all necessary controls for operation including a pressure switch, safety relief valve, directional valves, and electrical control box.
  - c. The electrical control box shall start and stop the electric motor and shall act to change the direction of rotation of the hydraulic motor (and the unit) when jammed.
  - d. The pump shall deliver oil to the hydraulic motor through an appropriate high pressure hose with suitable connectors. The hydraulic system shall be designed for 3000 psi maximum pressure.
  - e. Under no load conditions, the pressure is less than 300 psi. Pressure shall build as required to about 2850 psi to provide maximum full load torque to the unit.
  - f. At about 2850 psi, the pressure switch is actuated

which works through the control box to reverse the direction of rotation of the unit in order to clear very tough materials that may tend to stall the machine. Switching of the direction of rotation is accomplished through a directional valve system.

- g. If for any reason the pressure in the system should rise to about 3000 psi, the safety release valve is actuated, causing the hydraulic oil to bypass the hydraulic motor and go back to the reservoir. The hydraulic motor and unit shall be capable of operating satisfactorily under at least 50 feet of water.

### **3.1150.05** Flow Control Devices

#### A. Flow and Particle Deflectors

For either type of sewage grinder unit specified in Section 3.1150.02, a flow deflector (Individual Cutters and Spacers Grinder Unit) or particle deflector (Single Piece Cutter Cartridge Grinder Unit) shall be provided by the manufacturer to guide particles directly to the cutting chamber and to prevent large particles from by-passing the cutting action. The design of the flow or particle deflector for the grinder unit provided shall be that which the manufacturer recommends and has proven and recorded previous successful use with the proposed particular model of the type of sewage grinder unit to be provided.

#### B. Overflow Provisions

Both type grinder units referenced in Section 3.1150.02 shall be designed for direct flow from the influent pipe into the grinder. At the location where the wastewater influent flow initially enters the grinder unit process, the manufacturer shall provide overflow bar screens or racks, which shall provide a bypass capability system for the wastewater, in the event of grinder jam conditions or temporary loss of power.

### **3.1150.06** Related Equipment

#### A. Support System

##### 1. Installation

Each Grinder unit shall have an associated wall mounted wet well frame and guide rail system that provides for easy installation and removal from the wet well as recommended by the manufacturer. The wet well frame and guide rails shall have a history of proven successful use with the selected grinder. The support frame shall



guide the grinder unit to the operating position by lowering with a hoist and shall fully support the grinder unit.

2. Materials

The support frame and additional supports shall be Type 304 stainless steel, constructed of welded square tube, angles and plates.

B. Seals and Bearings

1. Individual Cutters and Spacers Grinder Unit

a. The radial and axial loads of the shafts shall be borne by four sealed oversize deep-groove ball bearings.

b. The lower bearings shall be protected by a combination of a replaceable and independent tortuous path device and end face mechanical seals. Face materials must be a minimum of tungsten carbide to tungsten carbide, NOT requiring an external flush or any type of lubrication. The seal supplier shall rate the mechanical seal at 90-psi continuous duty.

c. Products requiring continuous or occasional lubrication or flushing shall NOT be accepted.

d. The upper bearings shall be protected by a combination of a replaceable and independent tortuous path device and a dual lip elastomer low-pressure seal. Elastomer materials must be a nitrile or polyacrylate. The dual lip elastomer seal shall be rated at 7-psi.

e. The bearings shall be part of a replaceable cartridge that supports and aligns the bearings and seals, as well as protects the shafts. The cartridge shall be independent of the shafts; therefore cutter stack tightness shall NOT affect seal performance. Seals shall meet required pressure rating regardless of cutter stack fit. Independent seal design shall provide protection against axial loading on shafts and bearings during shaft deflection.

f. O-rings shall be made of Buna-N elastomers.

2. Single Piece Cutter Cartridge Grinder Unit

a. Primary Seals shall feature elastomeric members which operate as opposing disk springs when compressed and at the same time keeping the faces of the two metallic rings together insuring positive sealing. No metal springs shall be used.

b. Labyrinth Rings shall be contact-less, and shall be supplied to further protect from coarse and fine granular contaminants.

c. Bearings shall be oversized deep groove double seal Conrad type. The basic Dynamic Load is 7500 lbs.

- d. Shaft retightening for the unit shall not be required as part of a regular maintenance procedure.
- e. The bearings and seals shall be housed in a replaceable cartridge that supports and aligns the bearings and seals. The cartridge housings shall be constructed of hardened 17-4 PH stainless steel.

C. Housings

1. Individual Cutters and Spacers Grinder Unit

- a. Grinder end housings shall be cast of ASTM A 536 ductile iron with a cast-in-place flow deflector, designed to protect the bushings while guiding particles directly into the cutting chamber. The cutting chamber shall be a nominal height of \_\_\_\_\_ inches and the opening to the chamber shall be a minimum of 8½ inches in width.
- b. The maximum bottom end housing height shall be 3-7/8 inches to minimize effect on upstream head. The top end housing shall provide access to "stack tightening nuts" to enable maintenance of cutter stack tightening without removing unit from channel.
- c. Top covers shall be ASTM A536 ductile iron and bottom covers shall be ASTM A36 hot rolled plates.
- d. Hi-Flow Side Rails For In-Channel Grinders: The inside profile of the side rail shall be concave to follow the radial arc of the cutters. The side rails shall be affixed to the grinder and maintain a clearance NOT to exceed 5/16-inch between the major diameter of the cutter and the concave arc of the side rail. Keeping this clearance directs larger particles toward the cutters to assure fineness of grind. Hi-Flow side rails shall have evenly spaced slots, which increase flow and decrease head loss. Side rails shall be of ASTM A536 ductile iron.

2. Single Piece Cutter Cartridge Grinder Unit

The main housing components shall be a cast structure made of ductile iron in accordance with ASTM A536 standards. On a case by case basis, stainless steel construction may be required. Components subject to wear shall be designed into replaceable elements and shall not be a part of the ductile iron unit main housing.

**3.1150.07** Electrical Controls

The Design Engineer shall assure that wiring for the electrical controls for the grinder units shall be coordinated with the total pump station electrical controls

design so that they function simultaneously, not separately. Sewage grinder equipment must operate when the pump station is being powered by the standby generator set.

A. Individual Cutters and Spacers Grinder Unit

1. Motor Controller(s)

- a. The controller shall be the supplier's standard UL listed Model.
- b. The controller shall be equipped with a HAND-OFF/RESET-AUTO three-position selector switch. The selection of the position desired shall be performed at the pump station site. In OFF/RESET the grinder shall NOT run. In HAND and AUTO position the grinder shall run.
- c. When a grinder jam condition occurs in either the HAND or AUTO mode the controller shall stop the grinder and reverse its rotation to clear the obstruction. If the jam is cleared, the controller shall return the grinder to normal operation. If the jam condition still exists, the controller shall go through eight additional reversing cycles within 45 seconds (nine times total) before signaling a grinder overload condition. When a grinder overload condition occurs the controller shall shut the grinder off and activate a fail indication and relay.
- d. If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.
- e. Controller reset shall be from local panel controls only.
- f. The controller shall provide overcurrent protection for the hydraulic power unit oil pump motor through an overload relay mounted directly on the oil pump motor starter.
- g. The controller shall have indicator lights for POWER ON, RUN, GRINDER OVERLOAD, MOTOR OVERLOAD, OIL OVERTEMP, and LOW OIL LEVEL conditions.
- h. The controller shall be rated 5 HP, 480-volts, 3-phase, 60-Hz.
- i. Short circuit protection requires that a properly sized circuit breaker or fuses be installed by others.

2. Components

a. Enclosure

1. Enclosures shall be fabricated of fiberglass reinforced polyester resins or stainless steel NEMA 4X rated.

2. Enclosures shall house the control devices, relays, terminal blocks, and non-reversing motor starter and shall be suitable for wall mounting. Doors shall have hinges and corrosion resistant latches.
  - b. Control Devices
    1. Pilot devices shall be mounted on the enclosure front panel.
    2. Indicators shall be integral transformer type with low voltage long life 6-volt lamps. Lamps and selector switches shall be heavy duty NEMA 4X type.
    3. Two sets of contacts shall be included. One for a FAIL signal output and one for a RUN signal output. The contacts shall be rated 10 amp, 240 VAC, resistive load.
  - c. Motor Starter
    1. A non-reversing contactor type motor starter shall be provided for the hydraulic pump oil motor.
    2. The overload relay shall be adjustable so that the range selected includes the full load amps rating and service factor.
- B. Single Piece Cutter Cartridge Grinder Unit
1. Motor Controller
 

An Automatic Reversing Controller shall be supplied with oil tight controls and overload heater protection. The contents of the controller shall be encased in a NEMA 4x enclosure. The enclosure shall be suitable for wall mounting.
  2. Selector Switch
 

A three position "Hand-Off-Auto" switch shall control the mode of operation. The controller shall sense overload currents indicating a jam condition. The Grinder unit shall stop, momentarily reverse, and resume forward position.

The controller shall reset itself back to zero count if no overloads occur after 30 seconds. The controller shall incorporate a main disconnect switch.

    - a. Indicator lights shall be provided as follows: A Green "Run Light" shall indicate the grinder is running
    - b. Two sets of contacts shall be provided as follows:
      - One for RUN signal output
      - One for FAIL signal output

3. Components

An Automatic Reversing Controller shall be supplied with oil tight controls and overload heater protection. The contents of the controller shall be encased in a NEMA 4x enclosure.

**3.1150.08** Quality Assurance

A. Manufacturing Qualifications

Hydraulic In-Channel Sewage Grinder suppliers shall be firms regularly engaged in the manufacture of Grinders which have been in satisfactory use in wastewater service for not less than 5 years, and familiar with standard practices of installation, operation and safety for sewage grinder systems.

B. Field Quality Control

Supplier shall provide the services of a factory-trained representative to check installation and to start-up each grinder. Factory representative shall have complete knowledge of proper installation, operation and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.

**3.1150.09** Manufacturer's Responsibilities

A. Factory Test

Each grinder and controller shall be factory tested to ensure satisfactory operation.

B. Installation

Grinder and controller shall be installed in accordance with the supplier's written installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

C. Operation and Maintenance (O&M) Manuals

Supplier shall provide three (3) Operation and Maintenance (O&M) Manuals to the County. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

D. Technical Assistance

The Grinder manufacturer shall offer technical assistance through support by a factory representative.

**3.1150.10 Spare Parts**

A. Repair Facility

The manufacturer shall maintain and provide a complete repair facility within 250 miles of the pump station site(s). The repair facility shall maintain a complete inventory of spare parts for the grinders, and be able to provide these spare parts to the County.

C. Exchanges

The manufacturer shall offer an exchange program so that a replacement cutter assembly can be on site before removing an operating unit. The manufacturer also shall provide the service of rebuilding cutter elements or cartridges for only the cost of the parts supplied.

**3.1150.11 Guarantee**

The manufacturer of the pump station grinder equipment shall guarantee for a period of one year from the date the grinder is placed into operation and accepted by the County, that the grinder unit and all associated equipment shall be free from defects in design, materials and workmanship. In the event that the grinder or any associated components fail, or are proven defective during the guarantee period; the manufacturer shall provide a replacement part without cost to the County, upon return of the defective part. Normal use items, such as hydraulic fluid, are excluded.

**3.1200 Furnishings** (Not Included, Refer to Design Engineer's Specifications.)

**3.1300 Instrumentation and Controls**

**3.1310 Control Panels** (refer to 3.1100 Equipment Sections)

**3.1320 Surge/Transient Protection Devices**

**3.1321 Related Documents**

- A. National Electric Code (NEC)
- B. UL1449
- C. UL1283
- D. IEEE C62.41

**3.1322** Quality Assurance

- A. Manufacturing / System Supplier Qualifications:
  - 1. Surge/Transient Protection Device (SPD) supplier shall be a firm regularly engaged in the manufacture of SPDs whose products have been in satisfactory use in similar service for not less than one year and familiar with standard practices of safety and installation for surge/transient protection devices and systems.
  - 2. SPD manufacturing facility shall be registered by nationally recognized testing laboratories to ISO 9001:2000 Quality Systems Requirements Standard, English version.

**3.1323** Submittals

- A. General: Submit the following as specified.
  - 1. Product Data for system components from Manufacturer.
  - 2. Operation and maintenance data for inclusion in Operation and Maintenance (O&M) Manuals. Include data on each type device, including all features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at the site. Provide names, addresses and telephone numbers of service organizations that carry stock of service items for the system to be furnished.
  - 3. Manufacturers Declaration of Conformity, showing results of UL 1449 let-through voltage test as specified below.
  - 4. Product certification signed by the Manufacturer of the system components certifying that their products comply with indicated requirements.

**3.1324** Manufacturer / System / Service Supplier

- A. Subject to compliance with requirements, provide surge/transient protection system and services of one/more of the following;
  - 1. MTL, Inc. Telematic Series
  - 2. Phoenix Contact GmbH & Co.
  - 3. Or approved equivalent

- B. Manufacturers of specific components are hereinafter specified.

**3.1325** General

- A. Provide a surge/transient protection system where indicated in Section 3.1100 Equipment Specifications containing surge/transient protection devices (SPD's) on all services entering the protected system with cabled connections to/from other systems and devices external to the main system installation room/building;
  - 1. SPD's shall be provided on all process I/O points to electronic indication, recording and control apparatus, for the AC power feed to control equipment, and for telemetry/data communication connections where interconnected to the system being protected.
  - 2. SPD's shall be auto-resetting without manual intervention and shall either indicate failed devices by external automatic monitoring or through internal fail-safe operation.
  - 3. SPD's requiring periodic disconnection for testing or manual resetting are not acceptable.
  - 4. Include all mounting hardware, loop identification and grounding connection accessories required for an operational system.
- B. Provide surge/transient protection devices for field-mounted measurement and control devices as indicated in the Drawings and Specifications.
  - 1. Local surge protection shall be provided on all loops exceeding 1000 feet in total or further than 500 ft from the main control system location. Particular attention shall be paid to measurement and control devices located in tank farms, on waste water / effluent discharges or process / combustion stack emission monitoring.

**3.1326** Surge/Transient Protection Device Types

- A. Measurement and Control SPD's:
  - 1. Multistage hybrid (gas-filled discharge tube (GDT) plus secondary semiconductor) electronic protection devices are required for normal loop operating voltages below 90V peak, metal oxide varistor (MOV) based devices shall be provided for normal loop operating voltages above 90V peak. No hybrid SPD can be used for voltages above 90V peak without measures to limit power follow-through current.
  - 2. Maximum size per loop shall be 7 mm wide installed.
  - 3. Hybrid SPDs shall be rated for minimum 10kA (8/20  $\mu$ s) peak impulses, MOV based SPD's for 6kV(1.2/50  $\mu$ s)/3kA(8/20  $\mu$ s) peak impulses.



4. SPD series connection shall be through resistor or resistor/inductor combination; circuits reliant only on series inductors shall not be acceptable.
5. SPD leakage current shall be 10  $\mu$ s maximum on 4/20mA DC 2-wire circuits at normal operating voltage defined in the Specifications.
6. SPD's shall be encapsulated or otherwise protected from casual interference, and all SPD components shall be within one housing per loop.
7. Means shall be provided for individual loop identification, which shall positively identify that loop and be transferable to any replacement device. Adhesive labels are not acceptable.
8. SPD common grounding shall be provided automatically with mounting and no additional grounding connections after mounting shall be required. Grounding can be via dedicated busbar or via DIN rail, both must be insulated from chassis steelwork until connected at the dedicated system grounding point.
9. SPD with less than 2 Ohm series resistance shall be provided with individual fuses where connected to bulk I/O power supplies not already protected by hold-up resistors or individual line fusing.

B. AC power SPD's:

1. Provide SPD on AC power feed into the protected system, rated for normal operation current + 50%.
2. SPD shall provide duplicated and redundant protection networks based on metal oxide varistors (MOV's) with electronic monitoring and remote indication of service availability.
3. Indicator lights shall be provided on the front cover indicating Full Operational Status and Partial Operational Status.
4. Remote annunciation shall be provided through a contact closure as follows:
  - rated at 250VAC 0.5A minimum
  - CLOSED on power energization AND Full Operational Status
  - OPEN on power failure OR Partial Operational Status.
5. SPD's shall comply with UL1449 let-through voltages as follows:
 

Voltage (nom.)	Let-through (L-N,L-G,N-G,L-L)
120/208	400V
220/380	700V
277/480	800V
6. UL (or recognized equivalent) listed SPD's shall be required.
7. Internal line noise filters (where specified) shall be UL1283 listed.
8. Panel-board protectors shall be Category C1/B3 as per IEEE C62.41; 6kV/3kA impulse rated.

- C. Data-communication SPD's:
1. Duties herein described are private wire / leased line telephone, Ethernet (Thick/Thin), Arcnet, TwinAx and other proprietary communication protocols/electrical specifications.
  2. Manufacturers' confirmation of device suitability for application shall be provided.
  3. Devices shall provide full hybrid (gas-filled discharge tube (GDT) plus secondary semiconductor) electronic protection devices.
  4. Hybrid SPD's shall be rated for minimum 10kA (8/20  $\mu$ s) peak impulses.
  5. SPD leakage current on communication circuits shall be 10 $\mu$ A maximum at normal operating voltage.
  6. SPD's shall be encapsulated or otherwise protected from casual interference, and all SPD components shall be within one housing per loop.
  7. Means shall be provided for individual loop identification, which shall positively identify that loop and be transferable to any replacement device. Adhesive labels shall not be acceptable.
  8. SPD common grounding shall be provided automatically with mounting and no additional grounding connections after mounting shall be required. Grounding can be via dedicated busbar or via DIN rail, both must be insulated from chassis steelwork until connected at the dedicated system grounding point.
- D. Field-mounting SPD's:
1. Shall be provided for all measurement points identified on Drawings and Specifications and/or fulfilling protection criteria as follows:
    - part of loop wiring in excess of 1000 ft
    - installed in locations where access is difficult  
(defined as: - where ladders or other access gear is necessary or where apparatus is located in confined spaces or requiring more than one person for replacement)
    - associated with effluent/waste treatment, stack/emission monitoring.
  2. SPD's shall be as specified in 3.1326 A.
  3. 2-wire 4/20mA transmitters shall be protected with hybrid electronic devices encapsulated and designed for location directly into transmitter conduit entries.
  4. SPD's shall be single-ended or be supplied with all necessary mounting and loop wiring accessories required. The wiring installer or others shall not provide additional accessories to complete installation into 2-wire circuits.

5. Enclosures rated for the installation conditions specified shall be provided for SPD's not mounted directly onto transmitters.
6. Directly-mounted SPD's are exempt from separate tagging requirement of 3.1326 A.

**3.1327** Panel /Control Room Installation

- A. Contractor shall install equipment in accordance in applicable Codes and Manufacturers' written installation guides.
- B. Route conduit and wiring as required to make neat and operational system. Tubing shall be void of kinks, sags and other irregularities. All bends shall be made with a tube bender or with standard fittings.
- C. Field wiring prior to SPD's (exposed wiring) must be segregated by at least 2" from, and not run in the same conduit/raceway as, wiring from SPD's (protected wiring).
- D. Ground wiring from SPD dedicated busbar or insulated DIN rail must be independently run to the Main Electrical System Ground bar as per Manufacturers' installation guide. Ground wire shall be 12 AWG minimum and clipped or otherwise secured every 3 ft if installed using raceway. Resistance of ground wire shall not exceed 0.1 Ohm between SPD ground and Main Electrical System Ground bar.
- E. Main Electrical System Ground bar may or may not be connected to a local Ground Rod(s) or Mat, as required by local Codes. Where so connected, bonding link shall be 10AWG minimum, and have resistance of 0.1 Ohm or less.

**3.1328** Field Installation

- A. Contractor shall install equipment in accordance in applicable Codes and Manufacturers' installation guides.
- B. Route conduit and wiring as required to make neat and operational system. Tubing shall be void of kinks, sags and other irregularities. All bends shall be made with a tube bender or with standard fittings.
- C. Where separate enclosures are provided, field wiring prior to SPD's (exposed wiring) must be segregated by at least 2" from, and not run in the same conduit/raceway as, wiring from SPD's (protected wiring). Installer shall dress wiring of internally connected SPD's as separately as possible.

- D. Ground wiring from local enclosure SPD dedicated busbar or insulated DIN rail must be independently run to a local Grounding Point or Building Steel. Ground wire shall be 12AWG minimum and clipped or otherwise secured every 3 ft if installed using raceway. Resistance of ground wire shall not exceed 0.1 Ohm between SPD ground and local Building Steel. Mounting posts or stanchions are acceptable as Building Steel.
- E. 2-wire 4/20mA transmitter-mounted SPD's shall be grounded as recommended by Manufacturer.

**3.1329** Acceptance Testing

- A. Prior to project completion, the Contractor shall request manufacturer's factory trained personnel to verify that installation is satisfactory and in compliance with the manufacturer's installation guides. In particular, ground connection resistance and security shall be verified and the County furnished with a signed report certifying compliance.
- B. Three (3) copies of the Operation and Maintenance (O&M) Manuals including parts list and as-constructed drawings shall be provided to the County.

**3.1330** Service Inspection and Testing

- A. Every year after final acceptance until expiration of warranty (see below) system shall be inspected with regard to wiring security, labeling, mounting integrity and ground connections, including resistance measurement.
- B. Contractor shall furnish the County with written report certifying that system inspection has been accomplished with results. Any failures or defects are to be reported to operating personnel, documented in report, and if under warranty, replaced.

**3.1331** Warranty

- A. System shall be provided with two (2) year warranty and all applicable recommended spare and consumable parts for two (2) years operation.

**3.1340** **Magnetic Flowmeter**

- A. For stations with a capacity greater than 600 gpm, a magnetic flowmeter shall be installed in the common discharge line, as required by the County,

sized for the design flow of the pump station as defined in the specifications and plans. The meter shall be installed in an external vault with bypass piping, valving, sump pump, entrance hatch and high water alarm. Instruments shall be mounted in the pump station building enclosure. A sump pump meeting the requirements of Section 3.1110.23 shall be provided.

- B. The meter shall be designed to measure flows of single and multiple pump operation. Meter shall be sized for a nominal minimum velocity of 1.0 foot per second and a nominal maximum velocity of 20 feet per second with all pumps in operation. Unless otherwise approved, the meter shall be 3 inch for flows less than 260 gpm, 4 inch for flows between 260 and 599 gpm, and 6 inch for flows between 600 gpm and 1080 gpm. The meter shall be located in a straight section of the discharge piping a minimum of three diameters from an upstream and two diameters from a downstream fitting or valve.
- C. Meter sizes of 4" or less shall be flangeless, with liner of ceramic material and shall NOT have wetted electrodes. The meter shall be immune to insulating type coating processes and hard slurry noise. The meter housing shall be weather resistant design.
- D. Meter sizes greater than 4" shall be of the low frequency electromagnetic induction type and shall produce a pulsed DC signal directly proportional to and linear with the liquid flowrate. The meter shall be designed for 120 VAC +/-10% operation, 60 Hz +/-5%, with a power consumption of less than 23 VA for meters 24" and smaller and 50 VA for meters 30" and greater. The metering tubes shall be constructed of carbon steel with magnetic field generating coils inside the metering tube. The meter housing shall be NEMA 4X rated. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics or interruption of the flow measurement. All magnetic flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges through 24-inch and AWWA flanges in sizes 30-inch and larger. Laying length of meters shall be a minimum of 1-1/2 times the nominal meter sizes. Meters shall have polyurethane liners and Type 316 bullet nose stainless steel electrodes. All electrodes shall be supplied with ultrasonic cleaning. Grounding rings shall be supplied with all meters, if required; grounding electrodes are not acceptable.
- E. The magnetic flowmeters shall be constructed in a facility operating under a total quality system to provide assurance of product quality. To ensure

this, the facility must be certified to be in compliance with the quality requirements of ISO Standard 9001.

- F. The following companies are acceptable Magnetic Flow Meter Manufacturers. The list is not exclusive. But other companies must comply with all specifications and be approved by the County.
  - 1. Fisher Porter Co.
  - 2. Or approved equivalent
  
- G. The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Institute of Science and Technology (NIST). A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three (3) flow rates shall be provided with the meter. The accuracy of the metering system using the frequency output shall be 1/2% of rate from 1 to 100% of meter capacity (flow velocities of 0.5 to 33.33 feet per second).
  
- H. Signal Converter-Transmitter
  - 1. The signal converter portion of the magnetic flowmeter shall include both a magnet driver to power the magnet coils and the signal converter electronics. When remote mounted, the signal converter shall be housed in a NEMA 4X die cast aluminum case and supplied with 30 feet of signal cable. Signal converters shall be interchangeable with like meters of all sizes without affect on meter accuracy or requiring the need for re-calibration.
  - 2. The electronics shall be of the solid state, feedback type, and utilize integrated circuitry and microprocessor controls. The entire data base of the converter shall be addressable and configurable through remote intelligent terminal such as an IBM-PC compatible personal computer running appropriate communication software, HART (Highway Addressable Remote Transducer) protocol communications shall also be available. The HART protocol system supplied shall permit simultaneous 4-20 mA and digital signal transmission on the same 2 wire cable. With this protocol installed, process parameters such as instantaneous flow can be monitored by an external "smart" device. Data shall be transmitted at 1200 baud, with the serial information being encoded and detected as outlined in the Bell 202 standard.
  - 3. The converter shall have input impedance of  $10^{12}$  ohms or greater and not be affected by quadrature noise. It shall require no zero adjustment or special tools for start-up. The converter shall not require calibration over its expected life under normal use. Input and output signals shall be fully isolated. The converter output

shall be 4 to 20 mA Dc into 0 to 750 ohms. The unit shall be capable of accommodating bidirectional flow, if required. Complete zero stability shall be an inherent characteristic of the meter system. This shall eliminate the need to zero adjust the system with a full pipe at zero flow.

4. The converter shall be provided with a back lighted, dot matrix-type, liquid crystal display for easy and configuration data. The display shall have two rows of 16 alpha-numeric characters displaying both flowrate in engineering units and totalization with minimum of seven digits. For configuration adjustment and system monitoring, all data base parameters and error messages shall appear in the display in plain English language. Error messages shall announce incorrect entry values, which shall be rejected by the converter.
  5. Converters shall be mounted external to valve vaults in building or station enclosure. These units shall be mounted on concrete based pipe supports with centerline of the converter a minimum of 5.0 feet above ground level.
- I. Ultrasonic Electrode Cleaners (UEC)
1. Ultrasonic cleaners shall be provided for all meters larger than 4" and shall have all solid-state electronics which produce pulses of High Frequency Electrical Energy to crystal transducers mounted on magmeter electrodes. These pulses induce mechanical energy to the electrodes thus removing and/or preventing the buildup of coating substances on the electrodes.
  2. The generator shall provide field selectable pulse outputs of 6 to 20 pulses per minute over a switch selectable range of 45 to 65 kHz. These units shall be mounted below or beside the converter on the same mounting support.

### **3.1400 Conveying Systems**

#### **3.1410 Monorail**

**3.1411** The Work under this Section includes but is not limited to the following:

- A. Monorails.

#### **3.1412 Acceptable Manufacturers**

- A. Monorail Track, Switches, Curves, Hangers & Accessories
1. T/C American Monorail, Inc.

2. FKI Group – ACCO Louden
3. Or approved equivalent

**3.1413** Monorail System

- A. The monorail systems shall be furnished and installed at the locations shown on the Drawings complete with supports and stops. The monorail system shall be supported as indicated with a maximum deflection to span ratio of 1/450 while supporting the maximum live loads.

**3.1500 Mechanical**

**3.1510 Pipe and Fittings**

**3.1511** Description

- A. The work under this section includes, but is not limited to the following:
1. Ductile iron pipe & fittings.
  2. Ductile iron pipe coatings.
  3. Reinforced concrete pipe.
  4. PVC C-900 pipe.

**3.1512** Quality Assurance

- A. All sewer pipe and materials used shall be tested and inspected by an approved commercial testing laboratory prior to delivery to the site and all materials which fail to conform to these specifications shall be rejected. After delivery to the site, any material which has been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Certified copies in duplicate of the inspection and acceptance the laboratory shall be supplied to the Engineer prior to use of the materials. Each joint of pipe delivered to the work shall be stamped or marked to indicate the testing laboratory's acceptance or approval. Laboratory tests of other materials may be required if deemed necessary by the Design Engineer.

**3.1513** General Application

- A. Metal Pipe: Unless otherwise indicated on the drawings:
1. Metal pipe 4 inches in diameter and larger shall be cement mortar lined ductile iron.
  2. Buried ductile iron pipe shall have push-on joints with mechanical joint ductile iron fittings.



3. Exposed ductile iron pipe shall have flanged joints with ductile iron flanged fittings.
- B. Sanitary Sewers
1. Unless otherwise indicated on the Drawings, Sanitary Sewers shall be cement mortar lined Ductile Iron Pipe.
- C. Storm Drain Sewers: Unless otherwise indicated on the Drawings:
1. Storm Drain Sewers shall be reinforced concrete pipe.

**3.1514** Product Delivery, Storage, and Handling

- A. During loading, transporting, and unloading, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings.
- C. Store all materials on site in enclosures or under protective coverings to keep clean and dry.
- D. Do not store materials directly on ground.

**3.1515** Materials

- A. Ductile Iron Pipe:
1. Pipe: ANSI/AWWA C115/A21.15
  2. Fitting: ANSI/AWWA C110/A21.10
  3. Joints:
    - a. Flanged: ANSI/AWWA C115/A21.15 and ANSI/AWWA C110/A21.10
    - b. Push-on and mechanical: ANSI/AWWA C111/A21.11
  4. Class: per ANSI/AWWA C151/A21.51, Standard Thickness Class, Class 52 Minimum
  5. Pressure Rating: 350 psi for pipe 20 inches and smaller, 250 psi for pipe 24 inches and larger.
  6. Ductile Iron Pipe Coatings:
    - a. Cement-mortar lining:
      1. ANSI/AWWA C104/A21.4
      2. Required except on air pipelines and unless noted otherwise on the Drawings.
    - b. Asphaltic coating: ANSI/AWWA C151/A21.51

- B. PVC C-900 Pipe
  - 1. Refer to Standards for Construction of Commercial and Residential Sanitary Sewer Systems, Section 4.0300.
- C. Reinforced Concrete Pipe:
  - 1. Storm sewers or surface drains:
    - a. ASTM C76
    - b. Smaller than 36 inch: Class III with B wall
    - c. 36 inch and larger: Class III with C wall

**3.1516** Heat Trace and Insulation for Pipe

- A. All outside exposed piping, unless otherwise indicated on the Plans, shall be heat traced and covered with 4 lb. density fiberglass sectional pipe covering 1" thick, having presized ASJ jacket stapled in place. Fittings on covered piping shall be covered with factory premolded fitting covers of same thickness as adjacent covering with glass fab jacket pasted on and finished with vinyl-acrylic mastic over glass fab, 1/8" thick (dry) coat.
- B. At all hangers install factory fabricated pipe shields equal to Pipe Shields, Inc., "Thermal-Hanger-Shields", model CS, or approved equivalent.
- C. All insulation and adhesives used shall have an Underwriter's Laboratories listed flame spread rating not over 25 without evidence of continued progressive combustion and with a smoke developed rating not higher than 50.

**3.1517** Installation

- A. Piping Layout in Buildings:
  - 1. Completed installations should present a neat, orderly appearance.
  - 2. Do not block opening or passageways.
  - 3. Run piping parallel to walls of buildings.
  - 4. Keep piping free from contact with structure or installed items.
- B. Erection:
  - 1. Vertical piping:
    - a. Secure at sufficiently close intervals to keep pipe in alignment, and to support weight of pipe and its contents.
    - b. Install supports at each floor or at intervals of not more than 15 ft. and not more than 8 ft. from end of riser.
    - c. If no structural element is available for providing support during construction, secure in position braces fastened to pipe.

2. Horizontal piping, suspended:
  - a. Support at sufficiently close intervals to prevent sagging and provide thrust restraint.
  - b. Install hangers at ends of runs or branches and at each change of direction or alignment.
3. Horizontal piping, underground: Install horizontal underground piping in accordance with Section 3.0232.
4. Flanged joint installation: Per manufacturer's instructions.
5. Mechanical joint installation: Per manufacturer's instructions.
6. Push on joint installation: Per manufacturer's instructions.
7. Junction with other materials: Use type of adapter and technique recommended by pipe manufacturer.

**3.1518**      Cleaning

- A. Keep inside of all pipe, fitting, and valves clean and free from dirt and debris.
- B. Flush all lines before testing or placing in service.

**3.1519**      Testing

- A. All new pressure pipe and valved sections that have been installed and backfilled or partially backfilled shall be tested with a hydrostatic pressure of at least 50% above normal operating pressure for a minimum period of two hours. Before applying the specified test pressure, all air shall be expelled from the pipe.
- B. Should any test of combined sections of the newly laid pipe disclose any leakage, the Contractor shall at his expense, locate and repair the defective joints until the leakage has been stopped.

**3.1520**      **Hangers and Supports**

**3.1521**      The work under this section includes, but is not limited to the following:

- A. Pipe hangers and support
- B. Accessories

**3.1522**      Acceptable Manufacturers

- A. Grinnel Mechanical Products

- B. Unistrut Corp.
- C. Or approved equivalent

**3.1523** General

- A. Provide hangers and supports for piping, valves and equipment to prevent sagging or lateral movement.
- B. Stress shall not be placed on equipment flanges or couplings by secondary supports and hangers.
- C. Trapeze hangers will be permitted where two or more lines are to the same elevation and parallel, if roller supports are provided for each pipe. Steel channels may be used where indicated on drawings.
- D. Each hanger bar shall be supported by two or more hanger rods. Rods shall extend 1/2 inch below lower lock nut. Any excess rod shall be cut off and rough ends filed smooth. No all-thread rods shall be used where length of rod is more than 6 inches long. Two nuts shall be provided, one for locking purposes, on all hanger rods and supports subject to vibration. Perforated strap hangers shall not be acceptable.
- E. Hanger rods shall be of sizes shown or as required to adequately suspend the equipment. Secure rods to construction with No. 1 UPC "Code Devices" wrought iron swivel-type concrete inserts, No. 21 swivel beam clamps, No. 23 anchor bolts, No. 44 steel joist bar clamps or No. 25 swivel weld attachment as required.
- F. Where cast-in-place concrete construction is used, hanger rods shall be secured to malleable iron inserts embedded in the concrete. Toggle-joint hanger supports shall not be acceptable.
- G. Where steel framing is used, supports shall be approved-type forged steel beam clamps or supplementary members spanning the space between structural members.
- H. Hangers and supports shall allow for insulation and coverings for piping. Insulated lines shall have insulation continuous through supports.
- I. All supports shall be securely fastened in a manner acceptable to the Design Engineer.
- J. Hangers and supports located in the Pumping Station Wet Well shall be manufactured of stainless steel.

**3.1524**      Installation

- A.      Vertical piping shall be supported with friction clamps anchored to building construction or by full size pipe extended to a base at the floor.
- B.      All exposed piping along walls and buried piping 4 inch diameter and smaller within one foot horizontal distance of a structural wall shall be supported by return line hooks, offset type.
- C.      Piping shall be free to move when it expands or contracts except where fixed anchors are indicated on the Drawings. Where adequate hanger rod swing length cannot be provided, or where pipe movement based on expansion of 1 inch per 100 feet for each 100°F (37.8°C) change in temperature exceeds 1/2 inch, provide approved roller supports. All piping 2 inch diameter and larger on trapeze hangers shall be supported on cast iron roll stands.
- D.      Saddles for insulated pipe shall consist of protection sleeves.
- E.      Spacing of hangers and supports for horizontal piping shall not exceed the pipe manufacturer's maximum recommended span and, unless otherwise noted or specified, shall not exceed the following:

<u>Pipe Size</u>	<u>Hanger Spacing</u>
	<u>Metal Pipe</u>
1" or less	5' - 6"
1-1/2 " to 2", incl.	8' - 0"
2-1/2 " to 4", incl.	10' - 0"
6" or over	15' - 0"

- F.      Pipe hanging suspension rods for metal pipes shall be adequate to support applied loads and shall conform to the following minimum sizes:

	<u>Rod Diameter</u>
Up to 2" size pipe	3/8"
2-1/2 " and 3" pipe	1/2"
4" pipe	5/8"
6" pipe	3/4"
8" to 12" pipe	7/8"
14" and up	1"
Trapeze hangers	As required

- G. For uninsulated piping 2 inches and smaller, provide clamps, adjustable nut and steel band.
- H. For insulated piping 2 inches and smaller, provide 12 gage galvanized steel shield over insulation in 180-degree segments, minimum 12 inches long with clevis type pipe attachment.

### **3.1530 Valves**

#### **3.1531 Gate valves**

- A. Valves, 4 inches through 12 inches, shall be the resilient seated type.
- B. Acceptable Manufacturers
  1. ACIPCO American Darling Valves
  2. U.S. Pipe and Foundry Co.
  3. Kennedy Valve, Inc.
  4. M & H Valve (McWane, Inc.)
  5. Mueller Co.
  6. Or approved equivalent
- C. Resilient Seat Gate Valves
  1. All resilient seated gate valves shall conform to American Water Works Association Specification Number C509 for resilient seated gate valves.
  2. Stem Construction: Non-rising stem type. Bronze.
  3. Stem Seals: Valves shall be provided with at least two O-rings located below the integral stem collar. The area between the o-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. One anti-friction washer shall be located below and one anti-friction washer located above the thrust collar which shall provide low operating torques and easier valve operation.
  4. Gate Type: The sealing mechanism shall consist of a cast iron gate with resilient seat. It shall be designed so that the compression seat shall not affect the ability of the valve to seal when unbalanced pressure is applied to either side of gate installed with line flow in either direction. The valve shall be so designed that no metal fasteners or screws other than the stem and stem nut are exposed to water.
  5. Painting: All ferrous surfaces shall be shot blasted to a white metal finish. All interior ferrous surfaces of the valve, including the interior of the gate shall be epoxy coated in accordance with the

AWWA C550 Standard specification. All exterior surfaces of the valve shall be coated with the same epoxy such that all exposed external surfaces, including end connections, bolt holes, body-to-bonnet boltholes, etc. shall be coated. The minimum thickness of the coating shall be 8 mils.

6. Testing: Each valve shall be seat tested and operated tested in full accordance with Section VI of AWWA C509.

D. Installation

1. Install valves and accessories in accordance with manufacturer's written instructions.
  - a. Valves installed in location accessible from floor or ground shall be equipped with handwheels.
  - b. Valves installed in locations higher than 6' - 6" above finished floor or ground shall be equipped with chainwheels and chain.
  - c. When valves are operated through floorstands or benchstands; valves shall be equipped with enclosed operators, extension stems, floorstands (or benchstands), and indicators.

- E. Check and adjust valves and accessories for smooth operation.

**3.1532** Plug Valves

A. Acceptable Manufacturers:

1. DeZURIK Water Controls
2. Clow Valve Co. (McWane, Inc.)
3. Or approved equivalent

B. Cast Iron-body Plug Valves

1. Comply with AWWA C507 and C504 and ASTM A126 Class B Standards.
2. Valves shall be 90° turn, nonlubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the Drawings. Flanged valves shall be faced and drilled to the ANSI 125/150 pound standard. Mechanical joint ends shall be to the AWWA C111. Screwed ends shall be to the NPT applicable ANSI/AWWA Standard.
3. Valve bodies and plug shall be of ASTM A126 Class B cast iron, 30,000 psi tensile strength minimum in compliance with AWWA C504. All exposed nuts, bolts, springs, washers etc., shall be zinc-plated. Resilient plug facings shall be hycar or neoprene. Plug

- shall be one-piece construction and have a cylindrical seating surface eccentrically offset from the center of the plug shaft.
4. Valves shall be furnished with permanently lubricated stainless steel or oil impregnated bronze upper and lower plug stem bushings. These bearings shall comply with AWWA C507 and with AWWA C504 Standards.
  5. Seats in 3 inches and larger valves shall have a raised welded-in overlay of not less than 1/8-inch thickness of 90% pure nickel to positively mate on all surfaces contacting the plug face which comply with AWWA C507 and with AWWA C504.
  6. Valve shaft seals shall be externally adjustable and repackable without removing valve from service and comply with AWWA C507 and with AWWA C504.
  7. Valve pressure ratings shall be as follows and shall be established by hydrostatic tests as specified by ANSI/ASME B16.1. Pressure ratings shall be 175 psi for valves through 12 inches, 150 psi for valves in sizes 14 inches through 36 inches and 125 psi for valves in sizes 42 inches through 54 inches. Valves shall be capable of providing driptight shutoff to the full valve rating with the pressure in either direction.
  8. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc., as indicated on the Drawings. All valves 6 inches and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semisteel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be zinc-plated. Valve packing adjustment shall be accessible without disassembly of the actuator.
  9. Valves and gear actuators for submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel. All gear actuators shall be capable of accepting the input torque requirements as set forth in AWWA C504.

C. Installation

1. Install valves and accessories in accordance with manufacturer's instructions. Valves installed in locations accessible from floor or ground shall be equipped with handwheels; and valves installed in



locations higher than 6'-6" above finished floor or ground shall be equipped with chainwheels and chain. When valves are operated through floorstands or benchstands, valves shall be equipped with enclosed operators, extension stems, floorstands (or benchstands), and indicators.

2. Valves installed underground shall be equipped with grease packed operators having gasketed covers to prevent entrance of moisture into case when subjected to external hydrostatic pressure of 10 psi; and valves shall be operated through an AWWA valve nut mounted on vertical operating shaft extending through top of gear case. Operator extension, valve box, indicator, and cover shall be provided for each valve. Extensions and valve boxes shall be of correct length and height to suit elevation of ground surface. Valves shall open "left".
3. Valves installed under surface of liquids shall be equipped with gasketed operator cases as specified hereinabove and with extension stems, floorstands, and indicators as required.
4. Valves remotely and/or automatically controlled shall be equipped with power positioners as specified or as indicated on the Drawings.

D. Check and adjust valves and accessories for smooth operation.

### 3.1533 Check Valves

A. Acceptable Manufacturers:

1. Check Valves
  - a. APCO Willamette Valve & Primer Corp. - Cushioned Check Valves
  - b. GA Industries, Inc. Golden-Anderson
  - c. Or approved equivalent

B. Check Valves

1. Body: Ductile or Cast Iron.
2. Type: Cushioned gravity swing type, equipped with levers, weights and air cushion chamber adjustable for controlling closure.
3. Seats: Stainless steel ASTM A276.
4. Seat Rings: Buna-N (80 Durometer).
5. Hinge Pins: Stainless Steel, Grade 304, 309, or 316.

C. Install valves and accessories in accordance with manufacturer's written instructions.

D. Check and adjust valves and accessories for smooth operation.

### **3.1534 Flap Valves**

- A. Acceptable Manufacturers
  - 1. M&H Valve & Fittings Co.
  - 2. Mueller Co.
  - 3. Or approved equivalent
- B. Flap valves shall be iron body, bronze mounted flanged, spigot or hub end frame as required.
- C. Install valves and accessories in accordance with manufacturer's written instructions.
- D. Check and adjust valves and accessories for smooth operation.

### **3.1540 Valve Accessories**

- A. Valve Boxes and Vaults
  - 1. Valve Boxes for valves less than three feet deep shall be cast iron, screw type, with extension pieces as required, manufactured by:
    - a. Mueller - Buffalo Type
    - b. M&H Valve & Fittings Co.
    - c. Or approved equivalent
  - 2. Vaults for valves greater than 3 feet deep shall be precast manhole risers as shown in Standard Drawing SD3100 as manufactured by:
    - a. Sherman Concrete Pipe Company
    - b. Or approved equivalent
  - 3. Furnish and install valve boxes or vault for all buried valves, including all by-pass valves.
  - 4. Valve box or manhole covers shall be marked as shown on the Drawings or, if not shown, shall be marked "WATER" or "SEWER".
  - 5. Valve boxes shall be installed plumb, centered over operating nut, and securely positioned while backfill is placed and tamped in such a manner that plumb and concentric position shall be maintained.
- B. Extension Stems
  - 1. Stems shall be furnished by valve manufacturer.
  - 2. All valve stems shall be pin connected in lieu of set-screw connected.
  - 3. Extension stems shall be provided for all valves in buried locations and in other locations where shown.

4. Extension stems shall be fabricated from stainless steel shafting not smaller in diameter than the stem of the valve and pin connected to valve stem.
5. Extension stems shall extend to within 6 inches of the ground surface.
6. Each extension stem shall be provided with spacers to center the stem in the valve box or hangers to mount to the vault wall and shall be equipped with standard AWWA wrench nut as described in AWWA C500.
7. Provide one (1) "T" handle wrench approximately 4 feet long, to fit stem wrench nut.

C. Air Release Valves

1. Combination Air/Vacuum Release Valves (automatic type) for sewage as manufactured by:
  - a. APCO Willamette Valve & Primer Corp.
  - b. GA Industries, Inc.
  - c. Or approved equivalent
2. Combination Air/Vacuum Release Valves (automatic type) for sewage shall be:
  - a. Body: Cast iron long body
  - b. Float: Stainless steel
  - c. Air Flow Control: Fixed orifice
  - d. Working Pressure: 175-psi minimum
  - e. Size: As shown on the plans or applicable to service
  - f. Operation: Allow air to leave when pipe is filling or under pressure and to enter to release vacuum when pipe is draining.

D. Quick Connection Pipe Couplings

1. Jefferson County Standard for emergency pumping connections
2. American Packing and Gasket Co.
3. Or approved equivalent

E. Install all equipment in accordance with manufacturer's written instructions.

F. Check and adjust for smooth operation.

### **3.1550 Pressure Gauges**

#### **3.1551 Acceptable Manufacturers of Pressure Gauges:**

- A. Ashcroft, Inc.
- B. Ametek U.S. Gauge
- C. Or approved equivalent

#### **3.1552 General on Pressure Gauges**

- A. Pressure gauges shall be liquid filled direct reading, male bottom connections, graduated in both feet and pounds per square inch and shall have a 4½-inch dial face diameter.
- B. A gate valve, pulsation damper and wye strainer shall be installed between the gauges and the point of connection.
- C. Gauges for non-potable water shall be diaphragm-type to prevent contact of the pipe contents with the gauge mechanism.

#### **3.1553 Install gauges and accessories in accordance with manufacturer's written instructions.**

### **3.1600 Electrical**

#### **3.1610 Electrical General Provisions**

##### **3.1611 Description**

- A. The work under this section includes, but is not limited to the following:
  - 1. Electrical Materials and Methods
  - 2. Packaged Engine Generator
  - 3. Grounding
- B. General Requirements:
  - 1. The Electrical service shall be 3 Phase, 480/277 Volt Special permission must be granted for 208 Volts, 3 Phase or for 240 Volts, 3 Phase. A single-phase service shall not be acceptable.
  - 2. Carefully examine general conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully

- acquainted with their effect on electrical work.
3. Do all work in compliance with applicable codes, laws, and ordinances, the National Electrical Code, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, and certificates of inspections and approvals.
  4. Class I, Division I and Division II hazardous areas shall be as defined in NFPA, Factory Mutual and Local Requirements.
- C. Clearance with Utilities
1. It shall be the responsibility of the Owner/Developer to confirm with the utility companies involved that the locations, voltage, phase, and metering are in accordance with their regulations and requirements. The Owner/Developer shall request and receive approval from the County if the utility company requirements are at variance with these Drawings and Specifications.
  2. The Owner/Developer shall be responsible to get in writing the available fault current from the utility company. All electrical components must be capable of withstanding the published fault levels.
- D. Installation of Equipment - General
1. Care shall be exercised in exact routing and location of equipment at all times so as not to obstruct access to equipment or personnel walkways, or expose the equipment to potential mechanical damage.
  2. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and re-painted.
- E. Each panel shall have each circuit identified. Panels without nameplates shall have typewritten directories. Each individual mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by 1/2 inch stencil lettering or by approved metal nameplate.

**3.1612** Submittals

- A. Submit shop drawings as specified.
- B. Shop drawing submitted shall include, but not be limited to: Physical and schematic drawings of control panels, motor control, and other panels.

**3.1613** Operation and Maintenance (O&M) Manuals and Data

- A. Submit to the County for review three (3) copies of the Electrical System Operation and Maintenance (O&M) Manuals and Data.

**3.1620 Electrical Testing**

**3.1621** Description

- A. The intent of the inspection, testing, and check-out work specified herein, or required, is to insure that all electrical workmanship and equipment is installed and performs in accordance with the specifications, drawings, manufacturer's instructions, and all applicable codes and requirements.

**3.1622** Quality Assurance

- A. All testing and checkout work shall be performed with qualified personnel skilled in the particular tests being conducted.
- B. All test data shall be recorded on standard forms. Each form (and sheet) shall be dated and signed by the Contractor or his representative and the person who performed the tests. List equipment by Manufacturer and Model Number used in test.

**3.1623** Tests

- A. Check and record voltage phase to phase and phase to ground at the main service entrance, on the load side and at each switchboard and panelboard.
- B. Test insulation of following circuits:
  - 1. Feeders
  - 2. Branch Circuits
  - 3. Motors

Test shall be with 1000 Volt DC insulation tester. Record circuit name and test result.
- C. Test new main ground, and grounds for isolated ground panels, record results.
  - 1. Test main ground disconnected from main service.
  - 2. Test main ground connected to main service.
  - 3. All grounds must be 25 OHMS and below.

### **3.1630 Electrical Materials and Methods**

#### **3.1631 Metal Raceways**

##### Materials

- A. Conduit-type: All conduit shall be Rigid Galvanized Steel or Intermediate Metal Conduits (IMC), unless otherwise noted (See Section 3.1632, "Non-Metallic Raceways".)
- B. Water Tight Flex and Connectors shall be "Sealtite," UL approved, grounding type.
- C. Bushings: All rigid bushings 1 " and larger shall be insulating type. All other bushings shall be insulated metallic type.

##### Installation

- A. Conduit (Rigid or I.M.C.)
  - 1. Provide flexible conduit connections with watertight fittings to all motors and/or any equipment, which has moving or vibrating parts. Sealtite flexible conduit, code approved for grounding, shall be used in all cases. (Sizes above 1-1/4" inch must have separate green ground wire).
  - 2. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
  - 3. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings.
  - 4. Apply two coats of asphaltum paint to all underground metallic conduit. Carefully repaint and retouch any breaks and allow to dry before covering with earth.
  - 5. Exposed threads on all conduits used on exterior shall be painted with zinc primer.
  - 6. All conduit connections to sheet metal cabinets or enclosures exterior and/or subject to the elements shall terminate by use of raintight hubs.

#### **3.1632 Non-Metallic Raceways**

##### Materials

- A. Schedule 40 PVC conduit shall be UL Listed for use with 90 degree rated

conductors. Conduit shall conform to NEMA Standards and applicable sections of NEC.

#### Installation

- A. All elbows, bends, etc. shall be either factory bends or made with an approved heat bender.
- B. PVC conduit shall be used in concrete-encased exterior duct runs or as otherwise indicated on the Drawings. Convert to rigid steel prior to exiting slab. No PVC conduit shall be exposed.
- C. Install ground wire sized per NEC in all PVC conduits.

### 3.1633 Conductors and Cables

#### Materials

- A. 600 Volts and Below
  1. General: Conductors shall be copper, have current-carrying capacities according to the NEC, 600 volt insulation, #12 minimum except for controls. Conductors shall be copper.
  2. #12 thru #10, General use: Conductors shall be solid with nylon jacket PVC insulation type THHN-THWN. Must meet UL standard VW-1 Flame Test.
  3. Feeders and General Use: Conductors #8 and larger, and any size to motors, shall be stranded with cross-linked polyethylene insulation type RHW 167°F (75° C), RHW-2 194°F (90° C) or XHHW.
- B. Control wire shall be #14, 19 strand, with 0.015 inch polyvinyl chloride insulation, 0.004 inch nylon jacket, type THHN-THWN insulated building wire, rated 194°F (90° C), full color range.
- C. Instrumentation wiring shall be multi-conductor shielded #16 minimum.

#### Connections

- A. Connections on copper wire larger than #12 shall be made with approved solderless connectors and covered with electrical tape so that insulation is equal to conductor insulation.
- B. #12 and smaller copper connections shall be made with wire joints,



complete with insulating caps, to be installed with proper tool or approved equal.

#### Installation of Conductors

- A. No splices shall be pulled into conduit.
- B. Both conductors and conduits shall be continuous from outlet to outlet.

#### Conductor Designation and Color Coding

- A. Non-ferrous identifying tags or pressure sensitive labels shall be securely fastened to all cables, feeders, and power circuits, in vaults, pull boxes, manholes, switchboards, panels, starters, terminations of cables, etc. Tags or labels shall be stamped or printed to correspond with markings on drawings so that feeder or cable number and phase can be readily identified.
- B. A color coding system as listed below shall be followed throughout the network of branch circuits. Owner/Developer shall verify scheme with local authority.

<b>Phase</b>	<b>1 Phase, 3 Wire 120/208V Color</b>	<b>3 Phase, 4 Wire 277/480V Color</b>
A	Black	Yellow
B	Red	Orange
C	---	Brown
Neutral	White	White
Ground	Green	Green

- C. Control Conductors shall be color coded by use of colored "tracers". No control circuit shall contain two identical conductors.

### **3.1634** Outlet Boxes and Junction Boxes

#### Materials

- A. Outlet and Junction Boxes (thru 4-11/16")
  - 1. Sheet Metal shall be standard type with knockouts, made of hot dipped galvanized steel.
  - 2. Cast: Shall be type FS, JB, GS, or SEH as required for application.
  - 3. Non-ferrous identifying tags or pressure sensitive labels shall be securely applied to all junction boxes.

#### Installation

- A. Outlet Boxes and Junction Boxes
  - 1. All boxes shall be securely anchored.
  - 2. All boxes shall be sealed during Construction.
  - 3. Recessed boxes for wiring devices, surface fixtures, or connections shall be set so that edge of cover comes flush with finished surface.
  - 4. No more knockouts shall be opened in any sheet metal box than are actually used.
  - 5. Any unused opening in cast boxes shall be plugged.
  - 6. Cast boxes shall be used on all exposed work, on exterior or any work exposed to moisture, fumes or gases.

### **3.1635** Wiring Devices

- A. Wall switches shall be specification grade, 15 Amp 120 VAC minimum.
- B. Convenience receptacles shall be specification grade, 20 Amp 125 VAC minimum.

### **3.1636** Motors

- A. Motors shall be rated 480 Volts, 3 Phase, 60 Hertz. See Sections:
  - 3.1120.08 - Drive Unit for Self-priming Pumps
  - 3.1130.04 - Submersible Centrifugal Pumps and Motors
  - 3.1130.05 - Submersible Chopper Pumps and Motors
  - 3.1110.08 – Pumps and Motors (Package Stations)
- B. Acceptable Manufacturers
  - 1. Rockwell Automation/Reliance Electric
  - 2. U.S. Electrical Motors

3. General Electric Co.
4. Or approved equivalent

### **3.1637 Safety Switches and Fuses**

#### **A. Safety Switches**

1. Safety switches shall be quick-make, quick-break, NEMA heavy-duty type HD, fused or non-fused. Switch blades shall be fully visible in the "off" position.
2. Switches shall have provisions for Class R, rejection type fuses.
3. Switches shall be NEMA 12 enclosure indoor and, NEMA 3R outdoors.
4. Safety switches shall be installed as shown on the Drawings and in accordance with NEC.
5. Adequate support shall be provided for mounting safety switches.

#### **B. Fuses (600V)**

1. Fuses for all branch switches shall be Dual Element, Class "R".
2. Fuses shall be sized as required by manufacturer.
3. Provide not less than one spare set of fuses for each size used.

### **3.1640 Standby Engine-Generator Package**

#### **3.1641 Engine-Generator**

##### **A. Description of Work**

1. This section outlines the quality, type and installation of the Standby Power Generator.
2. The standby engine-generator set shall be furnished and installed as a complete system of the latest type and design. The engine generator set shall be completely built, factory tested and shipped as units by a manufacturer regularly engaged in the production of such equipment for the past five (5) years. Dealer assembled and/or tested units shall not be considered as equal.
3. Furnish and install the complete engine generator set including a reinforced concrete isolated mounting pad, fuel system, cooling system, exhaust silencer, piping, duct work, excavation and accessories to complete the installation for operation as required and specified herein. Field-test the entire installation after completion.

##### **B. The following information shall be furnished for County approval on each installation.**

1. Evidence of the selling agency's experience and maintenance capabilities.
  2. Make and model of engine proposed.
  3. Brake horsepower curve of engine.
  4. Generator manufacturer, model, and rating.
  5. Type of excitation and voltage regulation.
  6. Weight and basic dimensions of the engine generator set.
- C. The following companies manufacture acceptable Standby Power Generators that may be selected for design conditions. This list is not exclusive, but other companies must comply with the specification and be approved by the County.
1. Caterpillar, Inc. (Power Generation)
  2. Cummins, Inc. (Onan)
  3. Kohler Co. (Power Systems)
  4. Or approved equivalent
- D. The Contractor shall also include as a portion of the submittal the following job drawings.
1. Location of the engine generator set, accessories, and pertinent conditions. Plan shall be 3/8" scale minimum.
  2. Fuel system diagram approved by an authorized representative of the engine manufacturer.
  3. Schematic wiring diagram for automatic start/stop control and for alarm annunciation, including remote annunciators.

**3.1641.1 Engine-Generator Rating**

- A. The rating of the package-engine-generator set shall be based on operation of the set when equipped with all necessary operating accessories such as radiator, fan, air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pump, jacket water heater, generator and exciter regulator.
- B. The above rating shall be for operation at 1000 feet above sea level and at ambient maximum 125°F (51.7°C) and minimum temperature 0°F (-17.7°C).
- C. The engine generator set shall be rated to operate all pumps and equipment at the sewage lift station simultaneously and continuously. The fuel capacity, if other than natural gas, shall be sufficient for 3 days (72 hours) operation.

### **3.1641.2 Engine**

- A. Where natural gas service is available, the engine and fuel system for standby power shall be natural gas. Propane gas or Diesel fuel systems may be considered on a case-by-case basis. Engine and generator operating speed shall be a maximum of 1800 RPM.

### **3.1641.3 Starting System**

- A. Starting System: The engine shall be equipped with a 12 volt DC electric starting system of capacity recommended by the manufacturer. Batteries shall be lead-acid (nickel cadmium) having a minimum capacity of cranking the engine for at least 45 seconds at firing speed in the ambient conditions specified under section 3.1641.1, "ENGINE-GENERATOR RATING", paragraph "B", and to start the engine a minimum of four times without recharging. Batteries to be mounted in marine type enclosure within the generator enclosure.
- B. A current limiting battery charger shall be furnished to automatically recharge batteries. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, DC, ammeter, and fused AC input. Amperage output shall be no less than 5 amperes. Connect charger cables to batteries, NOT starters. The battery charger shall have a high-low rate capable of fully charging the starting battery during running conditions. Charger shall be capable of fully recharging the batteries in 24 hours or less. Battery charger to be located in automatic transfer switch enclosure.
- C. Provide 120 Volt thermostatically controlled battery heater. Battery heater shall automatically shut off when the battery temperature attains 85° F (29.4°C).
- D. Jacket Water Heater Starting Aid: An engine mounted thermostatically controlled immersion type engine coolant heater shall be provided to ensure a minimum coolant temperature 100°F (37.8°C) in a minimum ambient of 32°F (0°C) The heater shall be suitable for operation at 120/240 volts single phase. Provide manual cut off valves, mounted to engine block for heater isolation. The jacket water heater shall be automatically deactivated while the engine is running.

### **3.1641.4 Engine-Generator Control Panel**

- A. The engine-generator control panel shall be mounted in a engine mounted

enclosure and prewired to terminal strips. The control panel shall function to start and stop the engine automatically or manually, to provide visual indication and automatic shutdown of the engine as required for safety control, and to provide all other functions as required for engine generator control for the specific engine furnished.

- B. Safety Control: Audible and visual pre-alarm warning annunciation and dry contacts for future SCADA connections shall be provided to indicate the following conditions:
  - 1. Engine temperature above the manufacturer's recommended safe range.
  - 2. Lubrication oil pressure is below the manufacturer's recommended safe range.
  - 3. Low coolant.
  - 4. Future SCADA remote monitoring of engine running status.

#### **3.1641.5 Generator Main Breaker**

- A. A generator main molded case circuit breaker shall be furnished and sized as required. Main breaker shall be mounted in enclosure on generator.

#### **3.1641.6 Generator**

- A. The AC generator shall be a revolving field type with voltage ratings the same as the station main service. The generator shall conform to NEMA and IEEE Standards.
- B. Voltage regulation shall be within plus or minus 2% of rated voltage from no load to rated load. The steady state voltage stability shall remain within a 0.5% band of rated voltage.
- C. For any addition of load up to and including 90% of rated load, the voltage dip shall not exceed 20% of rated voltage. The voltage shall recover to and remain within the steady band in not more than 1.5 seconds.
- D. The frequency regulation from no load to rated load shall be in accordance with that defined by the engine governor performance. For any addition of load up to 90% of rated load, the frequency shall recover to the steady state frequency band within 5 seconds.

#### **3.1641.7 Engine-Generator Housing**

- A. When required because of exterior installation the engine-generator set shall be furnished complete with weatherproof housing. Side, front and

rear panels shall be removable for access. All louvers used shall be designed to prevent the entry of water into the housing while the engine is idle or while running. The housing shall be all aluminum, tamperproof and painted the color selected. Units to be complete with maintenance light fixture and switch.

- B. Sound attenuation housings shall be furnished.

### **3.1641.8 Engine-Generator Mounting**

- A. The set shall be mounted on a welded base, which shall provide suitable for mounting on any level surface. Generator shall be mounted using recommended compression spring vibration isolators.

### **3.1642 Automatic Transfer Switch**

- A. An automatic transfer switch, which causes the engine to be started upon normal power failure, shall be included. When the electric set reaches rated voltage and speed, the switch shall transfer the load to the generator. Upon restoration of normal power, the switch shall transfer load back to normal supply. The transfer switch shall control the automatic start-stop system.
- B. The Automatic Transfer Switch shall be rated as shown on plans with solid neutral, 600 volts. Accessories to be included are a time delay starter, (3 seconds) to ignore momentary outages; adjustable time delay on retransfer to normal, (2 minutes to 25 minutes); 5 minute cool down timer; test switch to simulate an outage and load the generator; pilot contact to close and initiate starting controls on engine; 2 sets of auxiliary contacts for remote alarms: 1 NO (during transfer) and 1 NC (before transfer); exerciser to automatically start and run the generator loaded once per week.

### **3.1643 Remote Shutdown**

- A. A remote engine shutdown switch shall be included. For exterior installations the emergency shutdown switch shall be located a minimum of 15'- 0" away and in line of sight of generator housing. For interior installations the emergency shutdown switch shall be located inside door next to light switch.

### **3.1644 Installation of Equipment**

- A. All equipment shall be properly supported and additional support provided

where necessary.

- B. Installation shall be according to the manufacturer's written recommendations and shall be done in a neat workmanlike manner. The generator set shall be installed under the supervision of a factory-trained service representative.

### **3.1645 Wiring**

- A. All wiring shall conform to manufacturer's wiring diagrams and shall be installed in a neat manner and in accordance with all other sections of the specification. Wiring shall be stranded and terminated in ring terminals.

### **3.1646 Mounting Foundation**

- A. A suitable isolated concrete mounting foundation shall be provided for mounting the generator set. Mass of concrete shall be equal to or greater than the mass of the engine generator set. Concrete equipment pad shall extend 4' on all sides of generator enclosure.

### **3.1647 Tests at Site**

- A. The performance of the generator set shall be tested after it is installed to verify full power rating, voltage and frequency regulation. A copy of the performance log shall be made and supplied to the Design Engineer.

## **3.1650 Grounding**

- A. General Requirements
  - 1. All equipment, building steel, and main service must be effectively and permanently grounded as required by the National Electrical Code (NEC) and of capacity sufficient to insure continued effectiveness of the ground connections for fault current. Ground conductors must be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.
- B. Conductors
  - 1. Grounding conductors shall be bare, softdrawn, stranded or, single conductor copper wire.
  - 2. Insulated grounding conductors shall be green in color and shall have 600 volts insulation.
  - 3. Motors having power supplied by individual conductor wire in conduit shall be grounded with a green insulated ground wire sized



per NEC.

- C. Grounding electrodes shall be copper-clad steel rods 3/4-inch in diameter and minimum ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.
- D. Connections
  - 1. All underground connections shall be crucible weld process unless otherwise noted on applicable Drawings. Connections to equipment shall be by bolted compression type lugs (except for motors).
  - 2. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.
  - 3. Ground connections to conduit must be made with approved ground clamps.
- E. Main Service Ground
  - 1. Main service ground shall be connected to driven ground rods.
  - 2. Ground rods shall be imbedded below permanent moisture level. Ground rods shall be spaced a minimum of 6 feet apart and connected in parallel until resistance to ground does not exceed 5 ohms.

### **3.1660 Panelboard - Power (PP-MP)**

- A. Scope
  - 1. This section outlines the quality, type and installation of Power Panelboards.
  - 2. Power panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
  - 3. Panelboards shall be factory assembled.
  - 4. Panelboards shall contain circuit breakers.
- B. Panelboard Bus Assembly
  - 1. Panelboard bus structure and main lugs shall have current rating. Such rating shall be established by heat rise test with maximum hot spot temperature on any connector or bus bar not to exceed 149°F (65°C) rise above ambient, at full rated load. Bus shall be tin plated aluminum or silver plated copper. All neutral bus shall be full size.

2. Ground bus shall be 25% size.
- C. Panelboard Equipment Short Circuit Rating: Each panelboard, as a complete unit, shall have a short circuit current rating (full, not integrated or series) equal to or greater than the rating established by the Electric Utility Company. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- D. Installation
1. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.
  2. Conductor color-coding shall be carefully followed in the connection of all wiring.
  3. Panelboard directories shall be typewritten and shall be field verified by the Contractor to ensure accuracy. Directories shall include adequate descriptions to allow accurate identification of the load and location served.

### **3.1670 Lighting Materials and Methods**

#### **3.1671 Fixtures**

- A. Lighting fixtures shall be suitable for the service and location installed.
- B. Fluorescent Fixtures shall have a low temperature Ballast.

#### **3.1672 Ballasts**

- A. Fluorescent Ballasts:
1. Shall be approved by ETL and have UL and CBM labels.
  2. Shall be equipped with Class "P" protection against overheating.
  3. Shall all be high power factor (including twin-tube and retrofit twin tube compact fluorescent).
  4. Shall have noise level rating in accordance with IES recommendations.
  5. Energy efficient ballasts shall be CBM rated full light output, for use with single or double lamps as required.
  6. Electronic Ballast shall be of the Integrated Circuit (IC) type for T5 Twin Tube or T8 lamps specified. Instant start shall not be acceptable.

- B. High Intensity Discharge (HID) Ballast:
  - 1. Shall have UL label.
  - 2. Shall be core and coil construction with minimum power factor of 90%.
  - 3. All ballast on interior units shall be epoxy encapsulated, for sound rating.
  - 4. All high-pressure sodium ballast shall be magnetic - regulator type.

**3.1673** Fuses

- A. Each ballast, fluorescent and/or HID shall be fused; one (1) fuse required per phase to each Ballast.
- B. Provide Type GMF/HLR fuse of proper size and rating for each individual fluorescent ballast.
- C. Provide Type HEB/KTK fuse of proper size and rating for each individual HID ballast except pole mounted fixtures without Lowering Devices.
- D. For pole mounted fixtures ballast fuses shall not be in fixture but shall be mounted near ground level, one for each phase wire to each ballast, complete with proper sized Type KTK fuse.
- E. For fixtures mounted on hollow steel or aluminum poles, fuses to be located inside pole hand holes. For fixtures mounted on towers or wood poles, fuses to be mounted in NEMA 4 box located near base. All fuses in hand hole or NEMA 4 box shall have sufficient slack in conductors to extend outside for servicing.

**3.1674** Lamps

- A. All fixtures shall be equipped with lamps. Lamps shall be installed new, immediately prior to final inspection, and shall not be used for construction purposes.

**3.1680** Surge Suppression

- A. Provide surge/transit protection devices in accordance with Section 3.1320.
- B. Quality Assurance
  - 1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of

such devices for electrical and electronics systems equipment. The said firm shall offer a five (5) year warranty.

2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative.

### **3.1690 Variable Frequency Drive Control Systems for Sewage Pumping Stations**

#### **3.1690.01 General**

- A. The County requires that 480V, 3 phase, 60 Hz power service be provided to pumping stations. Single phase service for pump motors and controls shall not be allowed, unless approved by the County after a case by case evaluation of the proposed pump station. If single phase service is allowed, a Low Voltage Variable Frequency Drive (VFD) system with inverter duty motors shall be provided.
- B. If single phase service is allowed, and a VFD system is provided, it shall be completely compatible for use with the particular proposed sewage pumping station, either the Flooded Suction (See Section 3.1110), Self-Priming (See Section 3.1120) or Submersible (See Section 3.1130) type pumping station. The manufacturer shall have proven experience in the manufacture of VFD systems for use in similar applications for the specified voltage and power ratings.
- C. On a case by case basis, independent of the power service being supplied, the County may require VFD systems for the Factory-Built Flooded Suction Sewage Pumping Stations.

#### **3.1690.02 Products**

##### **A. Description**

The VFD system supplier shall furnish all materials, equipment and start-up services required to place into operation an integrated low voltage variable frequency drive system. All material and labor necessary to interconnect any VFD system elements, even if shipped separately, shall be included.

##### **B. Components**

At a minimum, the following components shall be integrated into the VDF system:

1. VFD Operator Interface
2. VFD Controllers, including an integral line reactor or integral isolation transformer, input rectifier (PWM converter), DC Link, and output rectifier (PWM Inverter)
3. VFD Inverter Duty Motors
4. Input and Output Filters, if Applicable

C. Submittals

Submit product data for Variable Frequency Drive (VFD). Include manufacturer's publications and data sheets, shop drawings, dimensions, ratings, listings, elementary power, and control wiring diagrams and data on all features and components.

**3.1690.03** Variable Frequency Drive System Controls

A. General

The control system shall consist of adjustable frequency drives and associated components necessary to automatically operate pump motors to control the level in the wet well. Each VFD controller shall be dedicated to a separate inverter duty motor.

B. Speed Control Automation

The VFD shall be designed to accept a signal from a Transducer, Air Bubbler, or Float level control system in an automatic speed control mode or a programmable preset speed when the manual mode is selected. The selected speed signal shall control the motor speed between the adjustable minimum and maximum speed settings. The total speed signal shall follow a linear time ramp which is adjustable from 4 to 20 seconds to provide acceleration and deceleration control.

A circuit breaker shall be provided to disconnect the VFD from all power, and the VFD shall be segregated within the enclosure to eliminate the danger of power-off servicing while the remainder of the control system is in operation. The VFD shall be capable of operating the motor continuously at 100% rated speed.

The variable speed power unit shall be a completely solid-state power conversion device. The unit shall be capable of transforming either 120V single phase, or 208V and 240V 3 phase input power service into a variable voltage, adjustable frequency, 3 phase output of suitable capacity and wave-form to control the speed of the inverter duty AC motor.

Control shall be throughout a step-less speed range, under variable torque load on a continuous basis.

**3.1690.04** Quality Assurance

A. Manufacturing Qualifications

VFD suppliers shall be firms regularly engaged in the manufacture of VFD systems which have been in satisfactory wastewater service for not less than 5 years, and familiar with standard practices of installation, operation and safety for VFD systems.

B. Industry Standards

The VFD system shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electric Code.

C. Support

VFD supplier shall provide the services of a factory-trained representative to check installation and to start-up each VFD system. Factory representative shall have complete knowledge of proper installation, operation and maintenance of the equipment components supplied. The manufacturer's support representative shall inspect the final installation and supervise a start-up test of the VFD system equipment.

**3.1690.05** Manufacturer's Responsibilities

A. Factory Test

Each VFD system or component shall be factory tested to ensure satisfactory operation. All instruments, meters, protective devices, and associated controls shall be functionally tested by applying the specified control signals, current and/or voltages. A copy of all test reports shall be provided to the County.

B. Installation

VFD systems shall be installed in accordance with the supplier's written installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations. The electrical Contractor shall verify all field measurements prior to the fabrication of the variable frequency drives.

C. Operation and Maintenance (O&M) Manuals

Supplier shall provide three (3) Operation and Maintenance (O&M) Manuals to the County. The manuals shall include equipment and component descriptions, operating instructions, drawings and diagrams, troubleshooting techniques, and a recommended maintenance schedule.

**3.1690.06** Spare Parts

At a minimum, the following spare parts shall be furnished by the manufacturer for each VFD system:

- a. Three of each type power and control fuse
- b. Two power modules, for system provided
- c. Two LED's of each type used
- d. Two control relays of each typed used
- e. Two sets of all replacement air filters
- f. One hoisting mechanism for removal and replacement of power cells, if required
- g. One set of all control printed circuit boards

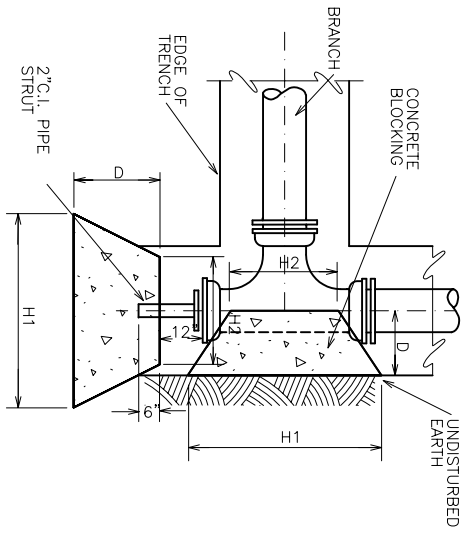
**3.1690.07** Manufacturer's Warranty

The manufacturer of the VFD system equipment shall guarantee for a period of one year from the date the VFD system is placed into operation and accepted by the County that the VFD system and all associated components shall be free from defects in design, materials and workmanship. In the event that the VFD system or any associated components fail, or are proven defective during the guarantee period, the manufacturer shall provide a replacement part without cost to the County. The warranty shall include labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service during the warranty period.

# **APPENDIX**

## **Standard Drawings**

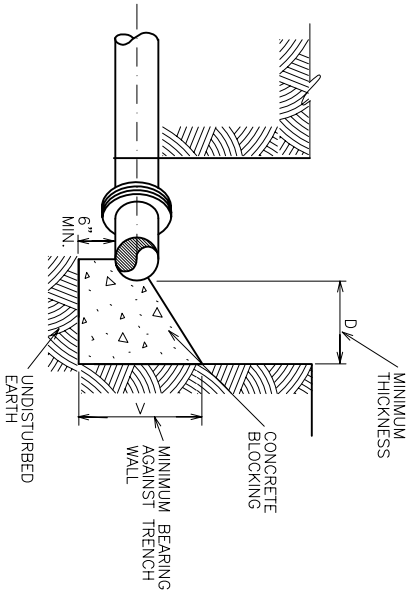




**TEES, CROSSES AND PLUGS**

NOTE: DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.

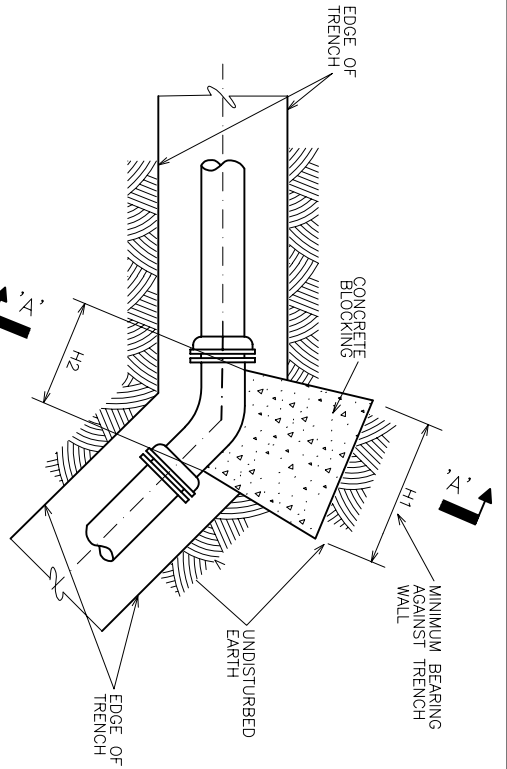
N.T.S.



**SECTION 'A-A'**

N.T.S.

- NOTES:**
1. THRUST BLOCK DIMENSIONS ARE BASED ON 100 P.S.I. MAX. PIPE PRESSURE.
  2. 3000 P.S.I. CONCRETE SHALL BE USED IN THE CONSTRUCTION OF THRUST BLOCKS.
  3. THRUST BLOCKS SHALL BE POURED AGAINST A MIN. AREA OF UNDISTURBED SOIL. MIN. SOIL BEARING PRESSURE - 2,000 P.S.F.

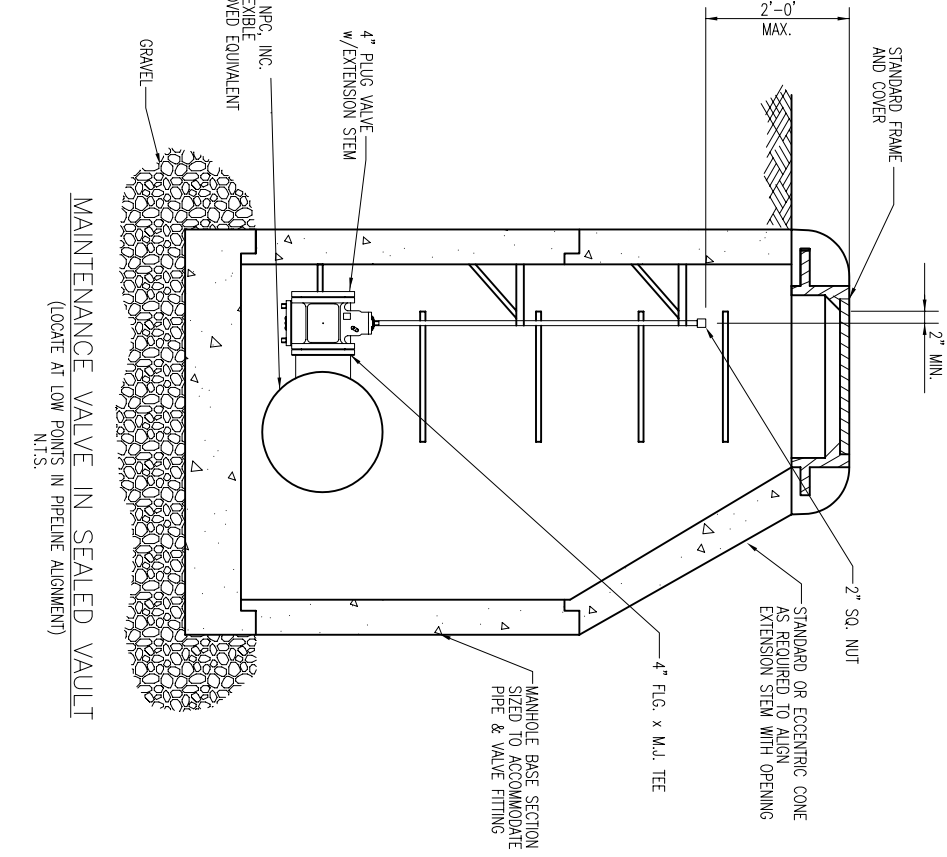
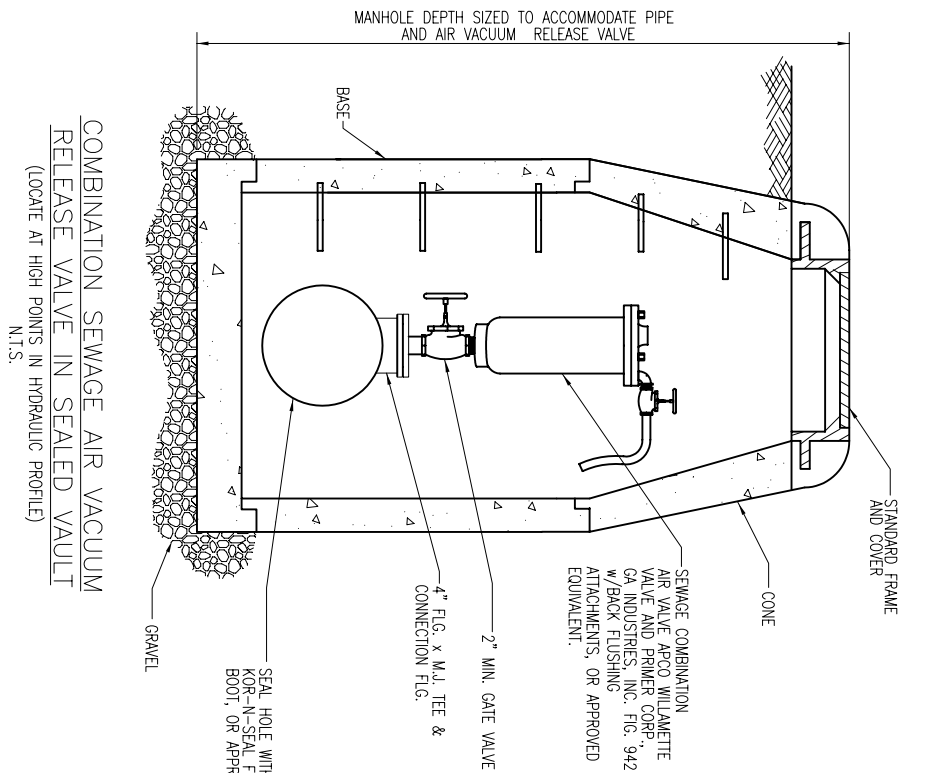


**HORIZONTAL BENDS**

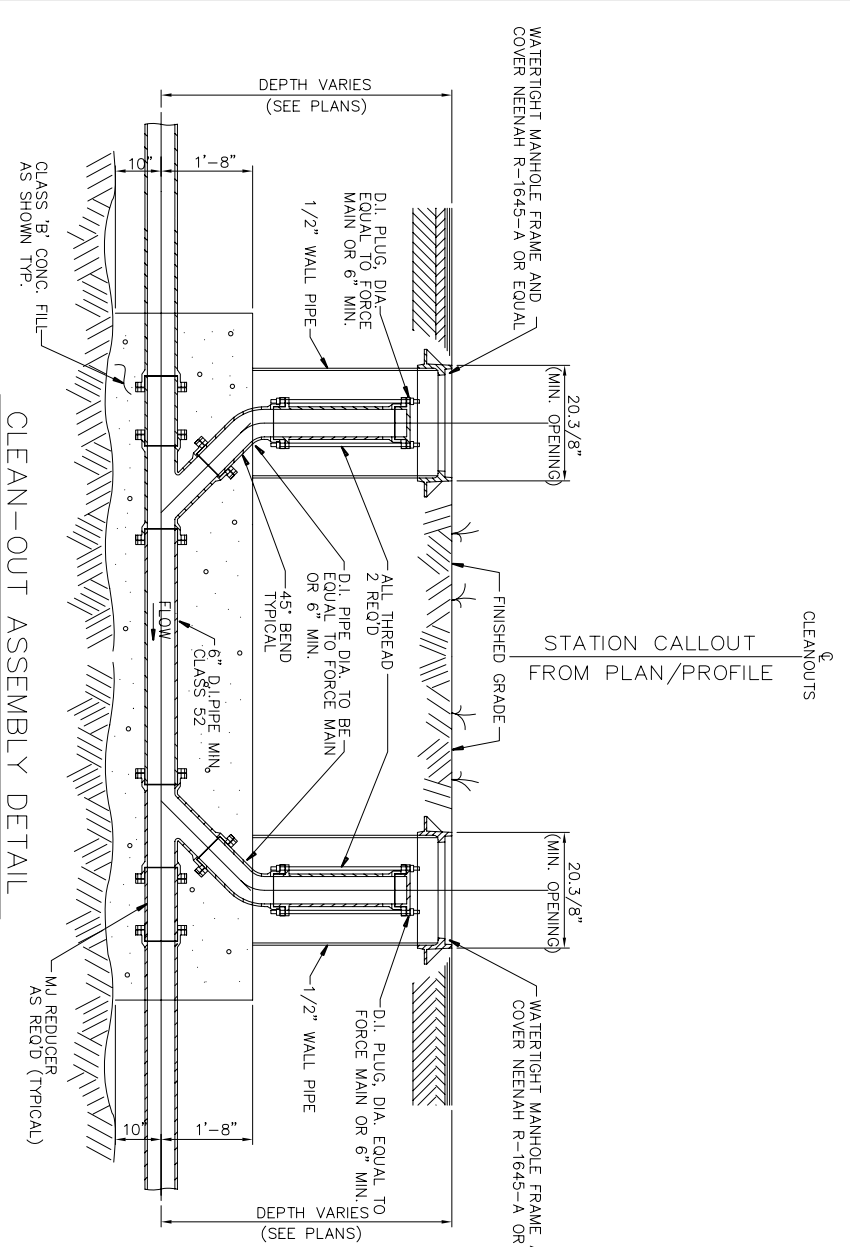
N.T.S.

PIPE SIZE DIA.	TEES, CROSSES & PLUGS			45° BENDS			22-1/2° BENDS			11-1/4° BENDS			
	H1	H2	V	D	H1	H2	V	D	H1	H2	V	D	
3" & 4"	24"	12"	12"	18"	18"	8"	12"	18"	18"	8"	12"	18"	18"
6"	24"	16"	18"	18"	24"	10"	16"	18"	24"	10"	16"	18"	18"
8"	36"	18"	18"	18"	30"	11"	18"	18"	24"	18"	18"	24"	16"
10"	48"	24"	18"	24"	30"	18"	21"	18"	24"	18"	21"	18"	21"
12"	54"	30"	24"	24"	42"	18"	24"	24"	24"	18"	24"	24"	21"
14"	60"	32"	30"	24"	44"	24"	30"	24"	30"	24"	24"	27"	24"
16"	66"	34"	36"	24"	48"	30"	36"	24"	36"	30"	27"	24"	24"
18"	66"	36"	40"	24"	48"	30"	36"	24"	36"	30"	24"	27"	30"
20"	66"	38"	48"	30"	60"	40"	42"	30"	39"	36"	33"	24"	30"
24"	72"	42"	60"	36"	66"	48"	48"	36"	45"	42"	36"	24"	36"
36"	102"	58"	84"	48"	90"	72"	78"	48"	75"	72"	48"	24"	40"

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD2070

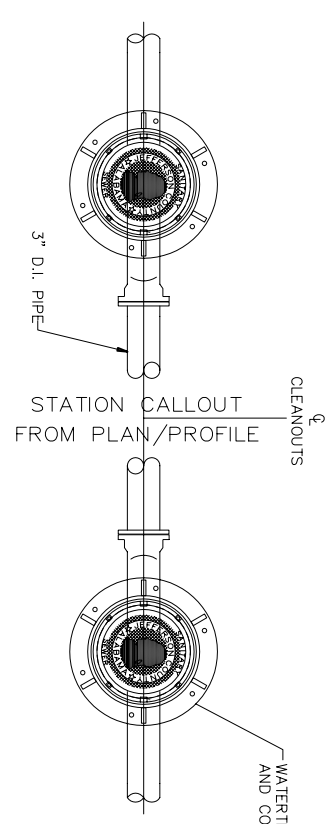


DATE	REVISIONS	
MAY 2006		JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
		FORCE MAIN COMBINATION SEWAGE AIR VACUUM RELEASE VALVE AND MAINTENANCE VALVE ASSEMBLY
APPROVED: _____		STANDARD DRAWING NO. SD2071



N.T.S.

CLEAN-OUT ASSEMBLY DETAIL



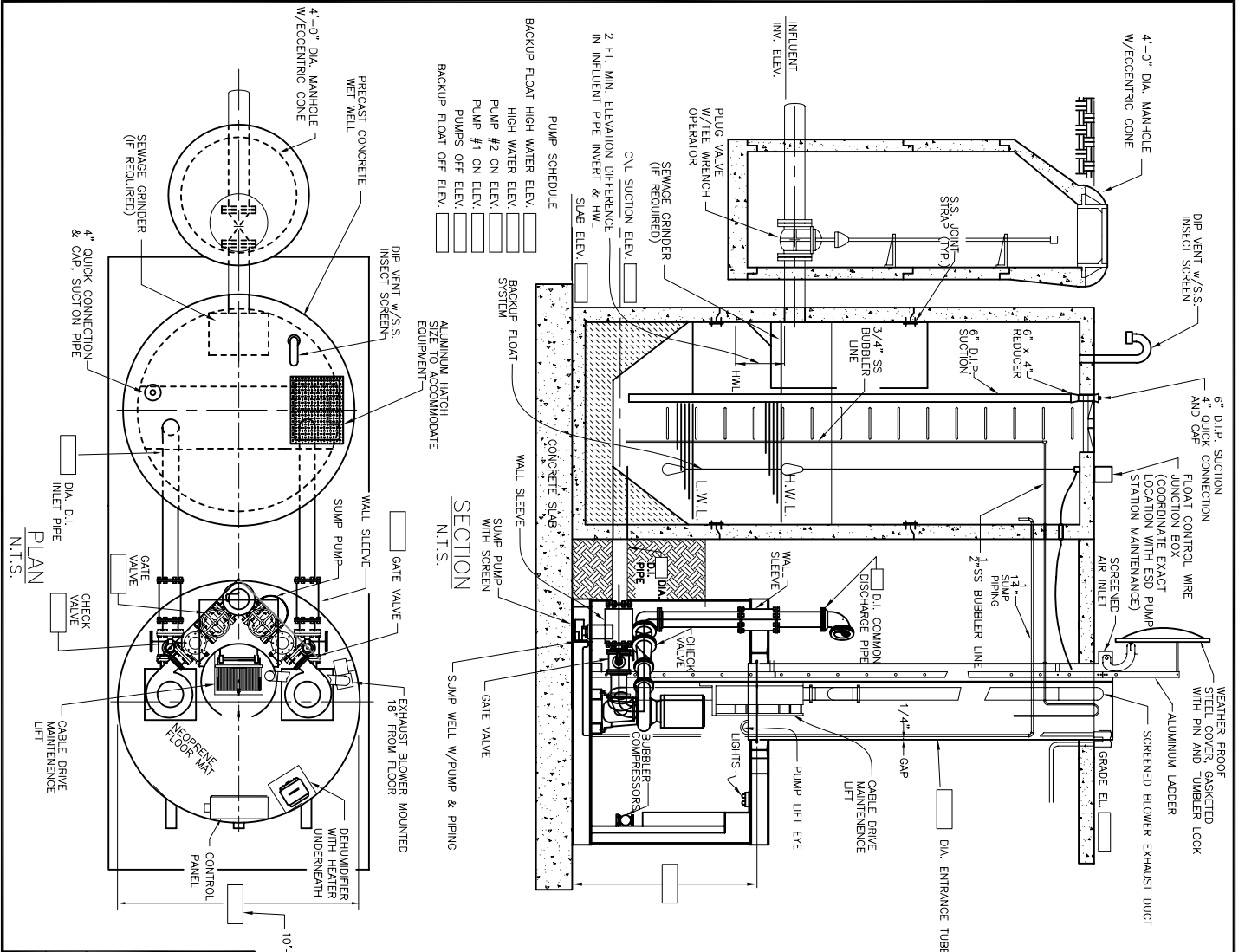
N.T.S.

CLEAN-OUT ASSEMBLY DETAIL - PLAN VIEW

- NOTES:
1. 400' MAXIMUM SPACING BETWEEN CLEANOUTS.
  2. ALL PIPE SHALL BE CLASS 52 DUCTILE IRON PIPE.
  3. ALL FITTINGS SHALL BE MECHANICAL JOINT WITH MINIMUM RESTRAINT EQUAL TO RETAINER GLANDS.

DATE	REVISIONS	
MAY 2006		FORCE MAIN CLEANOUT DETAILS
APPROVED: _____		STANDARD DRAWING NO. SD2080

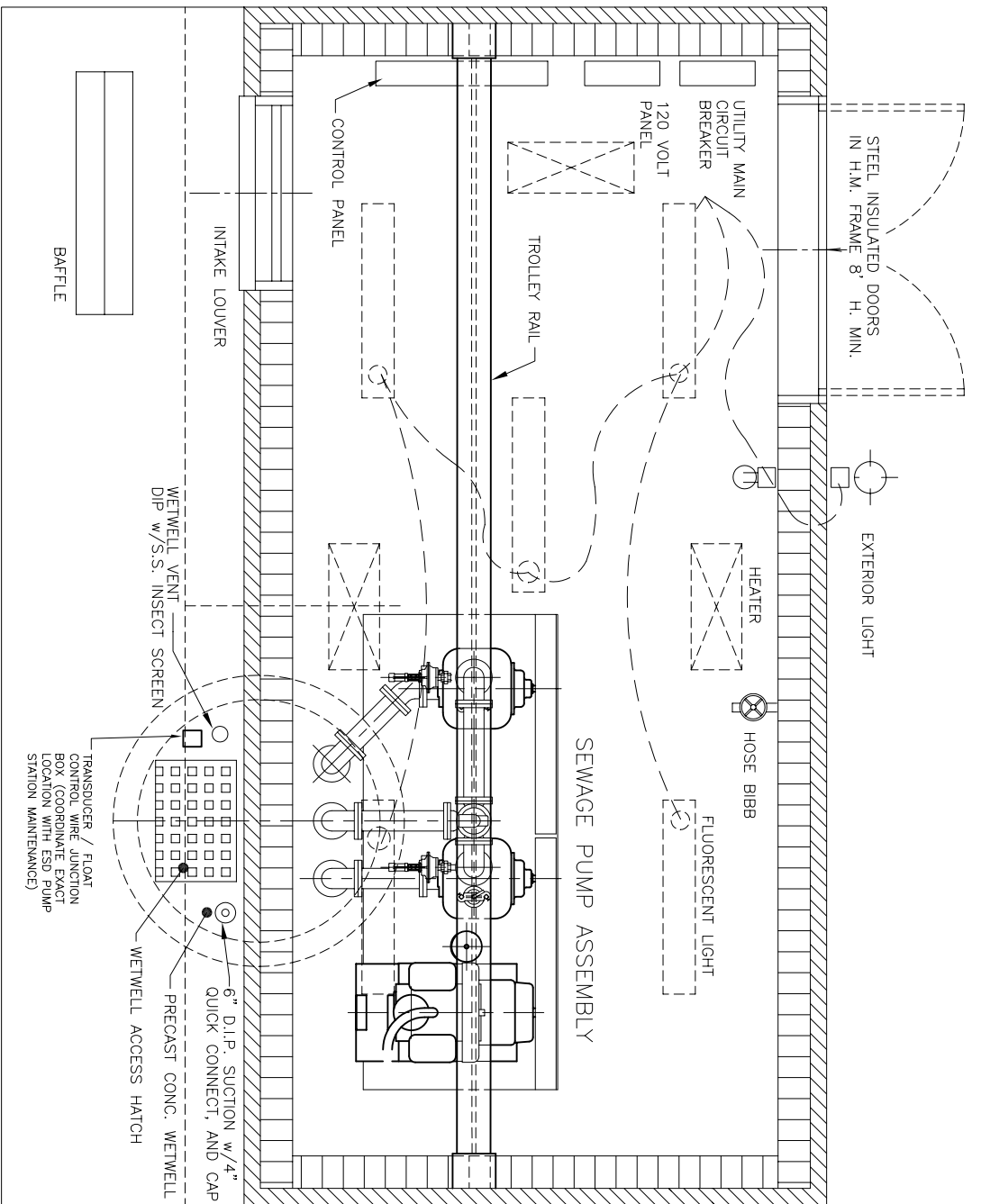
JEFFERSON COUNTY ALABAMA  
ENVIRONMENTAL SERVICES DEPARTMENT



- PUMP SCHEDULE
- BACKUP FLOAT HIGH WATER ELEV.
  - HIGH WATER ELEV.
  - PUMP #2 ON ELEV.
  - PUMP #1 ON ELEV.
  - PUMPS OFF ELEV.
  - BACKUP FLOAT OFF ELEV.

- NOTES:
1. ALL PIPING SHALL BE RESTRAINED JOINT D.I.P.
  2. PROVIDE EITHER A MAGNETIC FLOWMETER WITH PLUG VALVES (SEE STANDARD DWG 3420) OR A FORCE MAIN QUICK CONNECT VALVE ASSEMBLY (SEE STANDARD DWG 3421) IN DISCHARGE FORCE MAIN.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL FACTORY BUILT STEEL DUPLEX FLOODED SUCTION PUMPING STATION
APPROVED: _____		STANDARD DRAWING NO. SD3100

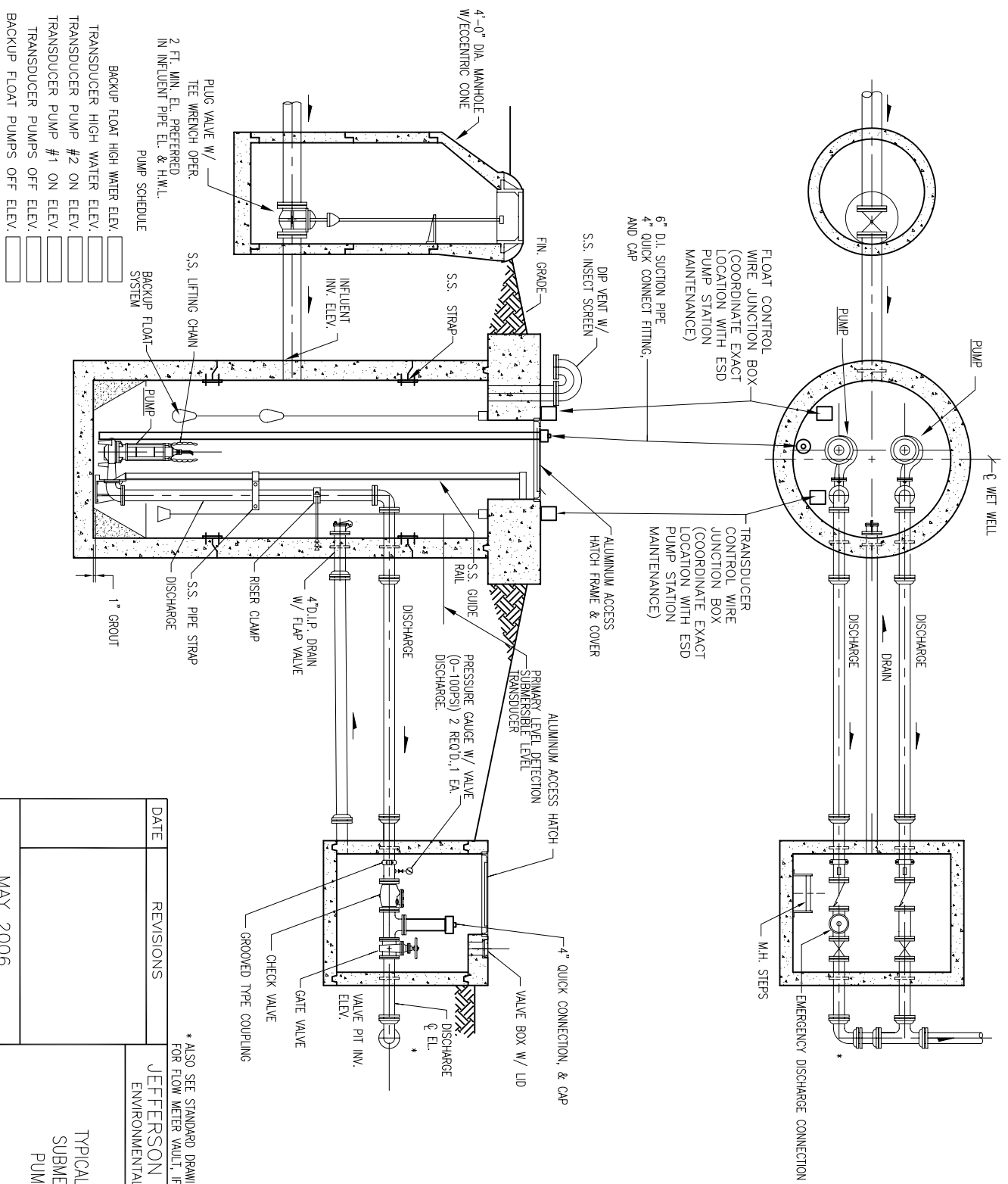


NOTE: SEAL ALL OPENINGS THRU CONCRETE PAD INTO STATION ENCLOSURE GAS TIGHT  
 GAS TIGHT FLOOR DRAIN REQUIRED FOR PUMP MAINTENANCE  
 SEE STANDARD DRAWING SD3250 FOR TYPICAL SECTIONAL ELEVATION AND TYPICAL BUILDING WALL SECTION

FLOOR PLAN  
 N.T.S.

DATE	REVISIONS	
		JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
		TYPICAL BUILDING AND BASE MOUNTED SELF PRIMING PUMPING STATION WITH STANDBY ENGINE FLOOR PLAN
	MAY 2006	
APPROVED: _____		STANDARD DRAWING NO. SD3200





- BACKUP FLOAT HIGH WATER ELEV.
- TRANSDUCER HIGH WATER ELEV.
- TRANSDUCER PUMP #2 ON ELEV.
- TRANSDUCER PUMP #1 ON ELEV.
- TRANSDUCER PUMPS OFF ELEV.
- BACKUP FLOAT PUMPS OFF ELEV.

DATE	REVISIONS

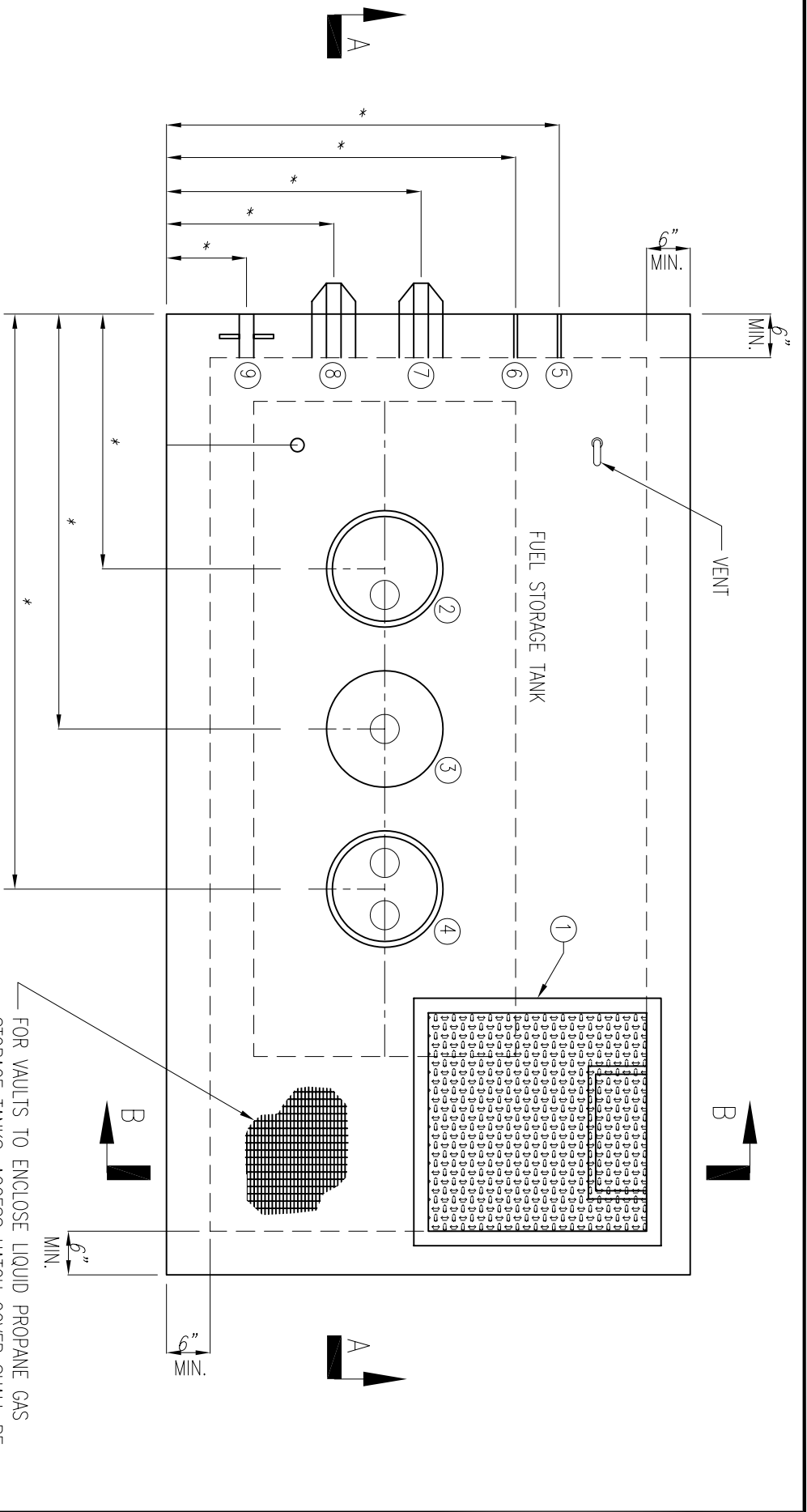
\* ALSO SEE STANDARD DRAWING, SD3420 FOR FLOW METER VAULT, IF REQUIRED

JEFFERSON COUNTY ALABAMA  
ENVIRONMENTAL SERVICES DEPARTMENT

TYPICAL FACTORY BUILT  
SUBMERSIBLE SEWAGE  
PUMPING STATION

MAY 2006

APPROVED: \_\_\_\_\_ STANDARD DRAWING NO. SD3300



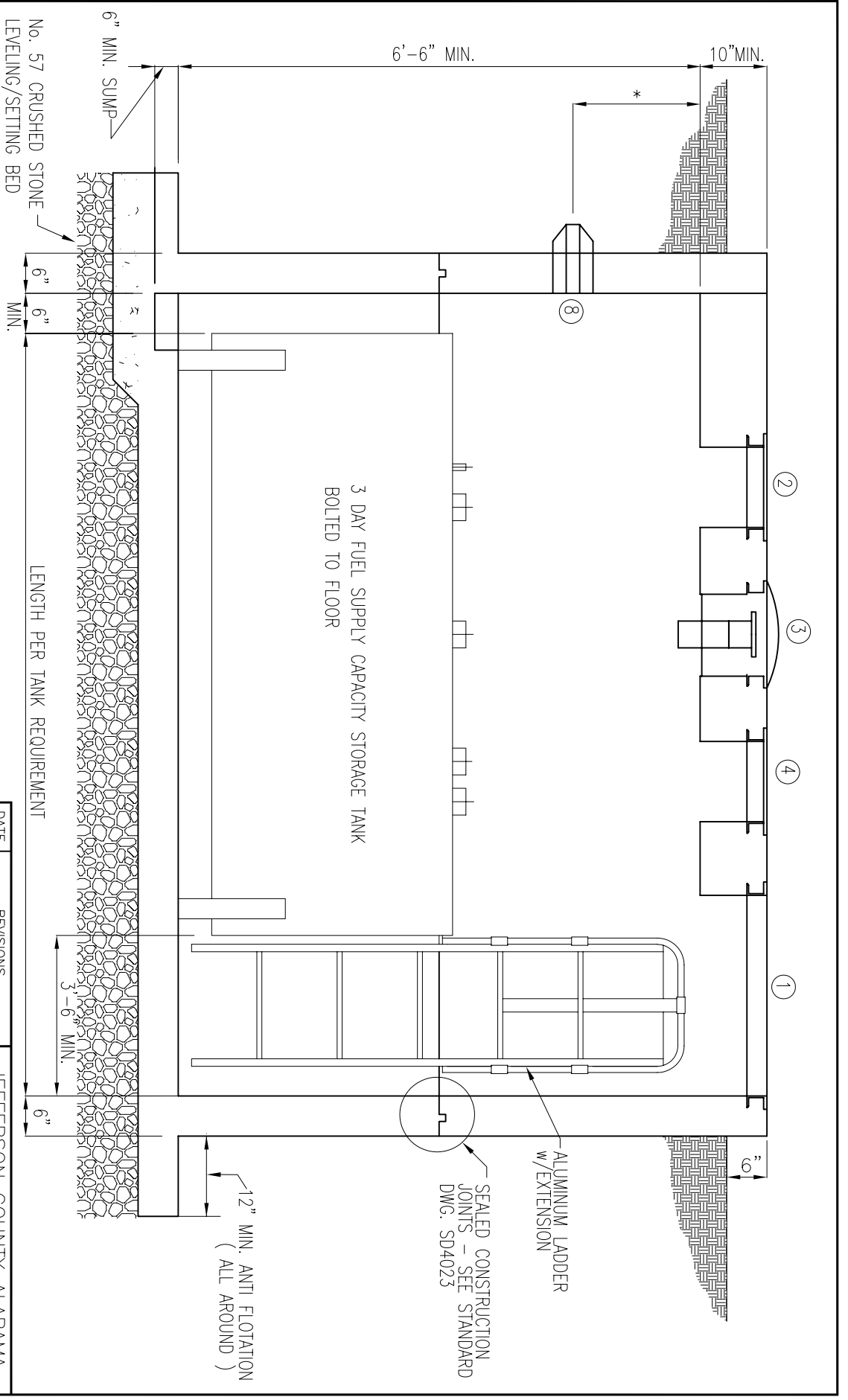
\* LOCATE OPENINGS PER TANK REQUIREMENTS  
 © SEE STANDARD DWG. SD3403 FOR  
 PENETRATION SCHEDULE

PLAN VIEW – TOP OF VAULT  
 N.T.S.

USE WITH STANDARD DWG'S SD3401, SD3402, & SD3403

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		FUEL STORAGE SYSTEM PLAN VIEW
STANDARD DRAWING NO. SD3400		





NOTES :  
 \* LOCATE OPENINGS PER TANK REQUIREMENTS  
 @ SEE STANDARD DWG. SD3403 FOR WALL PENETRATION SCHEDULE

SECTION "A-A"  
 N.T.S.

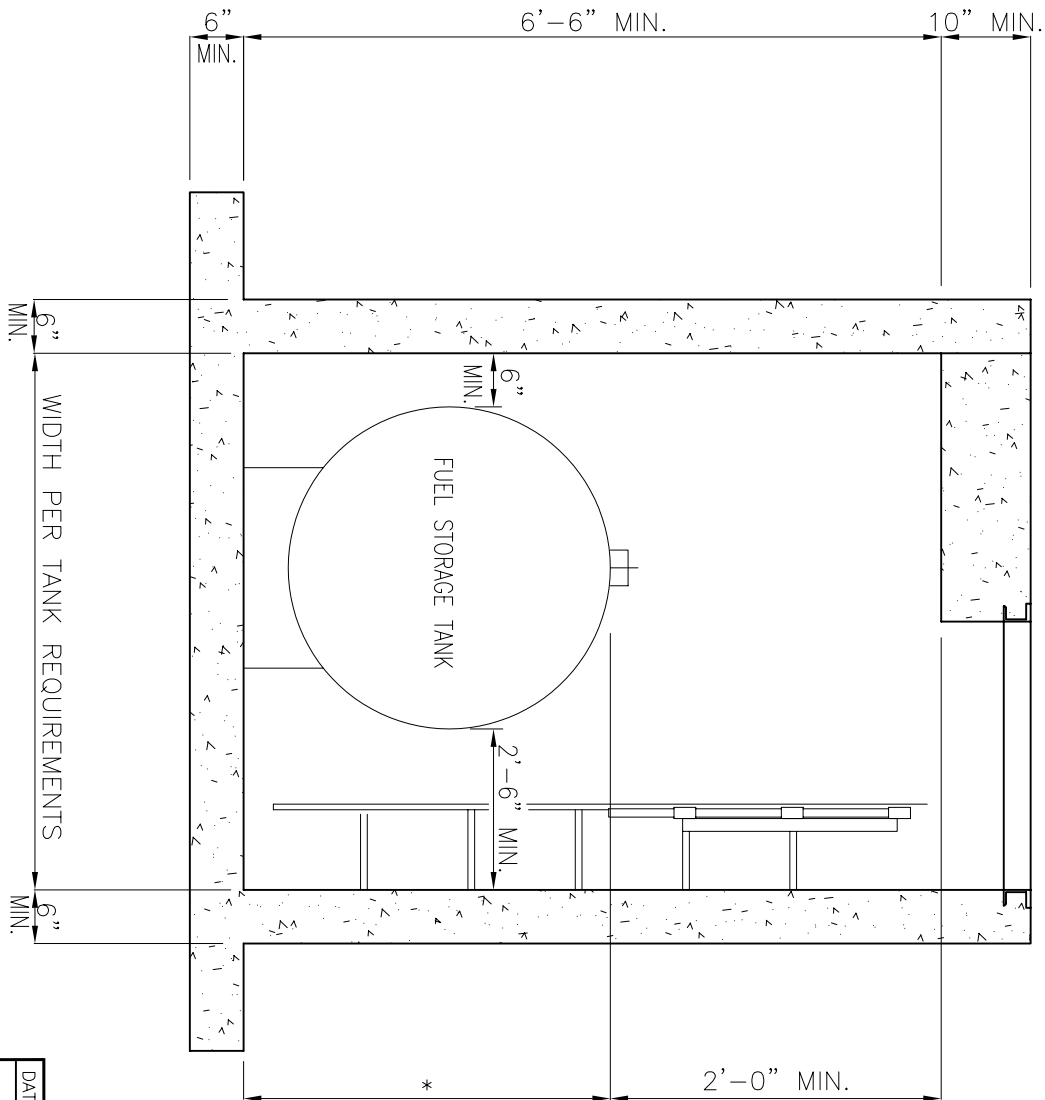
USE WITH STANDARD DWG'S SD3400, SD3402, & SD3403

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		

FUEL STORAGE SYSTEM  
SECTION A-A

APPROVED: \_\_\_\_\_

STANDARD DRAWING NO. SD3401



\* DIMENSION PER TANK REQUIREMENTS  
 SECTION "B-B"  
 N.T.S.

USE WITH STANDARD DWG'S SD3400, SD3401, & SD3403

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		FUEL STORAGE SYSTEM SECTION B-B
APPROVED: _____		STANDARD DRAWING NO. SD3402

DESIGN REQUIREMENTS FOR CONCRETE VAULT

1. CONCRETE MINIMUM STRENGTH – CLASS A 4000 PSI.
2. STEEL REINFORCEMENT – ASTM A615 OR ASTM A706, GRADE 60.
3. CONCRETE COVER – 2" MINIMUM OUTSIDE AND 1-1/2" MINIMUM INSIDE IN ACCORD W/ACI 318
4. DESIGN LOADING – AASHTO HS20-44.
5. CONSTRUCTION JOINT – SEALED WITH 2 ROWS OF 1-1/2" DIA. BUTYL RUBBER.
6. TOP INTERIOR SEALED WITH THOROCOAT, BOTTOM INTERIOR SEALED WITH SHELLCOAT.
7. DESIGN SPECIFICATION – ACI 318 & AASHTO LOAD FACTOR DESIGN METHOD.
8. VAULT AND TANK SHALL MEET REQUIREMENTS FOR FIRE RESISTIVE ABOVE GROUND TANK SYSTEM UL 2085 STANDARD

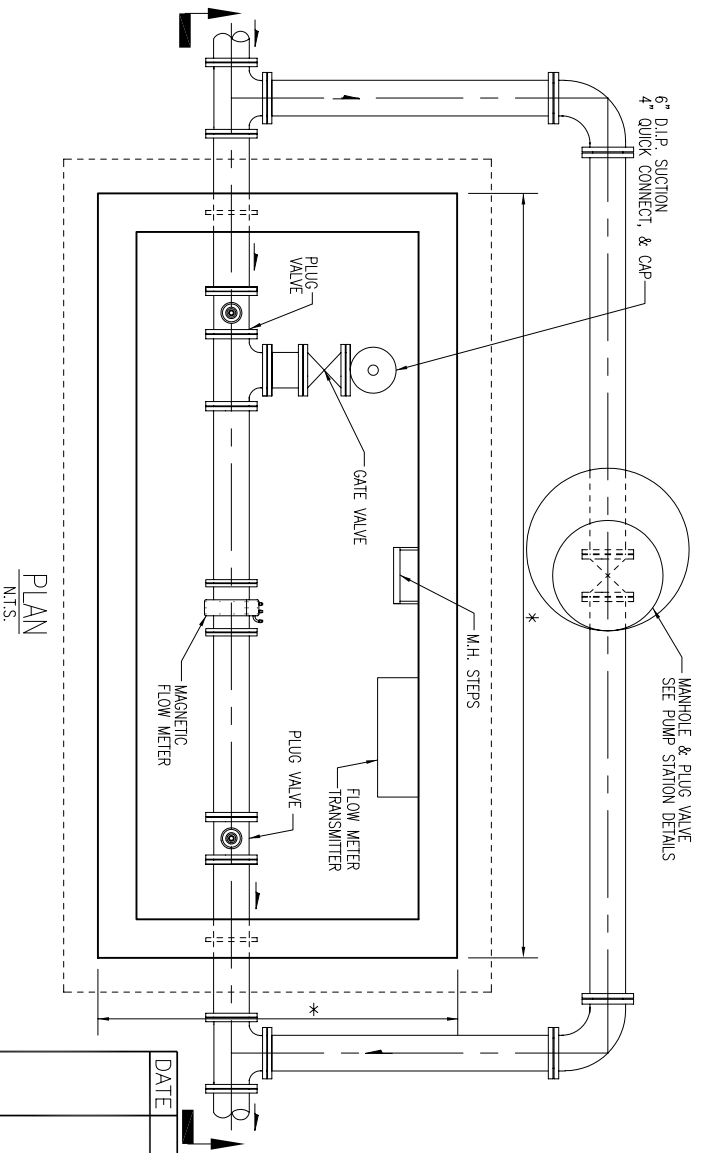
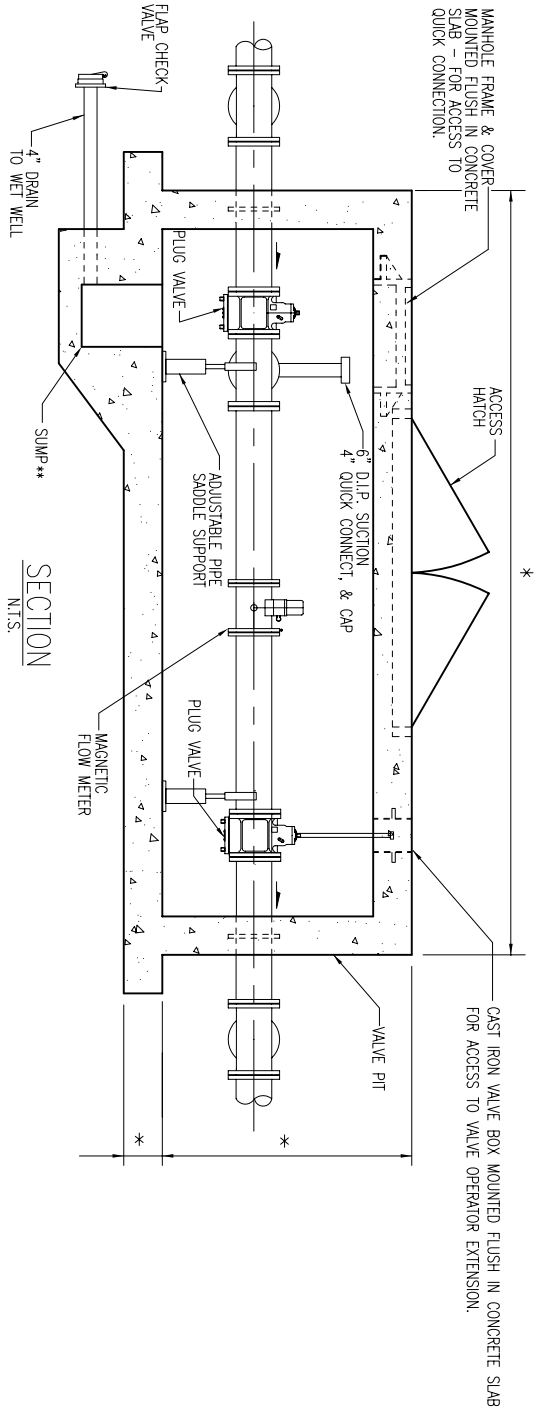
VAULT PENETRATION SCHEDULE

NO.	SIZE	TYPE	DESCRIPTION
1	30" MIN.	MANWAY w/HATCH *	ACCESS
2	12" MIN.	OPENING w/COVER *	
3	12" MIN.	4" TIGHT FILL CONNECTION *	w/5 GALLON SPILL BUCKET CAST-IN
4	12" MIN.	OPENING w/COVER *	
5	3/4"	GALV. FPT (BOTH SIDES) PENETRATION	LIGHTING CONDUIT
6	3/4"	GALV. FPT. (BOTH SIDES) PENETRATION	MONITORING CONDUIT
7	8"	FLEXIBLE PRESS-SEAL ENTRY BOOT	SUPPLY
8	8"	FLEXIBLE PRESS-SEAL ENTRY BOOT	RETURN
9	2"	GALV. FPT (BOTH SIDES) PENETRATION	

\* FOR VAULTS TO ENCASE LIQUID PROPANE GAS STORAGE TANKS, THE ACCESS HATCH COVER SHALL BE ALUMINUM GRATING, OPEN TO VENT WITH SIMILAR OPENING'S FOR TANK FILLING AND MAINTENANCE.

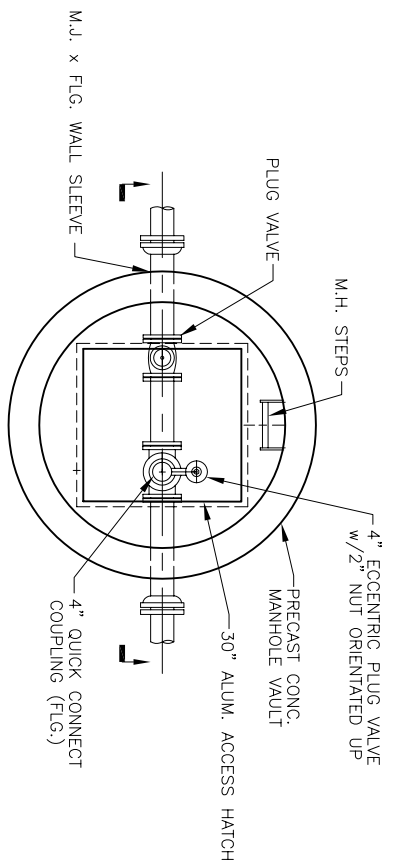
USE WITH STANDARD DWG'S SD3400, SD3401, & SD3402

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD3403

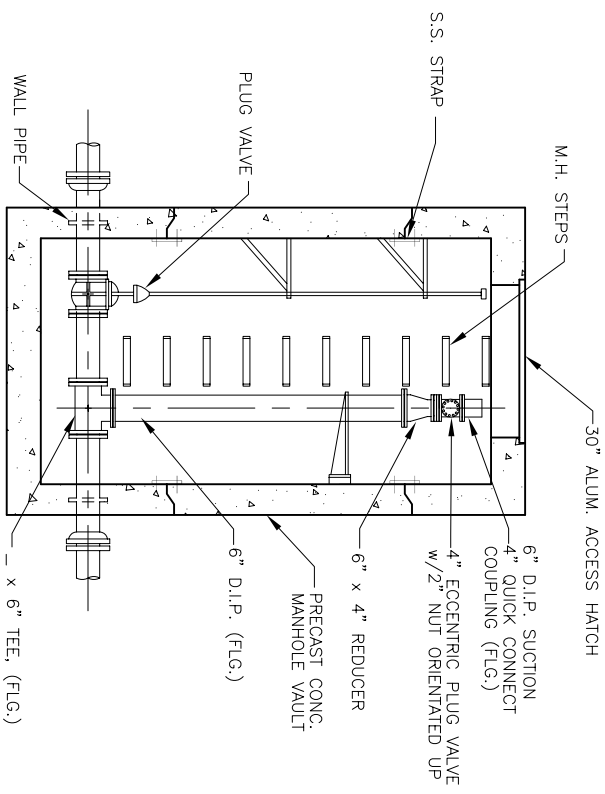


NOTE:  
 \*\* WHEN VAULT CANNOT BE DRAINED BY GRABBY, FURNISH AND INSTALL SUMP PUMP AND PUMP INTO WETWELL  
 \* SIZE TO ACCOMMODATE FLOW METER

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		VALVE AND FLOW METER VAULT
APPROVED: _____		STANDARD DRAWING NO. SD3420

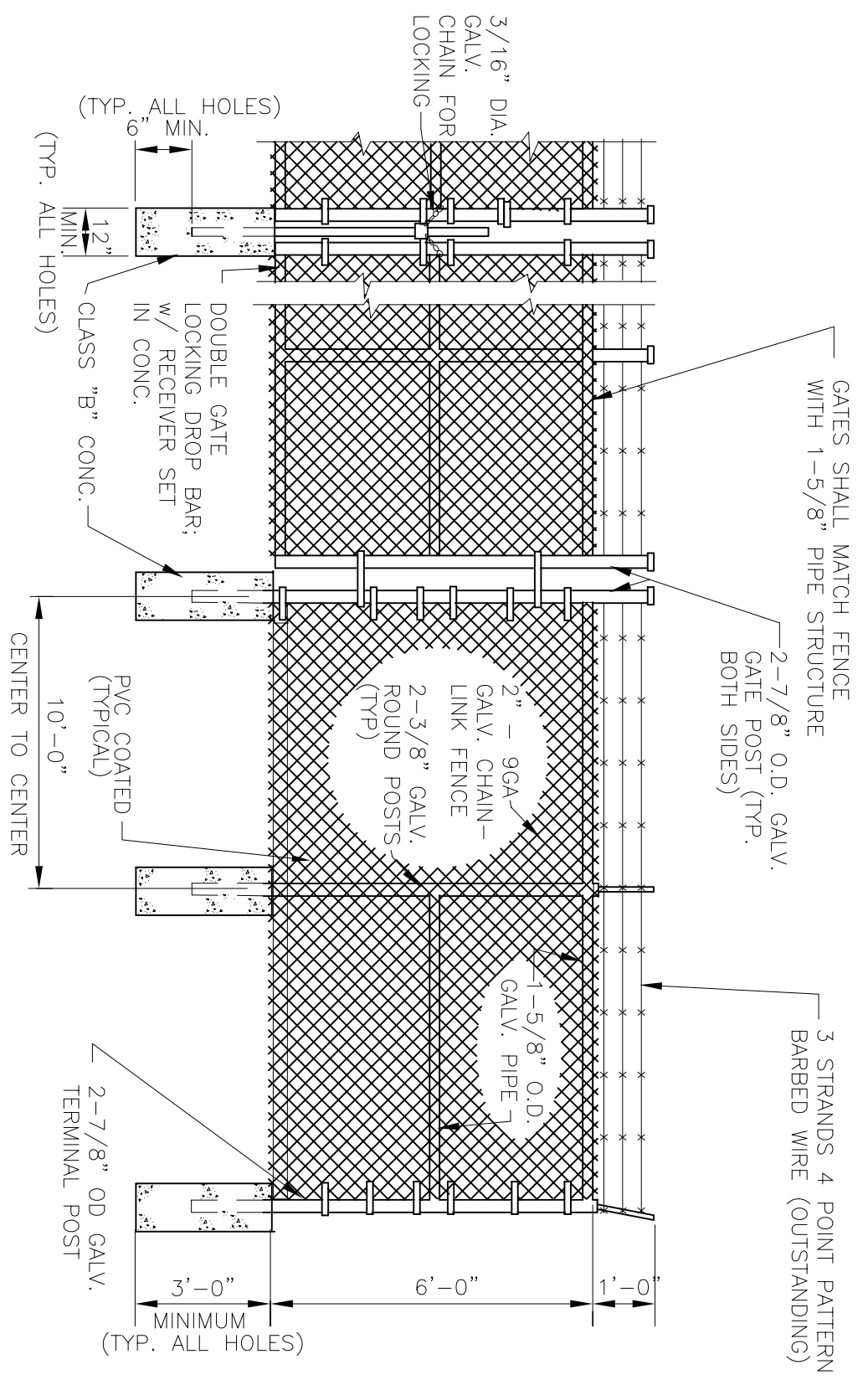


PLAN  
N.T.S.



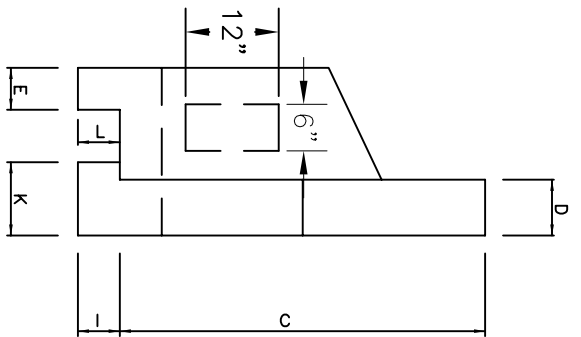
SECTION  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		FORCE MAIN QUICK CONNECT VALVE ASSEMBLY
APPROVED: _____		STANDARD DRAWING NO. SD3421

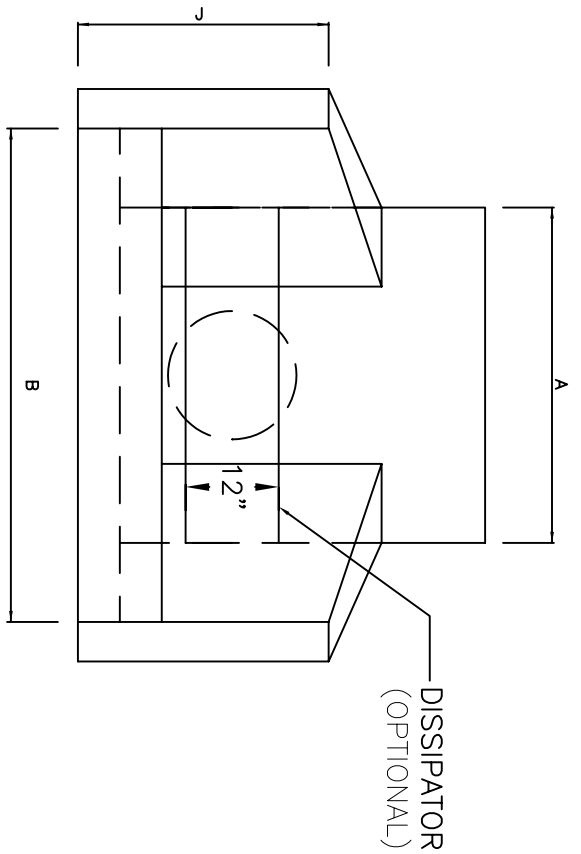


CHAIN LINK FENCE  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		PVC COATED CHAIN LINK FENCE AND ACCESSORIES
APPROVED: _____		STANDARD DRAWING NO. SD4000



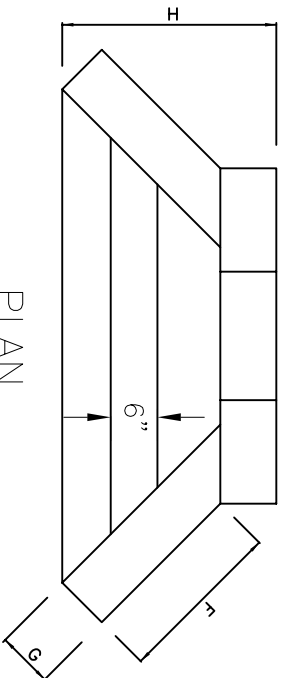
CROSS SECTION  
N.T.S.



END ELEVATION  
N.T.S.

INSIDE DIAMETER	HOLE DIA. UPSTREAM - DOWNSTREAM	A	B	C	D	E	F	G	H	I	J	K	L
15	22-19	48	72	40	8	6	24	8	24	6	40	12	8
18	29-22	48	72	40	8	6	24	8	24	6	40	12	8
24	34-29	64	98	53	8	6	33	8	34	6	49	12	12
30	40-34	67	120	63	8	6	48	8	41	6	59	12	12
36	48-40	67	120	63	8	6	48	8	41	6	59	12	12
42	54-48	75	120	63	8	6	42	8	41	6	59	12	12
48	NA-54	75	120	63	8	6	42	8	41	6	59	12	12

Dimensions are in inches.



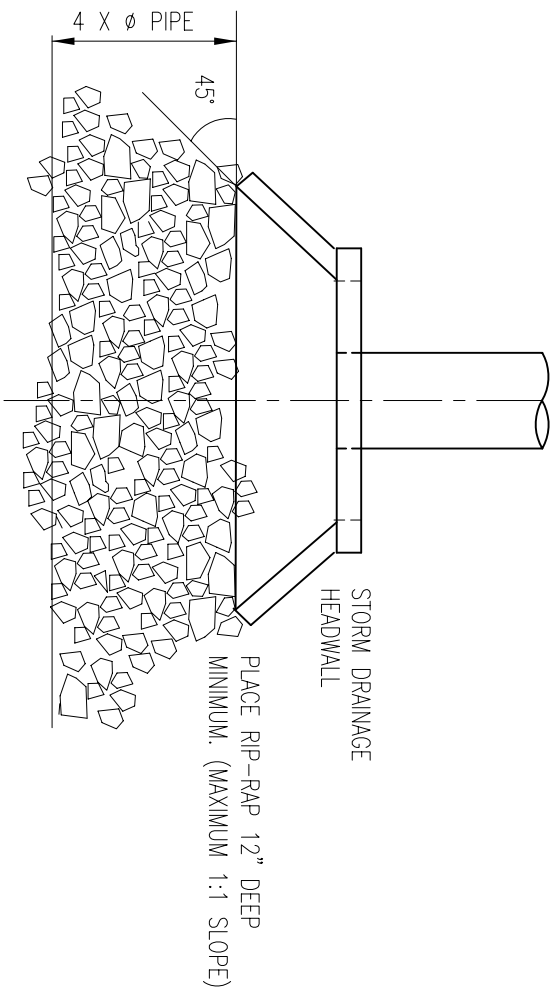
PLAN  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		PRECAST CONCRETE HEADWALL
APPROVED: _____		STANDARD DRAWING NO. SD4001

Class B  
3,000 psi CONCRETE  
REINFORCING - #4 BAR, 12" & 8"

NOTES:

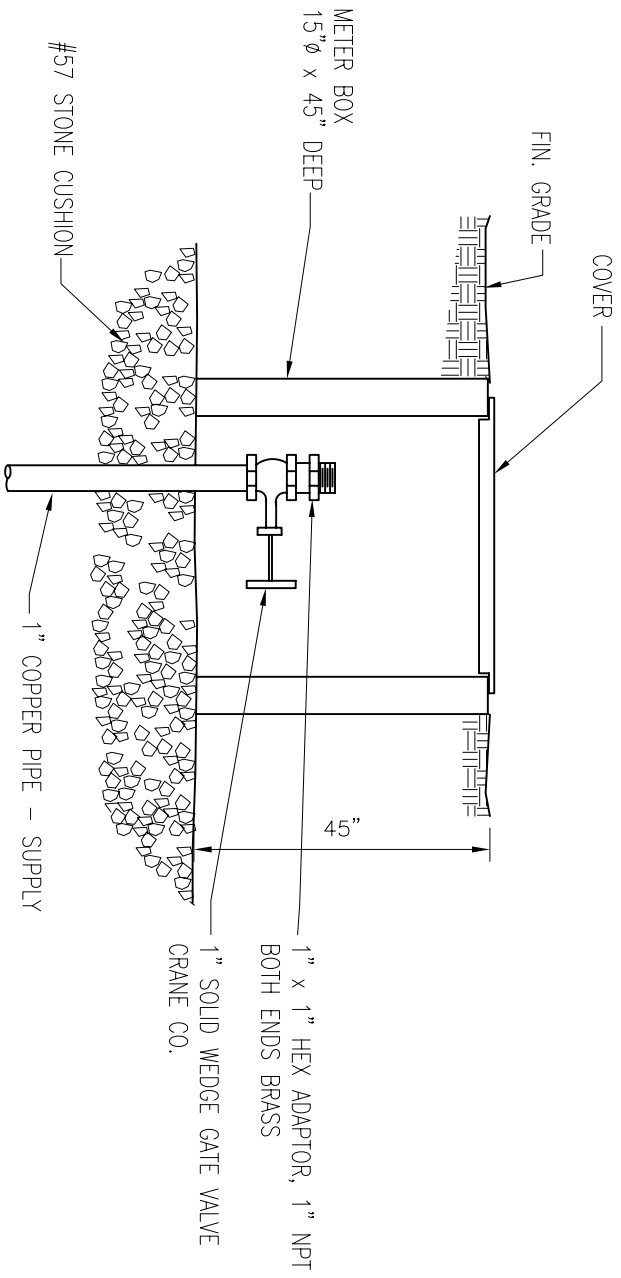
1. Reinforced concrete headwalls for storm drain systems may be required for pump station sites. Precast headwalls shall be Class B 3000 psi concrete with 60ksi grade reinforcing, as manufactured by Hanson Pipe and Precast, Inc. or approved equivalent. The Design Engineer shall specify and coordinate all geometry and rebar to be used in the precast concrete headwalls. The Design Engineer shall determine if energy dissipators are required with these headwalls.
2. Site conditions in the County R.O.W. where traffic is involved may require use of slope paved or flared headwalls. These headwalls shall be in accordance with A.L.D.O.T. Standard Specifications, Division 500 (Structures), Division 600 (Incidentals), Division 800 (Materials) and Special and Standard Highway Drawings, latest revisions. These headwalls shall be either cast-in-place Class B 3000 psi concrete or precast concrete design (as described in note 1) for the flared end headwalls or portions of the slope paved headwalls.
3. Stone for Rip Rap shall be selected stone from rock cuts or other approved sources or pieces of concrete. It shall consist of well graded stones weighing from 10 pounds to 200 pounds each with at least 50% weighing over 80 pounds. Both width and thickness shall be at least  $\frac{1}{3}$  the length for each stone. Not more than 10% by total weight shall weigh less than 10 pounds and not more than 10% by total weight shall weigh more than 200 pounds.



PLAN VIEW  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL RIP RAP FOR HEADWALL
APPROVED: _____		STANDARD DRAWING NO. SD4002



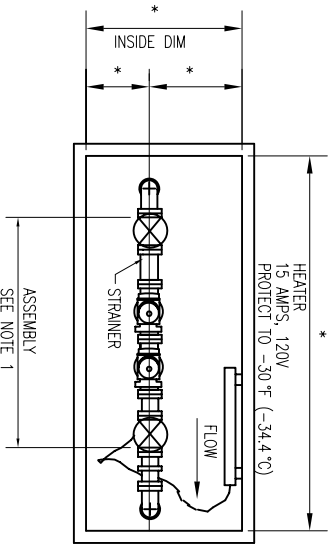


YARD HOSE BIBB DETAIL

N.T.S.

NOTE:  
PROVIDE BACKFLOW PREVENTER

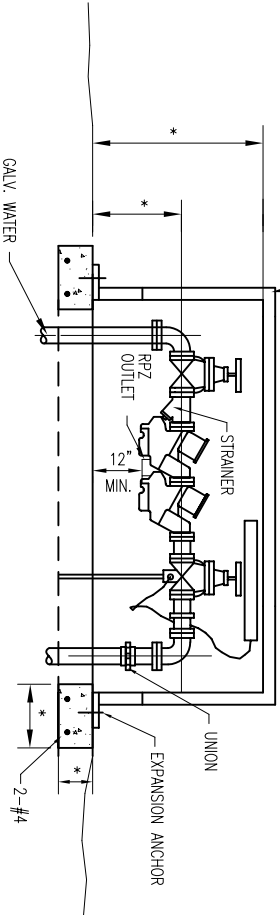
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		YARD HOSE BIBB DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD4003



PLAN  
N.T.S.

- NOTES:
1. WATTS REDUCED PRESSURE DETECTOR ASSEMBLY SERIES 9090T-S, OR APPROVED EQUIVALENT.
  2. ELECTRICAL OUTLET(S) SHALL BE FOR OUTDOOR USE & INSTALLED ON A GFCI OUTLET MOUNTED A MIN. OF 2" OFF THE FLANGE FACE & 6" ABOVE THE HIGHEST POINT OF DISCHARGE.
  3. INSTALLATION SHALL BE MADE IN STRICT ACCORDANCE WITH LOCAL UTILITY & AMWA STANDARDS

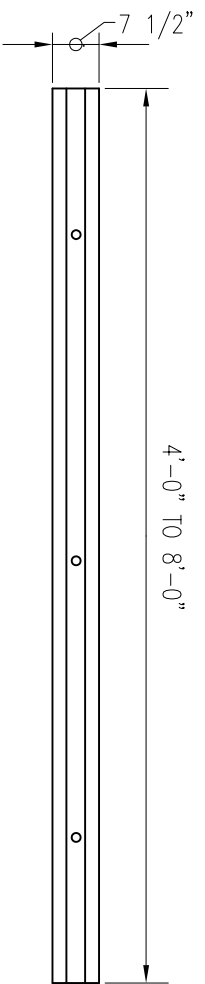
#2 INSULATED "HOT BOX" W/ HEAT STRIPS,  
DRAIN HOLES, LOCKING ACCESS; CDR SYSTEMS, INC.  
HOTBOX OR APPROVED EQUIVALENT



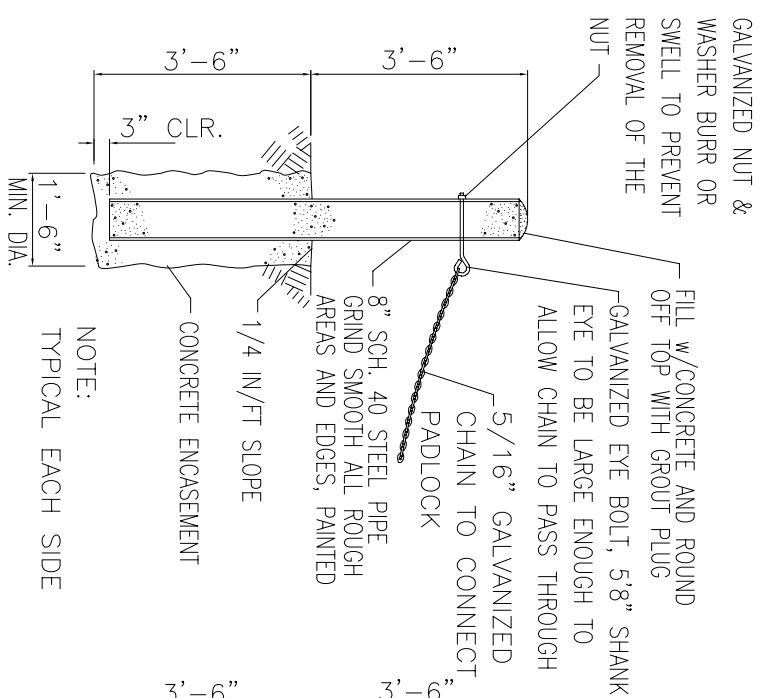
ELEVATION  
N.T.S.

\* SIZE TO ACCOMMODATE BACKFLOW PREVENTER

DATE	REVISIONS	
		JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		REDUCED PRESSURE PRINCIPAL BACKFLOW PREVENTER
APPROVED: _____		STANDARD DRAWING NO. SD4004 _____

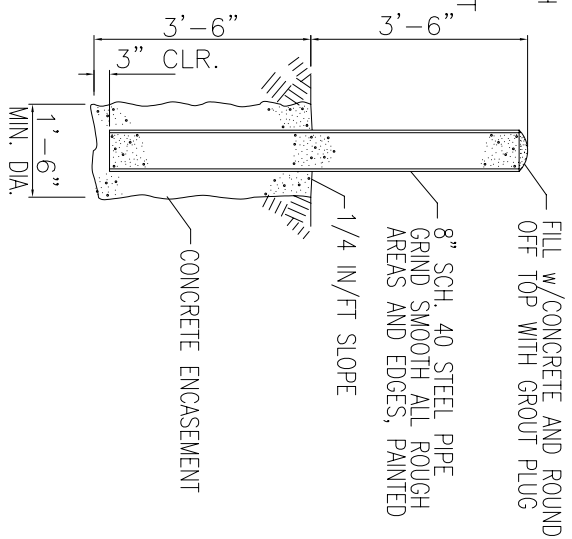


PLAN  
N.T.S.

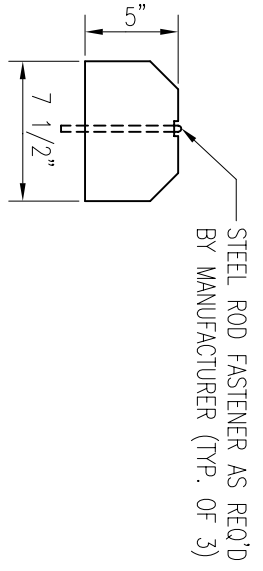


NOTE:  
TYPICAL EACH SIDE

ACCESS GATE  
N.T.S.



BOLLARD DETAIL  
N.T.S.



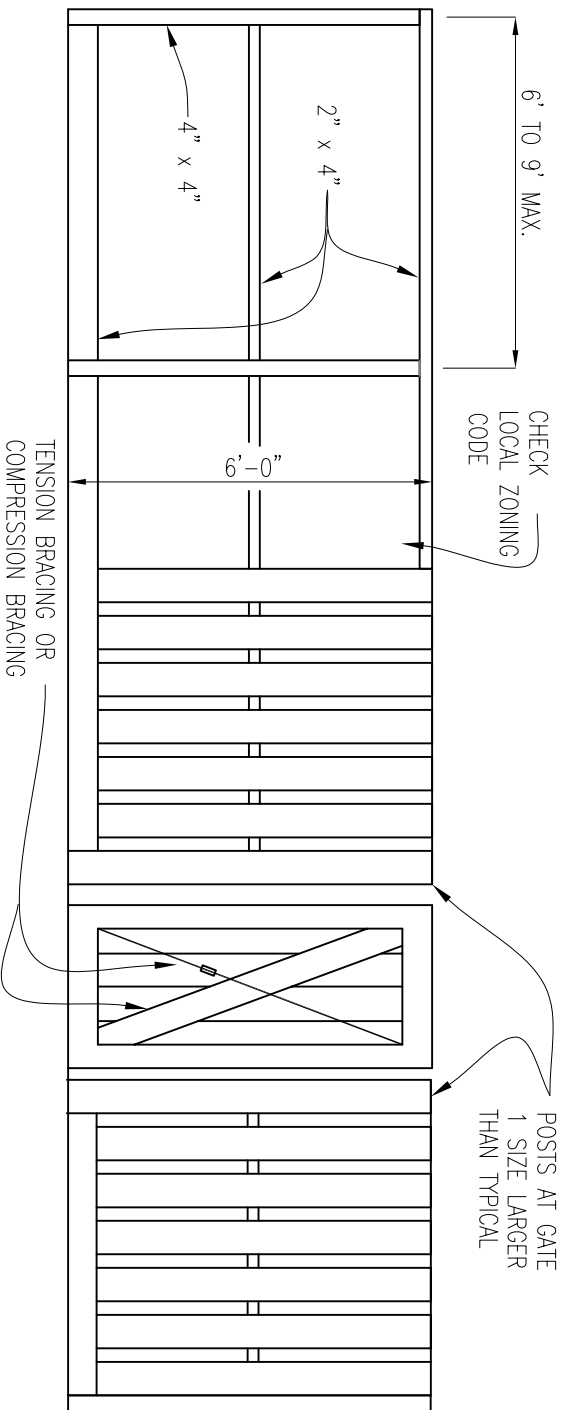
SECTION  
N.T.S.

PARKING BUMPER  
N.T.S.

NOTE:  
PARKING BUMBERS SHALL BE PRECAST CONCRETE MATERIAL.

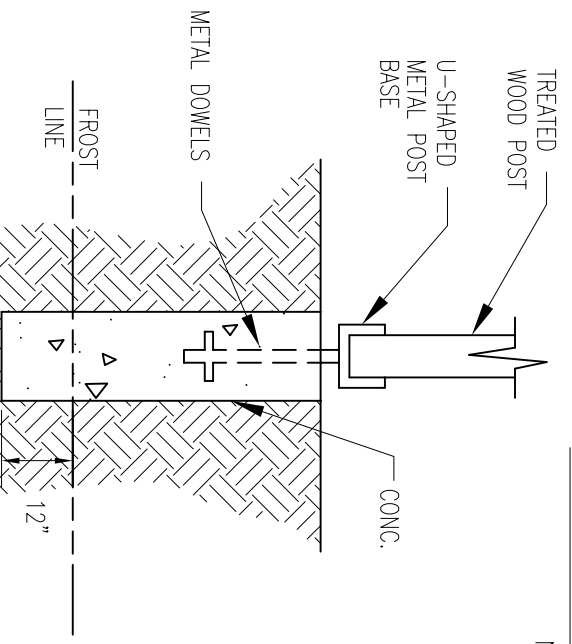
BOLLARDS AT ACCESS ROAD  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		PARKING BUMPER AND BOLLARDS AT ACCESS ROAD
APPROVED: _____		STANDARD DRAWING NO. SD4005



TYPICAL WOOD PRIVACY FENCE

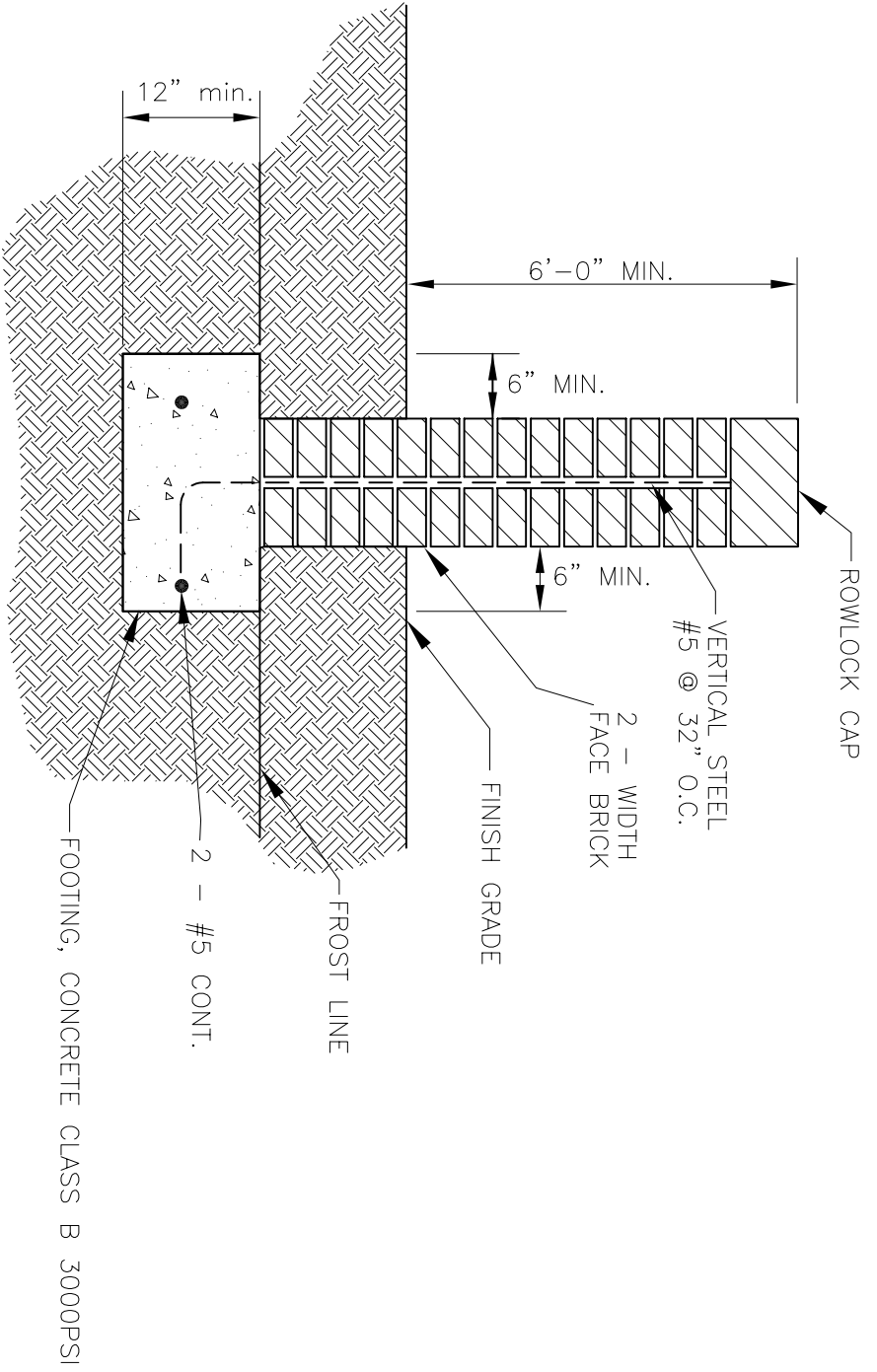
N.T.S.



FOOTING DETAIL

N.T.S.

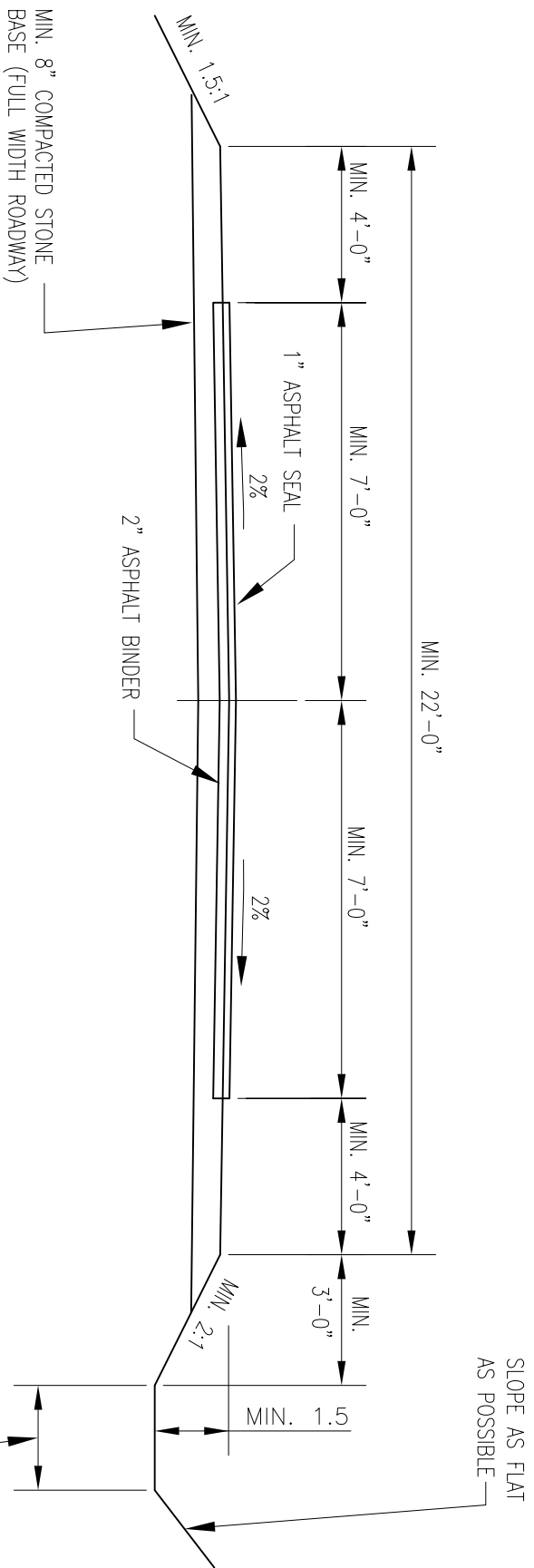
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL TREATED WOOD PRIVACY FENCE
APPROVED: _____		STANDARD DRAWING NO. SD4006



TYPICAL MASONRY PRIVACY WALL

N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT	
MAY 2006		TYPICAL MASONRY PRIVACY WALL	
APPROVED: _____		STANDARD DRAWING NO. SD4007	

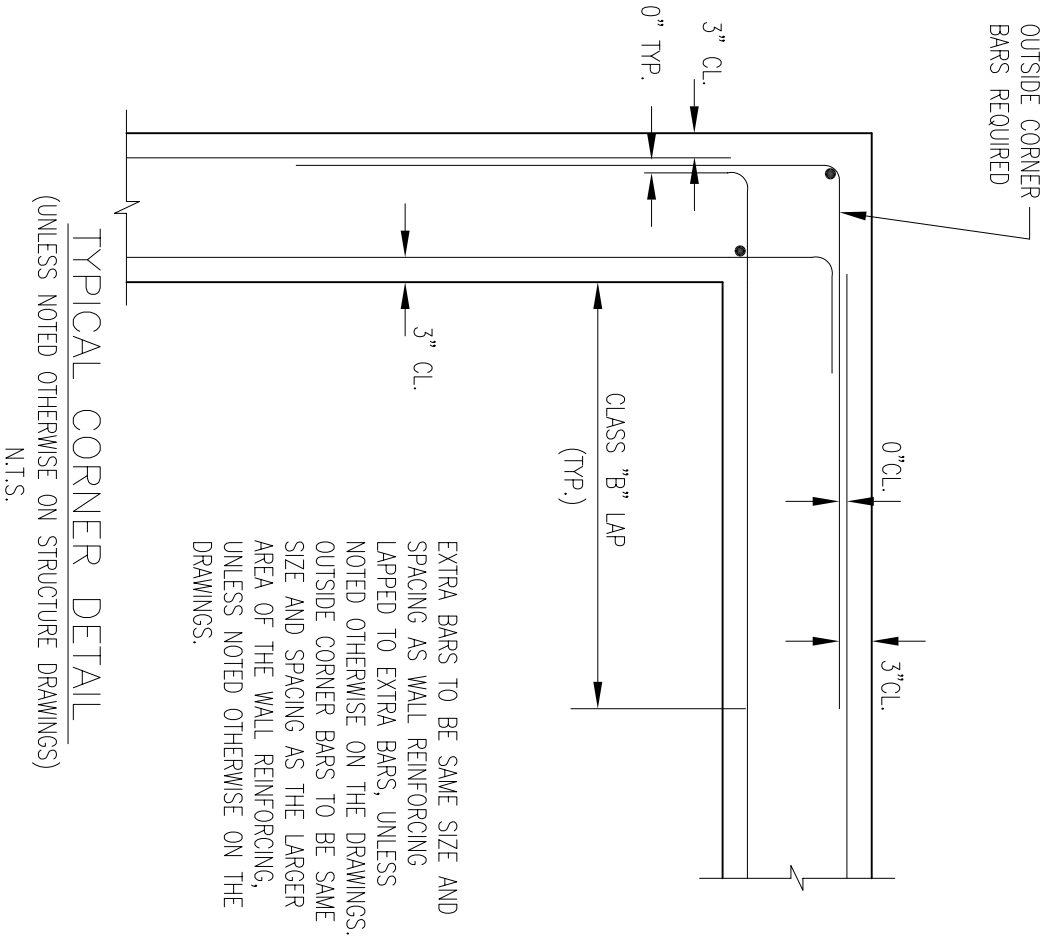


TYPICAL ACCESS ROAD SECTION - FLEXIBLE PAVEMENT

N.T.S.

NOTE:  
 WIDTH OF FLAT BOTTOM  
 DITCH SHALL BE GOVERNED  
 BY DRAINAGE CONDITIONS

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL ACCESS ROAD SECTION
APPROVED: _____		STANDARD DRAWING NO. SD4008

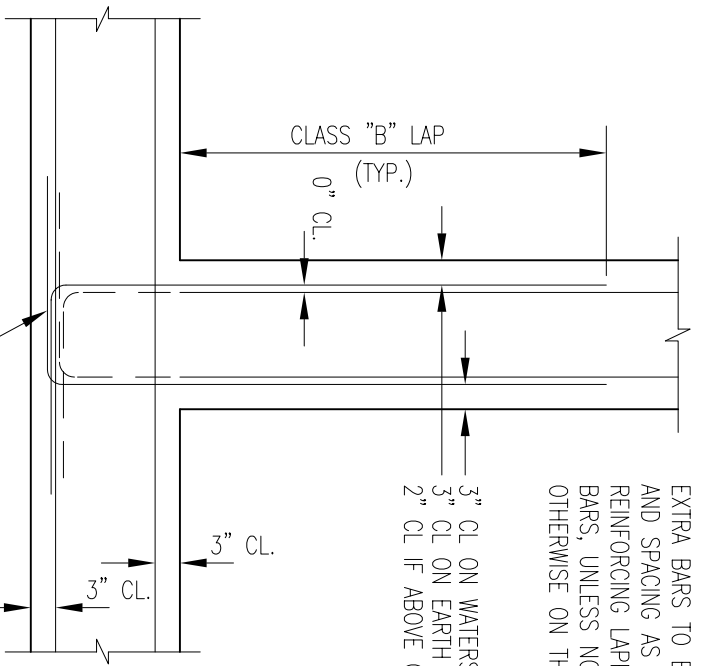


EXTRA BARS TO BE SAME SIZE AND SPACING AS WALL REINFORCING LAPPED TO EXTRA BARS, UNLESS NOTED OTHERWISE ON THE DRAWINGS. OUTSIDE CORNER BARS TO BE SAME SIZE AND SPACING AS THE LARGER AREA OF THE WALL REINFORCING, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

TYPICAL CORNER DETAIL  
(UNLESS NOTED OTHERWISE ON STRUCTURE DRAWINGS)  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL CORNER INTERSECTION REINFORCING DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD4020

EXTRA BARS TO BE SAME SIZE AND SPACING AS WALL REINFORCING LAPPED TO EXTRA BARS, UNLESS NOTED OTHERWISE ON THE DRAWINGS.



TYPICAL INTERSECTION DETAIL  
(UNLESS NOTED OTHERWISE ON STRUCTURE DRAWINGS)  
N.T.S.

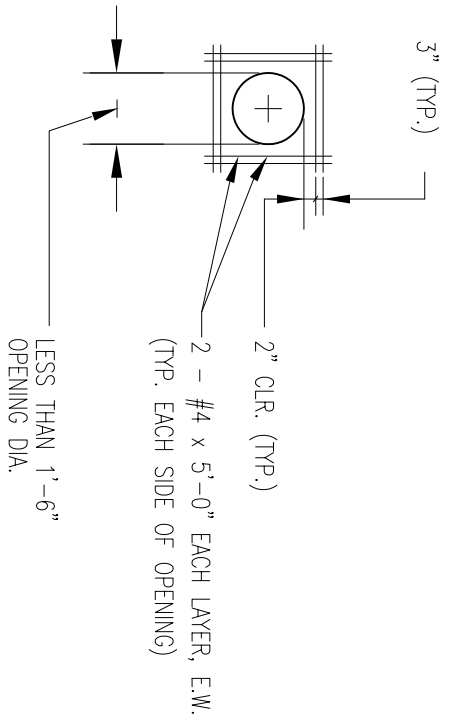
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL WALL INTERSECTION REINFORCING DETAIL
APPROVED: _____		
		STANDARD DRAWING NO. SD4021



PROVIDE REINFORCING T & B  
EQUAL TO ONE HALF AREA  
OF MAIN REINFORCING CUT  
BY OPENING (2 BARS  
EACH LAYER, E.W., MIN.)

PROVIDE REINFORCING T & B  
EQUAL TO ONE HALF AREA  
OF MAIN REINFORCING CUT  
BY OPENING (2 BARS  
EACH LAYER, E.W., MIN.)

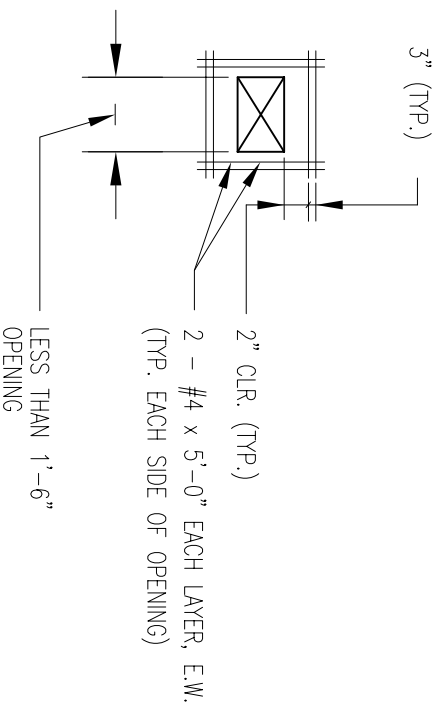
1'-6" - 4'-0" MIN. (TYP.)  
OPENING DIA.



PROVIDE REINFORCING T & B  
EQUAL TO ONE HALF AREA  
OF MAIN REINFORCING CUT  
BY OPENING  
(2 BARS EACH LAYER, E.W., MIN.)

PROVIDE REINFORCING T & B  
EQUAL TO ONE HALF AREA  
OF MAIN REINFORCING CUT  
BY OPENING  
(2 BARS EACH LAYER, E.W., MIN.)

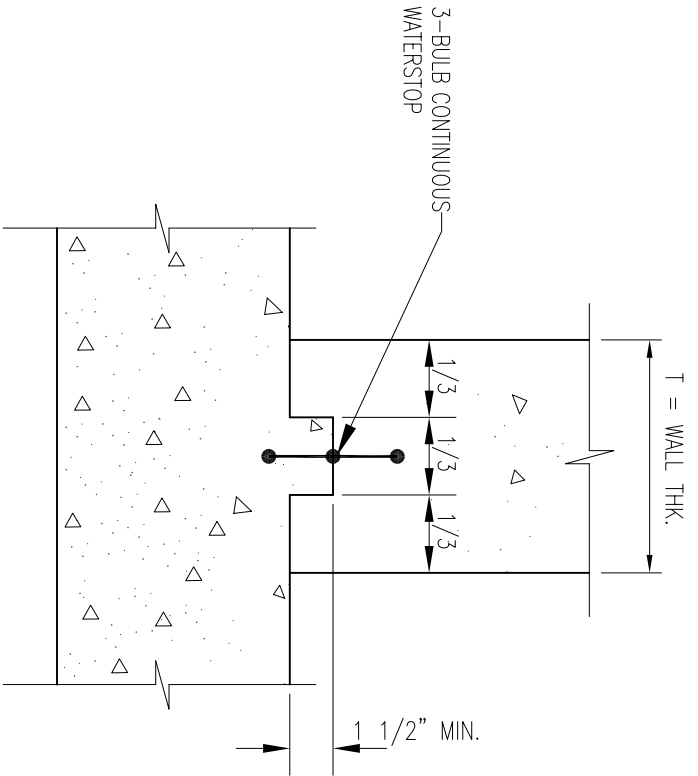
1'-6" - 4'-0" MIN. (TYP.)  
OPENING



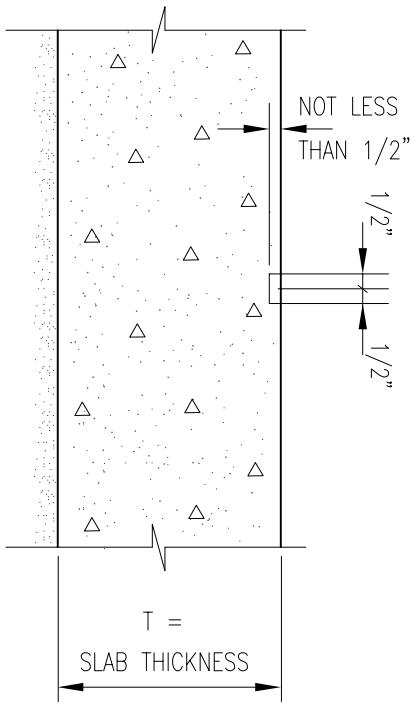
OPENING DETAILS

N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		OPENING REINFORCING CONCRETE SLABS AND WALLS
APPROVED: _____		STANDARD DRAWING NO. SD4022



HORIZONTAL CONSTRUCTION  
JOINT IN WALL  
N.T.S.

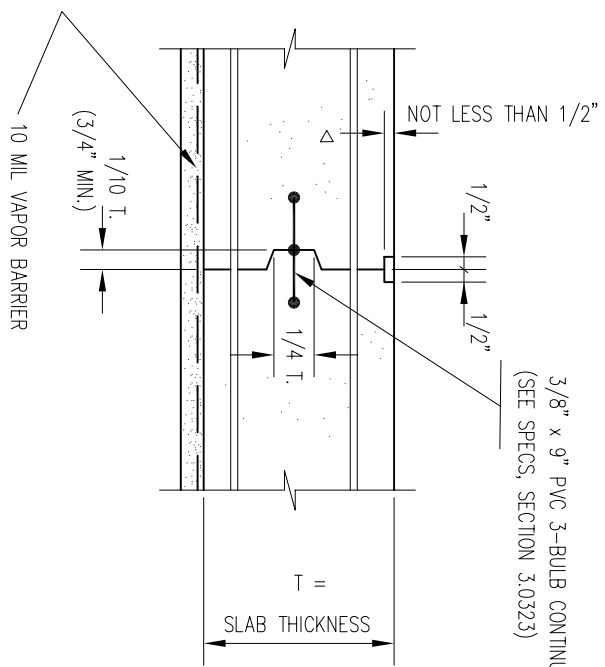


CONTROL JOINT IN SLAB  
N.T.S.

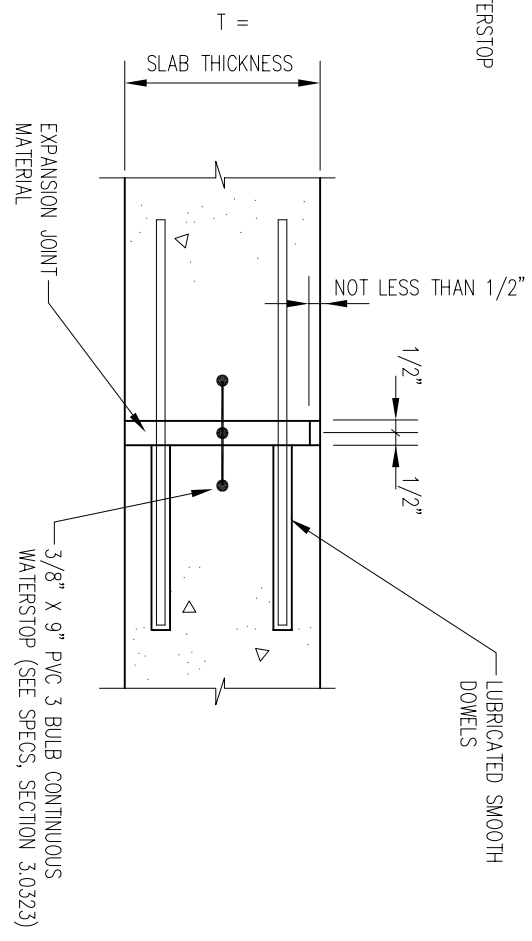
CONCRETE SLAB JOINTS  
N.T.S.

NOTE: PROVIDE PREMOULDED JOINT  
FILLER AND COLD APPLIED JOINT  
SEALANT USING APPROVED MATERIALS  
AND METHODS TO ALL CONTROL JOINTS.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		CONCRETE SLAB JOINTS
APPROVED: _____		STANDARD DRAWING NO. SD4023



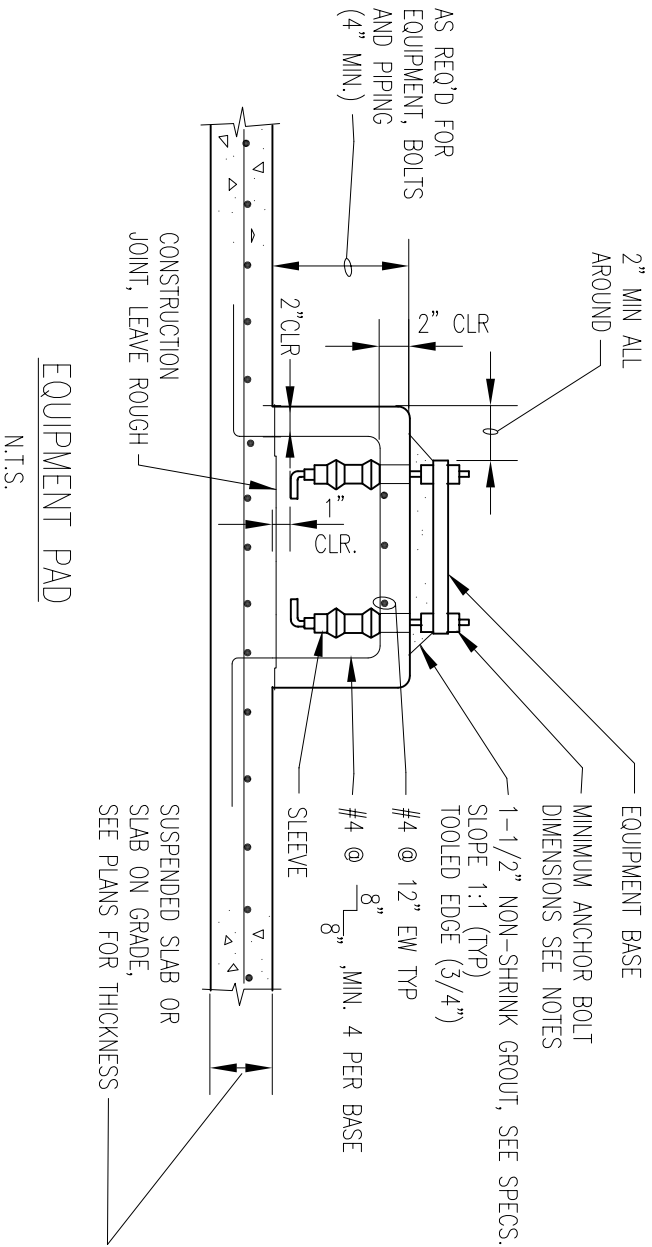
CONSTRUCTION JOINT IN SLAB  
N.T.S.



EXPANSION JOINT IN SLAB  
N.T.S.

NOTE: PROVIDE PREMOULDED JOINT FILLER AND COLD APPLIED JOINT SEALANT USING APPROVED MATERIALS AND METHODS TO ALL CONSTRUCTION AND EXPANSION JOINTS.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		CONCRETE SLAB JOINTS
APPROVED: _____		STANDARD DRAWING NO. SD4024

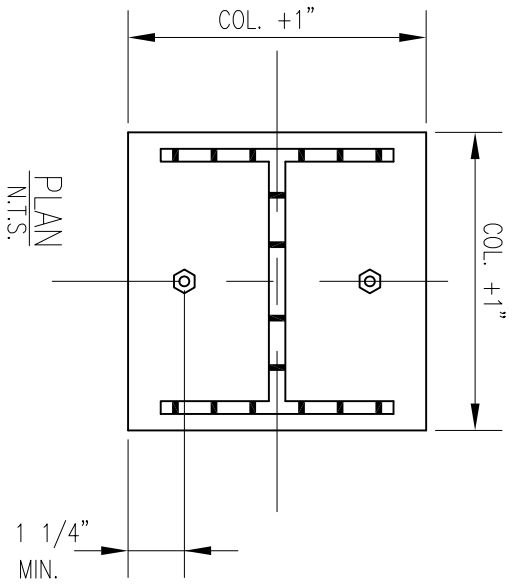


EQUIPMENT PAD  
N.T.S.

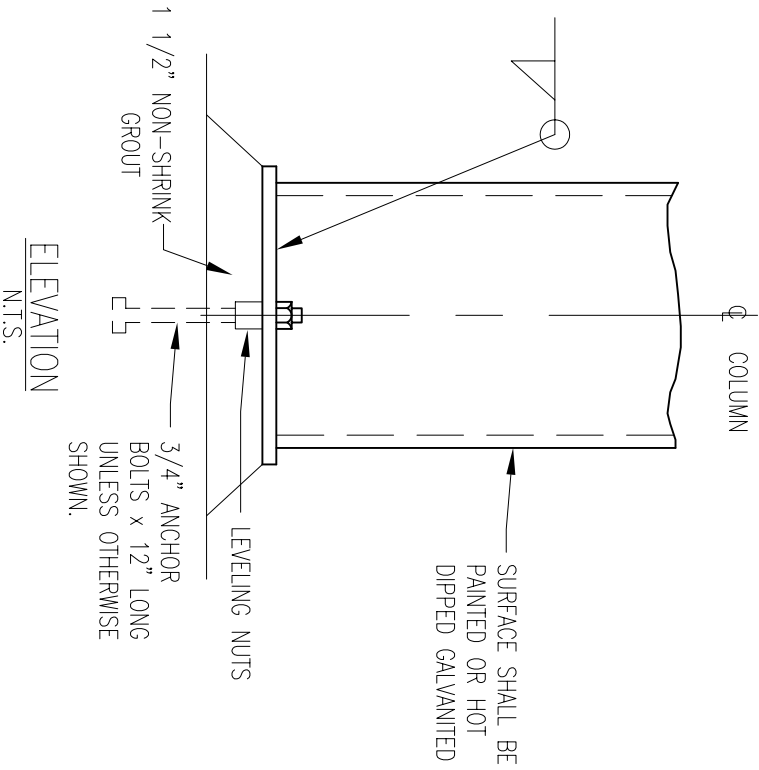
NOTES:

1. PAD SIZE SHALL BE MINIMUM INDICATED OR SHOWN ON THE PLANS OR AS DETERMINED BY THE EQUIPMENT MANUFACTURER AND APPROVED BY THE DESIGN ENGINEER
2. THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AND SHALL BE AS APPROVED BY THE DESIGN ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A TEMPLATE WHILE PAD IS BEING POURED.
3. EQUIPMENT BASES SHALL BE INSTALLED LEVEL UNLESS SPECIFIED OTHERWISE.
4. WEDGES OR SHIMS SHALL BE USED TO SUPPORT THE BASE WHILE THE NON-SHRINK GROUT IS PLACED. TEMPORARY LEVELING NUTS SHALL BE BACKED OFF. IF LEFT IN, THE WEDGES OR SHIMS SHALL NOT BE EXPOSED TO VIEW.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		EQUIPMENT PAD
APPROVED: _____		STANDARD DRAWING NO. SD4025



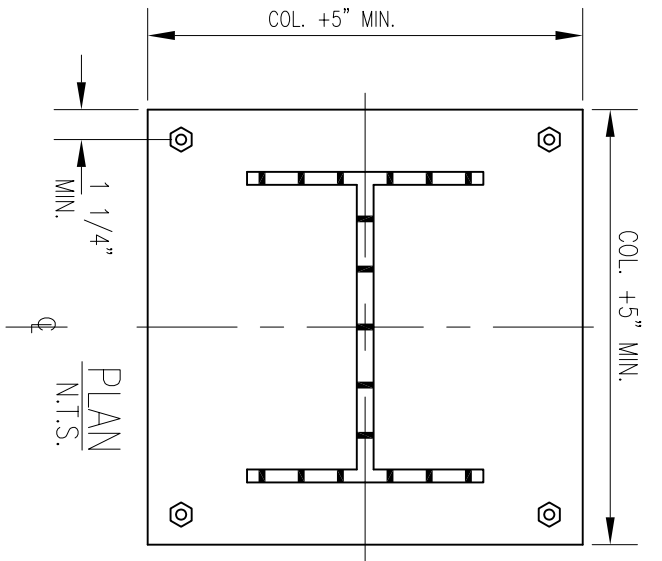
PLAN  
N.T.S.



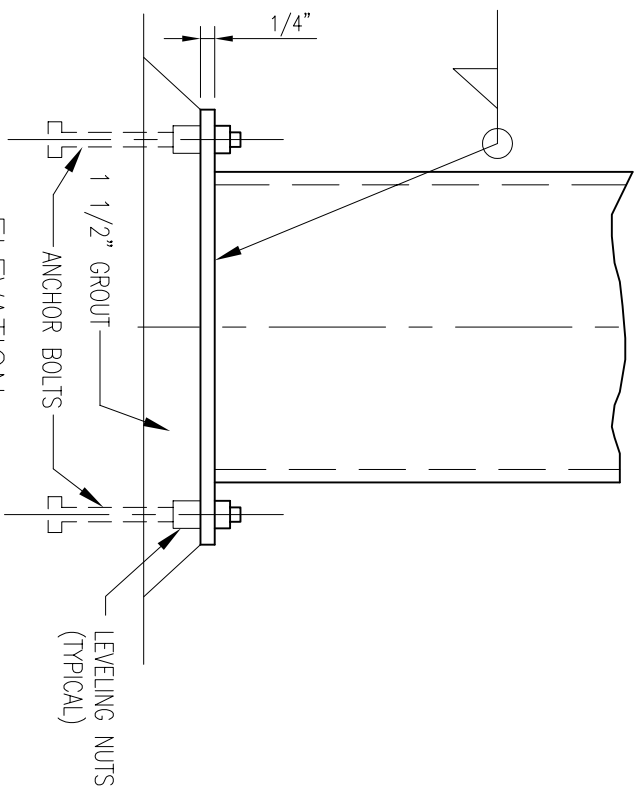
ELEVATION  
N.T.S.

- NOTES:
1. ANCHOR BOLTS SHALL BE STAINLESS STEEL, 3/4"φ X 12" LONG WITH STAINLESS STEEL NUTS UNLESS NOTED.
  2. GROUT SHALL BE NON-SHRINKING AS PER SPECIFICATIONS.
  3. THIS DETAIL SHALL GOVERN UNLESS OTHERWISE SHOWN ON THE PLANS.
  4. PLATE SHALL BE CONTINUOUSLY WELDED TO COLUMN.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4028



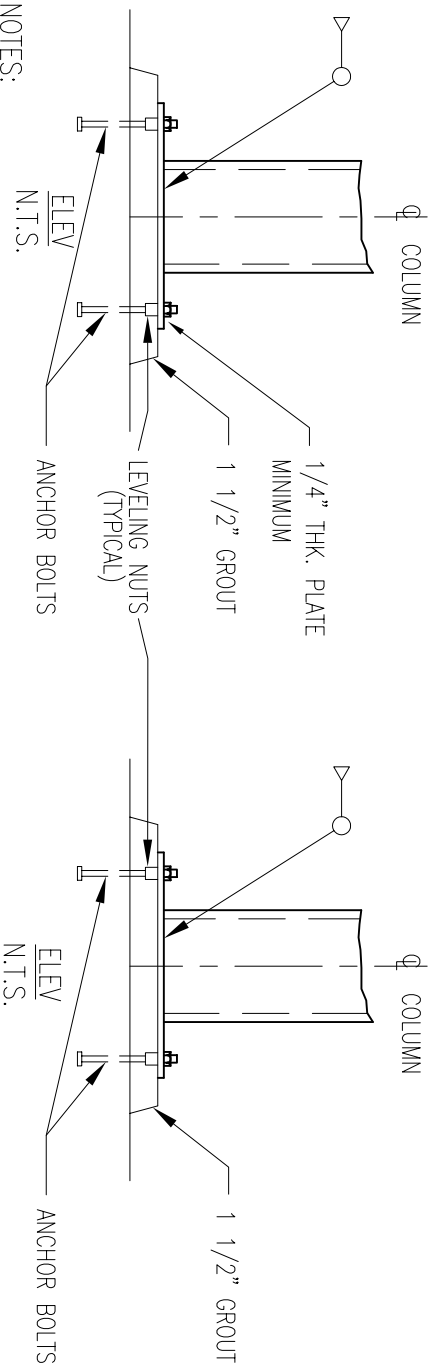
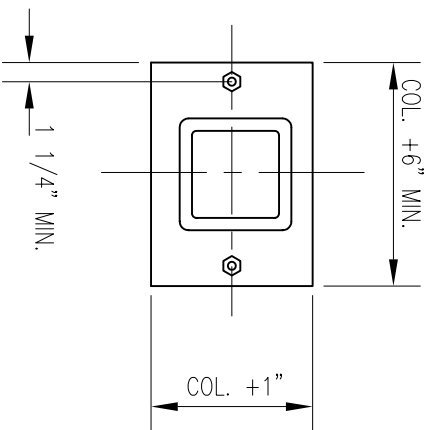
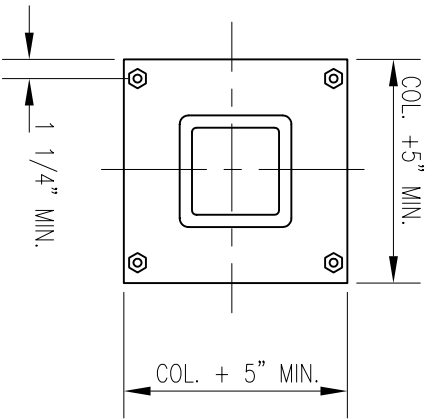
PLAN  
N.T.S.



ELEVATION  
N.T.S.

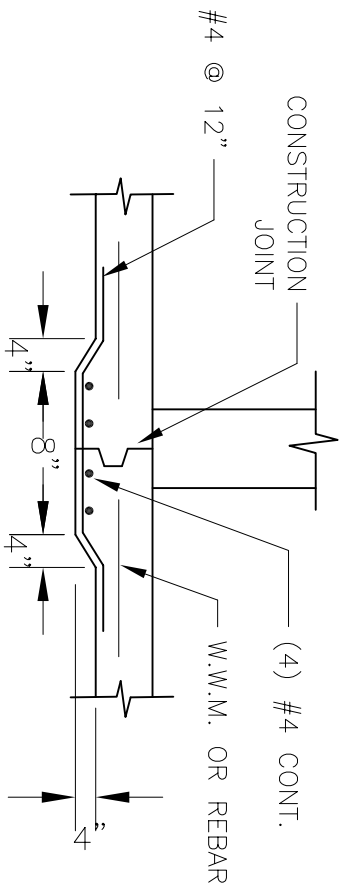
- NOTES:
1. ANCHOR BOLTS SHALL BE STAINLESS STEEL, 3/4"  $\phi$  X 12" LONG WITH STAINLESS STEEL NUTS UNLESS NOTED.
  2. GROUT SHALL BE NON-SHRINKING AS PER SPECIFICATIONS.
  3. THIS DETAIL SHALL GOVERN UNLESS OTHERWISE SHOWN ON THE PLANS.
  4. PLATE SHALL BE CONTINUOUSLY WELDED TO COLUMN.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		MISCELLANEOUS EQUIPMENT - WIDE FLANGE COLUMN BASE
APPROVED: _____		
STANDARD DRAWING NO. SD4029		



- NOTES:
1. ANCHOR BOLTS SHALL BE STAINLESS STEEL 3/4"Ø X 12" LONG WITH STAINLESS STEEL LEVELING NUTS UNLESS OTHERWISE NOTED.
  2. GROUT SHALL BE NON-SHRINK AS PER SPECIFICATIONS.
  3. THIS DETAIL SHALL GOVERN UNLESS OTHERWISE SHOWN ON PLAN.
  4. PLATE SHALL BE CONTINUOUSLY WELDED TO COLUMN.

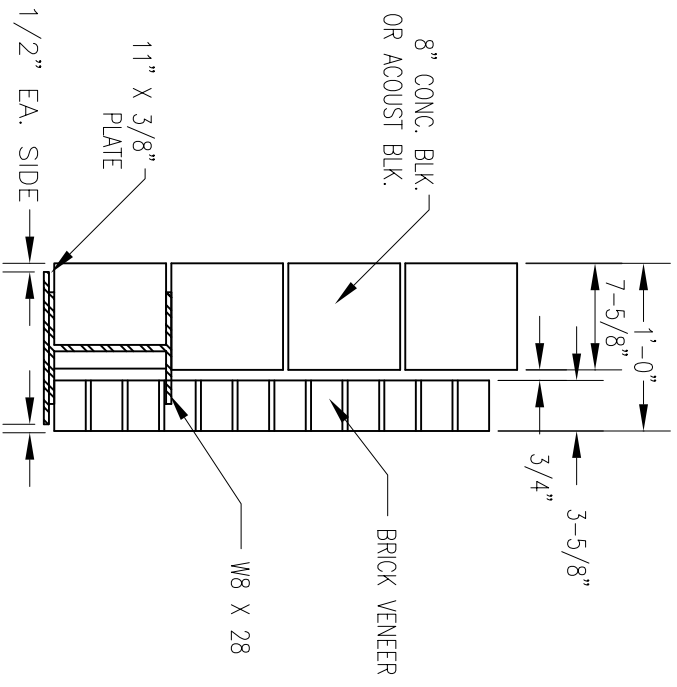
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		MISCELLANEOUS EQUIPMENT - TUBE COLUMN BASE
APPROVED: _____		STANDARD DRAWING NO. SD4030



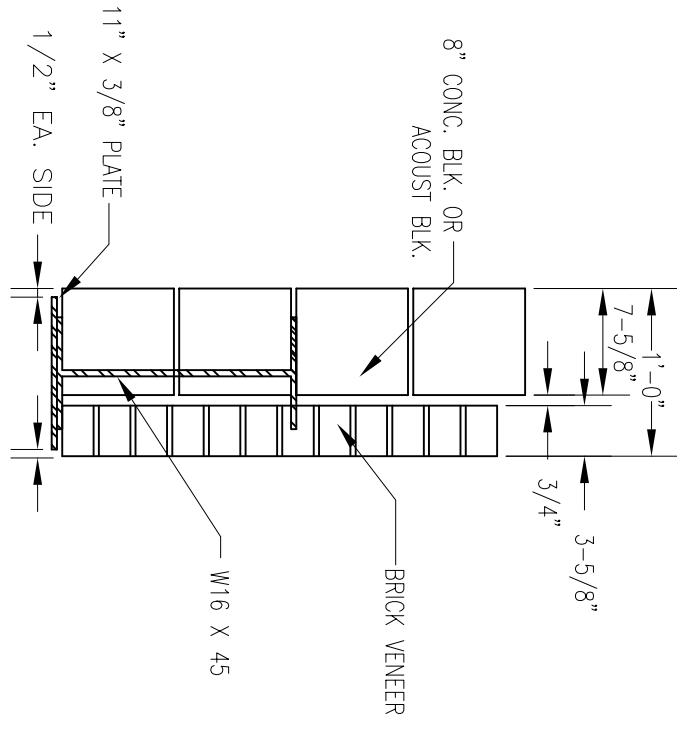
THICKENED SLAB  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL THICKENED SLAB DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD4031

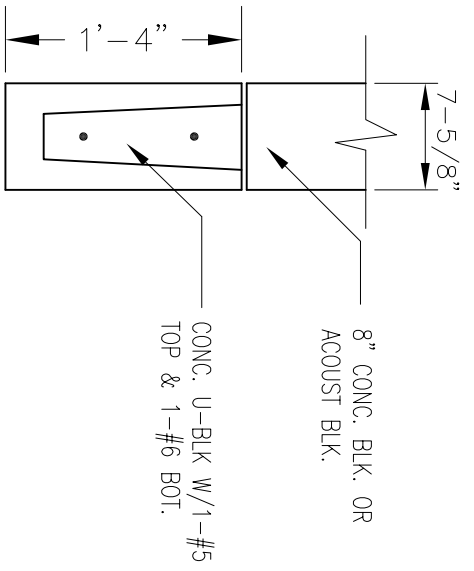




OPENINGS 4'-0" TO 8'-0"  
N.T.S.



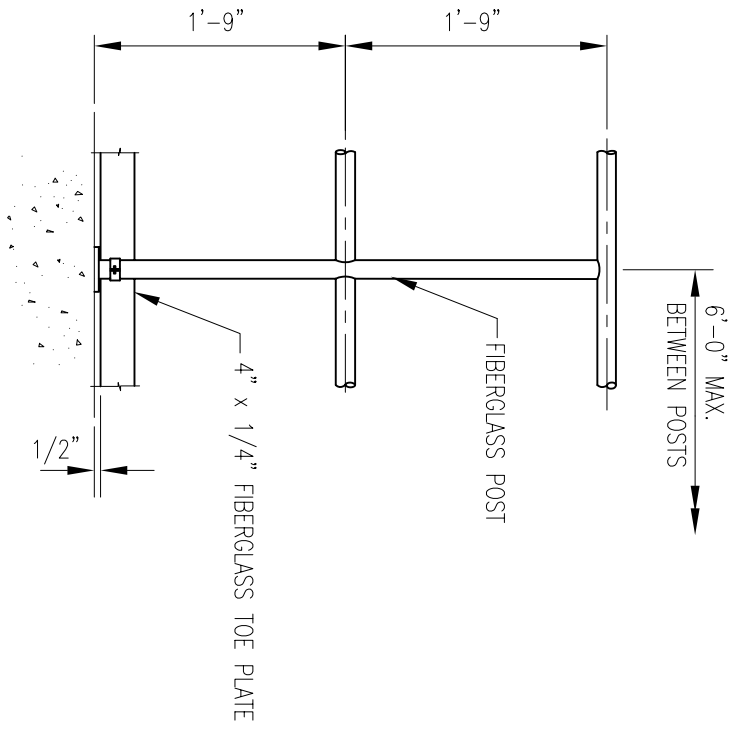
OPENING LARGER THAN 8'-0"  
N.T.S.



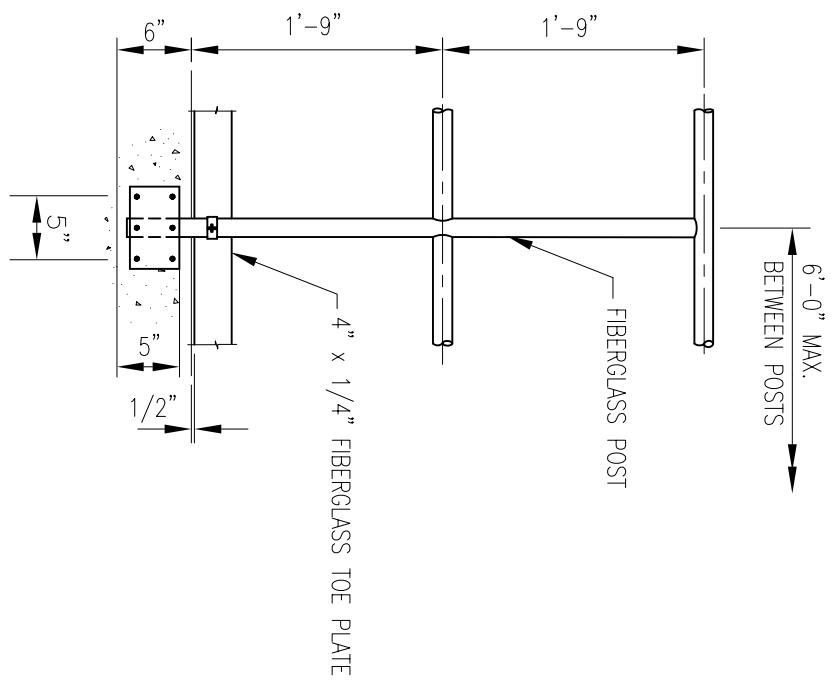
OPENING 4'-0" & SMALLER  
N.T.S.

- NOTES:
1. SEE STRUCTURAL FOR LINTEL PLACEMENT.
  2. ALL LINTELS SHALL BEAR 16" MINIMUM EACH END.
  3. FILL CELLS W/CONC. BELOW BEAM BEARING.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL LINTELS
APPROVED: _____		STANDARD DRAWING NO. SD4032

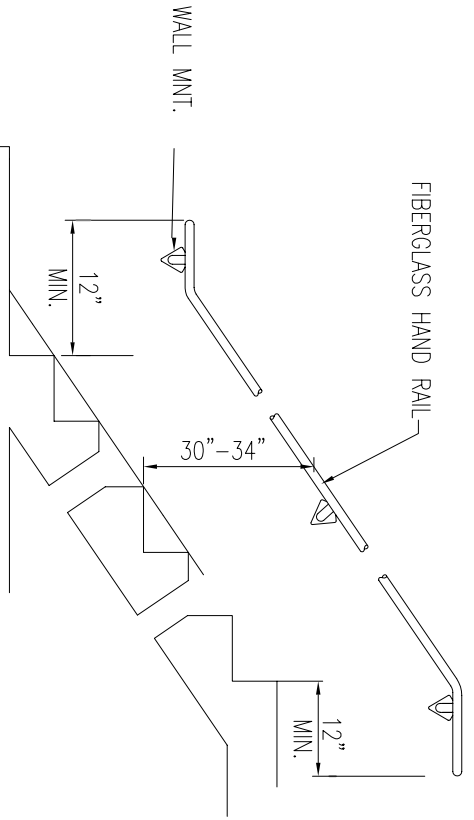


FLUSH-MOUNTED HANDRAIL  
N.T.S.

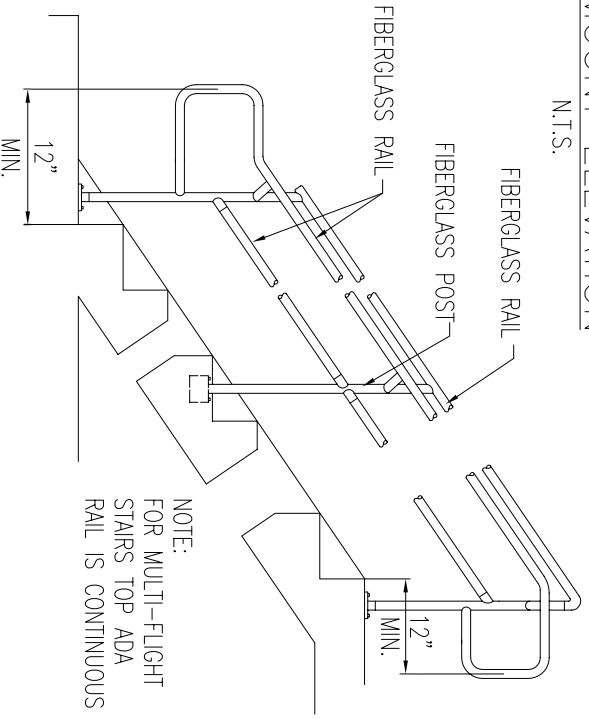
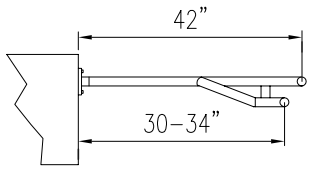


SIDE-MOUNTED HANDRAIL  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4034

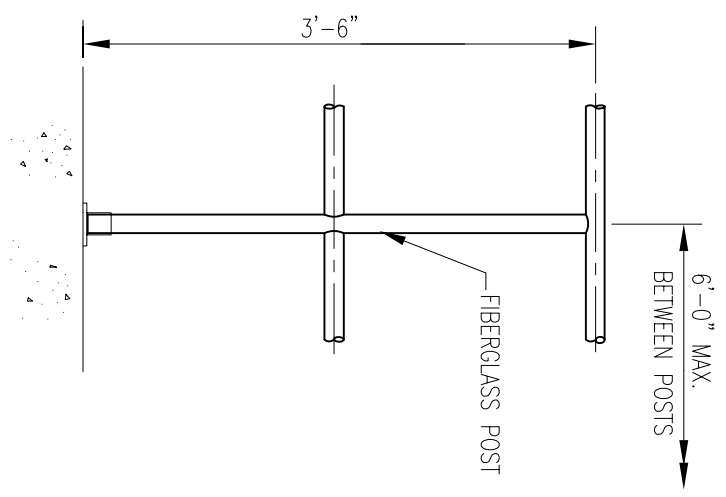


WALL MOUNT ELEVATION  
N.T.S.



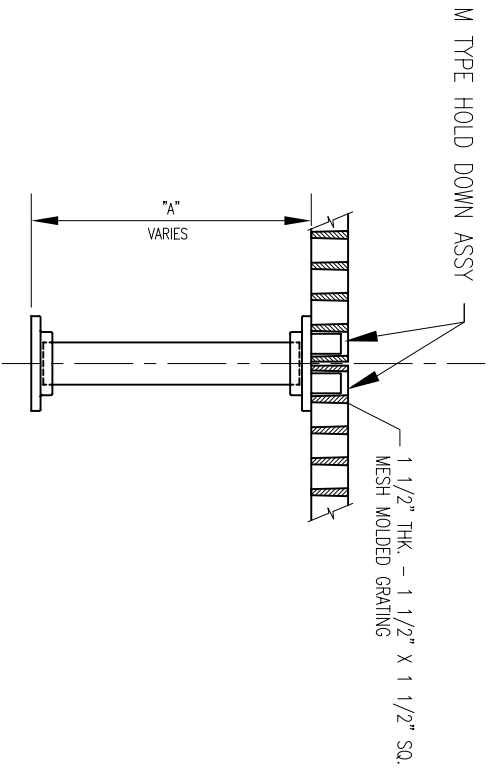
NOTE:  
FOR MULTI-FLIGHT  
STAIRS TOP ADA  
RAIL IS CONTINUOUS

TYPICAL HANDRAIL FOR STAIRS  
N.T.S.



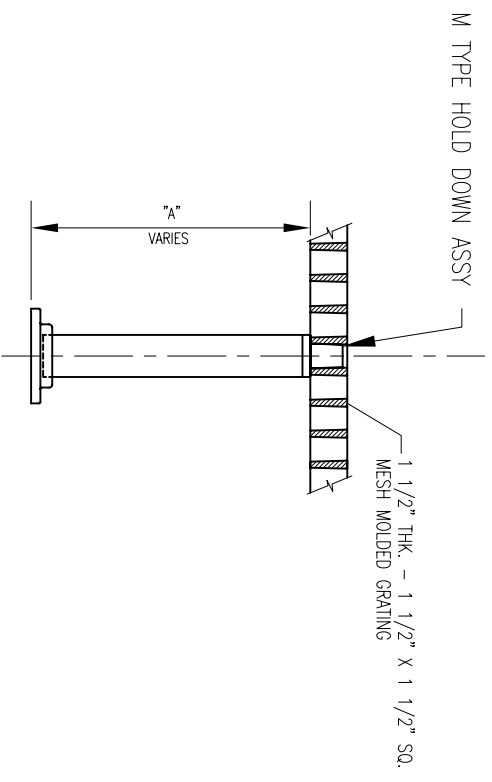
FLOOR MOUNT HANDRAIL  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL FIBERGLASS HANDRAILS AT STAIRS
APPROVED: _____		STANDARD DRAWING NO. SD4035



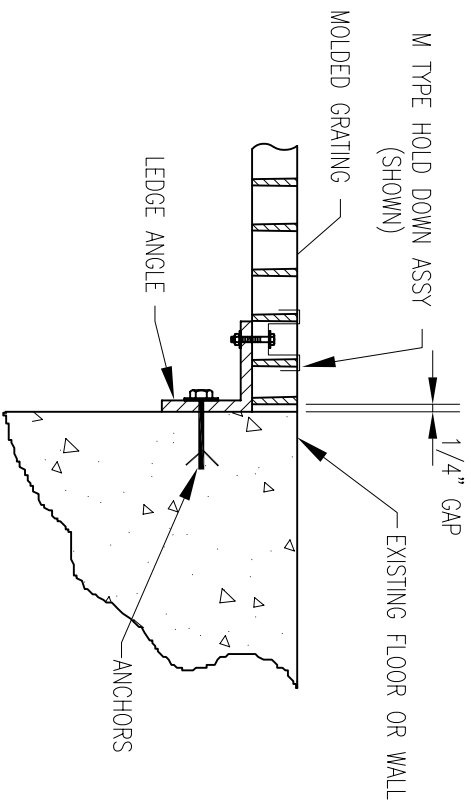
DOUBLE HEAD GRATING LEGS  
N.T.S.

NOTE:  
WHEN "A" EXCEEDS 24", CROSS BRACE LEGS AS REQUIRED

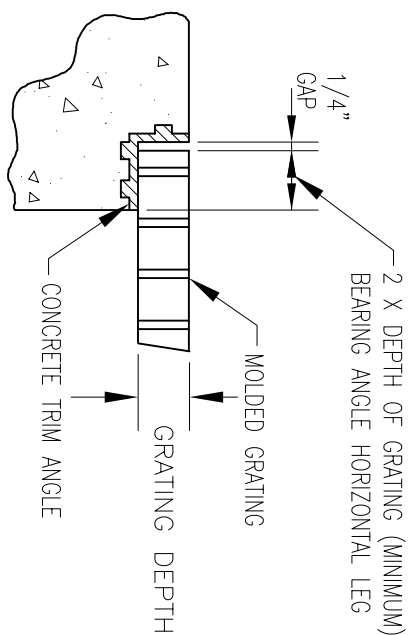


SINGLE HEAD GRATING LEGS  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL FIBERGLASS GRATING SUPPORT DETAILS
APPROVED: _____		STANDARD DRAWING NO. SD4036

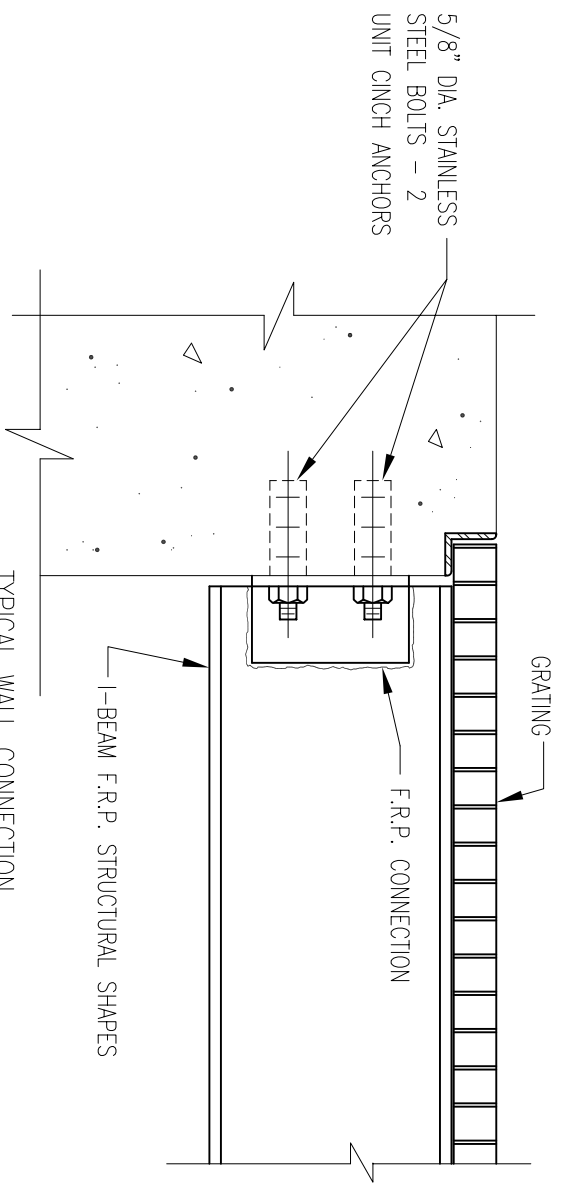


GRATING SUPPORT DETAIL  
N.T.S.

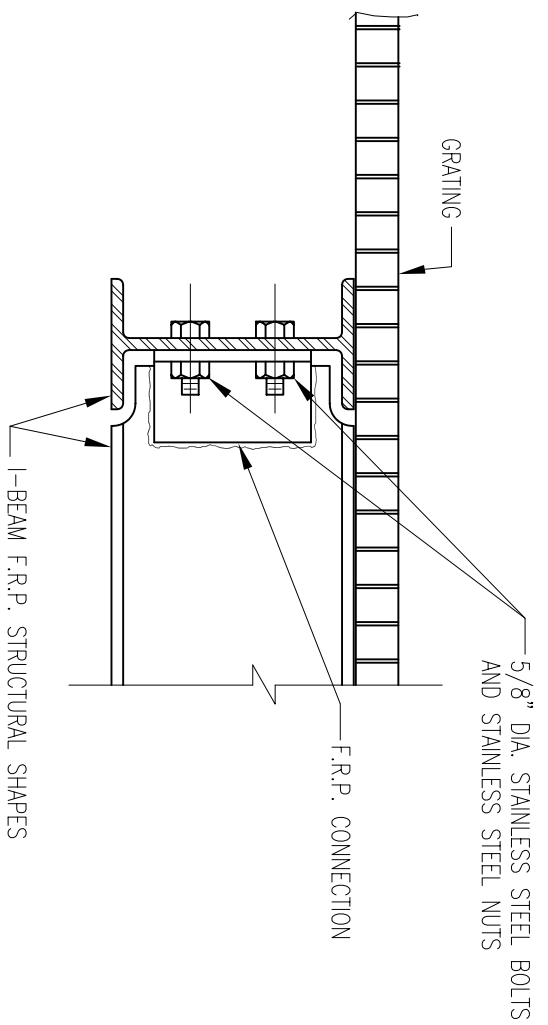


GRATING SUPPORT DETAIL  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4037



TYPICAL WALL CONNECTION  
 GRATING SUPPORT BEAMS  
 N.T.S.



TYPICAL INTERSECTION DETAIL  
 GRATING SUPPORT BEAMS  
 N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4038

# GENERAL STRUCTURAL NOTES

- 1.0 GENERAL
- 1.1 DESIGN CRITERIA
  - A. CODES:
    - BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318 LATEST EDITION).
    - SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDING (AISC LATEST EDITION).
    - STEEL JOIST INSTITUTE (SJI).
    - INTERNATIONAL BUILDING CODE (IBC)
  - B. DESIGN LIVE LOADS (PSF):
    - ELEVATED WALKWAYS, FLOORS, ETC.-- 150
    - FLOORS ON GRADE, SIDEWALKS, ETC.-- 150
    - WATER RETAINING STRUCTURES----- 63 PCF MINIMUM X MAX. HT. OF LIQUID
- 1.2 SUBMIT ALL SHOP DRAWINGS IN ACCORDANCE WITH APPLICABLE SUBMITTAL SECTIONS SHOWN IN SPECIFICATIONS.
- 1.3 ALL DETAILS SHOWN ARE TYPICAL. SIMILAR DETAILS APPLY TO SIMILAR CONDITIONS, UNLESS NOTED.
- 2.0 FOUNDATION
- 2.1 SOIL UNDER FOUNDATIONS SHALL HAVE THE FOLLOWING MINIMUM BEARING PRESSURE: 3000 PSF, EXCEPT AS NOTED BELOW.
- 2.2 COMPACTED FILL WITHIN BUILDING AND STRUCTURE AREAS (AND EXTENDING 10'-0" OUTSIDE THE EXTERIOR BUILDING LINE) SHALL MEET THE FOLLOWING REQUIREMENTS:
  - A. PLASTICITY INDEX LESS THAN 30.
  - B. MAXIMUM SIZE STONE 6 INCHES.
  - C. SOIL FREE OF ORGANICS AND DEBRIS.
  - D. PLACE IN 8 INCH LOOSE LIFTS.
  - E. COMPACT FILL MATERIAL TO 98 PERCENT OF STANDARD PROCTOR.
  - F. FIELD DENSITY TEST FOR EACH 2500 SQUARE FEET HORIZONTALLY AND TWO FEET VERTICALLY.
- 2.3 ALL FILL AND COMPACTION SHALL BE MONITORED BY A REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER OF THE STATE OF ALABAMA. RECORDS OF SUCH SHALL BE SUBMITTED FOR THE DESIGN ENGINEER'S RECORD.
- 2.4 SEE SPECIFICATION SECTION 3.0220 FOR FURTHER EARTHWORK REQUIREMENTS.
- 3.0 CONCRETE
- 3.1 CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
  - CLASS "A" - 4000 PSI - NORMAL WT.
  - CLASS "B" - 3000 PSI - NORMAL WT.

USE WITH STANDARD DWG. SD4040

- 3.2 ALL CONCRETE SHALL BE PROPORTIONED BY LABORATORY TRIAL BATCHES AND SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 3.0324.
- 3.3 REINFORCING BARS: ASTM A615 (LATEST REVISION), GRADE 60 TIES AND STIRRUPS: ASTM A615 (LATEST REVISION), GRADE 60 WELDED WIRE FABRIC: ASTM A185 (LATEST REVISION)
- 3.4 REINFORCING BAR PLACING ACCESSORIES IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE. WHERE CONCRETE IS EXPOSED IN FINISHED STRUCTURE, PROVIDE ACCESSORIES WITH RUSTPROOF LEGS.
- 3.5 DETAIL REINFORCEMENT IN ACCORDANCE WITH ACI 315. REINFORCEMENT SHALL NOT BE WELDED UNLESS NOTED OR APPROVED BY THE DESIGN ENGINEER.
- 3.6 ALL REINFORCEMENT LAPS, UNLESS OTHERWISE NOTED, SHALL BE CLASS "C" TENSION LAPS IN ACCORDANCE WITH ACI 318 (LATEST REVISION).
- 3.7 CONCRETE COVERAGE OF REINFORCEMENTS SHALL BE AS FOLLOWS UNLESS OTHERWISE INDICATED ON THE PLANS OR ORDERED BY THE ENGINEER:
  - SLABS, JOISTS, AND WALLS:
    - INTERIOR EXPOSURE-----1-1/2"
    - EXPOSED TO WEATHER OR LIQUID---3" FOR #5 BARS OR SMALLER
    - EXPOSED TO WEATHER OR LIQUID---3" FOR LARGER SIZES
  - BEAMS AND COLUMNS:
    - INTERIOR EXPOSURE-----1 1/2"
    - EXPOSED TO WEATHER OR LIQUID---3" FOR #5 BARS OR SMALLER
    - EXPOSED TO WEATHER OR LIQUID---3" FOR LARGER SIZES
  - FOOTINGS AND WALLS EXPOSED TO EARTH:
    - TOP ABOVE GRADE -----2"
    - FORMED SIDES AND BOTTOMS CAST ON WORKMAT-----3"
    - UNFORMED SIDES, AND BOTTOMS CAST AGAINST EARTH-----3"
- 3.8 ALL BENDS, UNLESS NOTED OR SHOWN OTHERWISE, SHALL BE 90 DEGREE STANDARD HOOK IN ACCORDANCE WITH ACI 318 (LATEST REVISION).
- 3.9 WALL CORNER AND WALL INTERSECTION REINFORCING SHALL BE AS INDICATED IN THE TYPICAL STRUCTURAL DETAILS, UNLESS NOTED OR SHOWN OTHERWISE. IN GENERAL HORIZONTAL WALL REINFORCING SHALL LAP TO CORNER REINFORCING.
- 3.10 ALL FOUNDATION SLABS AND FOOTINGS SHALL BE INSTALLED ON CRUSHED STONE MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 3.0200. CRUSHED STONE MATERIAL SHALL BE INSTALLED ON UNDISTURBED EARTH OR COMPACTED BACKFILL (AS SPECIFIED IN SPECIFICATION SECTION 3.0222), TO A MINIMUM DEPTH OF 6" AND TO 1'-0" HORIZONTALLY OUTSIDE THE FOUNDATION SLAB OR FOOTING, UNLESS NOTED OTHERWISE.

DATE	REVISIONS	
MAY 2006		JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
APPROVED: _____		GENERAL STRUCTURAL NOTES SHEET 1
		STANDARD DRAWING NO. SD4039

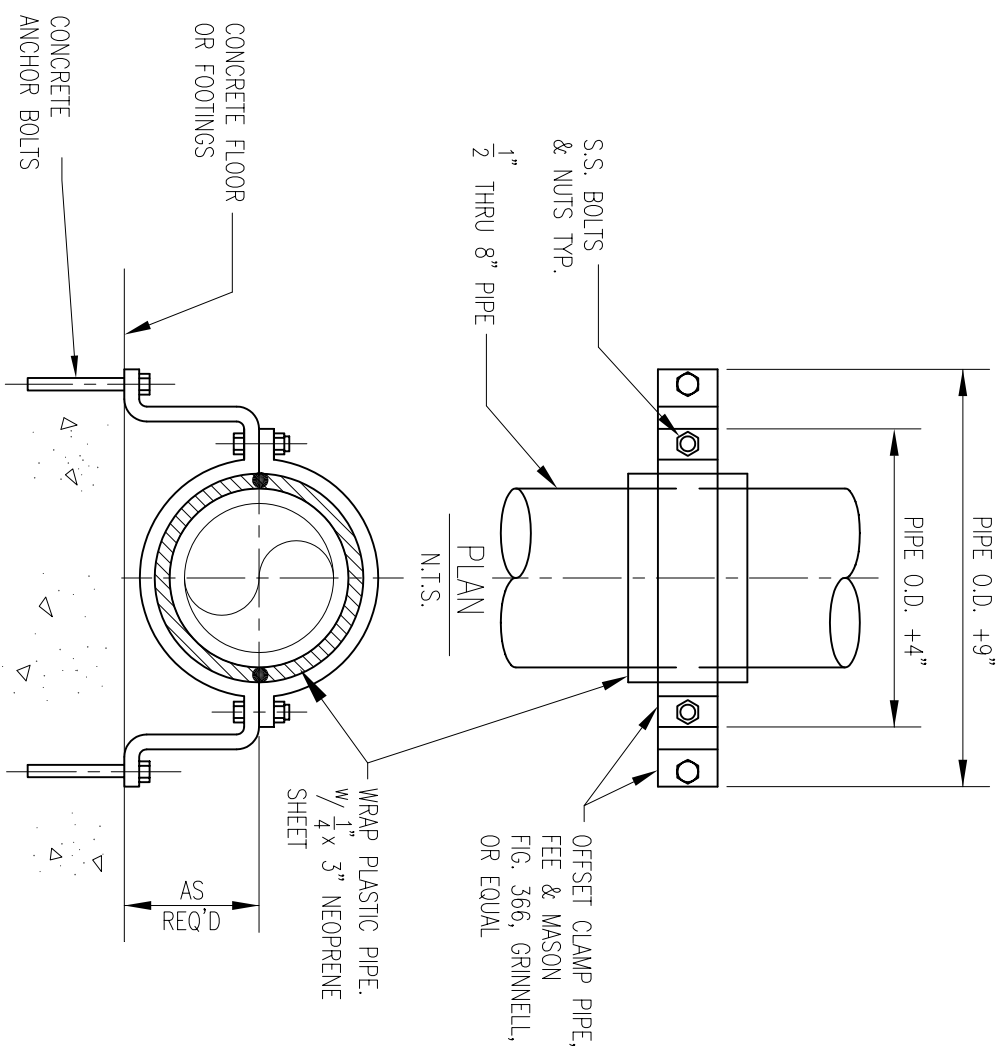
NOTES (CONTD) :

- 3.11 CONTINUOUS 3-BULB WATER STOP, AS SPECIFIED, SHALL BE INSTALLED IN ALL CONSTRUCTION JOINTS IN WALLS OF WATER RETAINING BASINS, TANKS, AND CHANNELS, EXCEPT WHERE SPECIFICALLY NOTED TO BE OMITTED.
- 3.12 NO BACKFILL SHALL BE PLACED AGAINST ANY SUBGRADE STRUCTURE WALLS UNTIL WALLS HAVE ATTAINED SPECIFIED STRENGTH.
- 3.13 NO BACKFILL SHALL BE PLACED AGAINST ANY WATER RETAINING STRUCTURE WALL UNTIL THE BASIN, TANK, OR CHANNEL HAS BEEN HYDROSTATICALLY TESTED BY FILLING WITH CLEAN WATER TO THE MAXIMUM WATER SURFACE ELEVATION IN THE STRUCTURE, AND HAS BEEN APPROVED BY THE ENGINEER FOR BACKFILLING.
- 3.14 EXPANSION BOLTS INTO CONCRETE SHALL BE WEDGE ANCHORS EQUAL TO "WJ-II CONCRETE ANCHORS", PHILLIPS' "RED HEAD" TYPE WS, HILTI OR MOLLY "PARABOLT" CONCRETE ANCHORS.
- 4.0 STRUCTURAL STEEL
- 4.1 STRUCTURAL STEEL: ASTM A36.
- 4.2 WELDED CONNECTIONS: E70XX ELECTRODES, MINIMUM SIZE FILLET WELD 3/16".
- 4.3 BOLTED CONNECTIONS: BEARING TYPE A325-N, IN ACCORDANCE WITH AISC "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS." BOLTS THROUGH 4" WIDE BEAM FLANGES SHALL BE 5/8" DIAMETER. OTHER BOLTS SHALL BE 3/4" DIAMETER.
- 4.4 ALL STRUCTURAL STEEL CONNECTIONS NOT SPECIFICALLY DETAILED ON THE DRAWINGS SHALL BE DESIGNED TO RESIST FORCES INDICATED BY THE CONTRACTOR, UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF ALABAMA.
- 4.5 ALL BEAM CONNECTIONS SHALL BE AISC TYPE 2 "SIMPLE FRAMING" CONNECTIONS. WHERE BEAM REACTIONS ARE NOT SHOWN ON THE DRAWINGS THE CONNECTIONS SHALL BE DESIGNED FOR THE MAXIMUM UNIFORM LOAD THE BEAM WILL SUPPORT (AS SIMPLE BEAM) FOR SPAN SHOWN ON THE DRAWING.
- 4.6 FABRICATE AND ERECT ALL STRUCTURAL STEEL IN ACCORDANCE WITH AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS" (LATEST EDITION)
- 4.7 WHERE STEEL BEAMS ARE CONTINUOUS OVER COLUMNS, PROVIDE WEB STIFFENER PLATES EACH SIDE OF BEAM WEB, OF THICKNESS EQUAL TO BEAM FLANGE THICKNESS, LOCATED IN ALIGNMENT WITH COLUMN WEB OR FLANGES OR CENTER LINE OF TUBES AND PIPE COLUMNS, UNLESS NOTED.
- 4.8 FABRICATE CROSS BRACING WITH SUFFICIENT DRAW TO PREVENT SAGGING.
- 4.9 THE STEEL FRAME IS "NON-SELF-SUPPORTING." ADEQUATE TEMPORARY SUPPORT MUST BE PROVIDED BY THE CONTRACTOR UNTIL REQUIRED CONNECTIONS OR ELEMENTS ARE IN PLACE.
- 5.0 STEEL JOISTS
- 5.1 DESIGN, FABRICATE AND ERECT STEEL JOISTS IN ACCORDANCE WITH THE STEEL JOIST INSTITUTE "STANDARD SPECIFICATIONS AND LOAD TABLES."
- 5.2 AT JOISTS PARALLEL TO MASONRY WALLS, ANCHOR BRIDGING ROWS TOP AND BOTTOM BY WELDING TO HOOKED BAR 2" X 1/4" EMBEDDED IN THE WALL, UNLESS NOTED.
- 6.0 MASONRY
- 6.1 DESIGN AND CONSTRUCTION SHALL CONFORM TO THE SPECIFICATION OF THE NATIONAL CONCRETE MASONRY ASSOCIATION AND ACI 530.
- 6.2 MINIMUM MASONRY UNIT STRENGTH SHALL BE 2800 PSI (F'W 2000 PSI).
- 6.3 MORTAR SHALL BE TYPE N OR S.
- 6.4 ALL BLOCK CELLS AND CAVITIES BELOW GRADE SHALL BE FILLED WITH CONCRETE.
- 6.5 LINTELS AT OPENING IN MASONRY WALLS:  
 AT SPANS LESS THAN 4'-0" IN CONCRETE BLOCK, PROVIDE CONCRETE CAST IN CHANNEL BLOCK OF SAME WIDTH AS WALL BLOCK, REINFORCED WITH 1 #6 BOTTOM AND 1 #5 TOP.  
 AT SPANS GREATER THAN 4'-0" AND LESS THAN 8'-0" PROVIDE W8 X 28 STEEL LINTEL. AT SPANS 8'-0" OR GREATER PROVIDE W16 X 45 STEEL LINTEL WITH 11" X 3/8" STEEL PLATE UNDER BOTTOM FLANGE.  
 ALL LINTELS SHALL BEAR 16" MIN. ON EACH END (SEE STANDARD DWG. SD4032).
- 6.6 AT LINTELS AND BEAMS SPANNING MORE THAN 6'-0", FILL CELLS OF MASONRY WITH CONCRETE UNDER BEARING ENDS, FROM FOUNDATION TO LINTEL OR BEAM.
- 7.0 METAL DECK
- 7.1 TYPE "B" STEEL ROOF DECK, 22 GAUGE, 1-1/2" DEEP, GALVANIZED.

USE WITH STANDARD DWG. SD4039

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		GENERAL STRUCTURAL NOTES SHEET 2
APPROVED: _____		STANDARD DRAWING NO. SD4040





SECTION  
N.T.S.

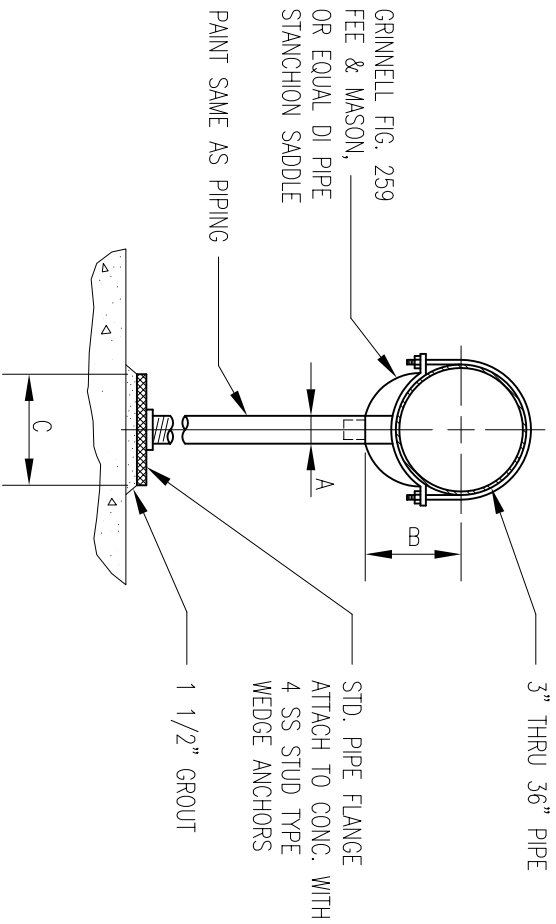
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT	
MAY 2006		OFFSET CLAMP PIPE SUPPORT	
APPROVED: _____			
		STANDARD DRAWING NO. SD4060	

DIMENSION TABLE

PIPE SIZE	A	B	C
3"	3"	4 3/16"	9"
4"	3"	4 3/16"	9"
5"	3"	4 13/16"	9"
6"	3"	5 7/16"	9"
8"	3"	6 15/16"	9"
10"	3"	8 7/16"	9"
12"	3"	9 15/16"	9"
14"	4"	10 15/16"	11"
16"	4"	12 3/8"	11"
18"	4"	13 7/8"	11"
20"	6"	15 3/8"	13 1/2"
22"	6"	16 5/8"	13 1/2"
24"	6"	17 15/16"	13 1/2"
26"	6"	19 1/8"	13 1/2"
30"	6"	21 5/16"	13 1/2"
32"	6"	22 1/2"	13 1/2"
36"	8"	24 1/2"	16"

NOTES

1. FOR BASE, HEIGHT AND FLANGE DIMENSIONS, SEE TABLE.
2. FOR 3" SIZE PIPE, U-BOLT MUST HAVE EXTRA 1" OF THREAD TO TIGHTEN SECURELY.

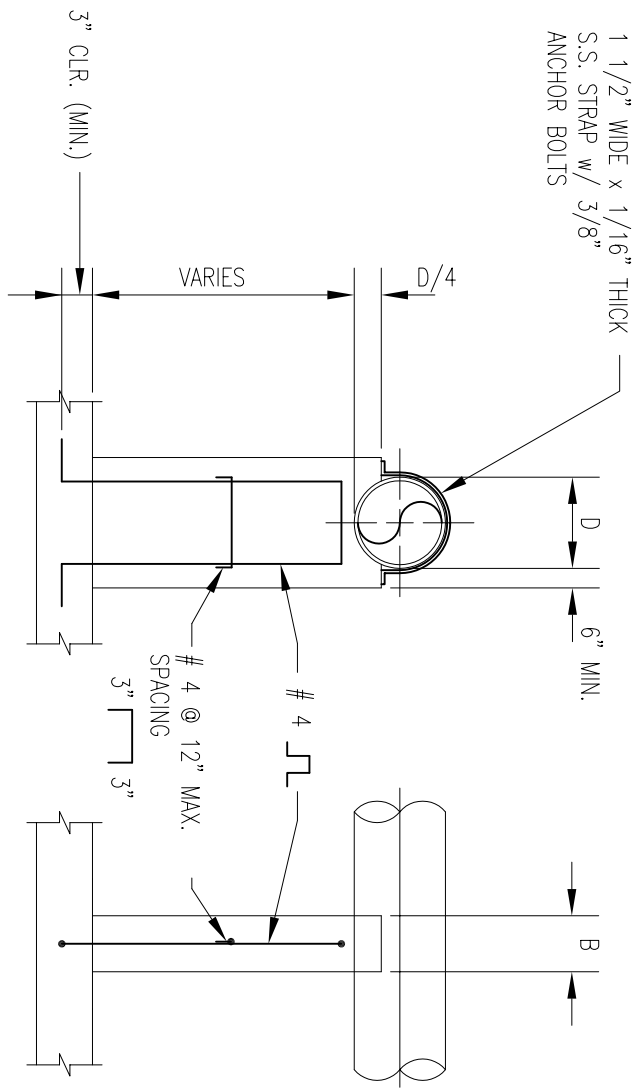


STANCHION SADDLE  
PIPE SUPPORT DETAIL

N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		STANCHION SADDLE PIPE SUPPORT
APPROVED: _____		STANDARD DRAWING NO. SD4061

B = 8" WHEN D ≤ 24"  
 B = 10" WHEN 42" ≥ D > 24"  
 B = 12" WHEN D > 42"



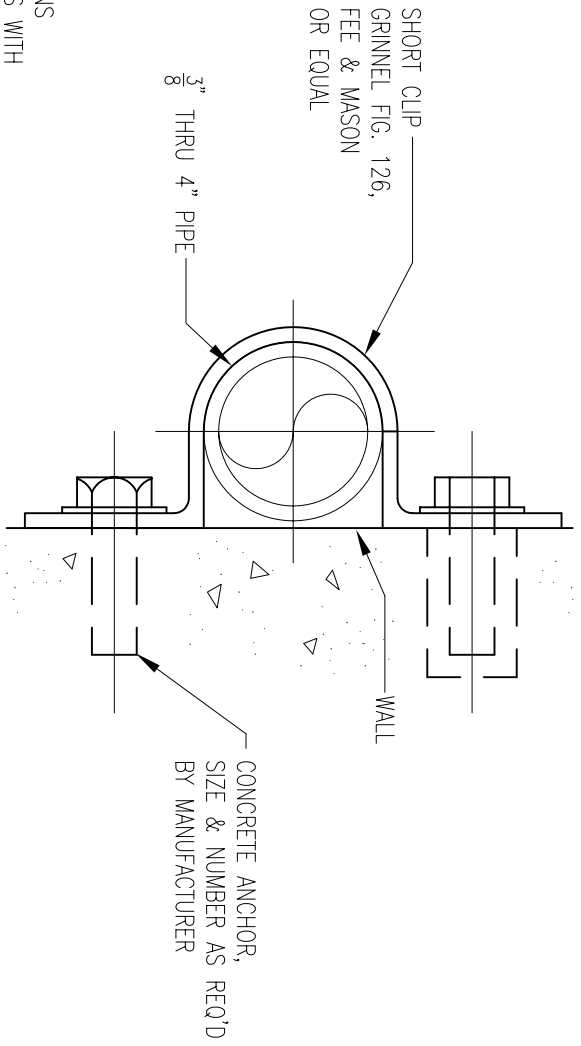
- NOTES:
1. FOR B = 12" USE 2 LAYERS OF REINFORCING, 1-1/2" CLR. EACH FACE (DOUBLE REINFORCING SHOWN).
  2. PROVIDE CONCRETE SUPPORT @ EACH JOINT OR 10' O.C. MAX.

CONCRETE SADDLE PIPE SUPPORT DETAIL

N.T.S.

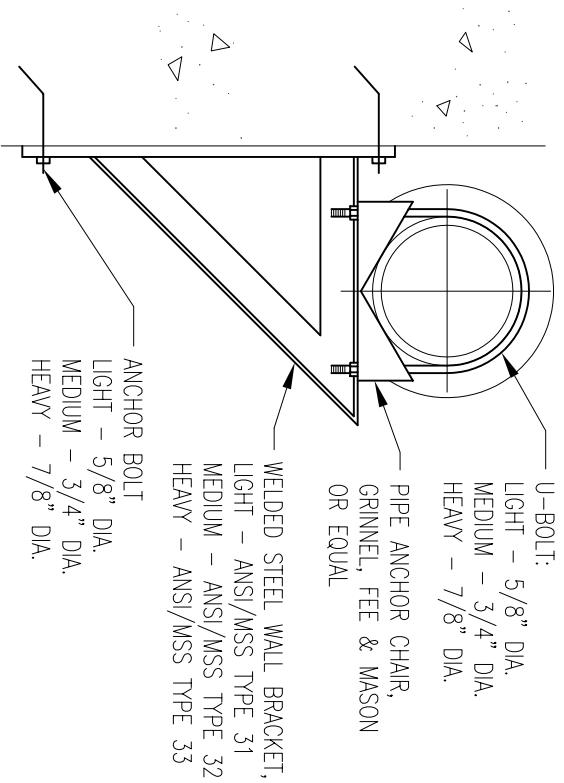
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		CONCRETE SADDLE PIPE SUPPORT
APPROVED: _____		STANDARD DRAWING NO. SD4062

- NOTES:
1. SPACE SUPPORTS TO SUIT LOAD.
  2. ON STEEL COLUMNS SECURE SUPPORTS WITH STAINLESS STEEL NUTS AND BOLTS AS REQUIRED.



PIPE STRAP SUPPORT  
N.T.S.

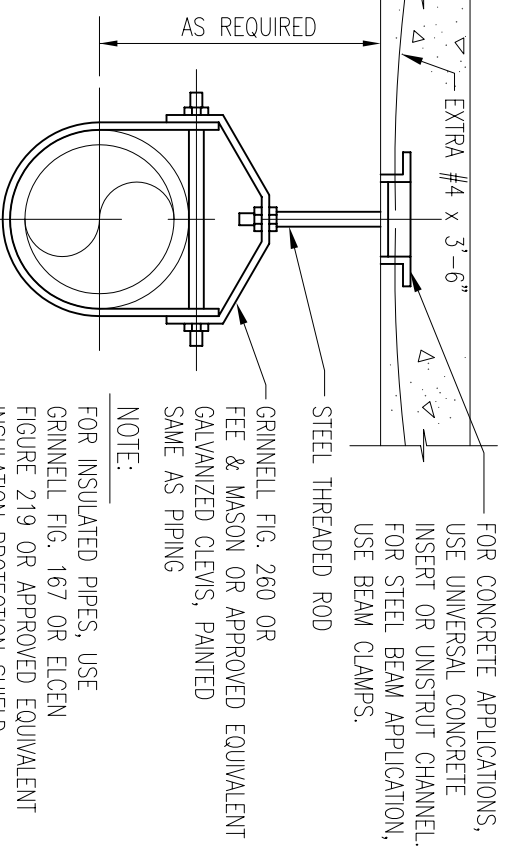
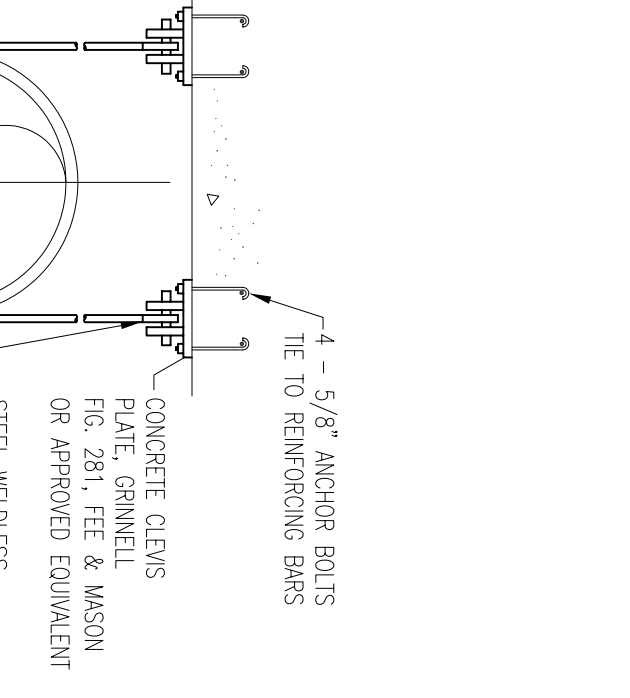
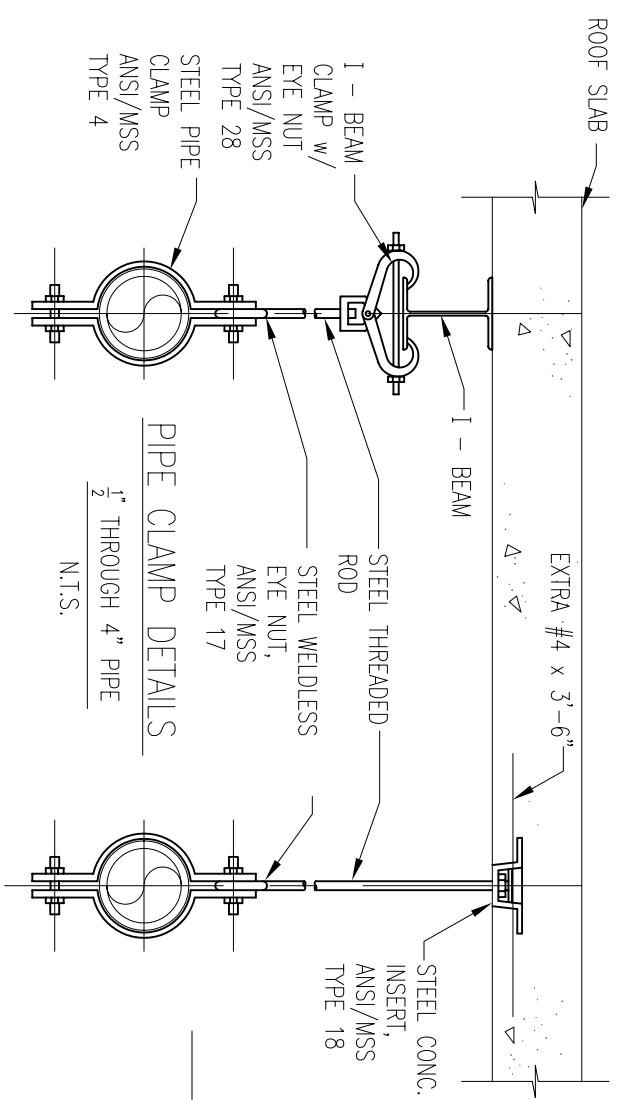
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		PIPE STRAP SUPPORT
APPROVED: _____		STANDARD DRAWING NO. SD4064



TYPICAL PIPE BRACKET DETAIL  
N.T.S.

PIPE SIZE	TYPE OF BRACKET	MAXIMUM SPACING (O.C.)
4"	LIGHT	12'-0"
6"	LIGHT	12'-0"
8"	MEDIUM	12'-0"
10"	MEDIUM	12'-0"
12"	MEDIUM	12'-0"
14"	MEDIUM	10'-0"
16"	HEAVY	10'-0"
18"	HEAVY	10'-0"
20"	HEAVY	10'-0"
24"	HEAVY	8'-0"

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		TYPICAL PIPE BRACKET DETAIL
		STANDARD DRAWING NO. SD4065



FOR CONCRETE APPLICATIONS,  
 USE UNIVERSAL CONCRETE  
 INSERT OR UNISTRUT CHANNEL.  
 FOR STEEL BEAM APPLICATION,  
 USE BEAM CLAMPS.

NOTE:  
 FOR INSULATED PIPES, USE  
 GRINNELL FIG. 167 OR ELCEN  
 FIGURE 219 OR APPROVED EQUIVALENT  
 INSULATION PROTECTION SHIELD.

PIPE HANGER DETAIL  
 4" THROUGH 20" PIPE  
 N.T.S.

TRAPEZE DETAIL  
 FOR 24" AND LARGER PIPE  
 N.T.S.

USE WITH STANDARD DWG. SD4067

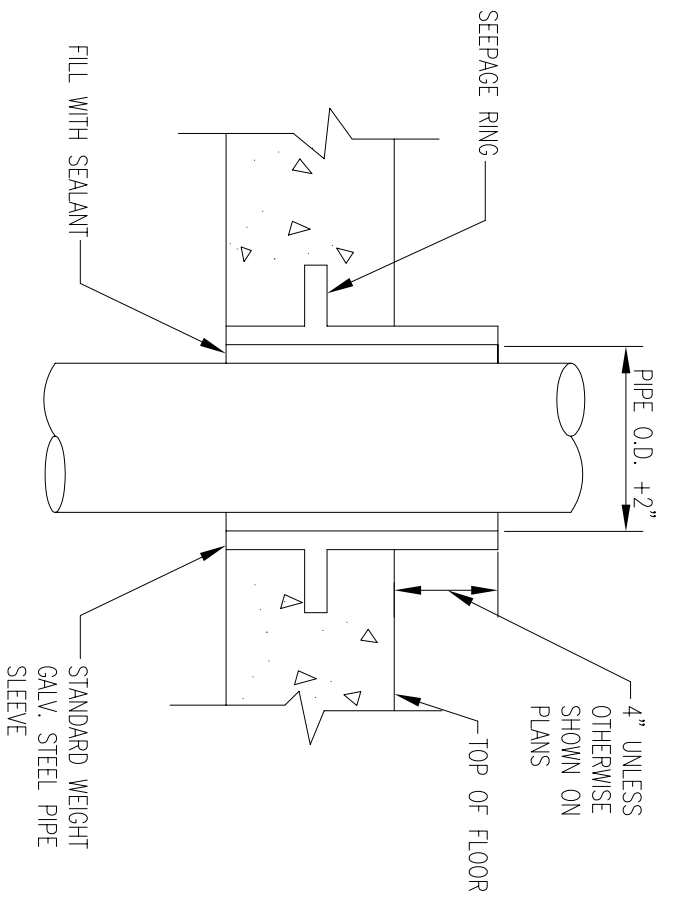
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TRAPEZE PIPE HANGER DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD4066

PIPE SIZE	PIPE ATTACHMENT	ROD SIZE	NUMBER OF RODS PER 20' INTERVAL	
			BEAM CLAMP	CONC. INSERT
4"	PIPE CLAMP OR HANGER	5/8"	3	3
6"	PIPE CLAMP OR HANGER	3/4"	2	2
8"	PIPE CLAMP OR HANGER	7/8"	2	2
10"	PIPE CLAMP OR HANGER	7/8"	2	2
12"	PIPE CLAMP OR HANGER	7/8"	2	2
14"	PIPE CLAMP OR HANGER	1"	3	3
16"	PIPE CLAMP OR HANGER	1"	3	3
18"	PIPE CLAMP OR HANGER	1"	3	4

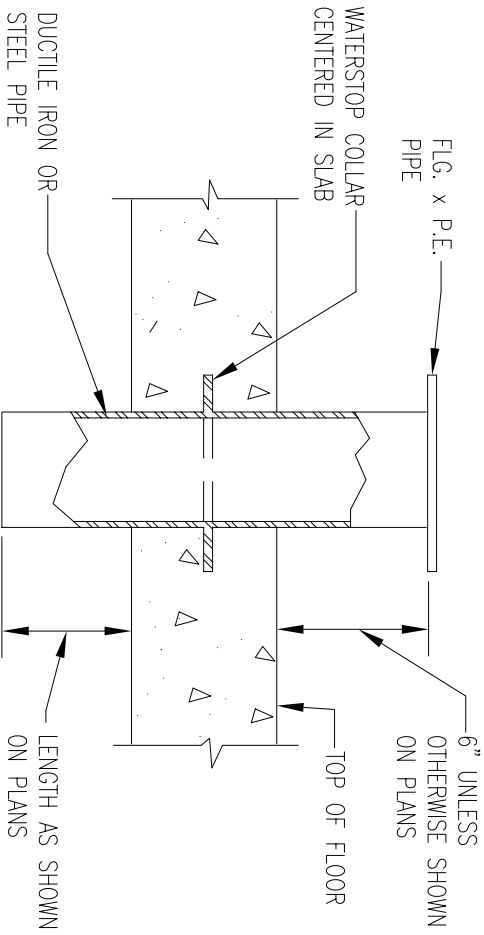
NOTE: TOTAL LOADING ON EACH CONCRETE INSERT OR OTHER TYPE HANGER ROD ANCHOR SHALL NOT EXCEED MANUFACTURER'S RECOMMENDED LOADING.  
FOR LARGE DIA. PIPES A TRAPEZE MAY BE SUBSTITUTED TO REDUCE THE NUMBER OF HANGERS.

USE WITH STANDARD DWG. SD4066

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4067



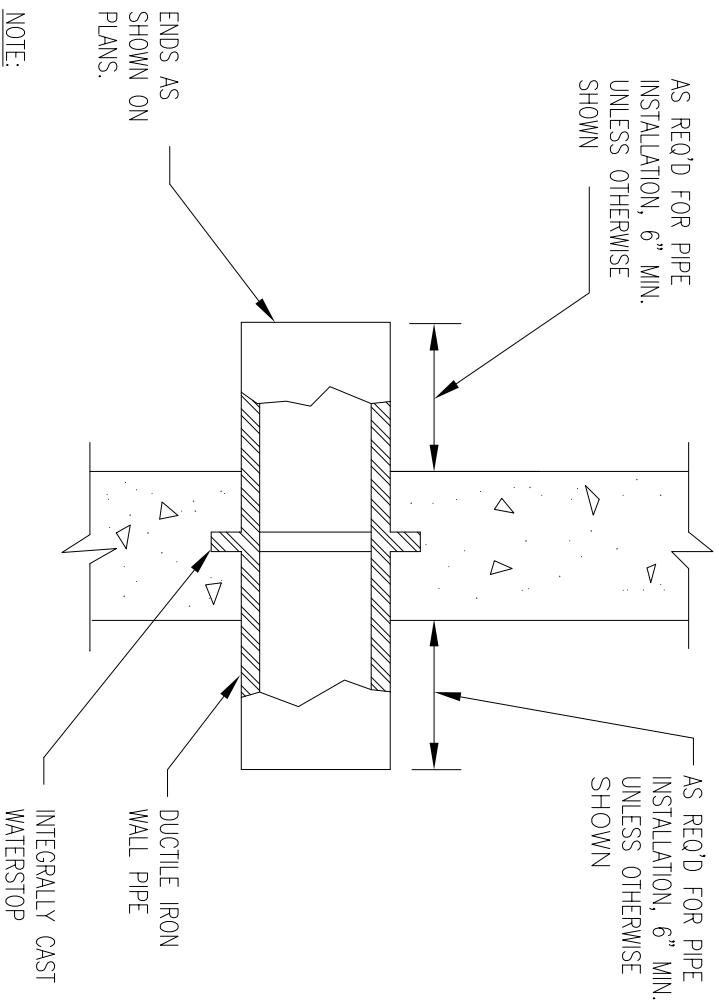
TYPE "B" FLOOR PIPE DETAIL  
N.T.S.



TYPE "A" FLOOR PIPE DETAIL  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4068

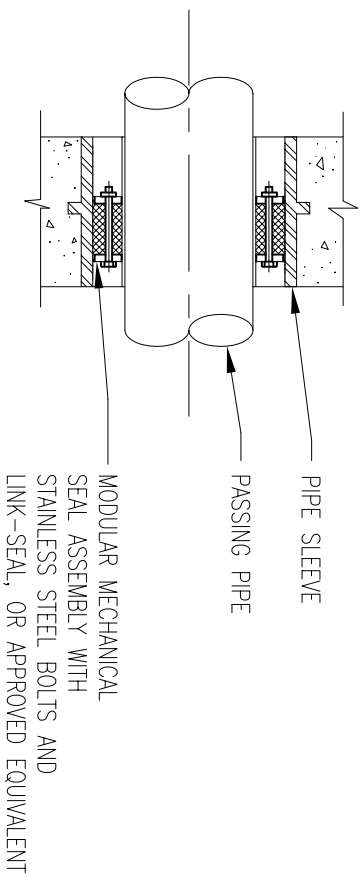




NOTE:  
 COAT WALL PIPE WITH SPECIFIED  
 PAINT SYSTEM PRIOR TO  
 CONCRETE PLACEMENT

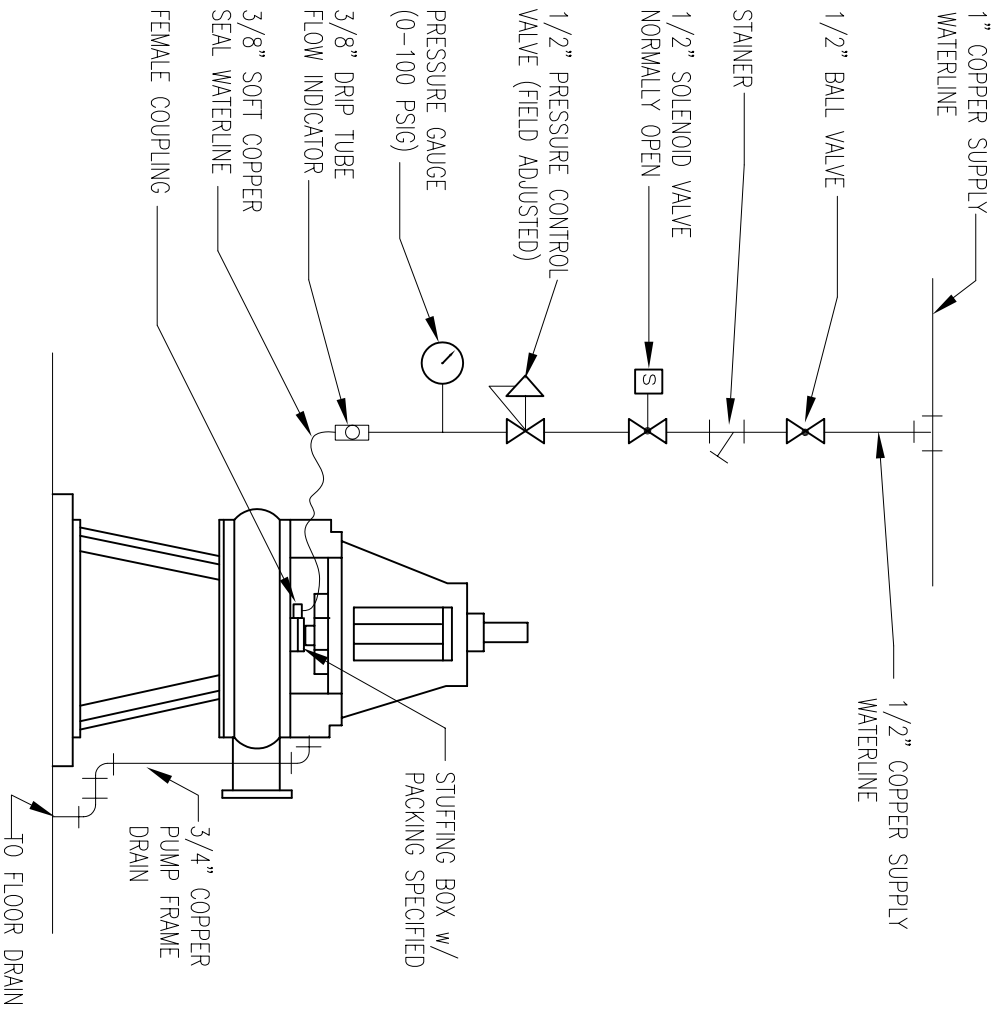
DUCTILE IRON PIPE  
 N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL WALL PIPE DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD4069



WALL AND FLOOR PENETRATION SEAL DETAIL  
N.T.S.

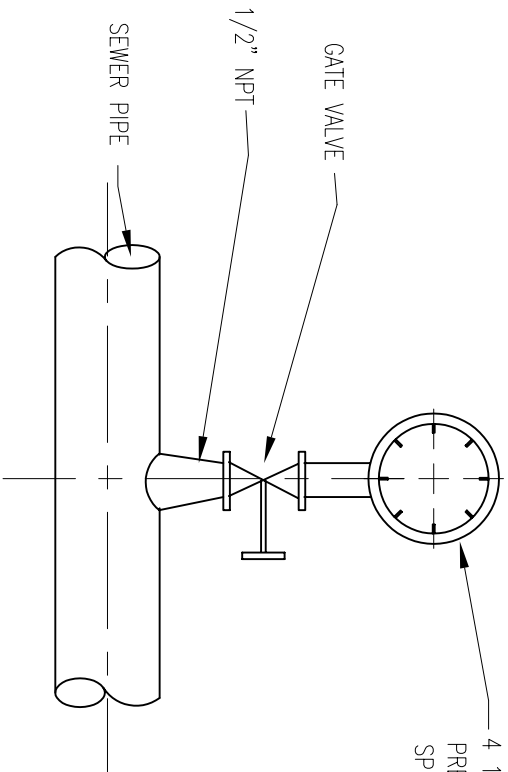
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4070



VERTICAL CENTRIFUGAL PUMP SEAL WATER PIPING

N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		VERTICAL CENTRIFUGAL PUMP SEAL WATER PIPING
APPROVED: _____		STANDARD DRAWING NO. SD4071



4 1/2" LIQUID FILLED DIAPHRAM TYPE  
 PRESSURE GAUGE SEE STANDARD  
 SPECIFICATION 3.1550

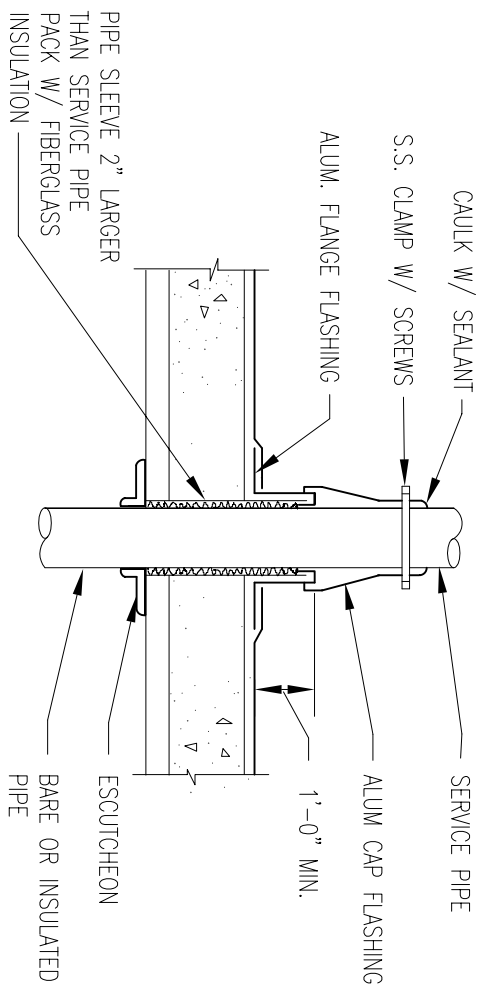
PRESSURE GAUGE MOUNTING DETAIL

N.T.S.

NOTES:

1. FOR GALVANIZED STEEL AND PVC 3" AND SMALLER  
 USE A BUSHING IN A TEE.
2. FOR DUCTILE IRON PIPE AND C-900 PVC PIPE, ALL SIZES,  
 USE PIPE SADDLE WITH BUSHING.
3. PROVIDE SNUBBER FOR POSITIVE DISPLACEMENT  
 PUMP INSTALLATIONS.
4. STANDARD WEIGHT NIPPLES.

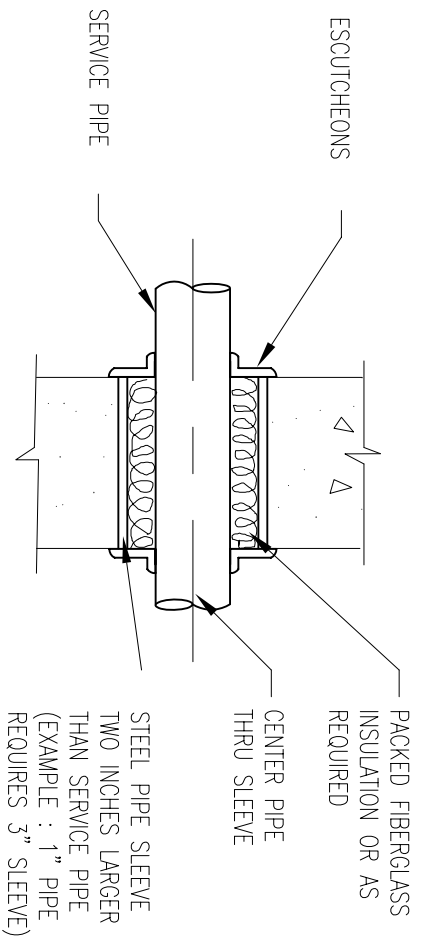
DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4072



ROOF PENETRATION DETAIL

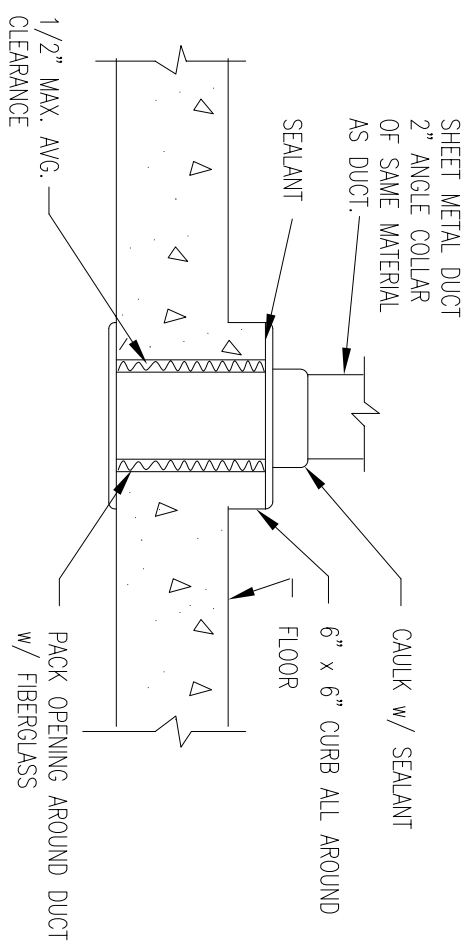
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4073



PIPE PENETRATION THRU MECHANICAL ROOM WALLS  
AND FLOORS DETAIL  
N.T.S.

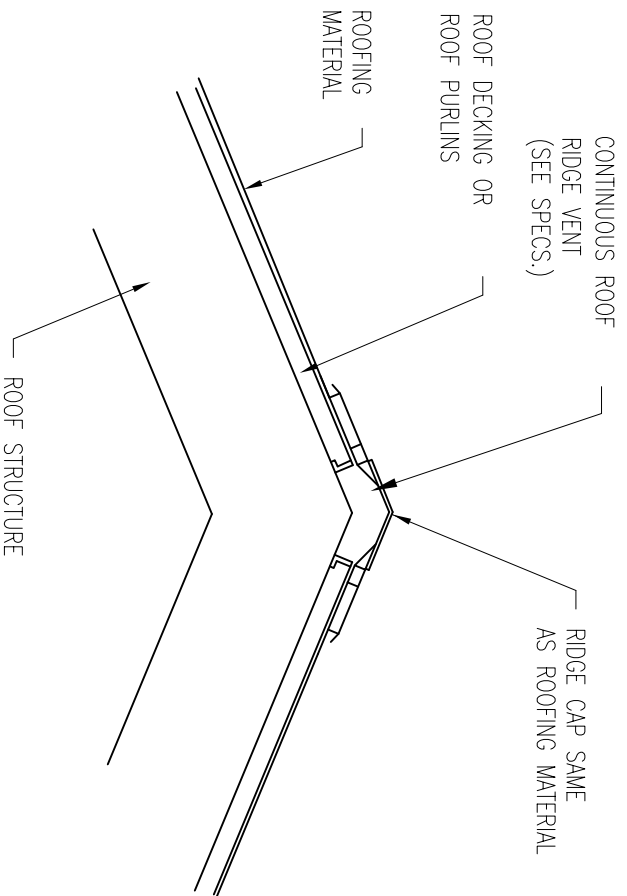
DATE	REVISIONS
	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006	PIPE PENETRATION THROUGH MECHANICAL ROOM WALLS AND FLOORS
APPROVED: _____ STANDARD DRAWING NO. SD4074	



FLOOR PENETRATION  
WET AREA DETAIL

N.T.S.

DATE	REVISIONS
	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006	FLOOR PENETRATION WET AREA DETAIL
APPROVED: _____ STANDARD DRAWING NO. SD4075	

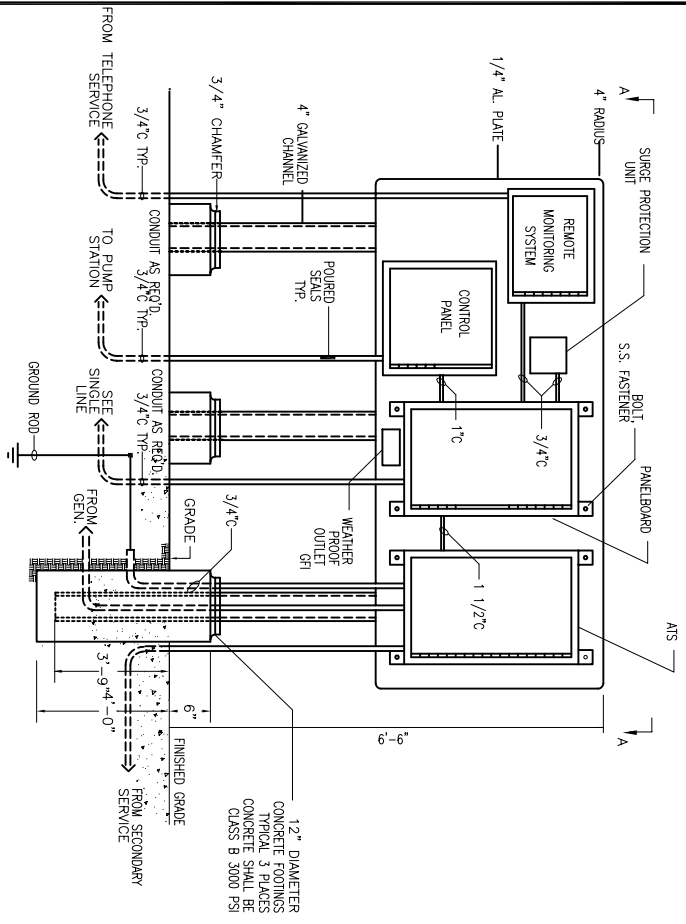


ROOF RIDGE VENT DETAIL

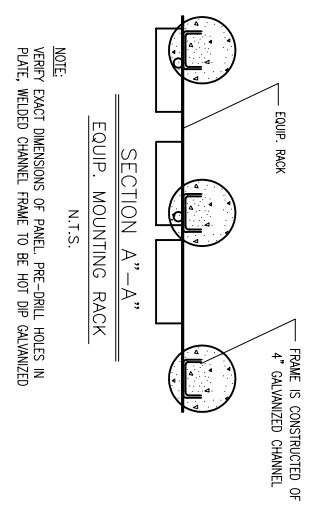
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD4080

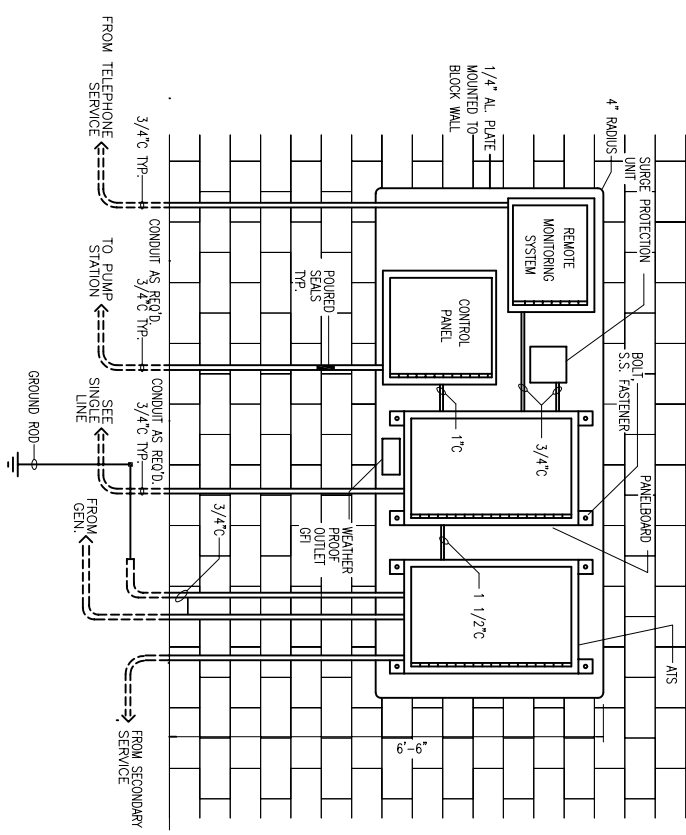




**DETAIL**  
CONTROL PANEL MOUNTING - EXTERIOR  
N.T.S.

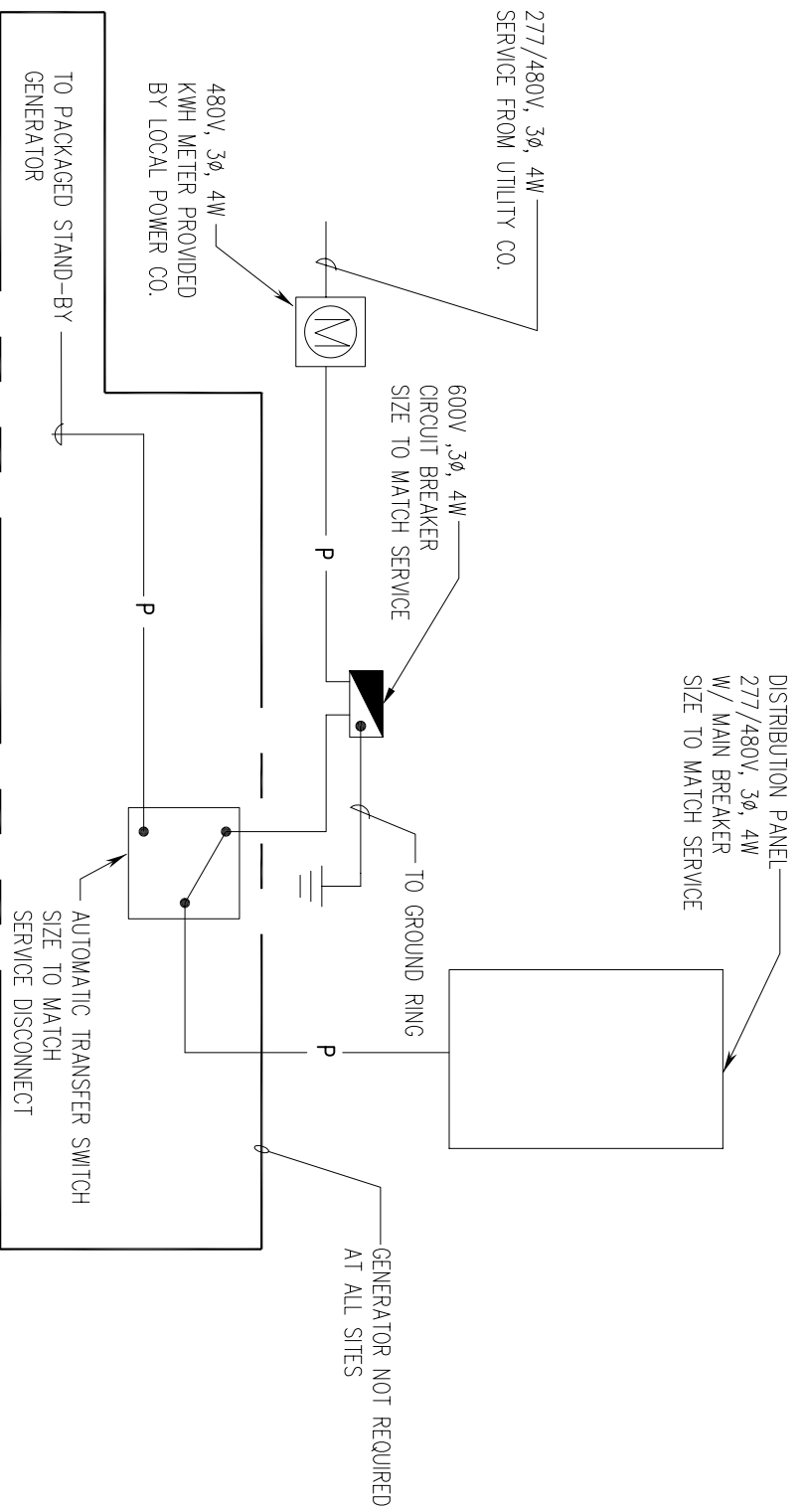


NOTE:  
VERIFY EXACT DIMENSIONS OF PANEL. PRE-DRILL HOLES IN PLATE. WELDED CHANNEL FRAME TO BE HOT DIP GALVANIZED



**DETAIL**  
CONTROL PANEL MOUNTING - INTERIOR  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		CONTROL PANEL MOUNTING DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD5001



SINGLE LINE DIAGRAM

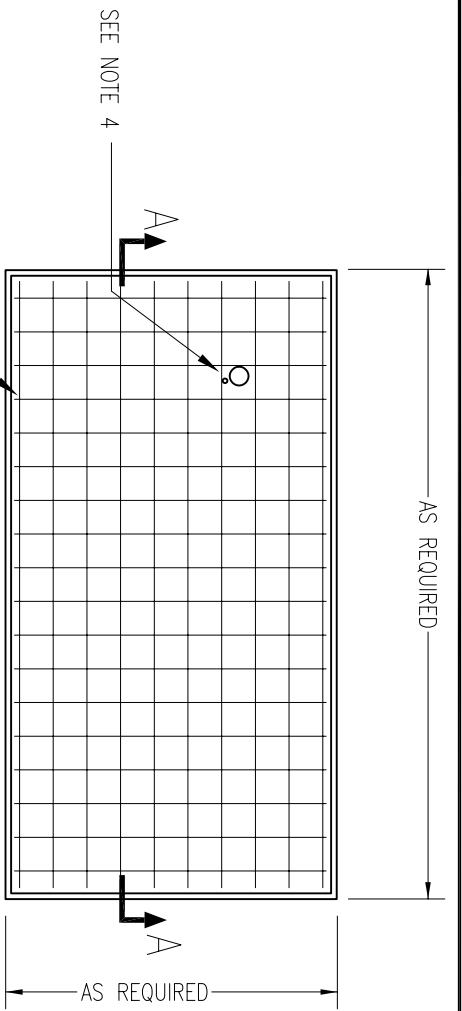
MAIN SERVICE

N.T.S.

NOTE:

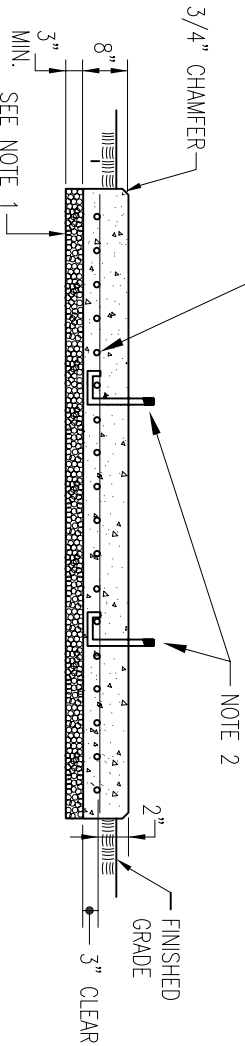
CONTRACTOR TO CONTACT UTILITY COMPANY FOR AVAILABLE FAULT CURRENT AND VERIFY RATING OF EQUIPMENT EXCEEDS AVAILABLE FAULT CURRENT.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		SINGLE LINE DIAGRAM
APPROVED: _____		STANDARD DRAWING NO. SD5002



TOP VIEW  
N.T.S.

#4 RE-BAR  
EQUALLY SPACED  
12" EACH WAY



SECTION "A-A"

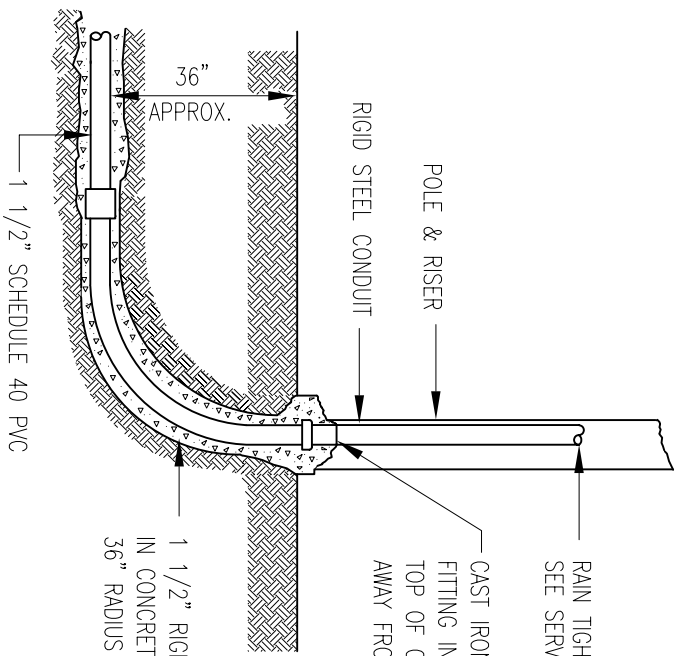
DETAIL  
GENERATOR/SUB BASE FUEL TANK PAD

N.T.S.

NOTES:

1. PAD SHOULD BE POURED AGAINST A 3 INCH MINIMUM COMPACTED GRAVEL FILL THAT IS PLACED ON WELL COMPACTED EARTH.
2. 3/4" HOOKED SS ANCHOR BOLT TO ANCHOR TANK/GENERATOR. CONTRACTOR TO VERIFY QUANTITY AND TANK FOOTPRINT.
3. CONCRETE SHALL BE CLASS B 3000 PSI.
4. CONTRACTOR TO VERIFY QUANTITY AND SIZE AND LOCATION OF ALL CONDUITS FROM CERTIFIED GENERATOR DRAWINGS.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		STANDBY GENERATOR PAD DETAIL
APPROVED: _____		STANDARD DRAWING NO. SD5003



RAIN TIGHT HUB TO DISCONNECT  
SEE SERVICE POLE DETAIL

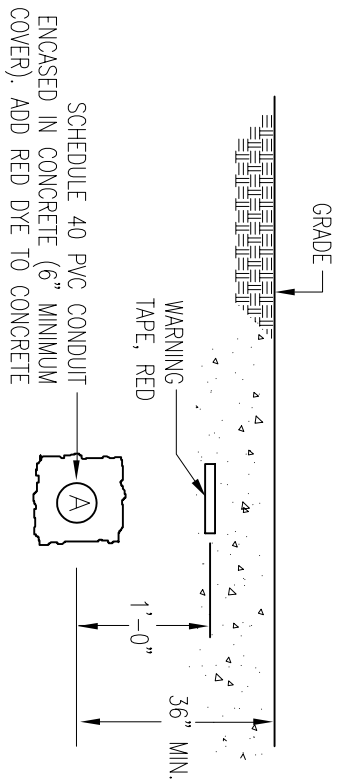
CAST IRON DOUBLE HUB  
FITTING IN CONCRETE. MOUND  
TOP OF CONCRETE TO SLOPE  
AWAY FROM FITTING.

1 1/2" RIGID STEEL CONDUIT BEND ENCASED  
IN CONCRETE (6" MINIMUM) ADD RED DYE TO CONCRETE.  
36" RADIUS

1 1/2" SCHEDULE 40 PVC

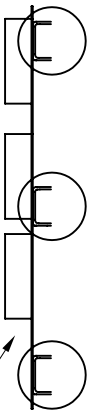
DETAIL  
SECONDARY SERVICE RISER  
N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD5004



DETAIL  
UNDERGROUND CONDUIT  
N.T.S.

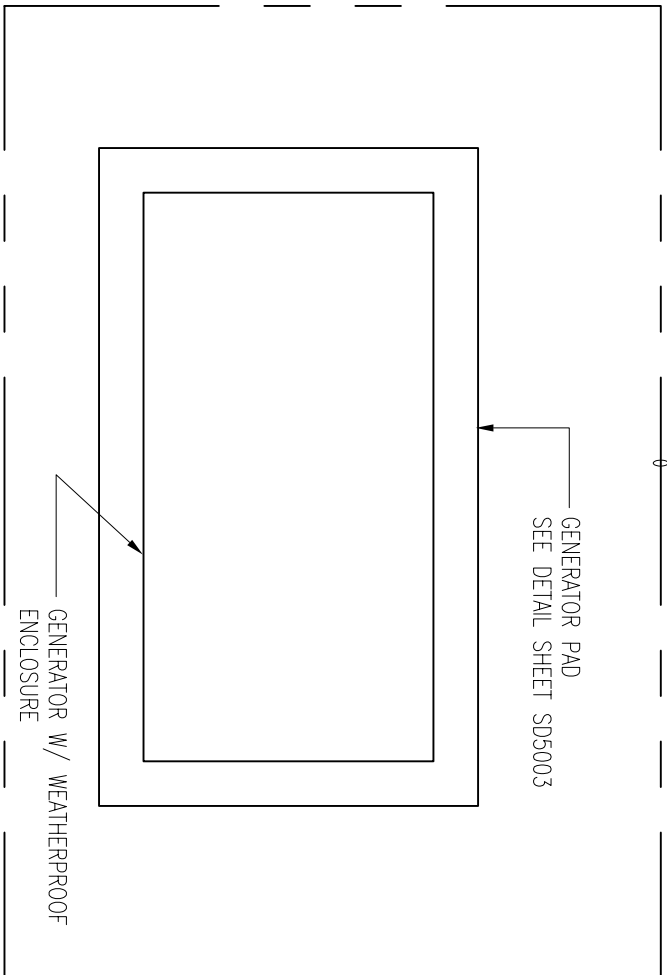
DATE	REVISIONS
MAY 2006	
APPROVED: _____	
JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT  UNDERGROUND CONDUIT DETAIL  STANDARD DRAWING NO. SD5005	



EQUIP. MOUNTING RACK  
SEE DETAIL SHEET SD5001

GENERATOR AND PAD ARE  
NOT REQUIRED AT ALL SITES

GENERATOR PAD  
SEE DETAIL SHEET SD5003

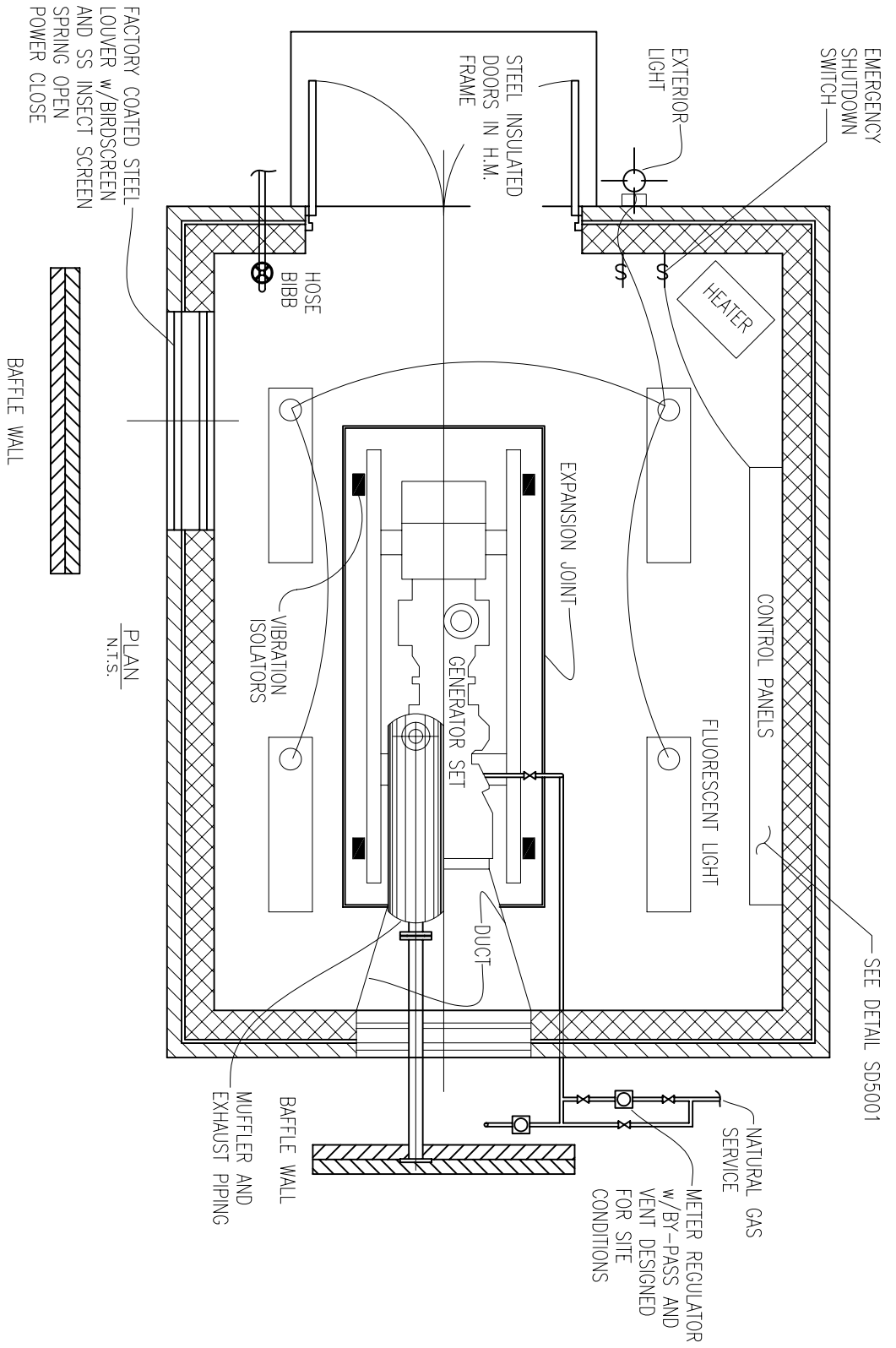


DETAIL

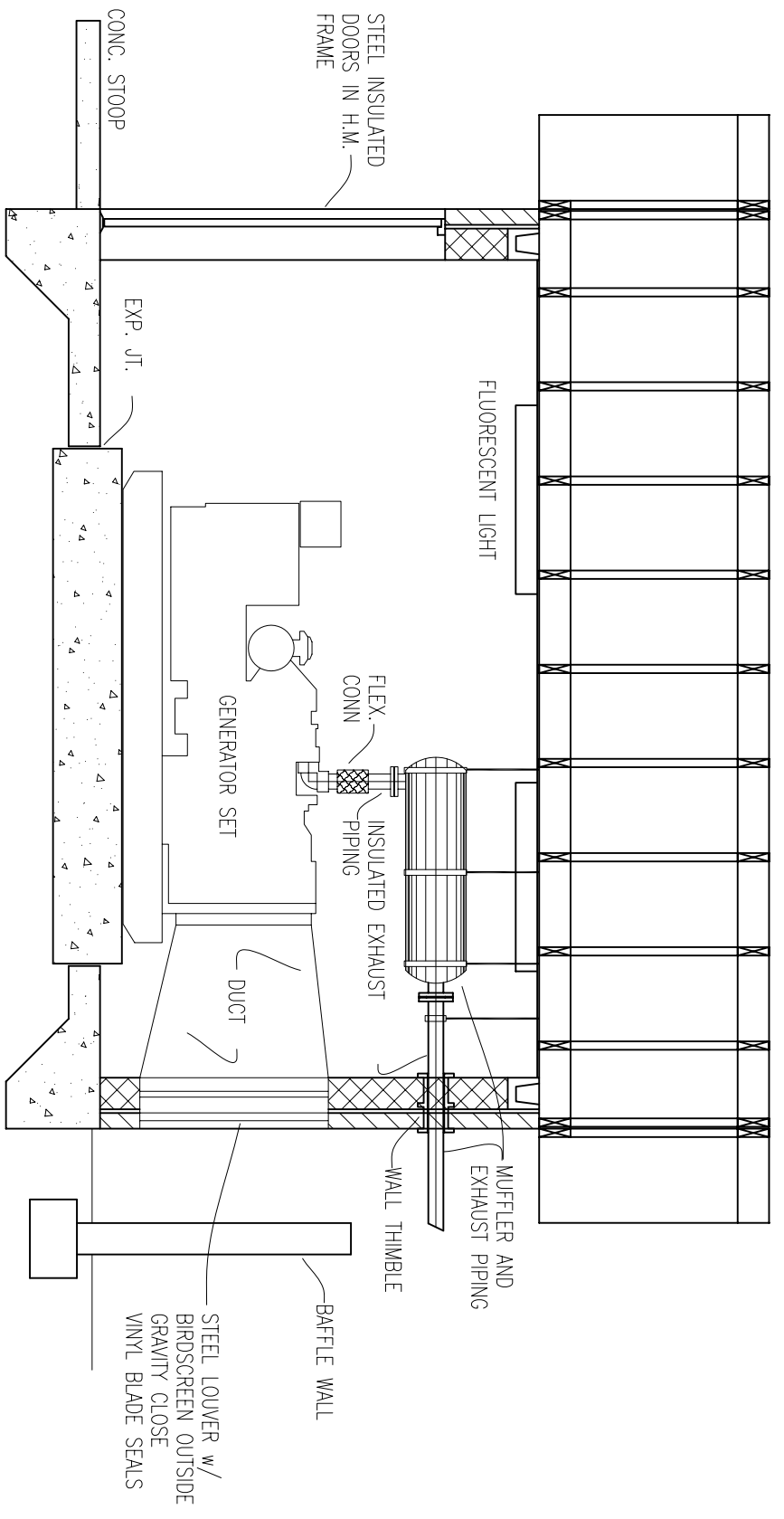
EXTERIOR INSTALLATION

N.T.S.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		
APPROVED: _____		STANDARD DRAWING NO. SD5006



DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
MAY 2006		TYPICAL STANDBY ENGINE GENERATOR SET BUILDING FLOOR PLAN
APPROVED: _____		STANDARD DRAWING NO. SD5007



NOTE:  
 SEE TYPICAL SECTION ON  
 SD 3250 FOR BUILDING  
 DETAILS

SECTION  
 N.T.S.

DATE	REVISIONS	
MAY 2006		TYPICAL STANDBY ENGINE GENERATOR SET BUILDING SECTION
APPROVED: _____		STANDARD DRAWING NO. SD5008 _____

JEFFERSON COUNTY ALABAMA  
 ENVIRONMENTAL SERVICES DEPARTMENT