

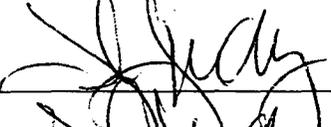
FLUOR

**Technical Specifications
For
Soils and Disposal Facility Project
Area 4B Dewatering**

**Document 20810-TS-0001
Revision 0**

November 2003

PREPARED BY:  CHRISTOPHER R. NEUMANN 11/6/03

CHECKED BY:  THOM HASTINGS 11/6/03  11/6/03

APPROVED BY:  THOM HASTINGS 11/6/03  11/6/03

**U.S. DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

Fluor Fernald
P.O. Box 538704
Cincinnati, OH 45253-8704

ORIGINAL

000001

**U.S. DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

Area 4B Dewatering Technical Specifications

TABLE OF CONTENTS

SECTION	TITLE	REV.	DATE
02668	Transfer Lines	0	11/06/03
15060	Pipe, Fittings, Valves, and Accessories	0	11/06/03
15160	Lift Station Pumps	0	11/06/03
16050	Basic Electrical Materials and Methods	0	11/06/03
16170	Grounding and Bonding	0	11/06/03
16370	Overhead Power Distribution	0	11/06/03
16462	Dry Type Transformers/Panelboards	0	11/06/03

REFERENCED OSDF SPECIFICATIONS

02100	Surveying	1	03/13/02
02200	Earthwork	1	03/13/02

SPECIFICATION REVISION RECORD

Spec. No./Rev.	Description	Approval	Date
02668, Rev.A	Issue for 90% design review	CN	09/25/02
02668, Rev 0	Issue for CFC design package	JM	11/06/03
15060, Rev A	Issue for 90% design review	CN	09/25/02
15060, Rev 0	Issue for CFC design package	JM	11/06/03
15160, Rev A	Issue for 90% design review	CN	09/25/02
15160, Rev 0	Issue for CFC design package	JM	11/06/03
16050, Rev A	Issue for 90% design review	CN	09/25/02
16050, Rev 0	Issue for CFC design package	TH	11/06/03
16170, Rev A	Issue for 90% design review	CN	09/25/02
16170, Rev 0	Issue for CFC design package	TH	11/06/03
16370, Rev A	Issue for 90% design review	CN	09/25/02
16370, Rev 0	Issue for CFC design package	TH	11/06/03
16462, Rev A	Issue for 90% design review	CN	09/25/02
16462, Rev 0	Issue for CFC design package	TH	11/06/03

000002

SECTION 02668
TRANSFER LINES**PART 1 GENERAL****1.1 SCOPE**

This Section includes, but is not limited to:

- A. High-density polyethylene (HDPE) pipe and fittings for transfer lines.
- B. Tie-in to existing storm sewer system.

1.2 RELATED SECTIONS AND PLANS

- A. Section 02200 - Earthwork.
- B. Section 15060 - Pipe, Fittings, Valves and Accessories.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D1248-84 (1989)e1 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 2. ASTM D2657-90 Standard Practice for Heat Joining Polyolefin Pipe and Fittings.
 - 3. ASTM D3350-96 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

4. ASTM F714-97 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- C. American Water Works Association (AWWA):
AWWA C207-94 Steel Pipe Flanges for Waterworks Service.

1.5 SUBMITTALS

- A. Product Data: Provide data on all pipe materials, pipe fittings, valves, accessories, and the methods and equipment for HDPE fusion welding.
- B. Cut sheets or other manufacturer's documentation that products meet or exceed specified requirements of this Section.
- C. Submit documentation of training and certification of personnel qualified to perform butt-fusion welding of HDPE pipe and fittings.
- D. Pressure test and examination reports after completion of test or examination.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Pipe bedding material shall be in accordance with the Construction Drawings.
- B. Transfer Line and Fittings:
1. HDPE pipe and fittings shall be manufactured from new, high performance, high molecular weight, HDPE resin conforming to ASTM D1248 (Type III, Class C, Category 5, Grade P34), a PPI rating of PE 3408, and maximum SDR of 11 and conform to ASTM F714 for 150-psi pressure rating (150-psi test pressure rating). The manufacturer's name and DR shall be marked on the side of the pipe. Transfer line and fittings shall be of the size indicated on the Construction Drawings.
 2. Mechanical Joints:

- a. Mechanical joints shall be made using HDPE flange adapters. Provide nipple-end for butt fusion to transfer pipe. Flat-face suitable for use under pressure with flange sealing gasket.
 - b. Metal back-up rings shall be Class D, slip-on type, in accordance with AWWA C207.
 - c. Stud bolts used with back-up rings on mechanical joints shall be ASTM A193, Type Grade 7M, fully threaded.
 - d. Nuts shall be ASTM A194, Grade 2H, heavy thick nuts.
- C. Marking Tape: Plastic marking tape, color green with metallic strip for locating pipe. Install over all buried pipelines.
- D. Piping and appurtenances shall be as indicated on the Construction Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

Verify existing conditions, tie-in connection, line size, line type, location, and inverts in area of work. Any discrepancies shall be brought to Construction Manager's attention upon discovery.

3.2 PREPARATION

Remove scale and dirt on inside and outside of new pipe and fittings and existing pipe at joints, prior to assembly.

3.3 ERECTION/INSTALLATION/APPLICATION

- A. Install pipe from HDPE to carbon steel transition at the valve boxes and in the transfer line, as indicated on the Construction Drawings.
- B. Sections of pipe with cuts, gouges or scratches on the outside diameter (OD) surface that exceed 10 percent of the wall thickness of the pipe shall be removed

completely and rejoin ends of the pipe. The inside diameter (ID) surface shall be free of cuts, gouges and/or scratches.

- C. Join HDPE piping and fittings by butt weld fusion method, in accordance with manufacturer's recommendations and ASTM D2657. Extrusion welding shall only be used where butt-fusion welding cannot be performed and as approved by the Construction Manager. Hot gas welding shall not be used.
- D. Route pipe as shown on Construction Drawings. The minimum bending radius shall be as specified by the pipe manufacturer.
- E. Install transfer line extensions above ground as indicated on the Construction Drawings.
- F. Locate below ground installations as indicated on Construction Drawings. Trenching and backfilling shall be in accordance with the Construction Drawings.
- G. Testing of HDPE shall be as specified in Section 15060.

END OF SECTION

SECTION 15060
PIPE, FITTINGS, VALVES, AND ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

This Section includes, but is not limited to:

- A. Metal Pipe for Transfer Lines and Lift Stations.
- B. Fabricated piping assemblies.
- C. Fittings.
- D. Valves.
- E. Specialty items.

1.2 RELATED SECTIONS AND PLANS

- A. Section 02668 - Transfer Lines.

1.3 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. ASME A13.1-81 Scheme for the Identification of Piping Systems (R1993).
 - 2. ASME B16.5-88 Pipe Flanges and Flanged Fittings.
1992 Addenda
 - 3. ASME B31.3-96 Process Piping.
- B. American Society for Nondestructive Testing (ASNT):

1. ASNT-SNT-TC-1A-92 Personnel Qualifications and Certification Recommended Practice, December 1992 Edition.
- C. American Society for Testing and Materials (ASTM):
1. ASTM-A53-96 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM-A105/
A105M-96 Standard Specification for Carbon Steel Forgings for Piping Applications.
 3. ASTM A193/
A193M-Rev. A-96 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 4. ASTM-A194/
A194M-96 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
- D. American Water Works Association (AWWA)
1. AWWA C207-94 Steel Pipe Flanges for Waterworks Service.
- E. American Welding Society (AWS):
1. AWS A5.1-91 Carbon Steel Electrodes for Shielded Metal Arc Welding.

1.4 SUBMITTALS

- A. Submit product data for pipe, fittings, valves, and accessories.
- B. Submit shop drawings for shop-fabricated piping assemblies, including spool piece drawings.
- C. Submit installation, maintenance, and operation instruction manuals for valves and accessories.

- D. Submit pressure and flow test and examination reports.
- E. Submit welding procedures and welder and examiner qualifications.

1.5 QUALITY ASSURANCE

- A. Except where more stringent requirements are specified or indicated, the work specified herein shall conform to ASME B31.3.
- B. Welding Procedures and Qualifications
 - 1. Fabrication, assembly, and erection shall be in accordance with ASME B31.3.
 - 2. Welder qualifications shall be made available to, and approved by, the Construction Manager.
 - 3. Nondestructive testing personnel qualifications shall be in accordance with ASNT SNT-TC-1A.
- C. Inspection, Examination, and Testing
 - 1. Inspection, examination, and testing shall be in accordance with ASME B31.3.
 - 2. The Construction Manager shall be given advance notification prior to any testing.
 - 3. Results of the examination and testing by Quality Control shall be submitted to the Construction Manager following the successful completion of examination and testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging
 - 1. Materials shall be cleaned to remove chips, slag, weld spatter, oil, grease, debris, and other foreign material prior to packaging for shipment. Openings shall be covered, capped, or plugged to prevent damage and the ingress of foreign materials during shipment and storage. Tape alone shall not be used for sealing openings.

- B. Storage and Handling
1. Piping materials and prefabricated assemblies shall be stored off the ground and handled with care so that physical damage, contamination, or abrasion of the piping materials does not occur. End seals of pipe, flange covers, valve covers, and similar protection shall not be removed until necessary for cleaning, fabrication, inspection, and erection.
 2. Welding rods and electrodes shall be stored, handled, and identified to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used.

PART 2 PRODUCTS

2.1 PRODUCTS/EQUIPMENT

- A. Piping and Valve Specification
1. Piping materials and valves shall meet the requirements indicated on the piping material data sheets in Attachment A.
 2. For HDPE underground piping, see Section 02668.
 3. Schedule 40, Carbon Steel, 24-inch diameter, .200-slotted screen pipe for Lift Stations.
- B. Steel flanges shall conform to AWWA C207.

2.2 LABELING

- A. Valve Identification
1. Each valve shall be identified with the unique valve number and description, as directed by the Project Engineer.
 2. The tag shall not be attached to any part of the valve that may interfere with valve operation.
 3. Label size shall be based on using 1/2-inch letters.
 4. Labels shall be constructed of nonreflective corrosion-resistant materials, with good contrast and legibility.

- B. Pipe Identification
1. Identify the flow medium and the flow direction for piping systems by labeling adjacent to each valve, adjacent to abrupt pipe directional change, and at intervals of 50 feet along exposed pipe. Pipes shall be labeled in accordance with ASME A13.1.
- C. Product Marking
1. Piping materials shall be marked in accordance with the applicable ASTM specification.
 2. Welding rod and electrode packages shall be marked in accordance with AWS A5.1.
 3. Welding rods and electrodes shall be identified in accordance with AWS A5.1. In addition, welding rods 1/8-inch diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall include the classification number of the welding rod and the trade designation of the manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Trenching and pipe bedding shall be in accordance with the Construction Drawings.

3.3 ERECTION/INSTALLATION

- A. Layout, Cutting, and Fitting Up
1. Piping shall be Category D fluid service under ASME B31.3.
 2. Assembled piping shall be installed without springing, forcing, or cold bending. Cutting or otherwise weakening structural members to facilitate piping installation shall not be permitted.

3. Install valves with stems upright or horizontal, not inverted.
4. Slope field-routed piping and tubing, and arrange to drain at all low points.

B. Welding

1. Welding electrodes shall be in accordance with AWS A5.1.
2. Socketwelds shall be made by shielded metal arc or gas tungsten arc welding process.
3. Socketweld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch or no more than 1/8 inch.
4. Field welding shall be minimized through maximum use of shop-fabricated piping assemblies.
5. Arc strikes and weld starts shall not be made on the base metal outside the weld groove nor inside an area which will be encompassed by a fillet or socket weld. Inadvertent arc strikes outside a weld zone shall be removed by grinding or filing, and the arc strike area shall be visually examined under 5X magnification.

C. Flanged Joints

1. The mating surfaces of the flanges shall be in a plane that is perpendicular to the axis of the pipe. Flanges shall be rotated so that the bolt holes straddle the vertical flange centerline. Gaskets shall be evenly centered between the flange faces with ring-type gaskets engaging fully upon raised-face flanges. Flanges shall mate flush and the bolts shall be tightened uniformly to draw the flanges evenly and firmly upon the gasket. Bolts shall be torqued within the flange manufacturer's recommended range and tightening sequence.
2. Full-faced flanges and full-face gaskets shall be used.
3. Flanged joints shall be made with new gasket and bolting materials. Bolts and nuts damaged during installation shall be replaced.

- D. Install temporary Lift Stations and ultimately convert to permanent Lift Stations in accordance with sequence on Construction Drawings.

3.4 QUALITY CONTROL

A. Hydrostatic Testing

1. Piping systems shall be hydrostatically leak tested in accordance with ASME B31.3, Chapter VI.
2. Pressure vessels, equipment, and instruments shall not be included in these tests if they will be damaged by the test pressure.
3. Equipment which is not to be subjected to the pressure test shall be disconnected from the piping and a pipe spool inserted in its place, or the equipment may be isolated by way of a single-line blind. Valves may be used provided that the valve is suitable for the proposed test procedure.
4. Hydrostatic test pressures shall be 1.5 times the design pressure, as directed by the Construction Manager.
5. The piping system shall be examined prior to leak testing to ensure that connections are tight.
6. Test pressure gauges shall be calibrated no more than 90 days prior to the hydrostatic leak test. Gauges shall be selected so that the test pressures are at the mid-range of the gauge. Documentation shall be maintained and made available showing reliability of calibrated equipment.
7. Every precaution shall be taken during testing to ensure personnel safety.
8. Pressure gauges shall not be subjected to pressure in excess of their scale range.
9. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.
10. Joints found to be defective shall be repaired and retested. Retest pressures shall be the same as those originally specified for the test.
11. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.
12. High-point vents and low-point drains shall be provided for hydrostatic tests.

END OF SECTION

**ATTACHMENT A
PIPING MATERIAL DATA SHEETS**

(For HDPE Materials, See Section 02668)

000014

PIPING MATERIAL DATA SHEET	MAT'L CODE A (SPEC) PAGE 1 OF 2
-----------------------------------	---

RATING: CLASS 150
FACING: RF
MATERIAL: CARBON STEEL

CORROSION ALLOWANCE: 0.125"
PRESSURE LIMIT: PER ASME/ANSI B16.5
TEMPERATURE LIMIT: -20°F TO 750°F

CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			PIPE		
		1/2" - 2"	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, EXTRA STRONG, PLAIN ENDS		
		2-1/2" - LARGER	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, STANDARD WEIGHT, BEVELED ENDS		
			FLANGES		
		1/2" - 2"	CLASS 150, CARBON STEEL, RF, ASTM A105, SOCKETWELD (XS BORE)		
		2-1/2" - LARGER	CLASS 150, CARBON STEEL, RFSF, ASTM A105, WELD NECK (STANDARD WEIGHT BORE)		
		1/2" - LARGER	CLASS 150, BLIND, CARBON STEEL, ASTM A105, RFSF		
			FITTINGS		
		1/2" - 2"	CLASS 3000, CARBON STEEL, ASTM A105, SOCKETWELD		
		1/2" - 2"	CLASS 3000, THREADED CARBON STEEL, ASTM A105; THREDOLET CAP	1, 4 1	
			PLUG, ROUNDHEAD PLUG, HEX HEAD	1 4	
		2-1/2" - LARGER	SEAMLESS CARBON STEEL, BUTT WELD ENDS, ASTM A234 GRADE WPB, STANDARD WEIGHT		
			SWAGES		
		1/2" - 8"	SCHEDULE 80 CARBON STEEL, ASTM A234, GRADE WPB, PREPARE ENDS AS REQUIRED (BEVELED, PLAIN OR THREADED)	2	
			GASKETS		
		1/2" - LARGER	NEOPRENE, 1/8 INCH THICK		
			BOLTING		
			STUD BOLTS WITH 2 HEAVY HEX NUTS, ASTM A193 GRADE B7/ASTM A194 GRADE 2H		

000015

PIPING MATERIAL DATA SHEET			MAT'L CODE (SPEC)	A	
			PAGE	2 OF 2	
RATING: CLASS 150 FACING: RF MATERIAL: CARBON STEEL		CORROSION ALLOWANCE: 0.125" PRESSURE LIMIT: PER ASME/ANSI B16.5 TEMPERATURE LIMIT: -20°F TO 750°F			
CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			GATE VALVES		
		1/2" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD ENDS, OS&Y, BOLTED BONNET, SOLID WEDGE, 12% CR TRIM.	5	
		2-1/2" - LARGER	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, 11-13 CR TRIM, OS&Y, POWELL VALVES FIG. 1503 OR EQUAL (VALVES FOR UNDERGROUND INSTALLATION SHALL BE MUELLER NO. A-2072-20)	5	
		1/2" - 2"	BALL VALVES	5	
		2-1/2" - 4"	1500 PSI WOG, CARBON STEEL, ASTM A216 GRADE WCB, THREE PIECE, SOCKETWELD, CHROMIUM PLATED BALL, TFE SEATS, LEVER OPERATOR, APOLLO 83-600 SERIES OR EQUAL	5	
		6" - LARGER	CLASS 150, CARBON STEEL, ASTM A216, GRADE WCB, RFSF FLANGE, CHROME PLATED BALL, TFE SEATS, WRENCH OPERATOR, APOLLO 88-200 SERIES OR EQUAL.	5	
		2-1/2" - LARGER	CLASS 150, CARBON STEEL, ASTM A216, GRADE WCB, RFSF FLANGE, CHROME PLATED BALL, TFE SEATS, GEAR OPERATOR, APOLLO 88-200 SERIES OR EQUAL.	3	
			CHECK VALVES		
			CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF, FLANGE, CHROME TRIM, BOLTED COVER, SWING TYPE, POWELL FIG. 1561 FE OR EQUAL		
			PIPE NIPPLES		
		1/2" - 2"	CARBON STEEL, ASTM A53, GRADE B		
		1/2" - 2"	SCH 40, TBE, SMLS 3" LONG		
		1/2" - 2"	SCH 40, TBE, SMLS 6" LONG		
		1/2" - 2"	SCH 40, POE-TOE, SMLS 3" LONG		
		1/2" - 2"	SCH 40, POE-TOE, SMLS 6" LONG		
			NOTES		
			1. USE FOR UNVALVED VENTS AND DRAINS.		
			2. USE SWAGES WHERE SMALL END IS 2" AND SMALLER. USE WELD REDUCER WHERE SMALL END IS 2-1/2" AND LARGER.		
			3. INSTALL IN HORIZONTAL POSITION OR WITH FLOW UP.		
			4. USE FOR PROCESS DRAINS.		
			5. EQUIP VALVE WITH LOCKING DEVICE WITH NOT LESS THAN 3/8" DIAMETER HOLE FOR LOCK.		

000016

SECTION 15160 LIFT STATION PUMPS

PART 1 GENERAL

1.1 SCOPE

This Section includes, but is not limited to:

- A. Electric driven submersible pumps with float control.

1.2 RELATED SECTIONS

- A. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI HI11.6 Standard for Submersible Pumps.

1.4 SUBMITTALS

- A. Submit manufacturer pump curves showing performance characteristics with pump and system operating point plotted, including minimum and maximum flow.
- B. Submit completed pump data sheets.
- C. Submit an Installation, Operation, and Maintenance Manual:
 - 1. The pump manufacturer shall supply a complete set of comprehensive written instructions to enable an operator to properly operate and maintain the equipment supplied. Content of the instructions shall assume the operator is familiar with pumps, motors, piping, and valves, but that the

- operator has not previously operated nor maintained the exact equipment supplied.
2. The instructions shall be prepared as a system manual applicable solely to the pump equipment and related devices supplied by the manufacturer, as specified herein.
 3. The instructions shall include, but not be limited to, the following:
 - a. Descriptions of, and operating instructions for, each major component of the complete pump package as supplied.
 - b. Instructions on operation of the pump and pump controls in intended modes of operation.
 - c. Instruction for adjustments which must be performed at initial start-up of pump equipment, adjustments required after the replacement of liquid level control system components, and adjustments as required in the course of preventative maintenance as specified by the manufacturer.
 - d. Service instructions for major components not manufactured by the pump package manufacturer, but supplied by the manufacturer in accordance with the specifications. In such case, the literature supplied by the actual manufacturer shall be incorporated as appendices.
 - e. Electrical schematic diagram of the pump and control package.
 - f. Layout drawings of the pump package as supplied showing the location of submersible pumps, baseplates, and guide assemblies. Drawings shall provide necessary information to ensure proper installation and alignment of the guides and baseplate to the pump.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry place and protect from weather prior to shipment. Provide protection from weather and from damage during transit.
- B. Loose items shall be tagged and delivered in standard commercial package(s). The package(s) shall be protected from the weather, from climate conditions including temperature and humidity variations, and from dirt, dust, and other contaminants that could adversely affect assembly and operation.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Gorman-Rupp Company.

2.2 PUMPS

- A. See Attachment A - Pump Data Sheets. Written exception shall be taken to any requirements proposed pump-motor combination does not meet.
- B. Motors shall meet applicable NEMA Standards, including NEMA MG 1-93.

2.3 LABELING

- A. Equipment identification: Pumps shall be provided with a permanently attached nameplate indicating equipment name, number, model number, and rated capacity. Lettering shall be manufacturer's standard size and shall be stamped.

PART 3 EXECUTION**3.1 FIELD CONDITIONS**

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. The installation of the equipment shall be in accordance with the manufacturer's installation manual.
- B. A copy of the manufacturer's installation and service manual for each piece of the equipment shall be available at the site.

3.3 QUALITY CONTROL

- A. Pump/motor shall be checked for proper rotation prior to operation.
- B. Tests: Acceptance operating tests shall be performed after installation per the manufacturer's recommendations. If the results are unsatisfactory, adjust or

replace the equipment to meet the specification requirements and retest the equipment.

- C. Inspection: Notify Quality Control of testing and inspection activities at least 24 hours prior to the start of all tests and/or inspections.

3.4 MANUFACTURER ASSISTANCE

- A. The manufacturer shall provide 2-days installation supervision and start-up assistance. Service assistance shall be in accordance with the manufacturer's warranty.

END OF SECTION

**ATTACHMENT A
PUMP DATA SHEETS**

000021

PUMP DATA SHEET											
PROJECT TITLE: Soil Remediation Area 4B						TASK ORDER:					
PUMP NAME: Basin 4B1 Pump						QUANTITY: 1 + spare					
TYPE PUMP: Submersible centrifugal						DRAWING NUMBER 99X-5500-G-00683					
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP		X YES		NO					
MANUFACTURER AND MODEL NO.: Gorman-Rupp Model S4F-E20					EQUIP NO.: PMP-1 & include name for spare						
OPERATING CONDITIONS											
FLUID PUMPED: STORMWATER				AT A PUMPING TEMPERATURE OF:				60 °F			
SPECIFIC GRAVITY: 1.0		AT 60°F		AT P.T.		VISCOSITY: 1.1		AT P.T.			
SOLIDS IN FLUID: 1-5		WT%		DENSITY: NA		SIZE: ≤1/2" dia.		ABRASIVE: NO			
NATURE OF SOLIDS: NA				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.					
DESIGN CAPACITY: 570		GPM AT 72		FT. TH at P.T.		DESIRED RANGE: 500 GPM TO 650 GPM					
SUCTION PRESS: NA		FT.		PSIG		DISCHARGE PRESS: FT.		PSIG		NPSH AVAIL: NA	
PUMP SPECIFICATIONS											
TYPE PUMP: Centrifugal, direct-connected						NO. STAGES: 1		RPM: 3450			
TYPE IMPELLER: Open						SIZE: IN.		MAX SIZE: IN.			
EFFICIENCY AT DESIGN CAPACITY: (min)%				BHP @ DESIGN CAPACITY:		MAXIMUM BHP: 20					
TYPE BEARINGS: Oil-lubricated, anti-friction											
TYPE COUPLING:						LUBRICATION:					
TYPE OF SEAL: Double Mechanical											
CONNECTIONS - SIZE & RATING											
SUCTION: IN.				LB.		Flange		DISCHARGE: 4 IN. Class 125 NPT			
VENT: IN.				LB.				DRAIN: IN.			
CONSTRUCTION MATERIALS											
RESTRICTIONS:											
CASING: Aluminum Alloy					IMPELLER: Ductile Iron						
SHAFT: Stainless steel					SHAFT SLEEVE: Stainless steel						
CASE RING:					IMP. RING:						
DISCHARGE ELBOW: Aluminum Alloy					RELIEF VALVE:						
ELECTRIC MOTOR											
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE			
460	3	60		YES							
REMARKS: 1) Vendor shall complete data sheet as required. 2) Provide one set of recommended pump spare parts. 3) Provide float type level switches											

PUMP DATA SHEET

PROJECT TITLE: Soil Remediation Area 4B						TASK ORDER			
PUMP NAME: Basin 4B2 Pump						QUANTITY: 1 + 1 spare			
TYPE PUMP: Submersible centrifugal						DRAWING NUMBER 99X-5500-G-000683			
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP		X YES		NO			
MANUFACTURER AND MODEL NO.: Gorman-Rupp Model S3A						EQUIP NO.: PMP-2 & include name for spare			
OPERATING CONDITIONS									
FLUID PUMPED: STORMWATER						AT A PUMPING TEMPERATURE OF: 60 °F			
SPECIFIC GRAVITY: 1.0 AT 60°F		AT P.T.		VISCOSITY: 1.1		AT P.T.			
SOLIDS IN FLUID: 1-5 WT%		DENSITY: NA		SIZE: ≤1/2" dia.		ABRASIVE: NO			
NATURE OF SOLIDS: NA				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.			
DESIGN CAPACITY: 233 GPM AT 36 FT. TH at P.T.		DESIRED RANGE: 230 GPM TO 260 GPM							
SUCTION PRESS: NA FT.		PSIG		DISCHARGE PRESS: FT.		PSIG		NPSH AVAIL: NA	
PUMP SPECIFICATIONS									
TYPE PUMP: Centrifugal, direct-connected						NO. STAGES: 1		RPM: 3450	
TYPE IMPELLER: Open						SIZE: IN.		MAX SIZE: IN.	
EFFICIENCY AT DESIGN CAPACITY: (min)%				BHP @ DESIGN CAPACITY:		MAXIMUM BHP: 5			
TYPE BEARINGS: Oil-lubricated, anti-friction									
TYPE COUPLING:						LUBRICATION:			
TYPE OF SEAL: Double Mechanical									
CONNECTIONS - SIZE & RATING									
SUCTION: IN. LB. Flange				DISCHARGE: 3 IN. Class 125 NPT					
VENT: IN. LB.				DRAIN: IN.					
CONSTRUCTION MATERIAL									
RESTRICTIONS:									
CASING: Aluminum Alloy					IMPELLER: Ductile Iron				
SHAFT: Stainless steel					SHAFT SLEEVE: Stainless steel				
CASE RING:					IMP. RING:				
DISCHARGE ELBOW: Aluminum Alloy					RELIEF VALVE:				
ELECTRIC MOTOR									
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE	
230	1	60		YES					
REMARKS: 1) Vendor shall complete data sheet as required. 2) Provide one set of recommended pump spare parts. 3) Provide float type level switches									

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Combination magnetic motor starters.
- B. Selector switches.
- C. Receptacles.
- D. Conduit.
- E. Wire and cable.
- F. Instrument cable.
- G. Nameplates.
- H. Wire markers and cable tags.
- I. Wireway and auxiliary gutters.
- J. Splicing and termination components.
- K. Boxes.
- L. Cabinets.
- M. Supporting Devices.

- N. Underground Warning Tape.
- O. Electrical Testing, General.

1.2 RELATED SECTIONS

- A. Section 02200 - Earthwork.
- B. Section 15160 - Lift Station Pumps.
- C. Section 16170 - Grounding and Bonding.
- D. Section 16370 - Overhead Power Distribution.
- E. Section 16462 - Dry Type Transformers/Panelboards.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1-90 Rigid Steel Conduit-Zinc Coated.
- B. InterNational Electrical Testing Association (NETA):
 - 1. NETA ATS-95 Acceptance Testing Specification for Electrical Power Distribution Equipment.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code, 1999 Edition.
- D. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA ICS 1-93 Industrial Control and Systems General Requirements.
 - 3. NEMA ICS 2-93 Industrial Control and System Controllers, Contractors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.

- | | | |
|----|---------------|---|
| 4. | NEMA ICS 4-93 | Industrial Control and Systems Terminal Blocks. |
| 5. | NEMA ICS 6-93 | Industrial Control and Systems Enclosures. |
| 6. | NEMA OS 1-89 | Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports. |
| 7. | NEMA WD 1-83 | General Requirements for Wiring Devices. |
| 8. | NEMA WD 6-88 | Wiring Devices - Dimensional Requirements. |
| 9. | NEMA 250-91 | Enclosures for Electrical Equipment (1,000 Volts Maximum). |
- E. Underwriters Laboratories Inc. (UL):
- | | | |
|----|---|---|
| 1. | UL 360-96 | UL Standard for Safety Liquid-Tight Flexible Steel Conduit. |
| 2. | UL 486A-91 | UL Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors. |
| 3. | UL 510-94 | UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape. |
| 4. | UL 854-96 | Service-Entrance Cables. |
| 5. | UL 870-95 | UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings. |
| 6. | Electrical Construction Materials Directory - 98. | |

1.5 SUBMITTALS

- A. Provide submittals for equipment, hardware, materials, conduit and wire. Unless specified otherwise, submittals shall be made to the Construction Manager for review and approval.

1.6 QUALITY ASSURANCE PROGRAM

- A. Work shall comply with NFPA 70. Use of conduit for equipment ground is prohibited.
- B. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. Combination Magnetic Motor Starters
1. Combination Magnetic Motor Starters: NEMA ICS 1, NEMA ICS 2, AC general purpose Class A magnetic starter for induction motors for the rated horsepower combined with a magnetic circuit breaker, NEMA AB 1, with instantaneous magnetic trip in each pole. Starter, circuit breaker, and control power transformer shall be in a common enclosure. Terminals, minimum 75 degrees C rated.
 2. Provide externally operable handle interlocked to prevent opening of cover with circuit breaker in the ON position. Allow handle to be lockable in the OFF position.
 3. Contactor Coil Operating Voltage: 120 V, 60 Hz.
 4. Overload Relay: NEMA ICS 2, bimetal.
 5. Control Power Transformer: 120 V secondary, 50 VA minimum. Provide fused primary and secondary of transformer, and ground unfused leg of secondary to enclosure.
 6. Enclosure: NEMA ICS 6, Type 4X, outdoor.
 7. Heater elements shall be included, as required, for the described service conditions.
 8. Two auxiliary contacts (electrically dry), one each, normally closed and normally open, in addition to the hold-in contact, shall be provided.
- B. Selector Switches
1. Enclosure, NEMA ICS 6, Type 4.
 2. Two-position, maintained contact (start/stop), as indicated.
 3. Three-position, maintained contact (hand/off/auto or local/off/remote), as indicated.
- C. Receptacles
1. Convenience Receptacle: 125 V, 15/20 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-20. 125 V, 30 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-30.

Furnish with weatherproof "while in use" covers for outdoors, wet or industrial locations.

2. Convenience receptacles in potentially wet environments, in addition to those required by NFPA 70, shall be GFCI type for personnel protection with covers to protect the receptacle from water during usage.

D. Cabinets

1. Boxes: Galvanized steel with removable endwalls.
2. Box Size: As indicated on construction drawings.
3. Fronts: Steel, surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
4. Knockouts: Provide as required for conduits indicated plus 25 percent spare.
5. Provide metal barriers to form separate compartments wiring of different systems and voltages.
6. Provide accessory feet for free-standing equipment.
7. Terminal Blocks: NEMA ICS 4.
 - a. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
 - b. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
8. Provide ground bus and ground terminal block, each connector bonded to enclosure.
9. Provide plastic channel with hinged or snap-on covers for internal wiring raceway.

2.2 MATERIALS

A. Conduit

1. Rigid steel, heavy wall, galvanized conduit conforming to ANSI C80.1. Rigid steel intermediate metal conduit (IMC) shall be acceptable for interior spaces. Conduit shall be 1/2 inch diameter minimum.
2. Liquid-tight flexible metal conduit conforming to UL 360. Conduit shall be 1/2 inch diameter minimum, 5 feet in length (maximum) unless indicated on construction drawings.

3. Conduit connections shall be threaded.
- B. Wire and Cable
1. Single conductor, 600 volt insulated copper conductor, unless indicated otherwise. Conductors for power and lighting branch circuits shall not be smaller than No. 12 AWG. Conductors No. 12 AWG and larger shall be stranded. Conductors for control shall not be smaller than No. 14 AWG stranded. Conductors for Class 1 remote-control and signal circuits shall be enclosed in cable and shall comply with NFPA 70. Power and lighting conductor insulation shall be Type THW, XHHW, or THWN. Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be insulation Type XHHW-2 or THW-2. Direct burial cable shall be type USE, conforming to UL 854.
- C. Instrument Cable
1. Instrumentation cable shall be No. 16 AWG stranded tinned copper conductors. Conductors shall be polyethylene insulated and rated 600 volts, 60 degrees C. Conductors shall be twisted with aluminum-polymer shield; No. 18 AWG stranded, tinned copper drain wire. Cable shall have overall-chrome gray FR-PVC jacket.
- D. Nameplates
1. Nameplates shall be engraved, three-layer laminated plastic, 5/16-inch bold style, black letters on white background.
- E. Wire Markers and Cable Tags
1. Wire markers shall be single-conductor slip on, heat-shrinkable sleeve with typed or printed black letters on a white background. Wire markers shall be W. H. Brady Co. computer-printable "Bradysleeve" or approved equal.
 2. Cable tags shall be rectangular, flat, non-heat shrinkable tags with 1/8-inch-high letters. Cable markers shall be Raychem-type TMS or approved equal.
- F. Wireway and Auxiliary Gutters
1. Wireway and Auxiliary Gutters: General purpose, NEMA ICS 6, Type 3R enclosure with knockouts on bottom.

2. Size: As required.
 3. Cover: Screw cover with full gasketing.
 4. Fittings: UL 870, lay-in type with removable top, bottom, and side; captive screws.
 5. Material: Carbon steel.
 6. Finish: Rust-inhibiting primer coating with gray enamel finish.
- G. Splicing and Termination Components
1. Wire connectors, UL 486A, as applicable.
 2. Insulation tape, UL 510.
 3. Provide solderless terminal lugs, rated 75 degrees C minimum, on stranded conductors.
- H. Boxes and Cover Plates
1. Junction and Pull Boxes
 - a. Junction and pull boxes shall be sized as indicated in accordance with NFPA 70, Article 370.
 - b. Junction and pull boxes located indoors shall be code-gauge, galvanized sheet steel and shall be of welded construction with conduit knockouts or raceway openings and hinged or screwed covers as indicated. Type 3R, according to NEMA 250.
 - c. Junction and pull boxes located outdoors shall have screwed, gasketed covers, and watertight hubs. Type 3R, according to NEMA 250.
 2. Device and Outlet Boxes
 - a. Device and outlet boxes shall be pressed steel, zinc, or cadmium coated in accordance with NEMA OS 1 unless otherwise indicated.
 - b. Outlet boxes shall not be smaller than 4 inches octagonal by 1-1/2 inches deep and shall be provided with the proper size knockouts for the conduits intended. Unused knockouts shall remain closed or shall be sealed with knockout closures.
 - c. Device or outlet boxes shall be of unit construction of a size required for the number of switches or outlets called for on the construction drawings. No sectional device boxes shall be permitted.
 - d. Surface-mounted outlet boxes for receptacles, switches, or similar

devices shall be cast type.

- I. Supporting Devices
 - 1. Support Channel shall be galvanized or painted steel.
 - 2. Support hardware and accessories shall be corrosion resistant.
 - 3. Supports shall be of all-welded construction.

- J. Underground Warning Tape
 - 1. 4-inch-wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Ensure site is ready to receive work before start of construction.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. Conduit
 - 1. Route conduit parallel or at right angles to building lines. Provide conduit supports at approximately 8-foot intervals. Route conduit so as not to create a hazard for tripping or to compromise head clearance. Minimum height above floor shall be 7 feet, 6 inches.
 - 2. Cut conduit square using saw or pipecutter. Cut ends of conduit shall be reamed smooth.
 - 3. Install no more than the equivalent of three 90 degree bends between junction boxes. Use hydraulic one-shot conduit bender or factory elbows for conduit diameter larger than 1-1/2 inch.
 - 4. Use Form 8 conduit bodies to make sharp changes in direction. Avoid moisture traps, provide junction box with weep hole.
 - 5. Provide cast metal boxes such as FS or FD in damp or wet locations.
 - 6. Provide 1/8-inch nylon pull cord in empty conduits. Cap empty conduits to prevent entry of moisture and foreign objects.
 - 7. Final conduit connections to motors or other vibrating equipment shall be made with approximately 3-foot liquid-tight flexible metal conduit.
 - 8. Conduit and supports are to be field routed. They are not indicated

explicitly on construction drawings.

B. Wire and Cable

1. Swab conduit before installing cable. Remove burrs, dirt, or other debris. For existing conduit, pull a mandrel through before pulling cable to verify roundness and bending radii.
2. When pulling cable into conduit, use wire pulling compound.
3. Splices shall be made only in outlet or junction boxes.
4. Provide equipment grounding conductor along with phase conductors in conduits.
5. Multiconductor cables shall contain an integral ground conductor.
6. Grounding conductors shall be connected to equipment with compression lugs. Grounding connections shall be made to clean, dry surfaces. Scale, rust, grease, and dirt shall be removed from surfaces to which grounding connections are to be made.
7. Conductors shall be color coded. Conductors No. 6 AWG and larger shall be identified using colored tape at terminals and splice points. Conductors No. 8 AWG and smaller shall be identified using colored insulation or jacket. Color coding shall be as follows:

480Y/277V	Phase A	Yellow
	Phase B	Orange
	Phase C	Brown
	Neutral (grounded)	Gray
	Ground	Green
208Y/120V	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral (grounded)	White
	Ground	Green
	Plant Fire	Red and Yellow
	Alarm System	Brown and Yellow

C. Nameplates

1. Clean surfaces prior to installing nameplates.
2. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using self-tapping screws.

- D. Wire and Cable Markers
1. Provide wire markers on each conductor in pull boxes and junction boxes and at each load connection. Provide cable tags in pull boxes for multiconductor cables.
 2. Wire and cable tags shall identify panel and circuit number or control wire number, as required.
- E. Disconnect Switches
1. Mounting supports shall not be fastened to or penetrate wall panels.
- F. Receptacles
1. Install convenience receptacles as indicated on construction drawings.
 2. Label receptacles with panelboard and circuit number from which they are served.
- G. Combination Magnetic Motor Starters
1. Install motor controllers where indicated on construction drawings.
 2. Install motor controller with center line of disconnect operator 54 inches above grade.
 3. Install overload heater element in motor controller to match motor characteristics.
 4. Provide engraved nameplate identifying motor served.
- H. Selector Switches
1. Mount selector switches at a mounting height of 54 inches above grade adjacent to the equipment controlled.
- I. Clearances
1. Clearances from points of access to electrical equipment and other devices shall conform to the requirements of NFPA 70.
 2. Equipment control devices and other electrical equipment requiring operation or maintenance shall have a minimum working clearance of 3 feet from the surface of operation or access, unless greater clearance is required by NFPA 70.
- J. Boxes
1. Coordination of Box Locations

- a. Provide electrical boxes as indicated and as required for splices, taps, wire pulling, and equipment connections.
- b. Electrical box locations indicated are approximate unless dimensioned.
- c. Locate and install boxes to allow access.
- d. Do not install boxes back to back in walls. Provide 6-inches (minimum) separation in non-acoustic rated walls and 24 inches (minimum) separation in acoustic rated walls.
- e. Coordinate mounting heights of boxes and locations of outlets mounted above counters, benches, and backsplashes to ensure locations are useful.
- f. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

2. Outlet Box Installation

- a. Firmly secure in place outlet or utility boxes concealed in the construction. Set outlet or utility boxes true, square, and flush with the finish surfaces for the application of the appropriate cover plate.
- b. Provide knockout closures for unused knockout openings.
- c. Support boxes independently of conduit except for cast boxes when connected to two rigid metal conduits, both supported within 12 inches of the box to be supported.
- d. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

3. Pull and Junction Box Installation

- a. Support pull and junction boxes independently of conduit.

K. Cabinets

1. Install cabinet fronts plumb.

L. Supporting Devices

1. Installation of structural steel framing, concrete pads, etc., shall be complete before installing supporting devices.
2. Fasten hanger rods, conduit clamps, and outlet and junction boxes to

- building structures in accordance with manufacturer's recommendations as indicated.
3. Use expansion anchors for support on concrete surfaces.
 4. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
 5. Do not drill structural steel members for installing support devices.
 6. Fabricate supports from structural steel or steel channel. Rigidly bolt to structural steel to present a neat appearance. Use hexagon head bolts with spring lock washers under nuts.
 7. Install freestanding electrical equipment on concrete pads.
 8. Install surface mounted cabinets and enclosures with four anchors (minimum). Provide steel channel supports to stand cabinets and enclosures 1 inch from the wall.

3.3 QUALITY CONTROL

- A. Electrical Inspection and Testing - General
1. Electrical inspection and testing for work in this section and in other electrical sections shall conform to the following requirements and to NETA ATS. Tests required by NETA ATS for electrical work on this project shall be performed unless specific instruction is provided otherwise. Any additional requirements or exceptions shall be as noted in the other electrical sections for the specific electrical work of that section only.
 2. Testing shall be witnessed by Fluor Fernald, CQC Consultant-Quality Control personnel (who must approve results) and manufacturer's service representative(s), if required. Notice of testing must be furnished 7 days in advance.
 3. Submit test results and calibration data on approved forms.
 4. Perform operational tests to demonstrate control and interlocking wiring.
 5. Visual inspections shall be performed for phasing and connections. Phasing shall be A, B, C clockwise at all three phase disconnects.
 6. Repair or replacement of components where test results are unacceptable, including those damaged during testing process, is required.
- B. Electrical Inspection and Testing - This Section
1. Perform continuity and operation tests on power and control circuits. Low

voltage thermographic survey of cable connections required by NETA ATS are not required. Wire insulation for conductors No. 6 AWG and larger shall be megger tested between each conductor and ground. A 1000-volt megger shall be used for insulation rated 600 volts. Minimum resistance shall be 100 megohms.

2. Insulation resistance tests shall not be performed on solid state equipment unless authorized by its manufacturer and in strict accordance with the manufacturer's recommendations. Solid state equipment includes static ground fault devices, such as ground fault circuit interrupters.
3. Confirm that electrical connections to utilization equipment have been made in accordance with manufacturer's instructions.
4. Perform motor tests according to NETA ATS.
5. Motor windings shall be checked for continuity.
6. Motor windings rated 460 volts nominal shall be megger tested with a 1,000-volt megger prior to connection of power leads. Minimum acceptable resistance shall be 100 megohms. Motor and phase rotation shall be checked with a phase rotation tester manufactured by G. Biddle Company (Catalog No. 56060) or equal on equipment which could be damaged by reverse rotation.
 - a. Motor and phase rotation shall be verified before energizing motors.
 - b. Motors shall be "bumped" to check for proper direction of rotation prior to performing operational tests on the equipment in the presence of Construction Manager.

END OF SECTION

SECTION 16170 GROUNDING AND BONDING

PART 1 GENERAL

1.1 SCOPE

This Section includes but is not limited to:

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 RELATED SECTIONS

- A. Section 02100 - Surveying.
- B. Section 16050 - Basic Electrical Materials and Methods.
- C. Section 16370 - Overhead Power Distribution.

1.3 REFERENCES

- A. InterNational Electrical Testing Association (NETA):
 - 1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code, 1999 Edition.
- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 467-93 UL Standard for Safety Grounding and Bonding Equipment.
 - 2. Electrical Construction Materials Directory-98.

1.4 SYSTEM DESCRIPTION

- A. Rod electrode and grounding connections.
- B. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

- A. Provide submittals for hardware, ground rods and ground wire. Unless specified otherwise, submittals shall be made to the Construction manger for review and approval.
- B. Provide certification of ground testing instrumentation.
- C. Provide record of as-built locations, as specified in Section 02100, of grounding electrodes, if grounding electrodes are required.

1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed in the UL Electrical Construction Materials Directory as suitable for the purpose specified and indicated.
- C. Provide certification of ground testing instrumentation according to NETA ATS.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers
 - 1. Mechanical Connectors
 - a. Burndy.
 - b. Ideal.
 - c. IlSCO.
 - 2. Exothermic Connections
 - a. Cadweld.
 - b. Thermoweld.

2.2 MATERIALS

- A. Rod Electrode
 - 1. Copper-clad steel, 3/4-inch diameter, 10-foot length.
- B. Mechanical Connectors
 - 1. Bronze.
- C. Wire
 - 1. Stranded copper.
 - a. Grounding Conductor: Size to meet NFPA 70 requirements.
- D. Grounding and bonding materials shall conform to UL 467.

PART 3 EXECUTION**3.1 SITE CONDITIONS**

- A. Verify that final backfill and compaction have been completed before driving rod electrodes.
- B. Verify that underground utilities will not interfere with the proposed rod locations prior to driving rod electrodes.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install additional rod electrodes as required to achieve specified resistance to ground.
- C. Equipment Grounding Conductor: Provide separate, insulated conductor with each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Connect ground conductors to reinforcing bars in foundation before pouring concrete. Tie to structural steel members when they are installed, by exothermic connection.
- E. Ground metal equipment enclosures by attachment to ground rod system, the building steel, or existing periphery grounding system.
- F. Ground pole-mounted equipment and static line conductors as indicated on the construction drawings.
- G. Drive ground rods until the top is 12 inches below grade.

3.3 QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation as defined by contract documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes if required, and submit to Construction Manager. Test instrumentation shall conform to NETA ATS. Provide certification for instrumentation.
- B. Measure the system's resistance to the ground; perform testing in accordance with instrument manufacturer's recommendations using the fall-of-potential method. Measure resistance at each pole and at each 480 V service as a minimum. Provide written test reports indicating overall resistance to ground and resistance of each electrode to ground.

END OF SECTION

SECTION 16370
OVERHEAD POWER DISTRIBUTION

PART 1 GENERAL

1.1 SCOPE

This Section includes but is not limited to:

- A. Poles.
- B. Pole hardware.
- C. Line conductors.
- D. Anchors.

1.2 RELATED SECTIONS

- A. Section 16050 - Basic Electrical Materials and Methods.
- B. Section 16170 - Grounding and Bonding.

1.3 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code, 1999 Edition.
- B. American National Standards Institute (ANSI):
 - 1. ANSI C2-97 National Electrical Safety Code.
 - 2. ANSI C135.1-79 Galvanized Steel Bolts and Nuts for Overhead Line Construction.

3. ANSI O5.1-92 Wood Poles Specifications and Dimensions.
- C. American Society for Testing and Materials (ASTM):
1. ASTM A36/A36M-96 Standard Specification for Carbon Structural Steel.
 2. ASTM A475-95 Standard Specification for Zinc-Coated Steel Wire Strand.
 3. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- D. American Wood-Preservers Association (AWPA):
1. AWPA C4-89 Poles - Pressure Process.
 2. AWPA C25-89 Standard for the Preservative Treatment of Crossarms by the Pressure Process.
- E. National Electrical Manufacturers Association (NEMA):
1. NEMA WC 7-88 Cross-Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- F. Underwriters Laboratories, Inc. (UL):
1. UL 96-94 UL Standard for Safety Lightning Protection Components.
 2. Electrical Construction Materials Directory-98.

1.4 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70 and ANSI C2.
- B. Furnish products, where available, listed in the UL Electrical Construction Materials Directory, as suitable for the purpose specified and indicated.
- C. Installation shall comply with ANSI C2, Heavy Loading District, Grade B Construction.

- D. Provide submittals for poles, pole hardware, line conductors and anchors. Unless specified otherwise, submittals shall be made to the Construction Manager for review and approval.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect poles from damage and decay by stacking to provide free circulation of air. Maintain 1 foot minimum spacing between bottom pole and ground or ground vegetation. Do not store poles above decayed or decaying wood.
- B. Stack poles stored for more than 2 weeks on decay-resistant skids arranged to support poles without noticeable pole distortion.
- C. Handle treated poles with tools which will not produce an indentation greater than 1 inch deep. Do not drag treated poles along ground. Do not apply tools to that section of treated poles between 1 foot above and 2 feet below ground line.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Poles
1. Wood Poles: ANSI O5.1; treated southern pine poles of length and class indicated.
 2. Select poles for straightness, minimum sweeps, and short crooks.
 3. Preservative: ANSI O5.1 and AWPA C4, Pentachlorophenol.
 4. Apply preservative to poles as required by AWPA C4 with minimum net retention of 12 lbs/ft³ (285 kg/m³). Obtain complete sapwood penetration.
- B. Pole Hardware
1. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.
 2. Eye Bolts and Nuts: ANSI C135.1.
 3. Ground Rods: Copperweld 3/4 inch O.D. by 10 foot -0 inches long.
 4. Guy Strand: High strength, seven-strand steel cable galvanized to ASTM A475, Class A or B.
 5. Guy Termination: Preformed wire type.
 6. Guy Guards: 8-foot (2 m) long plastic, colored yellow.

7. Ground Wire: Soft drawn solid copper conductors, 4 AWG minimum size.
 8. Air Terminal: UL 96; 18-inch copper air terminal.
 9. Guy Adapter: Tripleye.
- C. Line Conductors
1. Secondary Conductors: aluminum, three insulated conductors and messenger/ground wire with 600 volt cross-linked polyethylene insulation for phase conductors conforming to NEMA WC 7.
- D. Anchors
1. Helical Screw Anchors: Galvanized steel, ASTM A36/36M.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Verify that field measurements are as shown on drawings.
- B. Verify that there are no underground utilities located below the poles prior to installation.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Plug unused holes in poles using treated wood dowel pins. Treat field-cut gains and field-bored holes with preservative.
- C. Shorten poles when required by cutting from top end. Apply hot preservative to shortened end of pole.
- D. Set poles in straight line. Place curved poles with curvature in line with lead pole. Maintain an even grade.
- E. Dig setting holes large enough to permit use of power tampers to full depth. Place earth in maximum 6-inch layers and power tamp each layer until hole is restored to grade.

- F. Rake poles located at corners, angles, and dead ends so that poles are vertical after line installation.
- G. Do not install poles along the edge of cuts and embankments or where soil may be washed out.
- H. Identify each pole using aluminum marker stamped with characters 2-1/2 inches high, minimum. Locate to provide maximum visibility from roadway and fasten with aluminum nails. Obtain identifying numbers from Construction Manager.
- I. Minimum depths in normal firm ground, measured from lower side of pole:

OVERALL LENGTH	DEPTH FOR STRAIGHT LINES	DEPTH AT CURVES, CORNERS, AND POINTS OF EXTRA STRAIN
30'	5'-6"	5'-6"
35'	6'-0"	6'-0"
40'	6'-6"	6'-6"
45'	7'-0"	7'-6"
50'	7'-6"	8'-0"
55'	7'-6"	8'-0"

- J. Set crossarms at right angles to line for straight runs; and to bisect the angle of turns in line direction.
- K. Provide two braces for each crossarm.
- L. Install conductors to ANSI C2. Maintain clearances required by ANSI C2, except as follows: phase to phase - 20 inches, phase to ground - 16 inches, above roads, 480 V conductors - 23 feet, over buildings, all conductors, 8 feet. Conductor arrangement shall be phase A, B, C from north to south and from east to west for horizontal construction.

- M. Conductor taps shall be made with bail clamps and hot line connectors using compression connectors. Taps shall not be made directly on line conductors. Make aluminum connections to copper or other material using only splices, connectors, lugs, or fittings designed for that specific purpose.
- N. Install guys and anchors according to ANSI C2 requirements.
- O. Use small diameter steel probe to verify area is free of underground obstructions prior to installation of anchors.
- P. Bond metal enclosures on poles to pole ground wire in accordance with NFPA 70, ANSI C2 and manufacturer's instructions.
- Q. After initial energizing of transformers, measure the secondary voltage and adjust to nominal voltage by changing taps.

END OF SECTION

SECTION 16462
DRY TYPE TRANSFORMER/PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

Section includes, but is not limited to:

- A. Dry type, two-winding transformers integrated with primary and secondary main breakers and feeder breakers.

1.2 RELATED SECTIONS

- A. Section 16050 - Basic Electrical Materials and Methods.
- B. Section 16170 - Grounding and Bonding.

1.3 REFERENCES

- A. InterNational Electrical Testing Association (NETA):
 - 1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA PB 1-90 Panelboards.
 - 3. NEMA PB 1.1-91 General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
 - 4. NEMA ST 20-92 Dry Type Transformers for General Applications.

5. NEMA 250-91 Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. National Fire Protection Association (NFPA):
 1. NFPA 70 National Electrical Code, 1999 Edition.
- D. Underwriters Laboratories, Inc. (UL):
 1. Electrical Construction Materials Directory-98.

1.4 SUBMITTALS

- A. Provide submittals for transformers and panel boards. Unless specified otherwise, submittals shall be made to the Construction Manager for review and approval.
- B. Product Data: Include outline and support point dimensions of enclosures and accessories; unit weight; voltage; kVA, number of phases, impedance ratings, and characteristics; X/R ratio; tap configurations; insulation system type; rated temperature rise; and main bus ampacity, integrated short circuit ampere rating, circuit breaker, arrangement, and sizes.
- C. Transformer Test Reports:
 1. Factory Test: NEMA ST 20. Indicate loss data; efficiency at 25, 50, 75, and 100 percent rated loads; and sound level.
 2. Field Test: Indicate primary and secondary voltages as measured.

1.5 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver transformers/panelboards individually wrapped for protection and mounted on shipping skids.

- B. Accept transformers/panelboards on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer/panelboards' internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Siemens.
- B. Westinghouse.
- C. Square D.

2.2 EQUIPMENT

- A. Two-winding transformers
 - 1. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers; ratings as indicated on construction drawings.
 - 2. Insulation system and average winding temperature rise for rated kVA as follows:
 - a. 1-30 kVA: Class 185 with 115 degrees C rise.
 - b. 16-500 kVA: Class 220 with 115 degrees C rise.
 - 3. Case Temperature: Do not exceed 40 degrees C rise above ambient at warmest point.
 - 4. Winding Taps:
 - a. Transformers: NEMA ST 20. Transformers shall have four full current taps, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage.
 - 5. Sound Levels: NEMA ST 20, not to exceed 85 dBA at 3 feet.
 - 6. Basic Impulse Level: 10 kV.

7. Ground core and coil assembly to enclosure by means of a visible, flexible copper grounding strap.
 8. Mounting: Suitable for wall or floor mounting.
 9. Coil Conductors: Continuous windings with terminations brazed or welded.
 10. Enclosure: NEMA ST 20. Provide lifting eyes or brackets.
 11. Isolate core and coil from enclosure, using vibration-absorbing mounts.
 12. Nameplate: Include connection data and overload capacity based on rated allowable temperature rise.
- B. Branch Circuit Panelboards
1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
 2. Enclosure: NEMA PB 1; Type 3R conforming to NEMA 250.
 3. Cabinet Size: As shown on manufacturer's drawings.
 4. Cabinet Front: Hinged cover with paddle lock hinge.
 5. Provide an integrated unit with transformer. Finish in manufacturer's standard gray enamel.
 6. Provide panelboards with copper bus, ratings as scheduled on construction drawings. Provide copper ground bus in each panelboard.
 7. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.
 8. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, rated for 75 degrees C copper conductors. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where required. Provide 20 percent spare breakers installed in the panelboard.

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

- A. Install transformer/panelboards in accordance with NEMA PB 1.1.
- B. Install plumb, and in accordance with manufacturer's instructions, and as indicated on construction drawings.

- C. Height: 6 feet, 6 inches to top of transformer section.
- D. Provide grounding connections in accordance with Section 16170.
- E. Provide filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Provide engraved plastic nameplates identifying transformer/panelboard equipment number.
- H. After initial energizing of transformers, measure the secondary voltage and adjust to nominal voltage by changing taps.

3.2 QUALITY CONTROL

- A. Test according to general requirements of Section 16050 and to the relevant requirements of NETA ATS.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, grounding, and conformance of installation to contract documents and manufacturer's instructions. Check tightness of wiring and mounting connections for circuit breakers and transformer prior to energizing.
- C. Record primary and secondary voltages; submit to Construction Manager.
- D. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION