U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 01 - General Requirements

Fluor Fernald, Inc.

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DATE:

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DATE:

SECTION 01010
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

A. These general requirements form a part of the technical divisions of these specifications.

B. In all cases where the words "A/E Subcontractor" appear in these specifications, it shall be understood to refer to Fluor Fernald or to such other individuals or organizations acting within the scope of the specific duties entrusted to them.

C. In all cases where the terms "Vendor" or "Seller" or "Manufacturer" or similar terms appear in these specifications or in the appendices to these specifications, they shall be understood to refer to an individual or firm(s) providing materials, equipment, or services, as noted, under a subcontract to Fluor Fernald, Inc.

D. In all cases where the term "Subcontractor" appears in these specifications, it shall be understood to refer to the Construction Contractor or Subcontractor.

E. In all cases where the words "Owner's Agent" or "Construction Manager" appear, they shall be understood to refer to Fluor Fernald.

F. The Subcontractor shall coordinate, supervise, and perform all construction acceptance tests. In addition, before the final acceptance of the work, Fluor shall coordinate, supervise, and perform an Integrated System Construction Acceptance Test (ICAT) with the assistance of the Subcontractor. Fluor Fernald retains the option to witness any or all tests. All test reports shall be submitted to Fluor Fernald.

G. ICAT shall be provided for the Subcontractor by Fluor Fernald in accordance with the following requirements:

1. Construction Acceptance Testing (CAT) must be completed prior to initiation of ICAT.
2. ICAT procedure shall be written by Fluor Fernald.
3. ICAT procedures shall be formatted per the requirements of Site Procedure RM-0034.
4. ICAT shall accomplish the following as a minimum requirement:
   a. The performance of the system meets design requirements.
   b. The optimum operating parameters of the system are met.
   c. Any problems that may adversely affect operational reliability of the system have been identified and corrective action taken.

Site Procedures ED-12-6003 and RM-0034 contain the procedure and guidance for system testing. ICAT procedures must meet these requirements as a minimum.

H. Generally, all field test instruments shall have been calibrated prior to use on this subcontract by a calibration laboratory whose calibration equipment and instruments are fully traceable to National Institute of Science and Technology (NIST) standards. The Subcontractor shall maintain individual certification of calibration which evidences traceability to NIST standards for all field test instruments used on this subcontract.

I. All work shall be accomplished in accordance with the following code requirements:

1. Ohio Basic Building Code (OBBC) 1995.
2. Uniform Building Code (UBC) 1994.
3. Code for Safety to Life from Fire in Buildings and Structures (NFPA 101, Life Safety Code) - 1997.
4. All other National Fire Protection Association (NFPA) Codes - All inclusive, including 1997 revisions.
5. Occupational Safety and Health Administration (OSHA) - 29 CFR 1910 and 29 CFR 1926.

1.2 SITE AND SCOPE

A. The intent of these specifications is to provide all technical information required and necessary to perform and complete the work as required by the Contract.

B. This project provides for the addition of two(2) Waste Storage Area Extraction at the Fernald Environmental Management Project (FEMP). The drilling and casing of the two new wells is by others.

C. The relevant drawings are listed in Section 01012. For clarity, in several cases, clouds have been added on the drawings to indicate the new equipment/material being provided by this contract (i.e. electrical single line and P&ID). Details that apply to the South Field Extraction System, SFES, in general, but are not be applicable to this contract, have been retained on the drawings in order to maintain documentation of the entire SFES.

D. The Subcontractor shall provide all labor, services, testing, materials, and equipment, and shall do all work necessary to accomplish this within the limits of work as defined in the Task Order.

1.3 LISTS OF MATERIALS, MANUFACTURERS, OR EQUIPMENT SUPPLIERS

A. Where indicated in the technical specifications or on the associated drawings, the contractor shall provide specific equipment or materials as listed by manufacturer, type, model and/or part number. If the indicated equipment is no longer manufactured, Fluor Fernald will approve a suitable substitution of "equal" equipment or materials. A list of specifically identified equipment and materials is located in Attachment A to this Specification Section.

B. Where lists of acceptable manufacturers are provided in these specifications, without reference to model and/or part number, these lists are intended to identify the

types and general quality of those items that are considered suitable. These lists in no way preclude the offerer from proposing alternate materials, equipment, manufacturers' names, or equipment suppliers of these items, except where specifically precluded by these specifications. It is the offerer's responsibility to propose the materials, manufacturers' names, or equipment that is best suited for this project in combined terms of quality and price.

1.4 REFERENCES

A. The publications listed in the technical specifications form part of this specification. Each publication shall be the latest revision and addendum in effect at the time of issue of contract and of issue of the specification unless notified otherwise. Except as modified herein or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.

1.5 SPECIFICATION EXPLANATION

A. General: The technical specifications are of the abbreviated, simplified, or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the contractor shall," "in conformity therewith," "shall be," "as noted on the drawings," "according to the plans," "a," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings.

The Subcontractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled either on the drawings, or specified herein, or both, including all labor, materials, equipment, and incidentals necessary and required for their completion and installation.

For convenience of reference and to facilitate the letting of contracts, the specifications may be

separated into titled divisions. Such separations, however, shall not operate to make Fluor Fernald an arbitrator to establish the limits of subcontracts in any manner. The following defines the separations referred to in the specifications.

1. Division: Separate numbered division of specifications (e.g., Div. 16)
2. Section: Separate numbered section of a division (e.g., Sec. 16050)
3. Article: Separate numbered article of a subsection (e.g., Article 2.1)

B. Definitions: Certain terms and words as used throughout the specifications shall be defined as follows, unless otherwise particularly specified:

1. "Provide": Furnish and install, complete, in place.
2. "Indicated": As shown on the drawings and/or specified.
3. "Directed," "Authorized," "Permitted": Shall be as directed, authorized, or permitted by Fluor Fernald.
4. "Selected": Shall be as selected by Fluor Fernald.
5. "Satisfactory," "Acceptable": Satisfactory or acceptable to FLUOR FERNALD.
6. "Necessary," "Required," "Suitable": As necessary, required, or suitable for the intended purpose as determined by FLUOR FERNALD.
7. "Submit": Submit to FLUOR FERNALD unless otherwise specified

1.6 ABBREVIATIONS FOR REFERENCED STANDARDS AND SPECIFICATIONS

A. The following list denotes abbreviations used in the technical portions of these specifications:

Abbreviation	Authority
AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGC	Associated General Contractors of America
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrator International
CFR	Code of Federal Regulations
FM	Factory Mutual System
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IMIAC	International Masonry Industry All-Weather Council
ISA	International Society for Measurement and Control
MBMA	Metal Building Manufacturer's Association
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	International Electrical testing Association

Abbreviation	Authority
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
NPCA	National Paint and Coatings Association
ODOT	Ohio Department of Transportation
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PS	United States Department of Commerce, Voluntary Products Standards
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
SWRI	Sealant, Waterproofing, and Restoration Institute
UL	Underwriters Laboratories, Inc.

END OF SECTION

ATTACHMENT A
TO 01010
SOLE SOURCE EQUIPMENT
WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE II

The equipment listed in the table below is specifically identified by manufacturer and model within the individual specification sections. This equipment is to be provided exactly as specified in accordance with Article 1.3.A of Section 01010.

Equipment	Specification / Article
Process Control Station (communications)	13401 / 2.2.B DWG 95X-5900-N-00273
Variable Frequency Drive (VFD)	16483 / 2.2.B
Magnetic Flow meter	13400 / 2.1.D
Pressure Indicating Transmitter	13400 / 2.1.B
Limit Switches, Multi-Purpose Position Indicator	13400 /2.1.E
Check Valve	15060 / 2.1.F
Butterfly Valves	15060 / 2.1.E
Submersible Pump	15160 / 2.1.A
Motors Driven by Variable Frequency Drive	15171 / 2.1.A
Unit Heaters	15500 /2.1.B.2
Combination Step-Down Transformer & Lighting Panel	16462 / 2.1.A.1
Distribution Panel	16462 / 2.1.A.2

SECTION 02110
SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove surface debris.

B. Remove paving/crushed aggregate paving.

C. Clear site of plant life and grass, where it affects construction only.

D. Remove fencing as directed by FLUOR FERNALD.

E. Topsoil excavation.

F. Traffic control.

G. Control of fugitive emissions.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 02270 - Erosion Control.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 QUALITY ASSURANCE

A. Erosion and sedimentation control shall comply with requirements of Section 02270 of this specification package.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Chemical additives for the control of fugitive emissions shall be handled and stored according to the

manufacturer's recommendations.

1.6 SEQUENCING AND SCHEDULING

A. Coordination
   1. Coordinate clearing work with the Construction Manager.
   2. Sequence clearing work with erosion control measures stated in Section 02270 of this specification package.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fugitive emission control materials shall be non-hazardous.

2.2 EQUIPMENT

A. Access control barricades are to be portable so they can be moved daily to allow through traffic during non-work periods. They should be marked with 4-inch to 8-inch-wide reflective orange and white diagonal strips.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that existing utilities and features designated to remain are staked, flagged, and identified.

B. Install perimeter sediment control measures according to Section 02270 prior to any clearing or earthmoving operations.

C. Install traffic control devices if required. Traffic shall be maintained at all times unless otherwise approved by the Construction Manager.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Clearing:
   1. Clear and grub areas along new groundwater lines, valve chambers, well houses, new roads, and areas accessing the site. Coordinate clearing limits with the Construction Manager.
   2. Remove paving and gravel according to the construction drawings.
   3. During site clearing and earth-moving operations, fugitive emissions, principally dust shall be controlled using water-misting techniques.

B. Removal:
   1. Remove debris, rock, and extracted plant life.

C. Topsoil Excavation:
   1. Excavate topsoil from areas to be graded.
   2. Stockpile in area designated on site or as directed by the Construction Manager to a height not exceeding 8 feet. Protect from erosion. Remove excess topsoil not re-used from the stockpile to a site designated by the Construction Manager.

3.3 PROTECTION

A. Locate, identify, and protect from damage all utilities that remain.

B. Protect trees, plant growth, and features designated to remain as final landscaping.

C. Protect survey benchmarks, monitoring wells, and existing structures from damage or displacement.

D. Maintain existing roadways at the construction site, including dust control.

END OF SECTION

SECTION 02200
EARTHWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site grading.

B. Excavating.

C. Backfilling and compacting.

D. Landscape grading.

E. Redistribution of topsoil.

F. Sampling and testing.

G. Trenching for utilities.

H. Soil and aggregate materials.

1.2 RELATED SECTIONS

A. Section 02110 - Site Clearing.

B. Section 02270 - Slope Protection and Erosion Control.

C. Section 02512 - Crushed Aggregate Paving.

D. Section 02667 - Site Water Lines.

E. Section 02720 - Site Drainage.

F. Section 03001 - Concrete.

G. Sectibn 16118 - Underground Ductbanks.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM C136-96	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2.	ASTM D422-63	Standard Test Method for Particle-Size Analysis of Soils. R(1998).
3.	ASTM D698-91	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft/[600 kn-m/m]). R(1998).
4.	ASTM D1556-90	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. E-1-1996 R(1996)
5.	ASTM D2487-98	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6.	ASTM D2922-96	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7.	ASTM D3017-96	Standard Test Methods for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth). E1-1997

B. State of Ohio, Department of Transportation (ODOT), Construction and Materials Specifications.

C. Occupational Safety and Health Administration (OSHA):

1.	29 CFR 1926	Subpart P - Excavations.

1.5 Submittals

A. Accurately record actual locations of utilities (i.e., buried pipe, conduit, or cable) remaining, by horizontal dimensions, elevations or inverts, and slope

gradients. Submit information on as-built drawings.

1.6 QUALITY ASSURANCE

A. Unless noted otherwise, all work shall be done in accordance with ODOT specifications.

B. If tests indicate that the materials do not meet specified requirements, change the material and retest.

PART 2 PRODUCTS

2.1 MATERIALS

A. Every effort shall be made to re-use surplus materials generated by the project before importing material from off site. Subsoil Type S1: Excavated and re-used material; graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris; conforming to ASTM D2487 Group Symbol CL, ML, SC.

B. Subsoil Type S2: Imported material; graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris; conforming to ASTM D2487 Group Symbol CL, ML, SC.

C. Topsoil Type S3: Excavated and re-used material; graded; free of roots, rocks larger than 1/2 inch, subsoil, debris, weeds, and foreign matter not suitable for subsequent seeding operations and maintenance; conforming to ASTM D2487 Group Symbol OH.

D. Coarse Aggregate Type A2: Conforming to ODOT Item 304 - Aggregate Base.

1. The aggregate shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, admixture of crushed and granulated slag, or other types of suitable materials meeting the requirements of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

Sieve Size	Percent Passing
2 inches	100
1 inch	70-100
3/4 inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-13

F. Fine Aggregate Type A3: Sand - natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136 and D2487; within the following limits:

Sieve Size	Percent Passing
No. 4	90-100
No. 50	7-40
No. 200	0-10

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that survey benchmark and intended elevations for the work are as indicated.

B. Identify and flag known utility locations which exist in the construction area.

C. Maintain and protect existing utilities to remain.

D. No backfill shall be placed around or upon any structure/foundation until it is shown that the

concrete has attained satisfactory strength in accordance with Section 03001 of this specification package and that the structure as a whole is ready to receive backfill. The compressive strength of the concrete shall also be determined in accordance with Section 03001.

E. Install erosion and sediment control measures in accordance with Section 02270 of this specification package.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Excavation:

1. Excavate subsoil required to accommodate foundations, slabs on grade, paving, site structures, and construction operations.
2. Slope banks to angle of repose or less, unless shored.
3. Correct unauthorized excavation.
4. Hand-trim excavation for structural footings. Remove loose material.
5. Do not interfere with 45-degree bearing splay of foundations.
6. Stockpile excess soil in the area designated.
7. Perform grading and other operations to maintain site drainage. No water shall be permitted to accumulate in excavations under structures, paving areas, or equipment pads. Control water by means of ditches, dams, temporary pumps and piping, plastic coverings, tarps, or other methods acceptable to the Construction Manager.
8. Areas that are disturbed or that lose firmness before concrete is poured shall be undercut, backfilled, and compacted. A lean concrete (2,500 psi at 28 days) may be installed.
9. Remove debris, lumped subsoil, boulders, and rock up to 1/3 cubic yard.

B. Trenching:

1. Cut trenches sufficiently wide to enable installation of utilities.

2. Excavation is to be free of loose matter.
3. Backfill trenches to required contours and elevations.
4. Install trace wire as indicated in Section 02667.
5. Trenching shall conform to OSHA requirements.

C. Rough Grading:
1. Prepare subgrade as follows:
   a. Compact exposed subgrade to density requirements for subsequent backfill materials.
   b. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type S1 fill and compact to density equal to or greater than requirements for subsequent fill material.
2. Backfill areas to contours and elevations shown. Use unfrozen and unsaturated materials.
3. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
4. Unsatisfactory subgrade:
   a. Where unsatisfactory subsurface conditions in an area of backfill are observed, excavate unsatisfactory material to satisfactory subgrade as approved by the Construction Manager.
   b. Backfill with fill material required for specific area. Compact to density required for the area.
5. Place and compact fill materials in continuous level layers not exceeding 8 inches loose depth.
6. Maintain optimum moisture content as determined by ASTM D698 (within 3 percent) of backfill materials to attain required compaction density.
7. Slope grade away from foundations and pads a minimum 1/4-inch per foot, unless noted otherwise.
8. Backfill simultaneously on each side of unsupported foundation walls.

D. Fill over Underground Utilities in trenches:
1. Fill Type S1 or S2, above bedding to subgrade, compacted to 95 percent standard Proctor (ASTM

D698).

2. Pipe bedding shall be Type A3 material compacted in layers not exceeding 6 inches loose depth to 95 percent Standard Proctor (ASTM D698).

E. Placing Topsoil:

1. Clean up and restore areas disturbed by and during construction operations.
2. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slope into level areas.
3. Remove large stones, roots, grass, weeds, debris, and foreign material while spreading.
4. Leave stockpile area and site clean, raked, and with positive drainage, ready to be seeded.

F. Material Stockpiles:

1. Stockpile materials on site at a location designated by the Construction Manager.
2. Separate differing materials with dividers or stockpile apart to prevent mixing.
3. Direct surface water away from stockpile site to prevent erosion or deterioration of materials. Prevent silt migration at the stockpile perimeter.
4. Provide stormwater runoff controls at pile to prevent sediment from leaving stockpile area.

G. Dust Control: Provide dust control using potable water or other materials in accordance with Section 02110.

H. Dewatering:

1. Should dewatering be required, all water shall be contained and collected.
2. Dewatering shall be achieved by gravity or by pumps. All methods shall be of sufficient capacity to keep excavations/trenches sufficiently dewatered.

I. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the

provisions of ODOT.

J. Lean concrete, minimum compressive strength of 2,500 psi, may be used to correct over-excavation.

K. Debris and waste shall be handled as specified in Section 02110.

3.3 FIELD QUALITY ASSURANCE

A. Compaction testing will be performed in accordance with ASTM D698, ASTM D1556, ASTM D2922, and ASTM D3017.

B. If compaction tests indicate that work does not meet specified requirements, remove work and replace. If visual inspection indicates that work has not been performed as specified, repeat procedure.

C. Frequency of Tests:

1. Frequency of in-place density testing shall be whichever of the following requires the greatest number of tests:
   a. Once each day of work filling.
   b. Once every layer of fill.
   c. Once every 200 feet of trench.

D. Notify the Construction Manager of activities that will require testing/ inspection, at least 24 hours prior to the start of such activities.

E. Minimum Compaction Requirements:

Location	Required Compaction
Trenches	95 percent Standard Proctor
Under all pavements	
Subsoil	95 percent Standard Proctor
Fill Type A2	100 percent Standard Proctor

All other fill (roads & grading)) (Fill Type S1 or S2)	95 percent Standard Proctor

Standard Proctor - ASTM D698.

3.4 ADJUSTING

A. Grading and Filling: Plus or minus 1 inch of indicated finish subgrade at structures. Other areas graded to drain at plus or minus 3 inches.

3.5 CLEANING

A. Remove soil stockpiles, leaving the area in a clean and neat condition. Grade and stabilize site surface to prevent freestanding surface water.

3.6 PROTECTION

A. Grade excavation top perimeter to prevent surface water runoff from entering into excavation or to adjacent properties.

B. Protect finished work and existing features, and landscaping which will remain.

C. Reshape and re-compact fills subjected to vehicular traffic to final grade and to compaction requirements.

D. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

E. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

F. Provide erosion and sediment control in accordance with Section 02270.

END OF SECTION

SECTION 02270
EROSION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Maintenance of erosion control measures already in place within the work area.

B. Soil erosion and sedimentation control for areas of the work area that are graded or disturbed as a part of the work.

C. Installation, maintenance and removal of all temporary erosion control facilities.

D. Dumped rock for storm drain lines and channels.

1.2 RELATED SECTIONS

A. Section 02110 - Site Clearing.

B. Section 02200 - Earthwork.

C. Section 02720 - Site Drainage.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specification. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

B. State of Ohio, Department of Natural Resources (ODNR):
   1. Rainwater and Land Development, Ohio's Standard for Stormwater Management, Land Development, and

Urban Stream Protection - 1996.

C. American Society of Testing and Materials (ASTM):

1.	ASTM D1777-96	Standard Test Method for Measuring Thickness of Textile Materials.
2.	ASTM D3776-96	Standard Test Method for Mass per Unit Area (Weight) of Woven Fabric.
3.	ASTM D3786-87	Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
4.	ASTM D4491-96	Standard Test Method for Water Permeability of Geotextiles by Permittivity.
5.	ASTM D4533-91	Standard Test Method for Trapezoid Tearing Strength of Geotextiles. (R 1996)
6.	ASTM D4632-91	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles (R 1996).
7.	ASTM D4751-95	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
8.	ASTM D4833-88	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products (E1-1996) (R 1996).

1.5 QUALITY ASSURANCE PROGRAM

A. Inspect sediment control measures periodically and after each rain exceeding 0.5 inches to evaluate the effectiveness of the control measures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stakes: Stakes shall be a minimum of 2 feet, 8 inches in height and 2 inches by 2 inches or more in depth and width and made from hardwood.

B. Silt Fence: Materials shall be as specified in ODNR's Rainwater and Land Development and the construction drawings.

C. Dumped Rock Fill: Dumped rock fill shall meet the requirements of ODOT Item 601.07 for type specified on drawings.

D. Non-woven geotechnical fabric for dumped rock fill bedding shall meet the requirements of ODOT Item 712.09 Type B.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Protective Measures

1. Construct protective devices as specified herein, and as required on the contract drawings.
2. Silt Fence: Conform to requirements on the construction drawings.
3. Stockpile areas for soil materials shall also be protected from erosion. If pile is not used for 45 days, it shall be covered with tarps, crusting agent or seeded. Slopes on pile shall not exceed 2:1 in steepness and shall be less than 15 feet in height. Pile shall be shaped with a drainage pitch of at least 2 per cent on all areas. The perimeter of the pile shall have proper sediment controls (i.e., silt fence). Tarps or other coverings placed on pile shall be properly anchored to withstand wind and fully cover all of the pile. The subcontractor is responsible for maintaining the controls on the piles until final acceptance or disposition.
4. Pipeline installation (trenching, pipe laying, and backfill) is to be kept to 500 feet or less in length of exposed, denuded conditions unless

otherwise approved by the Construction Manager. Proper sediment controls (i.e., silt fence) shall be used at denuded trench areas. Sediment controls can be re-used, if not in disrepair.

B. Silt Fences

1. Install in accordance with ODNR and manufacturer's recommendations. Place at locations shown on drawings prior to start of earthwork and as directed by the Construction Manager.

C. Dumped rock will be used to protect storm drain outfalls and ditch lines as indicated on drawings. Dumped rock shall conform to ODOT Type D dumped rock fill.

3.2 ADJUSTING

A. Removal of Sediment Accumulation

1. Remove accumulated sediments, debris, and obstructions as necessary. In no case shall sediment build up to a depth greater than 1/2 the height of the protective device. Respread on site in a manner and location as directed by the Construction Manager.

B. Removal of Temporary Erosion Control Facilities

1. Erosion control facilities shall be removed after the disturbed areas are stabilized with grass or other measures approved by the Construction Manager.

END OF SECTION

SECTION 02512
CRUSHED AGGREGATE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation and compaction requirements for aggregate surface for roads.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate materials shall meet the requirements of ODOT Item 304.

B. Geotextile fabrics shall conform to ODOT Item 712.09, Type D.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Verify grades and elevations of subgrade are correct.

B. Verify that compacted subgrade is dry and not frozen, soft, or spongy.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Prepare subgrade according to Section 02200.

B. Place geotextile on subgrade in accordance with manufacturer's installation instructions and as follows:

1. Geotextile fabric shall be placed directly over the subgrade. The geotextile fabric shall be placed and temporarily anchored in such a manner that placement of overlying materials will not excessively stretch or tear the fabric.
2. Geotextile fabric shall be installed to limits and grades indicated on plans for all new work. The geotextile shall not be dragged across the subgrade. The geotextile fabric shall be unrolled as smooth as possible on the prepared subgrade. Wrinkles and folds in the geotextile shall be removed by stretching and placing of sod staples or small aggregate piles as required. The fabric shall be installed according to the manufacturer's suggestion at curve locations.
3. The geotextile shall be field joined, factory seamed, or manufactured in seamless width. Methods of field joining shall include overlapping of adjacent edges and ends of geotextile or sewing of adjacent edges and ends of geotextile. Sand bags or other weights may be used for temporary anchoring. Overlap at edges and ends of geotextile shall be per manufacturer's installation instructions.
4. The geotextile fabric shall extend to the edges of the road aggregate surface.
5. Exposure of geotextiles to elements between lay down and cover shall be a maximum of 7 days to minimize damage potential by ultraviolet light.
6. End dumping or tailgate dumping shall not be permitted directly onto the geotextile fabric. The aggregate shall be dumped adjacent to the fabric or on previously placed stone. The

aggregate shall be spread from the backdumped pile using a bulldozer, loader, track hoe, or grader, with care being taken to avoid damage to the fabric by blades, tracks, tires, or buckets. The initial lift of aggregate on the geotextile fabric shall be a minimum thickness of 6 inches after compaction and shall be compacted with a smooth drum roller to the minimum compacted density per Section 02200.

7. Construction traffic shall not be permitted directly on the geotextile fabric.

C. When additional aggregate material is to be added to existing compacted aggregate, scarify existing aggregate to a depth of 3 inches.

D. Compact aggregate road surface as specified in Section 02200.

3.3 QUALITY CONTROL

A. Work shall be performed in accordance with ODOT requirements.

B. Tolerances

1. The top of the aggregate surface shall be a uniformly smooth grade surface without high or low points.
2. The thickness of the finished aggregate course shall be no less, at any point, than the thickness indicated on the drawings.

END OF SECTION

SECTION 02667
SITE WATER LINES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and fittings for groundwater discharge and treatment underground lines.

B. Valves and tap connections.

C. Air-relief manholes, frames, and lid.

D. Clean-outs, covers, and frames.

E. Guard posts.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 03001 - Concrete.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A53 -98 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM D3035-95 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
3. ASTM D3261-97 Standard Specification for

		Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
4.	ASTM D3350-93	Standard Specification for Polyethylene Plastic Pipe and Fittings Material.
5.	ASTM F714-97	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

B. American Water Works Association (AWWA):

1.	AWWA C104/ A21.4-95	Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2.	AWWA C105/ A21.5-93	Polyethylene Encasement for Ductile-Iron Pipe Systems.
3.	AWWA C110/ A21.10-93	Ductile-Iron and Gray-Iron Fittings, 3-Inch through 48-Inch, (75 mm through 1200 mm) for Water and Other Liquids.
4.	AWWA C111/ A21.11-95	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
5.	AWWA C115/ A21.15-94	Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6.	AWWA C150/ A21.50-96	Thickness design of Ductile Iron Pipe.
7.	AWWA C151/ A21.51-96	Ductile-Iron Pipe, Centrifugally Cast, for Water.
8.	AWWA C500-93	Metal-Seated Gate Valves for Water Supply Service; Addendum C500A-1995
9.	AWWA C504-94	Rubber-seated Butterfly Valves.
10.	AWWA C512-92	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service First Edition.

11. AWWA C600-93 Installation of Ductile-Iron Water Mains and Their Appurtenances.

C. The Plastic Pipe Institute Handbook Of Polyethylene Pipe, 1999.

D. State of Ohio, Department of Transportation (ODOT), Construction and Materials Specifications, January 1, 2005.

1.5 SUBMITTALS

A. Product Data: Provide data on all pipe materials, pipe fittings, valves, accessories, the methods and equipment for HDPE fusion welding, HDPE manholes, and manhole frame and cover.

B. Project Record Documents:
1. Accurately record actual locations by NAD83 coordinates of all underground utilities, piping mains, valves, connections, and invert elevations, and show on redline drawings.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Piping and Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to construction site.

B. Deliver and store valves in shipping containers or pallets with labeling in place.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe

1. Ductile Iron Pipe: AWWA C151, Class 55:
   a. Fittings: AWWA C110, Ductile iron cement lined, standard thickness per AWWA C150. All fittings and pipe at valves shall be flanged per AWWA C115.
   b. Jackets: AWWA C105, PE encasement.
   c. Cement Lined: AWWA C104, cement mortar lined.
2. High-Density PE Pipe: ASTM D3035, SDR 11 ASTM F714 for 150-psi pressure rating (150-psi test pressure rating).
   a. Fitting: Molded, butt fusion weld to pipe.
   b. Joints: Butt fusion, flanged gasket joints, and molded adapter pipe at interface connections with ductile iron pipe and valves.
   c. Branch Saddles: IPS Branch SDR-11 saddles.
   d. Trace Wire: Magnetic detectable 14 gauge insulated stranded conductor.
   e. Warning Tape: Brightly colored plastic tape, imprinted with "water service" in large letters.
   f. Electro-Fusion coupling and Electro-fused branch saddles are <u>not</u> acceptable and shall not be used.

B. Gate Valves

1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, Class 125 flanged ends, control rod, extension box, and valve key.
2. Provide a lockout device capable of receiving the lock hasp.

C. Bedding Materials

1. Bedding: Fill Type A3 as specified in Section 02200 of this specification package.

D. Manhole: HDPE, ASTM D3350. Pipe resin is cell classification 3454 34C.

E. Manhole frame and lid shall be heavy-duty cast iron as noted on the drawings.

F. Air Release Valve: Valve shall be screwed inlet connection and shall be cast iron body, top and inlet flange, stainless steel float and trim with BUNA-N seat to meet AWWA C512.

G. Post Indicating Valves: Post Indicating Valves Assembly - U.L. listed and FM approved.
   1. Sizes 4 inches - 14 inches, AWWA C500 gate valves, flanged ends Class 150, post assembly shall show open and shut, handcrank operator above ground, non-rising stem, and break-flange to separate the top works without removing the valve from the line.
   2. Provide a lockout device capable of receiving the lock hasp.

H. Guard Posts: Steel pipe, ASTM A53, Schedule 40.

I. Thrush Blocks: Thrush Blocks shall be located at each buried change in direction and connection. See Drawing 94X-5500-G-02139 for details.
   1. Concrete: 3,000 psi (minimum) as specified in Section 03001. Poured concrete against undisturbed soil or compacted fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions. Bring any discrepancies to the Construction Manager for resolution prior to start of work.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before

assembly.

C. Prepare pipe connections to equipment by using flanges or unions.

D. Excavate pipe trench in accordance with Section 02200 of this specification package for work of this section. Locate all existing utilities in the area and determine if they will interfere with the proposed utility. Notify the Construction Manager if there is an interference.

E. Remove existing pipe to the extent necessary to make new tie-ins. Tie-in locations shall be adjusted to conform to field conditions.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Installation - Pipe: Ductile Iron Pipe

1. Maintain separation of water main from sewer piping (10-foot horizontal minimum, 18-inch vertical minimum), or sewer encased in concrete.
2. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
3. Install ductile iron piping and fittings to AWWA C600.
4. Route pipe in straight line except as shown on drawing.
5. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendations.
6. Slope water pipe and position drain at low points.
7. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.
8. Establish elevations of buried piping to ensure not less than 3.0 feet of cover.
9. Backfill trench in accordance with Section 02200 of this specification package.

B. Installation - Pipe: HDPE

1. Maintain separation of water main from sewer piping (10-foot horizontal minimum, 18-inch

vertical minimum).

2. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
3. Install HDPE piping and fittings to SDR 11 ASTM F714.
4. Install branch saddles in accordance with manufacturer's recommendations, with the understanding that electro-fusion saddles and couplings shall not be used.
5. Route pipe in line as shown on drawing.
6. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendation.
7. Install access fittings to permit cleanout.
8. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.
9. Establish elevations of buried piping to ensure not less than 3.0 feet of cover.
10. Install separate 14 gauge stranded trace wire continuous to top of pipe. Install warning tape buried 6 inches below finish grade, above pipeline, coordinate with Section 02200 of this specification package.
11. Backfill trench in accordance with Section 02200 of this specification package.

C. Installation - Valves:

1. Set valves on solid bearing of concrete.
2. Center and plumb valve box over valve. Set box cover flush with finished grade.

D. Installation - Guard Post

1. Excavate for post and concrete in accordance with Section 02200.
2. Hand trim and remove loose material in excavation.
3. Position pipe in hole, maintaining clearances as specified on drawings.
4. Place concrete as specified in Section 03001, around and in pipe.
5. Paint post after concrete cures in accordance with ODOT Item 514.

3.4 FIELD QUALITY ASSURANCE

A. Damage or butt fusion misalignment should not exceed 10% of the minimum wall thickness required for the pipeline's operating pressure. Notify the Construction Manager for corrective action.

B. Deep cuts, abrasions or grooves cannot be field repaired by hot gas or extrusion welding. Notify the Construction Manager for corrective action.

C. Pipe installation will be inspected after installation but prior to hydrostatic test. After passing hydrostatic test, the installation will be again inspected prior to backfilling operations.

D. Perform hydrostatic tests on water line in accordance with Plastics Pipe Institute recommendation. Notify the Construction Manager at least 24 hours in advance of planned testing. Submit report to the Construction Manager within 1 week after completion of test.

E. The new pipes shall be hydrostatically tested prior to tie-in. Test will be conducted per PPI Monitored Make-up Water Test.

F. The test pressure shall be 1.5 Times the system design pressure at the lowest elevation in the section under test or per the limiting pressure of in line component(s) or device(s).

G. The test duration shall include the initial pressurization, initial expansion, and the time at test pressure. The total test time must not exceed eight (8) hours. Test failure due to leakage, equipment failure, etc., shall have the test section de-pressurized and allow to "relax" for at least eight (8) hours before re-testing begins.

G. Service test for tie-in locations shall be run for 1 hour. Joints will be visually observed for leaks. Testing shall be coordinated through the Construction

Manager. No visible leakage is allowed during the hydrostatic test.

END OF SECTION

SECTION 02720
SITE DRAINAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Culverts, including flared inlet and outlet.

1.2 RELATED SECTIONS

A. Section 01010 - General Requirements.

B. Section 02110 - Site Clearing.

C. Section 02200 - Earthwork

D. Section 02270 - Erosion Control.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. State of Ohio, Department of Transportation, Construction and Material Specification (ODOT). Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

B. American Association of State Highway and Transportation (AASHTO):

1. AASHTO M36M-96 — Standard Specification for Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains.

PART 2 PRODUCTS

2.1 MATERIALS

A. Corrugated Metal Pipe

1. Corrugated metal storm drain pipe and culverts shall be in accordance with AASHTO M36 and ODOT 707. Corrugated metal pipe shall be galvanized, of the sizes specified on the drawings.
2. Culverts, and fittings shall be corrugated steel, 14-gage thickness. Culverts shall have standard metal flared end sections.
3. Coupling bands shall be corrugated, galvanized steel bands in accordance with AASHTO M36. Pipe sections with rerolled ends shall be joined with annular corrugated connecting bands. Helically corrugated pipe ends shall be joined using helically corrugated connecting bands.

B. Bedding materials for storm drain pipes and culverts shall be in accordance with ODOT 304.

C. See Section 02270 for data on fabric under dumped rock fill and for dumped rock fill.

D. Concrete Materials:
1. All cast-in place concrete shall meet requirements of ODOT Item 499, Class F concrete (average compressive strength at 28 days of 3,000 psi.

E. Reinforcement Materials
1. Reinforcing Steel: All reinforcing steel shall meet the requirements of ODOT 709.01, 60 ksi yield grade, deformed billet steel bars, plain finish.
2. Welded Steel Wire Fabric: All Welded Steel Wire Fabric shall meet the requirements of ODOT 709.10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are ready to receive work.

3.2 PREPARATION

A. Hand trim excavations. Correct over-excavation according to the requirements of Section 02200 of this specification package.

B. Corrugated Metal Pipe

1. The pipe and fittings shall be free of foreign materials and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.
2. All pipe shall be laid as shown in the drawings.
3. Each piece of pipe shall be carefully inspected before it is placed and no defective pipe shall be laid in trench. Trench bottoms found to be unsuitable for foundations after pipe laying operations have started shall be corrected and brought to specified line and grade with approved bedding materials.
4. Joints for corrugated metal pipe shall be made with corrugated galvanized steel coupling bands in accordance with AASHTO M36.

3.4 QUALITY CONTROL

A. Inspection:

1. Inspection shall include checking for proper alignment and location of all piping.
2. Joints shall be tight and properly seated as per the manufacturer's recommendations.
3. Inspection is required prior to and immediately after placing backfill over pipe.
4. Piping must be free of debris, dirt, sand, silt, or other foreign matter.

B. Testing of backfill compaction shall be as specified in Section 02200.

END OF SECTION

SECTION 02900
SOIL PREPARATION AND SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seeding and mulching to stabilize disturbed areas.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 02667 - Site Water Lines.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in original, sealed containers. Seed in damaged packaging will not be accepted. Containers shall show:
   1. Names and percentage of each seed variety.
   2. Year of production, percentage of purity, minimum germination rate, and date of packaging.
   3. Net weight.

B. Deliver plant nutrients and soil conditioners in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Store materials in a dry area, free from wetting and physical damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Seed

1. Varieties of grass involved in the work of this section shall be as scheduled in Article 3.2.
2. Mixture shall be clean, guaranteed 95 percent pure, and have a minimum germination rate of 85 percent within 1 year of test.

B. Soil Materials

1. As specified in Section 02200.

C. Soil Conditioners

1. Lime:
   a. Lime shall meet the requirements of ODOT Item 659.02.
   b. Agricultural ground limestone, with a minimum total neutralizing power (TNP) of 90 percent, at least 40 percent passing a No. 100 sieve, and at least 35 percent passing a No. 8 sieve, is considered to be standard grade. Other grades of agricultural liming materials may be used. Apply substitute material at rates which are dependent on the TNP and sample fineness.

D. Plant Nutrients

1. Fertilizer:
   a. Fertilizer shall meet the requirements of ODOT Item 659.08.
   b. The standard application of fertilizer shall be with 22-5-10 slow release mix. Another analysis, in the same ratio, may be used by varying the application rate to produce the same values specified.
   c. Level of natural radiation levels within the fertilizer must be less than the allowable limits set by FLUOR FERNALD.

E. Potable Water

1. Clean, fresh (not salt water), and free of substances or matter that could inhibit vigorous growth of grass.

2.2 ACCESSORIES

A. Mulch:

1. Mulch shall meet the requirements of ODOT Item 659.06.
2. Materials used for mulching shall be straw or hay. Materials shall be reasonably free of weed seed and such foreign materials as may detract from their effectiveness as a mulch or injure desired plant growth.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Verify that the soil surface is ready to receive work of this section and that final dressing is within reasonably close conformity to lines, grades, and cross-sections.

B. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual; blend slopes into level areas.

C. Remove debris, weeds, and undesirable plants and their roots.

D. Scarify subsoil to a depth of 3 inches where topsoil is to be placed.

E. Repeat cultivation in areas where equipment used for hauling and spreading of topsoil has compacted subsoil.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Application of Soil Conditioners:

1. Apply lime conditioners at rate of 2,000 lbs per acre, or as determined by soil test.
2. Mix thoroughly into the top 2 inches of the topsoil.

B. Application of Plant Nutrients:
1. Apply fertilizer at 150 lbs. Per acre rate.
2. Apply after raking topsoil smooth, and prior to roller compaction.
3. Mix thoroughly into upper 4 inches of topsoil.
4. Lightly water to aid the distribution of fertilizer.

C. Seeding:
1. When applying seed with a mechanical spreader, apply evenly in two intersecting directions. Rake in lightly. Apply at a minimum rate of 1½ pounds per 1,000 square feet (65 lbs. per acre).
2. Do not seed areas in excess of that which can be mulched on same day.
3. Apply seed mixture as follows:
   a. Permanent seeding:
      1) 50 percent ReGreen.
      2) 40 percent Canada wild rye.
      3) 10 percent Partridge Pea.
   b. All seeding performed between October 15 and March 15 shall be temporary seeding in accordance with ODOT Item 207.
   c. Permanent seeding as specified above shall be performed between March 15 and October 15.
4. Lightly roll seeded area.
5. Immediately following seeding and compacting, apply mulch.
6. Apply water with a fine spray immediately after each area has been mulched. Saturate soil to approximately 4 inches deep, at a rate of 120 gallons per 1,000 square feet.
7. Hydroseeding may be used in lieu of a mechanical spreader. Follow manufacturer's recommendations.

3.3 QUALITY CONTROL

A. Notify FLUOR FERNALD at least 24 hours prior to date of anticipated inspection.

1. To qualify for acceptance, an area shall have a good, clean stand of perennial grass.
2. Coverage shall be at least 95 percent of the area, and no bare spots shall exceed 3 square feet.
3. Areas that fail to meet requirements of the specifications shall be repaired or re-seeded as necessary to produce an acceptable stand of grass.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 03 - Concrete
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: William A. Hartel 2/27/06
DATE:

SECTION 03001
CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete work for foundations, slabs, equipment supports, and other miscellaneous concrete.

B. Formwork and accessories.

C. Reinforcement and accessories.

D. Cast-in-place concrete, grout, and accessories.

E. Finishing and curing.

F. Sampling and testing of concrete work by an independent testing laboratory.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 02667 - Site Water Lines.

C. Section 16170 - Grounding and Bonding.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Concrete Institute (ACI):

1.	ACI 301-99	Standard Specifications for Structural Concrete.
2.	ACI 305R-99	Hot Weather Concreting.
3.	ACI 306R-88	Cold Weather Concreting.
4.	ACI 318-05/318R-05	Building Code Requirements for Structural Concrete and

		Commentary.
5.	ACI SP-66-04	ACI Detailing Manual.
6.	ACI 117-90	Standard Specification for Tolerances for Concrete Construction and Materials.

B. American Society for Testing and Materials (ASTM):

1.	ASTM A615/A615M-05	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement AASHTO No.: M31.
2.	ASTM C31/C31M-03	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3.	ASTM C33-03	Standard Specification for Concrete Aggregates.
4.	ASTM C39-04A	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5.	ASTM C94/C94M/04A	Standard Specification for Ready-Mixed Concrete
6.	ASTM C109/ C109M-02	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
7.	ASTM C143/C143M-03	Standard Test Method for Slump of Hydraulic Cement Concrete.
8.	ASTM C150-04AE1	Standard Specification for Portland Cement.
9.	ASTM C157-04	Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete AASHTO No.: T160.
10.	ASTM C231-04	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11.	ASTM C260-01	Standard Specification for Air-Entraining Admixtures for Concrete.
12.	ASTM C309-03	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

13.	ASTM C311-04	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
14.	ASTM C494/C494M-04	Standard Specification for Chemical Admixtures for Concrete.
15.	ASTM C618-03	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
16.	ASTM C827-01A	Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures E1-1997 R(1997).
17.	ASTM C920-02	Standard Specification for Elastomeric Joint Sealants.

C. U. S. Department Of Commerce, Voluntary Products Standards (PS):

1.	PS 1-83	Plywood.

1.5 SUBMITTALS

A. Test Reports: Submit test reports for all tests required under field quality assurance.

1.6 QUALITY ASSURANCE PROGRAM

A. ACI 301: References are made to ACI 301 to abbreviate text of this section. Only those portions of ACI 301 referred to specifically in this section shall apply.

B. Amend all references to the following titles to read as follows wherever they occur in ACI 301:

ACI 301	Change To Read
Architect/Engineer	Fluor Fernald
Owner	Fluor Fernald

C. Formwork shall be in accordance with Section 2 of ACI 301 unless specified otherwise in this section.

D. Perform concrete reinforcing work in accordance with Section 3 of ACI 301, unless specified otherwise in this specification.

E. Perform cast-in-place concrete work in accordance with Sections 4 and 5 of ACI 301, unless specified otherwise in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Tags: Reinforcing bar tags shall be made of durable material and marked in a legible manner with waterproof markings; not less than one tag per bundle, attached by wire. Identification tags shall show the grade, number of pieces, size, and mark or length of bars.

PART 2 PRODUCTS

2.1 MATERIALS

A. Plywood Forms: Not less than 5/8-inch-thick, 5-ply Douglas fir plywood conforming to PS 1, and as manufactured by a member of the American Plywood Association; B-B Plyform, Class I, Exterior-APA, with plyform faces sanded and oiled.

B. Prefabricated Type Forms: Matched, tight fitting, stiffened to support weight of concrete.

C. Form Release Agent: Colorless mineral oil that will not stain concrete nor impair natural bonding characteristics of subsequent coatings.

D. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars; plain finish.

E. Tie Wire: Minimum 16-gage annealed type wire.

F. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during

concrete placement conditions.

G. Fabrication: Fabricate concrete reinforcing in accordance with ACI SP-66 and Chapter 7 and 12 of ACI 318.

H. Cement:
1. Normal, Portland cement, conforming to requirements of ASTM C150, Type I.

I. Fly Ash:
1. Class F, conforming to requirements of ASTM C618 and ASTM C311.

J. Admixtures:
1. Air Entrainment: Conforming to ASTM C260.
2. Water Reducing and Retarding: Conforming to requirements of ASTM C494.

K. Aggregates:
1. Normal Weight Concrete: Conforming to requirements of ASTM C33.
2. Maximum aggregate size: 1 inch.

2.2 ACCESSORIES

A. Chamfer Strips: Chamfered, wood strip type; 3/4 by 3/4-inch size.

B. Nails, Spikes, and Anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while placing concrete.

C. Form Ties: Removable or snap-off type; designed to prevent form deflection; of adjustable length, cone type, with waterproofing washer; and free of defects that could leave holes larger than 1 inch in concrete surface.

D. Joint Sealer: Elastomeric joint sealant conforming to ASTM C920; Type S or Type M, Grade P, Class 25.
1. Acceptable products and suppliers (or equal):
a. Sikadur 51 SL, by Sika Corp.

b. Sonolastic SL-1, by Sonneborn Building Products.

E. Nonshrink Grout Under Equipment and Supports: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agent; capable of developing minimum compressive strength of 7,000 psi in 28 days; conforming to ASTM C109 and ASTM C827.

1. Acceptable products and suppliers (or equal):
   a. Masterflow 713, by Master Builders.
   b. SikaGrout 212, by Sika Corp.
   c. Sealtight 588, by W.R. Meadows.

F. Patching Grout: Premixed, nonshrink epoxy grout, capable of developing minimum compressive strength of 3,000 psi in 24 hours, conforming to ASTM C109. The grout must not shrink or expand more than 5 percent when tested in accordance with ASTM C157 and achieve a minimum bond strength of 1,200 psi in 24 hours when tested in accordance with ASTM C882.

G. Bonding Agent: Polyvinyl acetate polymer or acrylic polymer, water resistant when cured.

H. Curing Compound: Conforming to the requirements of ASTM C309, clear; must not impair natural bonding characteristics of subsequent coatings.

2.3 FABRICATION

A. General: All concrete used in the work shall be composed of Portland cement, fine and coarse aggregate, and the specified admixtures. Concrete for every part of the work shall be of homogeneous structure which, when hardened, will have the required strength and resistance to weathering. The proportions for all concrete shall be such as to produce a mixture that will work readily into the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate.

B. Mix Proportions:

1. The following mix designs shall be used for cast-in-place concrete.

   a. Slabs

Specified Strength (28 days)	4,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	4 inches ± 1 inch
Maximum Aggregate Size:	1 inch
Maximum Water/Cement Ratio:	0.35

   Water Reducing and retarding admixtures as required per ASTM C494.

   b. Foundations

Specified Strength (28 days):	3,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	4 inches ± 1 inch
Maximum Aggregate Size:	1 inch
Maximum Water/Cement Ratio:	0.46

   Water Reducing and retarding admixtures as required per ASTM C494.

2. The work has been designed for concrete having a minimum compressive strength at 28 days as determined by ASTM C39. The water/cement ratio shall be determined by consideration of the specified strength, the water reducing admixtures, the slump required for proper placement, air entraining requirements, the maximum allowable aggregate size and its specific gravity, the fineness modulus of the fine aggregate and its specific gravity, and the amount of water carried on the aggregates. The mix designs shall be proportioned in accordance with ACI 318, Section 5.3 or Section 5.4.

C. Mixing and Delivery: Mixing and delivery of concrete shall be scheduled so that all concrete placing operations can be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after introduction of mixing water to cement and aggregates, in accordance with Section 11 of ASTM C94. When air temperature has fallen to or is

expected to fall below 40 degrees F, the recommendations for cold weather concreting contained in ACI 306R shall be followed. When the air temperature exceeds 90 degrees F, the recommendations for hot weather concreting contained in ACI 305R shall be followed.

PART 3 EXECUTION

3.1 PREPARATION

A. Erect formwork and bracing to achieve design requirements in accordance with requirements of Section 2 of ACI 301.
   1. Provide bracing to ensure stability of formwork.
   2. Align joints and make watertight. Keep number of form joints to a minimum.
   3. Provide chamfer strips on external corners of permanently exposed edges.
   4. Shore or strengthen formwork subject to overstressing by construction loads.

B. Application - Form Release Agent: Apply form release agent on formwork in accordance with manufacturer's instructions.
   1. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
   2. Keep surfaces coated prior to placement of concrete.

C. Form Cleaning: Clean and remove foreign matter within forms as erection proceeds.
   1. Clean formed cavities of debris prior to placing concrete.
   2. Flush with water or use compressed air to remove remaining foreign matter.
   3. Ensure that water and debris drain to exterior.
   4. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms.

D. Tolerances: Construct formwork to maintain tolerances required by Section 2.3.

E. Form Removal: Forms or bracing shall not be removed until concrete has gained sufficient strength to carry its own weight and imposed loads.
   1. Loosen forms carefully.
   2. Do not wedge with pry bars, hammers, or tools against finished concrete surfaces.

F. Preparation for Grouting:
   1. To ensure proper bond to concrete, all grease, oil, dirt, and other deleterious materials shall be completely removed.
   2. Roughen the surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the existing concrete.
   3. After concrete surfaces have been washed clean, they shall then be saturated with water for 24 hours prior to placement of cement-based grout.
   4. Upon completion of saturation period, excess water shall be removed prior to grouting.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position. Make electrical ground system connection where required by Section 16170.

B. Maintain concrete cover around reinforcing according to the requirements of Section 3.3.2.3 of ACI 301 and Section 7.7 of ACI 318, and as shown on construction drawings.

C. Provide formed openings where required for work to be embedded in concrete members.

D. Coordinate work of other sections in forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other inserts.

E. Install concrete accessories straight, level, and plumb or as called out on the construction drawings.

F. Place concrete continuously between forms or other limits indicated on the construction drawings.
   1. Place concrete in accordance with Section 5 of ACI 301 and Chapter 5 of ACI 318.
   2. Ensure that reinforcement and forms are not disturbed during concrete placement.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Installation of Grout:
   1. Follow the manufacturer's instructions for mixing, placing, and curing grout.

3.3 QUALITY CONTROL

A. Testing: The testing agency shall perform field tests (take slumps, air, and cylinders) and shall perform laboratory tests on the specimens. Concrete testing shall be performed in accordance with Section 1 of ACI 301 for each 50 cubic yards, or fraction thereof, of each mix design placed in any 1 day.
   1. Slump Tests: ASTM C143. One sample for each strength test.
   2. Air Content Tests: ASTM C231. One sample for each strength test.
   3. Test Cylinders: ASTM C31. One set of three cylinders for above quantities.
   4. Compressive Strength: ASTM C39. One specimen tested at 7 days and two specimens tested at 28 days.

3.4 PROTECTION

A. Provide concrete curing and protection in accordance with Section 5 of ACI 301.
   1. Apply floor slab curing compound, where used, in accordance with the approved manufacturer's recommendations.

B. Provide finishes for formed concrete surfaces as

defined in Section 5 of ACI 301.

C. Provide finishes and tolerances for slabs in accordance with Section 5 of ACI 301.
   1. Provide troweled finish with Class A tolerance on all exposed slabs.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 07 - Thermal and Moisture Protection
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: William G. Hertel 2/27/06
DATE:

SECTION 07900
JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparing substrate surfaces.

B. Sealant and joint backing.

1.2 RELATED SECTIONS

A. Section 03001 - Concrete.

B. Section 13123 - Pre-Engineered Buildings.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM C919-02	Use of Sealants in Acoustical Applications.
2.	ASTM C920-02	Elastomeric Joint Sealants.
3.	ASTM D1056-00	Flexible Cellular Materials - Sponge or Expanded Rubber.

B. Sealant, Waterproofing, and Restoration Institute (SWRI):
1. SWRI - Sealant and Caulking Guide Specification.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SWRI requirements for materials and installation.

B. Perform acoustical sealant application work in accordance with ASTM C919.

1.7 PROJECT CONDITIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

C. Any products to be used shall not contain lead or asbestos, or be defined as possible carcinogens.

PART 2 PRODUCTS

2.1 MANUFACTURERS

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included in the offerer's proposal. It is the offerer's responsibility to propose equipment that is best suited for this project in combined terms of quality and price.

A. Dow Corning Corp.

B. General Electric.

C. W.R. Meadows Co.

2.2 MATERIALS

A. Silicone Sealant (Type A): ASTM C920, Grade NS, Class 25, Use NT; single component, solvent curing, nonsagging, nonstaining, color as selected; 795 manufactured by Dow Corning.
   1. Elongation Capability: 25 percent.

2. Service Temperature Range: -65 to 180 degrees F.
3. Shore A Hardness Range: 30.

B. Silicone Sealant (Type B): ASTM C920, Grade NS, Class 25, Use N; single component, chemical curing, nonsagging, nonstaining, color as selected; 791 manufactured by Dow Corning.
1. Elongation Capability: 25 percent.
2. Service Temperature Range: -65 to 180 degrees F.
3. Shore A Hardness Range: 30.

2.3 ACCESSORIES

A. Primer: Nonstaining type, (recommended by sealant manufacturer) to suit application.

B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1056; cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter that might impair adhesion of sealant.

B. Clean joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve 2:1 width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints channel shaped.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 SCHEDULES

A. Type A - All glazing and all building materials as indicated on drawings.

B. Type B - All expansion and control joints.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 08 - Doors and Windows
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By:

DATE:

SECTION 08110
STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel doors and frames.

B. Products furnished but not installed under this Section:
   1. Section 13123 - Pre-Engineered Buildings: Furnish templates for door and frame preparation.

1.2 RELATED SECTIONS

A. Section 08710 - Door Hardware.

B. Section 09900 - Painting.

C. Section 13123 - Pre-Engineered Buildings.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI/SDI A250.8-2003 Recommended Specifications for Standard Steel Doors and Frames.

   2. ANSI/SDI A250.10-1998 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

   3. ANSI/SDI 250.11-2001 - Recommended Erection Instructions or Steel Frames (Formerly SDI-105)

B. American Society for Testing and Materials (ASTM):
1. ASTM-A653/A653M-04A Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C. Door Hardware Institute (DHI):
1. DHI A115.1G - Installation Guide for Doors and Hardware.

1.5 SUBMITTALS

A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, closure method, hardware locations and finish.

B. Product Data: Submit manufacturer data sheets including door and frame configurations, preparation instructions and recommendations and storage and handling recommendations.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.6 QUALITY ASSURANCE

A. Doors and frames shall conform to requirements of ANSI A250.8 (SDI-100) and other specifications herein listed.

B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Protect doors with resilient packaging sealed with heat-shrunk plastic.

C. Break seal on site to permit ventilation.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate the work with door opening construction, doorframe, and door hardware installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included.

A. Steel-Craft.

B. Republic Builders Products.

C. Amweld Building Products. LLC.

2.2 MATERIALS

A. Exterior Doors Nonthermally Broken: ANSI/SDI A250.8, 3'x7', Level 2, Model 1 - Full Flush.

B. Exterior Frames: ANSI/SDI A250.8, Level 2 Heavy duty, 16-gage metal with a 2-inch face.

2.3 ACCESSORIES

A. Face: Steel sheet in accordance with ANSI/SDI A250.8.

B. Core: Polyurethane with vertical steel stiffeners.

C. Removable Stops: Rolled steel shape, mitered corners; prepared for countersunk style screws.

2.4 FABRICATION

A. Fabricate doors and frames with hardware reinforcement welded in place in accordance with ANSI/SDI A250.8.

B. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.

C. Configure exterior doors and frames with special profile to receive recessed weather-stripping.

D. Terminate door stops 6 inches above finished floor. Cut stop at a 45-degree angle and close.

E. Finish:
   1. Steel Sheet: Galvanized to ASTM A525.
   2. Primer: Air dried in accordance with ANSI/SDI A250.10.
   3. Factory Finish: Baked enamel in accordance with ANSI/SDI A250.3. Color as selected from manufacturer's standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable before beginning installation of frames.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Install doors and frames in accordance with ANSI A250.11 and DHI A115.1G.

B. Coordinate installation of doors and frames with installation of hardware specified in Section 08710.

D. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

D. Touch up factory finished doors in accordance with Section 09900.

E. Install Labels: Containing the well house number; constructed of nonreflective materials; black characters on white background, minimum character height of 3 inches.

3.3 FIELD QUALITY ASSURANCE

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust door for smooth and balanced movement.

END OF SECTION

SECTION 08710
DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hardware for hollow steel doors.

B. Thresholds.

C. Weather stripping, seals, and door gaskets.

D. Door Hinges

E. Products furnished but not installed under this section.
   1. Section 13123 - Pre-Engineered Buildings: Furnish templates for door and frame preparation.

1.2 RELATED SECTIONS

A. Section 08110 - Standard Steel Doors and Frame.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A117.1-03 Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
   2. ANSI A156.13-02 Bored and Preassembled Locks and Latches.

B. American Disabilities Act 1992 (ADA).

C. Door Hardware Institute (DHI):
   1. DHI A115.1G - Installation Guide for Doors and Hardware.

1.5 SYSTEM DESCRIPTION

A. Provide all hardware as required by hardware schedule, Article 3.6 of this section. Hardware to be installed per ADA 1992.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each item of hardware.

B. Hardware Schedule: Coordinate hardware with doors, frames, and related work.
   1. Organize hardware schedule into "hardware sets" indicating every item required for each door or opening, including:
      a. Type, style, function, size, and finish of each hardware item.
      b. Name and manufacturer of each item.
      c. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
      d. Mounting locations for hardware.
      e. Door and frame sizes and materials.
   2. Submittal Sequence: Submit schedule at earliest possible date.

C. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:
   1. ANSI A117.1.

B. Manufacturer: Obtain each type of hardware from a single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Tag each item of package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

C. Packaging of hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort, and repackage in containers clearly marked to match set numbers of approved hardware schedule.

D. Inventory hardware jointly with hardware supplier and hardware installer to verify correct count.

E. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

F. Provide secure lock-up for hardware delivered to the project but not yet installed. Control handling and installation of hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

PART 2 PRODUCTS

2.1 MANUFACTURERS

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify

the type of equipment and general quality of that equipment that will be included in the offerer's proposal. It is the offerer's responsibility to propose equipment that is best suited for this project in combined terms of quality and price.

A. Latches
   1. Sargent.
   2. Schlage.
   3. Best.
   4. Russwin.

B. Butt Hinges
   1. Stanley.
   2. McKinley
   3. Hager

C. Door Closers
   1. LCN.
   2. Dorma.
   3. Sargent.

D. Thresholds
   1. National Guard Products (NGP).
   2. Reese.
   3. Zero.

2.2 MATERIALS

A. Hardware throughout to be substantially manufactured and fabricated, and assembled parts well fitted and of easy operation. Cast work to be true, free from seams, blisters, or other defects. All lines, edges, and ornamental work to be sharp and true.

B. Mortise Lockset
   1. Per ANSI A156.13, Series 1000, Grade 1, F13, 626 Satin Chrome Finish; levers both sides.

C. Door Closers
   1. Per ANSI 156.4 Grade 1 and meets exterior barrier free codes. 689 Aluminum Lacquer finish. mounting

for conditions where required, LCN 4110 Series or equal.

D. Door Hinges
   1. Per ANSI A5133, (3) 4-1/2" steel per mandoor, 630 Satin Stainless Steel Finish with non-rising pins.

E. Strike Plates
   1. Strike plates to be wrought, box type.

F. Threshold
   1. 3-11/16" wide x 5/8" high extruded aluminum threshold (outswing)

G. Weather stripping
   1. 1/4" X 1/2" silicone rubber

PART 3 EXECUTION

3.1 PREPARATION

A. Factory or shop prepares all materials for installation of hardware.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Follow hardware manufacturer's instructions and recommendations.

B. Install surface-mounted items after substrates have been completely finished; install recessed items and recessed portions of items before finishes are applied and provide suitable, effective protection.
   1. When surface-mounted items are installed before final finish, remove, store, and reinstall, or apply suitable effective protection.

C. Mount at heights indicated in DHI A115.1G "Recommended Installation Guide for Doors and Hardware" by the Door Hardware Institute.

D. Set units level, plumb, and true to line and location.

E. Reinforce substrates as necessary for proper installation and operation.

F. Set thresholds in full bed of sealant.

3.3 ADJUSTMENT

A. Adjust each operating item of hardware and each door for proper operation and function; replace units that cannot be adjusted to operate freely and smoothly.

B. Adjust door closers to compensate for operation of heating and ventilating systems.

3.4 CLEANING

A. Clean adjacent surfaces soiled by hardware installation.

3.5 HARDWARE SCHEDULE

A. Hardware Sets
   1. Exterior Doors
      a. One mortise lock set with lever handle Operation both sides.
      b. One closer.
      c. One threshold.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 09 - Finishes
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: William A. Hertel 2/27/06
DATE:

SECTION 09900
PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, material, equipment, tools, and services required to complete all painting work as required by the drawings and/or as specified herein.

B. Except as otherwise indicated or hereinafter specified, include all necessary preparation and complete finishing of the following:
1. All structural steel and miscellaneous iron items, both prime coated and galvanized.
2. Field painting and/or touch-up of all piping and Wellhouse doors & frames.
3. All unfinished interior and exterior surfaces including carbon steel piping in Wellhouses with condensation insulation.
4. Uninsulated piping, exposed electric raceway, electrical cabinets, boxes, etc., in contracts for other divisions of the work and furnished either bare, zinc-coated (galvanized), or prime coated.
5. Color-coding or indication of piping as specified.

C. Surfaces not painted under this section:
1. Stainless steel and aluminum.
2. Factory finished items.

1.2 RELATED SECTIONS

A. Section 07900 - Joint Sealers.

B. Section 08110 - Standard Steel Doors and Frames.

C. Section 15060 - Pipe, Fittings, Valves, and Accessories.

D. Section 15090 - Pipe Supports and Anchors.

E. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES, CODES, AND STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. ASTM D16-03 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

B. National Paint and Coatings Association (NPCA):
   1. Guide to U.S. Government Paint Specifications - 1988.

C. Painting and Decorating Contractors of America (PDCA):
   1. Architectural Specifications Manual - Rev. 90.

D. Steel Structures Painting Council (SSPC):
   1. Steel Structures Painting Manual - Rev. 95.
      a. Paint 104 - White or Tinted Alkyd Paint.
      b. Paint 22 - Epoxy-Polyamide Paints (Primers, Intermediate, and Topcoat).
      c. SP-2 - Hand Tool Cleaning.
      d. SP-3 - Power Tool Cleaning.
      e. SP-6 - Commercial Blast Cleaning.

E. American National Standards Institute (ANSI):
   1. ANSI A13.1-96 Scheme for the Identification of Piping Systems.
   2. ANSI Z535.1-91 Safety Color Code
   3. ANSI Z535.5-98 Accident Prevention Tags for Temporary Hazards.

F. Federal Specifications (Fed. Spec.):
   1. Fed. Spec. TT-P-664C Primer Coating, Synthetic, Rust Inhibiting, Lacquer Resisting.
   2. Fed. Spec. MIL-C-8240 Epoxy for Steel Structures.
   3. Fed. Spec. TT-E-489 Enamel, Alkyd, Gloss

G. Federal Standards (FS):
   1. FS No. 595A Colors.

H. Occupational Safety and Health Administration (OSHA):
   1. OSHA 1910.144-96 Safety Color Code for Marking Physical Hazards.
   2. OSHA 1910.145-96 Specifications for Accident Prevention Signs and Tags.

1.5 SYSTEM DESCRIPTION

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.6 SUBMITTALS

A. Product Data: Provide data on all finishing products, including a Material Safety Data Sheet for each product used.

B. Manufacturer's Application Instructions.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Applicator: Firm or individual experienced in performing the work of this section with a record of in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage,

surface preparation, drying time, clean-up requirements, color designation, VOC content and instructions for mixing and reducing. Labels to be kept readable at all times.

D. Store paint materials at a minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area and a paint storage safety cabinet as required by manufacturer's instructions and where directed by Construction Manager. Keep storage space clean and accessible. Oil or paint-soaked rags or waste shall be placed in tight-covered metal containers or removed from the premises at the close of each day's work. Take every precaution to avoid damage by fire. In no case shall the amount of materials stored exceed that permitted by site procedures.

1.9 PROJECT CONDITIONS

A. Exterior painting shall not be done during or immediately following rainy or frosty weather, or when the temperature is below 50 degrees F or likely to drop to freezing. Avoid the application of treatments while surfaces are exposed to hot sun, or when temperature is above 90 degrees F or likely to be, during the drying period.

B. Interior work shall be done only when the building has been thoroughly dried out by natural or artificial heat, and when the work area is properly heated and ventilated, clean, and as dust-free as possible. Apply interior finishes only when a room temperature of at least 60 degrees F can be maintained during application of treatments and until coatings are dry.

C. Do not apply paint in rain, snow, fog or mist, when the relative humidity exceeds 85% or at temperatures less than 5 degrees above the dew point.

PART 2 PRODUCTS

2.1 MANUFACTURERS

The listing of suppliers below in no way precludes proposing alternative suppliers compliant with the scope of this specification. This list of suppliers is intended to identify the type and quality of the paint required for this work.

A. Benjamin Moore and Company (BM).

B. Sherwin-Williams Company (SW)

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags. Coatings shall be compatible. All coatings (i.e., primer and finish coats) shall be free of lead and chromates, and be non-carcinogenic.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

E. Follow NPCA guide for government specifications.
   1. Paints and paint types are as follows:
      a. Finish coating, gloss alkyd, conforming to Fed. Spec. TT-E-505A.
      b. Primer coating, alkyd, rust inhibiting, conforming to Fed. Spec. TT-P-664C.
      c. Epoxy-polyamide coating conforming to Fed. Spec. MIL-C-82407.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Before commencing work on surfaces of any type, the Applicator shall carefully inspect same and be satisfied that they are dry and in all other respects suitable to receive the specified treatment.

B. Application of any coating to a surface will constitute acceptance of the surface. If, after treatment, the completed finish (or any portion thereof) blisters, checks, peels, or otherwise shows indication of dampness or other irregular condition of surface, the Subcontractor shall remove the applied treatment and refinish the part affected. (The painting Applicator should determine dryness of all moisture-holding materials by use of a reliable electronic moisture meter.)

3.2 PREPARATION

A. General

1. Painting Applicator is responsible for proper preparation of all surfaces to receive the particular treatment specified.
2. All usual preparatory measures common to painters' work, as well as such special procedures as are herein stipulated, shall be employed.

B. Structural Steel

1. Prepare surfaces in accordance with SSPC procedure SP-6 prior to shop primer coat. Minimum field assembly surface preparation shall comply with no less than SP-2 or SP-3 for touch-up. Spot-prime all bare metal areas immediately with compatible, rust inhibiting primer. Prepare steel for final coat.

C. Prime-Coated Miscellaneous and Ornamental Ferrous Metal

1. Prepare surfaces of miscellaneous and ornamental ferrous metal items such as steel door frames,

hollow metal doors, exposed lintels, railings, ornamental brackets, etc., as specified for exposed-to-view structural steel parts in Article 3.2, Paragraph B.

2. Fill any open joints and bare tool marks in parts furnished in manufacturer's baked-on prime coat with mineral filler, to make inconspicuous; sand smooth, then spot prime.

D. Zinc-Coated Metal Parts; Galvanized or Zinc-Coated by Other Process

1. Unless the prime coat material to be used is recommended by its manufacturer for application over zinc-coated surfaces of the type at hand, after cleaning and any necessary de-glossing only, surfaces must be given phosphate pretreatment prior to application of prime coat; usual "vinegar etch" or acid pretreatment (wash) will not be permitted.
2. Phosphate pretreatment: Crystalline zinc phosphate type; either "Lithoform," made by the American Chemical Paint Co., Ambler, Pa., or "Galaprep No. S," made by Neilson Chemical Co., Detroit, Michigan, as approved by FLUOR FERNALD. Follow manufacturer's directions exactly as to cleaning prior to treatment, application of treatment, and after-rinse.
3. Preparation of surfaces for directly-applied prime coat: Clean all surfaces thoroughly with mineral spirits, naphtha, or other approved solvent, completely removing all oil, grease, and other film. Roughen with steel wool, as necessary, to remove gloss.
4. Primer must be applied at once, following either cleaning only or phosphate pretreatment.

E. Caulking

1. Caulking as required.
2. Use a resin-base, gun type, elastic caulking compound, free of volatile thinners; add no thinner.
3. Apply with gun and follow with tool, as required, to form a smooth coved fillet of the minimum

required width, at projecting, overlapping, and fully recessed frames. Fill flush and tool slightly concave where frame is flush or just scant of flush. Apply well in advance of scheduled paint treatment; compound must have formed a firm, dust-free surface skin before prime coat is applied. Avoid smearing adjacent wall and/or metal; clean off any misplaced compound at once.

3.3 ERECTION/INSTALLATION/APPLICATION

A. All work shall be done in a workmanlike manner; all coats flowed on, or brushed out, to a uniform film. Completed work shall be free of runs, sags, blocked angles, raised grain, and all other evidence of poor or careless workmanship. Follow PDCA instruction manual.

B. Tint all undercoats toward the color of the final coat, with shade of each coat sufficiently different from that of work in place to permit easy identification.

C. Allow sufficient time before recoating to ensure proper drying of the preceding coat.

D. Exercise care to avoid getting material on a surface not intended to receive it. Remove any misplaced material or resultant stain, leaving the surface in proper condition.

E. General

1. Following surface preparation as specified, apply coats or treatments as listed below on the several kinds of surfaces required to be treated. All coats to be applied in thicknesses specified by the product data sheets.
2. Refer to finish schedule and architectural drawings for the extent of wall and ceiling surfaces, metal doors, frames, trim, etc., requiring finish, and to drawings and specifications for mechanical and electrical work for extent of ductwork, piping, conduit, mechanical system devices, heating units, grilles, etc.

3. All coats specified herein are in addition to primer, sealer, or other preparatory or protective coats specified in other sections of this specification package or in the specifications for other contracts.

F. Structural Steel
   1. Finish Treatment: Two coats alkyd gloss enamel.

G. New Work
   1. Exposed miscellaneous steel items, lintels:
      a. Primer: One coat primer.
      b. Finish treatment: Two coats exterior latex gloss enamel.
   2. Mechanical equipment items:
      a. Finish treatment: First coat - alkyd gloss enamel.
      b. Second coat - alkyd gloss enamel.
   3. Pipe, Valves, and Fittings - Carbon Steel:
      a. Uninsulated: Two coats of epoxy-polyamids coating. Dry film thickness of 4 mils per coat.
      b. Insulated: One coat primer.
   4. Other Piping, Electrical Conduit in Exposed Locations:
      a. Primed: One coat primer.
      b. Finish Treatment: Two coats alkyd gloss enamel.
   5. Pipe Covering in Exposed Locations:
      a. Primer: One coat primer.
      b. Finish Treatment: Two coats alkyd gloss enamel.

H. Miscellaneous and ornamental fabricator-primed ferrous metals
   1. Includes prime-coated equipment items and their supports, in addition to parts regularly classified as "miscellaneous and ornamental ferrous metals." Any parts as named, but furnished bare, shall receive one coat of metal primer (as approved), followed by the treatment herein specified.

I. Mechanical equipment items furnished in prime coat
   1. Finish treatment: Two coats alkyd gloss enamel.

3.4 CLEANING

A. As work proceeds, promptly remove paint where spilled, splashed, or splattered.

B. During progress of work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect cotton waste, cloths, and materials which may constitute a fire hazard; place in closed metal containers as directed by the Construction Manager.

3.5 PROTECTION

A. Provide clean drop cloths and other protection as approved to protect floors, doors, and other parts from damage. Where any work is accidentally spattered, clean promptly, and leave in satisfactory condition.

3.6 SAFETY PAINTING

A. The Applicator shall apply safety painting for the marking of physical hazards and identification of piping systems, as required herein and as directed by the Construction Manager. Accident prevention signs will be provided by others.

B. Safety colors shall be applied by the Applicator where and as required on and in the appropriate areas and equipment. The safety color code shall mark physical hazards and shall continue to provide an orderly, coordinated standard of practice for the plant and the safety of workers.

C. Color coding and designation shall comply with current OSHA 1910.144, OSHA 1910.145, ANSI Z535.5, ANSI Z53.1, and Federal Standard No. 595A.

D. The following safety colors shall have Federal Standard numbers as follows:

1. Red - No. 11105
2. Yellow - No. 13655
3. Vivid Orange - No. 12246
4. Purple - No. 17142 (Magenta)
5. Green - No. 14260
6. Blue - No. 15102
7. Black - No. 17038

E. The color codes shall be used for the following identifications:

1. Red - Exposed fire protection systems shall be painted a continuous red.
2. Vivid Orange - Vivid orange shall be restricted to surface areas, machine guards where there is the potential for cutting, crushing, thermal burns, or electrical shock to personnel.
3. Magenta - Magenta shall be used to identify equipment, housing, containers, appurtenances, etc., which contain radioactive materials or contamination, where necessary to differentiate them from similar non-radioactive items. Approved signs or tags exhibiting the standard three bladed magenta radiation symbol on yellow background shall be used to identify the nature and/or magnitude of the radiation hazard together with specific safety instructions (by others).
   a. The following is a representative list of items that would typically be identified by magenta:
      1) "Hot" and "warm" drains (on floor drains use metal tags).
      2) "Hot" filter housing.
      3) Radiation ion exchangers.
      4) "Hot" waste containers (other than buried tanks).
      5) Radioactive sampling connections.
      6) Piping containing radioactive materials or contamination.
      7) Doors restricting access to radiation zones.

4. Green - Green shall be the basic color for designating safety and location of first aid equipment (other than fire fighting equipment).
5. Blue - Blue is limited to electrical equipment. Main electrical disconnects in all buildings shall be identified by stencil or label.
6. Black, White, or a Combination of These Two - Black, white, or a combination of these two shall be the basic colors for designating housekeeping and traffic markings.

F. Color coding for identification of piping systems shall conform to ANSI A13.1. Piping systems are defined as conduits for the transport of gases, liquids, and semi-liquids.

1. Identify pipes as follows:
   a. Content and direction of flow of piping systems shall be identified by Brady self-adhering B-580 labels fixed on pipe or pipe covering. Such identification shall be located so as to ensure immediate recognition of piping system content and direction of flow.
2. Line identification and directional flow arrows shall be arranged and located in ways to be easily read by a person standing on the floor, or at the normal access location of the pipe.
3. Labeling shall include:
   a. The labels shall include pipe content identification and unusual qualities of the pipe contents (i.e., hot, cold, pressure in lbs./sq. in.). <u>Construction Manager to approve all pipe label nomenclature prior to label fabrication</u>.
   b. On service piping, either liquid or gas, apply black arrows of same height and with same background color as adjacent identification labels, to indicate direction of flow.
   b. Lettering size shall be in accordance with the information in the chart below:

Nominal Pipe Diameter*	Size of Legend Letters*
3/4 to 1-1/4	1/2
1-1/2 to 2	3/4
2-1/2 to 6	1-1/4
8 to 10	2-1/2
Over 10	3-1/2

* All dimensions are given in inches.

d. Pipes to be marked shall first be wiped clean of dirt, dust, grease, and moisture. When applying mastic-backed label, pressure must be applied so that the label will lie smooth and flat.

e. Labels shall be applied only after the final inspection of the piping systems. The labels shall be applied on piping systems that require painting after the final coat has cured. Labels shall be applied in accordance with the manufacturer's recommendations.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 10 - Specialties
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2-19-06
DATE:

Checked By: William A. Hertel 2/27/06
DATE:

SECTION 10211
METAL WALL LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Adjustable louvers and frames.

B. Bird screening.

1.2 RELATED SECTIONS

A. Section 07900 - Joint Sealers.

B. Section 13123 - Pre-Engineered Buildings.

C. Section 15500 - Heating, Ventilating, and Air Conditioning.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. Air Movement Control Association (AMCA):
1. AMCA 500-92 Test Method for Louvers, Dampers, and Shutters.

1.5 SYSTEM DESCRIPTION

A. Louver: To permit passage of air at a velocity as required by AMCA 500 without blade vibration or noise.

B. Louver: To permit 50 percent free area, minimum.

1.6 SUBMITTALS

A. Shop Drawings: Indicate louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb and sill details; blade configuration; screens; blankout areas required; frames.

B. Maintenance Data: Include lubrication schedules and adjustment requirements at completion of work.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with AMCA Certification for Louvers.

B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years documented experience.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate the work with installation of metal siding.

1.9 WARRANTY

A. Manufacturer standard 20-year warranty.

B. Include warranty coverage for degradation of siliconized polyester finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Airolite Co.

B. Louvers & Dampers, Inc.

C. Ruskin.

D. Other manufacturers who meet or exceed the requirements of this specification.

2.2 MATERIALS

A. Furnish and install extruded aluminum drainable blade louver similar to Type K6746, as manufactured by the Airolite Company, Marietta, Ohio. Louvers shall be 6 inches deep and assembled entirely by welding. Blades and frame shall be 0.81 inch extruded aluminum, alloy 6063-T5. All louvers shall be factory finished after assembly with a Kynar® 500 coating in a color selected from the manufacturer's chart.

B. Louvers shall bear AMCA Licensed Ratings Seals for air performance and water penetration ratings.

C. Bird Screen: Interwoven wire mesh of aluminum, 0.063-inch-diameter wire, 1/2-inch open weave, diagonal design.

D. Backdraft Damper (if required): Shall be extruded aluminum with linkage concealed in frame, mounted behind the cover (see Section 15500 for coordination).

2.3 ACCESSORIES

A. Fasteners and Anchors: Stainless steel type.

B. Primer: Zinc chromate, alkyd type.

C. Flashings: Of same material as louver frames.

D. Sealants: Type specified in Section 07900.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and that opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure that moisture is shed from flashings and diverted to exterior.

D. Secure louvers in opening framing with concealed fasteners.

E. Install bird screen and frame to interior of louver.

F. Install perimeter sealant and backing rod in accordance with Section 07900.

3.3 ADJUSTING

A. Adjust backdraft dampers for freedom of movement of control mechanism. Lubricate operating joints.

3.4 SCHEDULE

A. See drawings for sizes and locations of louvers.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 13 - Special Construction
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: William G. Hertel 2/27/06
DATE:

SECTION 13123
PRE-ENGINEERED METAL BUILDINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered, shop-fabricated metal buildings.

B. All buildings to be assembled complete including all heating and electrical requirements. Building Supplier to decide if buildings cannot be assembled in the factory and will ship all components to the job site for assembly by Others.

1.2 RELATED SECTIONS

A. Section 01010 - General Requirements.

B. Section 07900 - Joint Sealers.

C. Section 08110 - Standard Steel Doors and Frames

E. Section 08710 - Door Hardware.

F. Section 09900 - Painting

G. Section 10211 - Metal Wall Louvers.

H. Section 15500 - Heating, Ventilating, and Air Conditioning.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Institute of Steel Construction (AISC):

1. AISC S335-89 — Specification for Structural Steel Buildings.

B. American Iron and Steel Institute (AISI):

1. AISI SG-673 Part II-86 — Design of Cold-Formed Steel Structural Members, Cold-Formed Steel Design Manual.

C. American Society of Civil Engineers (ASCE):

1. ASCE 7-02 — Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):

1. ASTM A36/36M-05 — Structural Steel.
2. ASTM A307-04 — Standard Specification for Carbon Steel Bolts and Studs.
3. ASTM A325-04B — Structural Bolts, Steel, Heat-Treated 120/105 ksi, Minimum Tensile Strength.
4. ASTM A653/ A653M-04A — Sheet Steel, Zinc-Coated Galvanized)by the HOT-Dip Process.
5. ASTM C553-02 — Specifications for Mineral Fiber Blanket Thermal Insulation for Commercial and Insulation for Commercial & Industrial Applications.

E. American Welding Society, Inc. (AWS):

1. AWS D1.1/D1.1M — Structural Welding Code - Steel (2004)

F. Building Officials and Code Administrator International (BOCA):

1. Ohio Building Code - Latest Edition.

G. Metal Building Manufacturer's Association (MBMA):

1. Recommended Guide Specifications for Pre-Engineered Metal Buildings.

2. Recommended Design Practice Manual.

1.5 SYSTEM DESCRIPTION

A. Design Requirements:

1. Pre-engineered, shop-fabricated, structural steel building frame. Work of this section begins at the top of the concrete foundation slab except as required specifically otherwise herein.
   a. Primary Framing: The buildings covered by these specifications shall be of self-framing design using the roof and wall panels as the primary structural supporting members.
   b. Horizontal Dimensions: As shown on drawings.
   c. Height from Slab to Eave: As shown on drawings.
   d. Roof Slope: As shown on drawings.
2. Prefinished metal wall and roof panels.
3. Steel doors and frames and related hardware.
4. Gutters and downspouts.
5. Building and its components shall provide weathertight building under loads and exposure required herein.

B. Design Criteria:

1. Except as required specifically otherwise herein, prefabricated metal building shall be designed, fabricated, and erected in accordance with requirements of MBMA.
2. Structural steel sections or welded-up plate sections shall be designed in accordance with AISC.
3. Cold-formed steel structural members shall be designed in accordance with AISI SG-673.
4. Roof and wall panels shall be cold-formed and shall be designed in accordance with AISI SG-673.

C. Performance Requirements:

1. Design Loads:
   a. Dead load shall include weight of building construction plus all collateral loads.
   b. Live loads shall be as defined and stated in ASCE 7 except as stated otherwise herein.

c. Vertical Live Loads:
   1) Primary Framing (Frames): 20 psf uniformly distributed over the roof area that it supports.
   2) The vertical live loads shall be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

d. Wind Loads:
   1) The site-specific basic wind speed shall be 90 mph per the Ohio Building Code (OBC).
   2) Load shall be proportioned and applied as horizontal and uplift forces according to the requirements of ASCE 7.

e. Snow Loads:
   1) The ground snow load shall be 25 psf.
   2) Roof snow loads, including balanced and unbalanced loads, shall be determined in accordance with ASCE 7. The importance factor for snow loads shall be 1.0.

f. Auxiliary and Collateral Loads:
   1) Other static load shall be considered as a part of the design requirements and shall be combined with the design loads (wind, live, etc.) as prescribed in contract documents.
   2) Static Loads: 5 psf on purlins and frames.

g. Combination of Loads: The combining of normal and auxiliary loads for design purposes shall be as prescribed and recommended by the MBMA Low Rise Building Systems Manual and the UBC, whichever produces the greater effect.

h. Deflection:
   1) Roof panels shall not deflect more than 1/180 of span under design loads.
   2) Roof purlins shall not deflect more than 1/180 of span under design loads.
   3) Girts shall not deflect more than 1/180 of span under design loads.

2. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
3. Assembly shall permit movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects, when subject to temperature range of 100 degrees F.

1.6 SUBMITTALS

A. Shop Drawings:
1. Indicate location, arrangement, dimensions, materials, finishes, anchorage, fastenings, closures, sealants, accessories, and relation to adjacent work.
2. Indicate vertical and horizontal loads and forces at bearing on concrete foundation slab.
3. Indicate framing anchor bolt settings, sizes, and locations from foundation loads.

B. Product Data: Submit manufacturer's data on:
1. Prefinished sheet-metal items (including profiles).
2. Accessories.

C. Manufacturer's Installation Instructions: Submit installation and erection requirements for information only.

D. Samples: Submit complete set of manufacturer's standard finishes to indicate color. Finish shall be actual materials on metal. Size shall be not less than 3 inches by 5 inches.

D. Design Calculations: Submit set of design calculations to confirm compliance with structural requirements of this section. Calculations shall be signed by engineer shall bear the engineer's seal.

1.7 QUALITY ASSURANCE

A. Design of Structural and Building Components:
1. Design of structural systems and building

components shall be performed by a structural engineer experienced in the design of pre-engineered, prefabricated metal building systems and who is licensed and registered in the State of Ohio.

2. Engineer's signature and seal shall be placed on calculations and engineering drawings required to be submitted herein.
3. Design shall include confirmation that building will perform as required under the design loads required in this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Site Assembled Buildings:

1. Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed.
2. Stack materials on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering.
3. Store metal sheets and panels if subjected to water accumulation so they will drain freely. Do not store sheets and panels in contact with other materials which might cause staining.
4. Damaged material must be reported to determine if replacement is required.
5. Inspect panels to prevent moisture between panels, and secure as required.

B. Factory-Assembled Buildings

1. Deliver and set in place on concrete pads all buildings.

1.9 WARRANTY

A. Warranty: Include coverage for exterior prefinished surfaces to cover prefinished color coat against chipping; cracking; or crazing, blistering, peeling, chalking, or fading.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Standard: For purposes of designating type and quality of the pre-engineered, prefabricated metal building and its accessories for work of this section, design documents are based on products and systems as manufactured by Parkline, Inc., Winfield, WV 25213.

B. Building systems equivalent to or better than those of the following manufacturers will be acceptable in addition to the manufacturer above for use on the project. Products and systems shall provide for the functions, construction, and arrangement as required by the design documents.

1. Steelox Building Systems, Cincinnati, OH 45246-6522.
2. Butler Manufacturing Co, Kansas City, MO 64141-0917.

2.2 MATERIALS

A. Fasteners:

1. Fasteners for primary framing shall comply with the requirements of ASTM A325. Provide equivalent nuts and washers. Bolts, nuts, and washers shall be galvanized to provide for requirements of ASTM A153.
2. Fasteners for secondary framing shall comply with the requirements of ASTM A307. Bolts, nuts, and washers shall be galvanized to comply with the requirements of ASTM A153.
3. Fasteners for roof covering, wall covering, trim and flashing, gutters and downspouts, and other sheet metal work shall be AISI Alloy Type 302 or 304 as specified in ASTM A666. Provide with neoprene gaskets where used to make weathertight.

B. Sealants: Tube sealant shall be a synthetic elastomer-based material, which becomes tack-free in less than 2 hours at 75 degrees F but retains flexibility. Service

range shall be from -30 degrees F to +160 degrees F.

C. Tape Mastic: Preformed butyl-rubber based compound. Compound shall be nonhardening, noncorrosive to metal, and shall have excellent adhesion properties. Service range shall be from -30 degrees F to +160 degrees F.

D. Resilient Closures: Preformed to match panel configuration. Closed-cell sponge of Ethylene Propylene Diene Monomer.

E. Gutter Sealant: Manufacturer's standard.

E. Wall and Roof Insulation:
1. Wall Insulation: Manufacturer's standard 3-inch fiberglass (R5.4) roll-in with white metalized polypropylene scrimkraft facing (flame spread rating of 25 per UL 725 ASTM E84) and retainer clips.

2. Roof Insulation: Manufacturer's standard 3-inch fiberglass(R10.4)blanket roof insulation with white metalized polypropylene scrimkraft facing (flame spread rating of 25 per UL 725 ASTM E84) and retainer clips.

2.3 ACCESSORIES

A. Trim and Flashing: Trim, flashing, and metal closures shall be fabricated from the same sheet metal material (thickness, composition, and finish) as required for wall panels.

B. Gutters and Downspouts:
1. Fabricate from same material and finish as required for roofing metal.
2. Form sections of gutters and downspouts in maximum possible lengths. Hem exposed edges.
3. Fabricate support straps of same material and finish as roofing metal.

C. Finishes:

1. Primary framing, purlins, girts, and miscellaneous secondary framing shall be cleaned and primed with shop primer.

2. Color of finish to match existing extraction well pumphouses: Wall - Twilight Blue
   Trim - Artic White

2.4 FABRICATION

A. Primary Framing:

1. Fabricate from structural steel plate, bar, tube, or rolled structural shapes complying with the requirements of ASTM A36 or better.
2. Fabricate components in accordance with the requirements of AISC.

B. Purlins: Cold-formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.

C. Girts: Cold formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.

D. Framed Openings:

1. Provide framed openings for doors, louvers, etc., as shown on design drawings and as specified herein.
2. Openings shall be designed to structurally support the panels or framing which they replace and shall support the equipment for which they are provided.
3. Include framing, clips, and fasteners as necessary to install the opening.

E. Roof Panels:

1. Roof panels shall be supplied in a single continuous length from eave line to ridge line and shall be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.

2. Roof panels shall be maximum of 16 inches wide with a flat surface between the interlocking side ribs. The interlocking ribs shall be a minimum of 3 inches high and shall be turned upward. All roof panels shall be factory punched for connection at the eave line of the building.
3. Roof panels shall be minimum 24-gage steel coated on both sides with a corrosion-resistant aluminum-zinc alloy applied by a continuous hot-dipping process. Coating weight shall be a minimum of 0.32 ounces of aluminum-zinc alloy per square foot of coated sheet (both sides) equivalent to about 0.80 mil thickness on each side. Minimum yield strength of panel material shall be 50,000 psi.

F. Wall Covering:
1. Exterior wall panels of the building shall be a single continuous length from the base channel to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings.
2. Wall panels shall be 16 inches wide with a 3-inch-deep, inward-turned interlocking side rib. Wall panels shall contain two 3/4-inch-deep by 3-1/8-inch-wide fluted recesses, each starting 2-7/16 inches from each panel edge.
3. Wall panels shall be fastened internally to the base channel and eave cap of the building with 3/8-inch diameter electrogalvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surfaces of the walls.
4. Wall panels shall be minimum 24-gage galvanized steel conforming to ASTM A525 specifications with the galvanized coating conforming to G90 (1-1/4 ounce) standards. Minimum yield strength of panel material shall be 40,000 psi. Panel material shall be embossed with a random pattern pebble embossure of approximately 0.007-0.008 depth.
5. The bases of the wall panels shall be closed off with closure plugs conforming to the panel profile.

PART 3 EXECUTION

3.1 EXAMINATION

A. Installation and erection of work of this section shall be in accordance with the requirements of the design documents and approved submittals.

B. Before factory assembled buildings are set on the concrete slabs, inspect slabs for proper clearances and that slabs are cleared of debris, etc.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Installation and erection of work of this section shall be in accordance with the requirements of the design documents and approved submittals.

B. Work shall be plumb and level, true to line and plane, rigid, and weathertight.

C. Work shall be free of rattles and loose components. Allow for expansion and contraction to prevent damage to components.

D. Pre-finished surfaces shall be free of dents, scars, and blemishes. Repairs (if allowed by Construction Manager) shall match adjacent finish and shall match durability of adjacent finishes.

E. Framing Members: 1/4 inch from level, 1/8 inch from plumb.

F. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

SECTION 13400
INSTRUMENTS AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Design and performance requirements of the instrumentation and controls that will support the Waste Storage Area Extraction System - Phase 2. This section includes:
1. Pressure Indicating Transmitters.
2. Magnetic Flowmeters.
3. Flow Control Valves.
4. Process Control Stations.
5. Position Indicating Limit Switches

B. Refer to Attachment A, Instrument Data Sheets, at the end of this section for detailed information and requirements for the instrumentation and controls defined herein.

C. Calibration of instruments and the installation of instrument piping and tubing systems, including piping, tubing, fittings, gauges, valves, meters, and other accessories (see Part 3 of this section). Refer to Attachment B at the end of this section for installation details.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

B. Section 15060 - Pipe, Fittings, Valves, and Accessories.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. ASME B31.3-96 — Chemical Plant and Petroleum Refining Piping.

B. American Society for Testing and Materials (ASTM):
   1. ASTM B68-95 — Standard Specification for Seamless Copper Tubing, Bright Annealed.
   2. ASTM B75-97 — Standard Specification for Seamless Copper Tube.

C. National Institute of Standards and Technology (NIST).

D. The Instrumentation, Systems, and Automation Society (ISA).

1.5 SYSTEM DESCRIPTION

A. General Design Requirements: For description of instrumentation equipment and detailed design requirements, reference Attachment A of this section.
   1. Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.
   2. Contact closure outputs shall be "dry" contacts isolated from ground.
   3. Instruments and control devices, which require external power, shall accept 120 volts, 60 Hz as the power source.
   4. Indication devices shall be located for ease of operator readability.
   5. Instruments operating at 30 volts or greater shall be insulated in front and back to avoid accidental contact by personnel.

B. General Performance Requirements

1. For detailed performance requirements for all instrumentation for this design package, reference Attachment A of this section.
2. All instruments shall be accurate to the tolerance levels specified in Attachment A, Instrument Data Sheets, and shall maintain these tolerance levels in conditions as described Article 1.9 of this section.
3. Instrumentation shall perform to the stated requirements whether stationary or mobile and require calibration if remounted or moved.

1.6 SUBMITTALS

A. Shop Drawings: Include assembly drawings and wiring diagrams with shipment.

B. Installation instructions, including recommended calibration procedures and installation details, with shipment.

1. Include frequency of calibration required at the time after system installation and regular intervals thereafter.
2. Certification of test equipment (calibration records) used to complete the work as described herein.

C. Recommended inspection and test procedures.

F. Test reports: Test reports shall be typewritten, listing equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test, with shipment.

G. Calibration reports, with shipment.

H. Operation and maintenance (O&M) manuals, with shipment.

I. Suggested spare parts inventory for each type of equipment with bid.

1.7 QUALITY ASSURANCE

A. Compatibility and Calibration: Instrumentation equipment provided shall be compatible with intended service.

1. Instrument equipment shall be calibrated to manufacturer's standards.

2. Test equipment shall be calibrated and shall be traceable by tag number, make, and model number to the instrument certified by the National Institute of Standards and Technology (NIST).

B. Manufacturers' Qualifications: Manufacturers shall have 5 years of verifiable experience in the production of instrumentation equipment of the same type and similar performance as that specified herein.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior.
2. Product shipping container(s) shall be clearly marked "FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.
3. Control components assembled prior to shipment shall be packaged to minimize entry of dirt and moisture.
4. Ensure that closures used for covering, wrapping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorides.

5. Exposed ports for process, electrical, and/or pneumatic connections shall be plugged to prevent interior accumulation of dirt and moisture. Ensure that closures used for covering, wrapping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorides.

B. Acceptance at Site

1. Products arriving at the site shall be examined for general damage during shipping. Those products found to be damaged shall not be accepted.

C. Storage and Protection

1. Instrumentation equipment shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, equipment shall be stored in a clean, dry area, protected from the weather, until required for installation.

1.9 PROJECT CONDITIONS

A. Services

1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks/year.
2. Industrial design with plant life of 30 years.

B. Ambient Conditions

1. Plant Location: Fernald, Ohio.
2. Plant Elevation: 580 feet above sea level.
3. Ambient Temperature Range: -10 to 100 degrees F.
4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.4.
5. Relative Humidity: Varies from 20 percent to 95 percent.

C. Electrical Supply: 120 volts, single phase, 60 Hz or 24 volts DC as indicated on drawings.

1.10 SEQUENCING AND SCHEDULING

A. The sequencing of work and scheduling of tasks shall follow the project schedule.

1.11 MAINTENANCE

A. Maintenance Service

1. Preventive/scheduled maintenance shall be performed per the manufacturer's instructions. Maintenance service numbers and information shall be provided along with product documentation sent in shipping. Maintenance policies and procedures shall be fully described in the maintenance documentation.

B. Extra Materials

1. Any extra/replacement parts or materials required to maintain acceptable product performance levels shall be referenced in the product documentation provided with shipping.

PART 2 PRODUCTS

The following equipment shall be provided in this contract.

2.1 EQUIPMENT

A. Pressure Indicating Transmitters (See Attachment A, Sheet 1 and 2).

1. Manufacturer: Bailey - Fischer & Porter Model PTSPGG1100101A0.

B. Magnetic Flowmeters (see Attachment A, Sheet 3).

1. Manufacturer: Bailey - Fischer & Porter Model 10DX4311CDD151P1A2BAA1132X3AABC.

C. Flow Control Valves (See Attachment A, Sheet 4)
   1. Manufacturer: Keystone K-LOK FIG 312

D. Valve Limit Switches for Position Indication.
   1. Manufacturer: Keystone-Type A Switch Box, Multi-Purpose Position Indicating Limit Switches, Part Number 150-954-920-792-A11, Tag Numbers, ZSLA & ZSLB.

2.2 MATERIALS

See Attachments A and B for materials of construction.

2.3 SOURCE QUALITY ASSURANCE

A. Test controls and instruments prior to shipment to ensure performance in compliance with requirements of these specifications under simulated operating conditions.

2.4 LABELING

A. Instrument Tagging: Instruments shall be tagged accordingly with three-layer, laminated plastic plate 1-inch by 2-1/2 inches, having a minimum thickness of 1/16 inch.
   1. Lettering shall be minimum 1/4 inch high and boldly stamped black on white background.
   2. Tags shall be secured to the instruments by a beaded SST chain or SST wire, 16 AWG minimum, so that they will remain attached to the instrument and not inhibit its operation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Perform work of placing initial operation equipment installed or wired following the instructions of the equipment manufacturers.

1. After energizing and prior to start-up, check control circuits and programs for proper sequence of operation and interlocking functions.
2. Any wiring changes required as a result of such checks shall be properly identified by changing terminal strip and/or wiring markers.

B. Prior to installation, instruments and materials shall be free from contamination in accordance with the following:

1. No residual contaminants present that could cause the instrument to become inoperative.
2. No residual moisture present.
3. No corrosion products, such as rust, present.

3.2 SPECIAL INSTRUCTIONS

A. General

1. Instrument locations shall be as indicated on drawings approved for construction. Any proposed deviation from the indicated locations shall be submitted to the Construction Manager for approval prior to implementation.
2. The hand valves shall be positioned so that handwheels or handles shall be facing the operator and easily accessible without any obstruction or interference.
3. Drain and blowdown valves shall be located so that they are accessible without a ladder or a portable platform and away from walkways, aisles, and operating areas.
4. Joiners (length of pipe made by welding together pieces shorter than 20 feet) shall not be permitted unless approved by the Construction Manager. Where joiners are permitted, the welds

shall be made by welders qualified and certified in accordance with the requirements specified in Article 3.3, Paragraph C. Where piping line classes interface with instrument piping classes, a threaded NPT pipe connection shall be used.

5. Support: Provide supports and brackets as necessary to make the installation rigid.
6. Instrument lines, tubing, or piping, in process, shall not be pocketed.
7. Traps in instrument lines are not acceptable.

B. Threaded Connections

1. When installing instruments, sealant compound shall be applied to male threads only. Sealant compound or tape shall cover all male threads.
2. In making threads, care shall be taken to cut the minimum thread for proper engagement; excessive threads shall be avoided. After each thread is made, burrs shall be removed from the inside and outside of pipe.
3. Prior to final connection of tubing to the instruments, ensure that pipes, valves, pipe fittings, tubing, tubing fittings, instruments, and every component have been thoroughly cleaned and dried, internally and externally, of oil, grease, thread compound, water, dust, thread burrs, and any other foreign material.
4. In general, instrument installation, including supports, air headers, subheaders, valves, instruments, fittings, and all associated work, will be inspected by the Construction Manager.

C. Welding

1. General: Welding and weld inspections, examinations, and tests of instrument piping shall conform to proper weld procedure and practices in compliance with the requirements of Piping Welding Specifications and the additional requirements specified herein.

required examination pressure and for such additional time as may be necessary to conduct the examination of joints for leakage with a bubble-type leak test.

a. The bubble test procedures shall be submitted for review and shall, as a minimum, include soap application procedure and soap material to be used.

C. Joints reconnected after initial test shall be service tested in accordance with ASME B31.3A, Paragraph 345.5.

3.4 ADJUSTING

A. Calibration

1. Calibrate instruments and components in accordance with manufacturer's calibration data over the full operational range; verify instruments to be within published specification and accuracy.
2. Instruments shall be calibrated individually and, where applicable, as a system.
3. Components that have adjustable features shall be carefully set for specific conditions and applications of their project. Affix a calibration sticker.
4. Calibration sticker shall contain the following information:
   a. Equipment identification tag number.
   b. Range of calibration.
   c. Date and name of persons doing calibration.

B. Calibration Ranges

1. Field Transmitters: Check zero and span at 10 percent, 50 percent, and 90 percent of range by impressing measured signal into input or signal connections, in accordance with manufacturer's instructions.

C. Repairs and Retesting: Test failures that require repairs shall be repaired and retested as specified in Article 3.4, Paragraph A.

3.5 CLEANING

A. Instruments shall be cleaned in accordance with the manufacturers recommended cleaning procedures.

B. After cleaning, work shall be free from contamination in accordance with the following:

1. No residual contaminants present that could cause the instrument to become inoperative.
2. No residual moisture present.
3. No corrosion products, such as rust, present.

3.6 ATTACHMENTS

A. The following Instrument Data Sheets are attached:

1. Pressure Indicating Transmitters
2. Magnetic Flowmeters
3. Flow Control Valves

B. The following Instrument Installation Details are attached:

1. Pressure Indicating Transmitter
2. Flowmeter - Magnetic Flange Style
3. Instrument Mounting Stand
4. Control Valve - Electric with Limit Switch

END OF SECTION

SECTION 13401
PROCESS CONTROL SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Design and performance requirements of a monitoring and control system for use with Waste Storage Area Extraction System - Phase 2, to include the following:
1. Hardware and Software for interfacing with the existing CAWWT Control System.
2. Existing CAWWT Control System software upgrade.
3. Sequence of operation.

1.2 RELATED SECTIONS

A. Section 13400 - Instruments and Controls.

B. Section 16050 - Basic Electrical Materials and Methods.

C. Section 16129 - Fiber Optic Cable and Accessories.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Electric Manufacturers Association (NEMA):
1. NEMA ICS 6-88 Enclosures for Industrial Control and Systems, Revision 1, March 1989.

1.5 SYSTEM DESCRIPTION

A. Design requirements, regardless of application, shall be as follows:

1. Electronics housing for outdoor field instruments shall be NEMA ICS 6, Type 4X as a minimum, and electronic housing inside well houses shall be NEMA Type 12 as a minimum.
2. Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.
3. Installed process control equipment shall not have any exposed terminals, wiring, or any other points where personnel may be exposed to live electrical voltage over 30 volts. This requirement applies to calibrating, servicing, repair, and operation of equipment.
3. All terminals over 30 volts shall be insulated or covered to prevent electrical shock exposure.
4. Wells EW-28 and 33 are identical in control except by device tag numbers.

B. Performance Requirements: The process control system shall be furnished and installed to provide for all monitoring and control systems required to operate all wells. Data from the extraction well houses shall be sent to and controlled from the existing CAWWT Distributed Control System.
1. All EW's shall be added to existing CAWWT Siemen's PLC system. All wells require programming, local and at the CAWWT, and shall include alarms and trending similar to existing extraction wells.
2. Existing Siemen's System software shall be used for system programming and existing software licensing is available for programming the Process Control Stations. Fluor Fernald CAWWT Programmer/Operator will preform programming.
3. Provide components compatible with the CAWWT Control system as indicated on the construction drawings.

1.6 SUBMITTALS

A. Shop Drawings and Logic Red-Lines
1. As built red-lines for all construction drawings.

2. System graphics indicating monitored systems, data point addresses, and operator notations.
3. As-built red-lines to existing logic diagrams, including alarm set points.

B. Process Control System Test: CAWWT Programmer/Operators will verify the programming.

E. Certificates: Certification of Test Equipment (calibration records) used to complete the work as described herein.

F. Operations and Maintenance (O&M) Data
1. Indicate manufacturer's installation instructions for all manufactured components.
2. Include interconnection wiring diagram, P&ID, and Control system Architecture drawing for the complete field installed systems with numbered system components and devices.
3. Include inspection period, cleaning methods, cleaning materials recommended, calibration tolerances, and recommended frequency of calibration.

G. Suggested spare parts inventory for each type of equipment.

H. Warranty: Submit manufacturer's warranty, and ensure that forms have been filled out in Owner's name and registered with manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging of the systems shall be in accordance with the following requirements:
1. Items to be installed in the CAWWT System Control Room and Process Control Stations shall be wrapped and placed in suitable shipping containers with sufficient cushioning material to prevent damage during shipment and storage.

B. Acceptance at the Site

1. Products arriving at the site shall be examined for general damage during shipping. Those products found to be damaged shall not be accepted.

C. Storage and Protection

1. Control system components shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, components shall be stored in a clean, dry area, protected from the weather, until required for installation.

1.8 PROJECT CONDITIONS

A. Services

1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks/year.
2. Industrial design with plant life of 30 years.

B. Ambient Conditions

1. Plant Location: Fernald, Ohio.
2. Plant Elevation: Approximately 580 feet above sea level.
3. Ambient Temperature Range: -10 to 100 degrees F.
4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.4.
5. Relative Humidity: Varies from 20 percent to 95 percent.

C. Electrical Supply: 120 volts, single phase, 60 Hz.

1.9 SEQUENCING AND SCHEDULING

A. The sequencing of work and scheduling of tasks shall follow the project schedule.

1.10 WARRANTY

A. Special Warranty

1. Provide 2-year manufacturer's warranty for materials.

1.12 MAINTENANCE

A. Maintenance Service

1. Preventive/scheduled maintenance shall be performed per the manufacturer's instructions. Maintenance service numbers and information shall be provided along with product documentation sent in shipping. Maintenance policies and procedures shall be fully described in the maintenance documentation.

B. Extra Materials

1. Any extra/replacement parts or materials required to maintain acceptable product performance levels shall be referenced in the product documentation provided with shipping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bailey Fischer & Porter, unless otherwise indicated.

2.2 EQUIPMENT

A. CAWWT Control System

1. No control system components are required.

B. Remote Process Control Stations

1. Provide Process Control Stations components as indicated on the drawing, 95X-5500-N-02143, and the Panel Layout Diagram (Attachment A of this section).

C. Communications

1. Communications system consisting of a fiber optic transmission system as indicated on the drawings. Communications cables required include:
   a. Fiber Optic Cable: see Section 16129.
   b. Interface Cable between ITB/CIO Board and Communications Interface Board Model, Fischer & Porter No. 40CA3200A0000.
   c. DB25 connectors and all connections per drawing 95X-5900-N-02144.

D. Operating System Software: Utilize existing Fischer & Porter System software for operations to allow:

1. Operation and programming including alarms of Wells EW-28 and 33.
2. Operator System Access: Passwords and level of access shall be coordinated with CAWWT Operations.

E. Test Mode Operation:

1. Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
   a. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
   b. Control output points but change only data base state or value; leave external field hardware unchanged.
   c. Enable control actions on output points but change only data base state or value.

2.3 SEQUENCE OF OPERATION

A. Programming of wells 28 and 33 shall all be similar except for instrument and device tag numbers as listed in chart below:

EW-33			EW-28
FY085			FY062
FIT085			FIT062
PIT085			PIT062
			V390
ZSL086			ZSL063
ZSH086			ZSH063
V432			V391
ZSL087			ZSL064
ZSH087			ZSH064
			V444
			ZSL100
			ZSH100
			V445
			ZSL102
			ZSH102

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to the control units. Verify that field end devices, wiring, and tubing have been installed prior to proceeding with installation.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Install distributed I/O in Process Control Station enclosures as shown on Panel Layout Diagram, Attachment A of this section.

B. Utilize existing software for configuration of control units and existing operator workstation. Implement all features of programs to specified requirements and appropriate to sequence of operation.

C. Provide conduit and electrical wiring in accordance with Section 16050.

D. Start and commission systems. Allow sufficient timo for start-up and commissioning prior to placing control systems in permanent operation.

3.3 DEMONSTRATION

A. Demonstrate complete and operating system to CAWWT Operations.

3.4 ATTACHMENTS

A. Panel Layout Diagram: Sheet 1

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 15 - Mechanical
Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: William A. Hertel 2/27/06
DATE:

MASTER VALVE LABEL LIST

Well House 33

Valve #	Label Line 1	Label Line 2	P&ID Number
V428	GW- WSA -V-428	EW 33 AVV Isolation Valve	95X-5900-N-02142
V429	GW- WSA -V-429	EW 33 Check Valve	95X-5900-N-02142
V430	GW- WSA -V-430	EW 33 Sample Throttling Valve	95X-5900-N-02142
V431	GW- WSA -V-431	EW 33 Sample Isolation Valve	95X-5900-N-02142
V432	GW- WSA -V-432	EW 33 Treatment Header Isolation Valve	95X-5900-N-02142
V433	GW- WSA -V-433	EW 33 Treatment Header Cleanout Isolation Valve	95X-5900-N-02142
V434	GW- WSA -V-434	EW 33 PIT Isolation Valve	95X-5900-N-02142
V435	GW-WSA-V-435	EW 33 Flush Isolation Valve	95X-5900-N-02142
AVV-33	GW-WSA-AVV-33	EW 33 Air Vacuum Valve	95X-5900-N-02142

MASTER VALVE LABEL LIST

Well House 28

(Use as reference only)

Valve #	Label Line 1	Label Line 2	P&ID Number
V394	GW-WSA-V-394	EW 28 AVV Isolation Valve	95X-5900-N-02139
V387	GW-WSA-V-387	EW 28 Check Valve	95X-5900-N-02139
V389	GW-WSA-V-389	EW 28 Sample Throttling Valve	95X-5900-N-02139
V388	GW-WSA-V-388	EW 28 Sample Isolation Valve	95X-5900-N-02139
V390	GW-WSA-V-390	EW 28 Discharge Header Isolation Valve	95X-5900-N-02139
V392	GW-WSA-V-392	EW 28 Discharge Header Cleanout Isolation Valve	95X-5900-N-02139
V391	GW-WSA-V-391	EW 28 Treatment Header Isolation Valve	95X-5900-N-02139
V393	GW-WSA-V-393	EW 28 Treatment Header Cleanout Isolation Valve	95X-5900-N-02139
V395	GW-WSA-V-395	EW 28 PIT Isolation Valve	95X-5900-N-02139
V396	GW-WSA-V-396	EW 28 Flush Isolation Valve	95X-5900-N-02139
AVV-28	GW-WSA-AVV-28	EW 28 Air Vacuum Valve	95X-5900-N-02139

SECTION 15060
PIPE, FITTINGS, VALVES, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe.

B. Fabricated Piping Assemblies.

C. Fittings.

D. Valves.

E. Specialty Items.

1.2 RELATED SECTIONS

A. Section 09900 - Painting.

B. Section 15090 - Piping Supports and Anchors.

C. Section 15160 - Pumps

D. Section 15250 - Insulation.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES, CODES, AND STANDARDS

A. American Society of Mechanical Engineers (ASME):
1. ASME Boiler and Pressure Vessel Code (BPVC), Section IX-98.
2. ASME A13.1-96 Scheme for the Identification of Piping Systems (R1998).

3.	ASME B16.5-96	Pipe Flanges and Flanged Fittings, NPS ½ thru NPS 24.
4.	ASME B16.11-96	Forged Fittings, Socket Welding, and Threaded.
5.	ASME B16.25-97	Buttwelding Ends.
6.	ASME B31.3-96	Process Piping.

B. American Society for Nondestructive Testing (ASNT):

1.	ASNT 2055-96	Recommended Practice #SNT-TC-1A.

C. American Society for Testing and Materials (ASTM):

1.	ASTM A53-98	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2.	ASTM A105/A105M-98	Standard Specification for Carbon Steel Forgings, for Piping Applications.
3.	ASTM A126-95	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings,E1-1998.
4.	ASTM A193/A193M Rev. A-98	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
5.	ASTM A194/ A194M Rev.B-98	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service or Both.
6.	ASTM A216/A216M-93	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
7.	ASTM A234/A234M-97	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel

for Moderate and High Temperatures.

D. American Welding Society (AWS):
   1. AWS A5.1-91 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.

E. National Institute of Standards and Technology (NIST).

1.5 SUBMITTALS

A. Pressure test and inspection reports.

1.6 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, FLUOR FERNALD prior to commencement of fabrication, examination, inspection, and installation activities.
   3. Nondestructive testing personnel qualifications shall be in accordance with ASNT SNT-TC-1A.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging
   1. Packaging shall conform to acceptable industrial practices. Materials shall be cleaned to remove chips, slag, weld spatter, oil, grease, debris, and other foreign material prior to packaging for shipment. Pipe spool openings shall be covered, capped, or plugged to prevent ingress of foreign materials during shipment and storage. Tape alone shall not be used for sealing openings. Pressure sensitive tapes shall be utilized for taping

covered, capped, or plugged openings. Closures used for covering, capping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorine.

B. Storage and Handling

1. Piping materials and prefabricated assemblies shall be stored off the ground and handled with care so that physical damage to 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. Care shall be taken in the storage and handling of all piping materials and prefabricated assemblies so that contamination or corrosion does not occur.
3. Welding rods and electrodes shall be stored, handled, and identified at all times to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used at all times.

PART 2 PRODUCTS

2.1 PRODUCTS/EQUIPMENT

A. Product Shipping Requirements

1. All furnished materials and equipment shall be delivered clean, undamaged, and in a workable condition.

B. Piping and Valve Specifications

1. All piping materials, valves, and valve operators shall meet the requirements of the referenced specification as indicated on the piping material data sheets in Attachment A.

C. Air and Vacuum Valves

1. Type: Float-operated valve to vent air and break vacuum in submersible pump columns.

2. Provide adjustable device to throttle airflow out while leaving inlet airflow unrestricted.
3. Construction
   a. Body: Cast iron.
   b. Float: Stainless steel.
   c. Seat: Buna-N.
   d. Water diffuser: Brass.
   e. Throttling screw and spring: Stainless steel.
   f. Throttling plug: Teflon.
   g. Connections: Threaded inlet and discharge.
4. Valve size shall match pump size as follows:

Pump Discharge Pipe Size	Valve Size
6"	1"

5. Provide an integrally mounted and piped automatic air release valve to vent air during prolonged pump operation. Provide an isolating gate valve for maintenance.

D. Air Release Valves
1. Float type, cast iron body, stainless steel float and trim, Buna-N seat, threaded connections, rated for 150 psig.

E. Butterfly Valves
1. V-432 - 6-inch, Keystone Model AR2 (lugged)
2. Provide a lockout device capable of receiving the lock hasp.

F. Check Valves
1. V-429 - 6-inch, Mueller, Model Surecheck 72

G. Pump Discharge Column
1. 6" schedule 40 304 Stainless Steel Pipe, threaded and coupling connections. Column piping shall be made of 10 foot-long interchangeable sections plus one 5 foot-long section to allow for field

adjustment. Approximate length is 85 feet per pump. Pipe to be provided by the well pump supplier.

2.2 LABELING

A. Valve Identification

1. Each valve shall be identified with the unique valve number and description, as shown in Attachment B.
2. Label size shall be based on available lighting and anticipated reading distances. Labels shall be readable from the normal operation location or position, such that an operator need not manipulate the label to read it.
   a. The minimum character height for a well-illuminated environment is 0.004 times the nominal reading distance (i.e., 0.122 inches height at 28 inches distance).
   b. The minimum character height for a poorly illuminated environment is 0.006 times the nominal reading distance (i.e., 0.168 inches height at 28 inches distance).
   c. An exception to this would be a 1/2-inch diameter pipe buried in a large bank of pipes on an overhead pipe bridge, which probably could not be read but should be labeled.
3. Labels shall be constructed of nonreflective materials. Black characters on a white background or white characters on a black background offer the best contrast and legibility. If white-on-black engraved labels are used, a clear overcoating shall be applied to prevent dirt from obscuring the white engraved characters.
4. Labels, including adhesives and other means of attachment, shall be made from corrosion-resistant materials that are compatible with the component and environment where they are used.
5. Valve identification tags on insulated valves shall be located outside the insulation jacketing

and be easily accessible for inspection.

B. Pipe Identification

1. Identify the flow medium and the flow direction for all piping systems including insulated pipe by labeling adjacent to each valve, adjacent to where the pipe passes through a wall or floor, adjacent to abrupt pipe directional change, pipe branches, and at intervals of 50 feet along exposed pipe. Pipes shall be labeled as indicated on the Piping and Instrumentation Diagrams and in accordance with ASME A13.1.
2. Content, size, material type, line number, and insulation requirements for each pipeline are identified on the drawings as follows:

<u>Example</u> GW - 8" - A - 2900 - ET

Medium Code	Size Code	Material Material	Line Number	Insulation
GW	6"	A	2900	ET

3. Refer to the Piping and Instrumentation Diagram Symbols and Legend Sheet for the flowing medium, medium code, and material code relationship.

C. Product Marking

1. All piping materials shall be marked and identified in accordance with the applicable ASTM specification as indicated on the piping material data sheets.
2. All bundles, boxes, or kegs in which welding rods and electrodes are delivered shall be legibly marked with the following information:
   a. Classification.
   b. Trade Designation.
   c. Standard Size and Length.
   d. Heat Number.
3. All welding rods and electrodes shall be

identified with at least one imprint per rod showing an AWS classification number 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 be clearly distinguishable and shall include the classification number of the welding rod and the trade designation of the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Twenty percent of all fabricated piping shall be visually examined by an inspector qualified and certified in accordance with ASNT SNT-TC-1A.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Layout, Cutting, and Fitting Up

1. All piping, tubing, fittings, components, welding, bonding, fabrication, erection, and assembly shall be in accordance with ASME B31.3.
2. All piping shall be Category D Fluid Service under ASME B31.3.
3. All assembled piping shall be installed without springing, forcing, or cold bending. Cutting or otherwise weakening of structural members to facilitate piping installation shall not be permitted.
4. All piping shall be installed to permit free expansion and contraction without damage to joints or supports.
5. Piping connections to equipment must ensure that mating flanges are parallel prior to bolt-up and no springing of pipe is required. All equipment nozzle sizes, locations, and flange facings shall be verified prior to pipe fabrication and/or installation.

6. Piping arrangement shall allow easy access for maintenance, operation, and inspection of equipment. Flanges, unions, and valves shall be accessible for maintenance, operation, and inspection after installation. Piping shall be routed in such a way so as not to create a tripping hazard, or provisions shall be made to protect against a tripping hazard.
7. Threading of steel pipe shall preferably be done after bending, forging, heat treating, or welding operations. Where subsequent threading is very difficult and threads are cut first, they shall be fully protected during the above-mentioned operations. Threads shall be concentric with the outside of the pipe.
8. Pipe dope shall be applied to male threads only. Teflon tape, when used as thread dope, shall not be applied to the first two threads.
9. When welding joints involving two different pipe wall thicknesses, the joints shall be made in accordance with ASME B31.3, Chapter V.
10. Branch connections shall be made in accordance with the requirements specified in ASME B31.3, Chapter V.
11. All butt-welded pipe shall be beveled in accordance with ASME B16.25.
12. All socketwelded pipe shall be square cut to within the tolerances specified in ASME B16.11.
13. Remove plastic or elastomeric components from welded end prior to welding in-line.
14. All welded end valves shall be in the closed position prior to welding in-line. Valves with nonmetallic seats shall be disassembled and the seat material removed prior to welding. After the weld has cooled, reassemble the seat material in the valve.
15. 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.

16. Branch connection joints shall be prepared to permit full penetration welds of a quality comparable to the circumferential welds in the same piping system.
17. Welding will not be permitted on galvanized carbon steel piping.

B. Welding

1. All welding electrodes shall be in accordance with AWS A5.1.
2. All 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. Branch connections to headers shall be per the material data sheet branch connection charts.

C. Painting

1. All carbon steel piping shall be painted in accordance with the requirements of Section 09900 including piping insulated for the prevention of condensation.

D. Flanged Joints

1. All flanged joints shall be assembled in accordance with ASME B31.3, Chapter V.
2. 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 flange centerlines. All 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.

3. All flanged joints shall be made with new gasket and bolting materials. Bolts and nuts damaged during installation shall be replaced.
4. Flat ring-type gaskets shall be used between steel flanges equipped with raised serrated faces.
5. Where flanges of different ratings are bolted together, the rating of the joint is equal to that of the lower rated flange.
6. Where metallic flanges are bolted to non-metallic flanges, both shall be flat-faced flanges. Full-face gaskets shall be used.
7. Class 150 or Class 300 steel flanges shall be bolted to flanged cast iron valves, fittings, or equipment having integral Class 125 or Class 250 flanges, respectively. When such construction is used, flat-face steel flanges shall be used with a full-face gasket.

3.3 QUALITY CONTROL

A. Inspections and Tests

1. Piping shall be pressure tested in accordance with ASME B31.3, Chapter VI.
2. All pressure testing shall be complete systems testing conducted in the presence of Fluor Fernald.
3. Pressure testing shall not start until the testing procedure has been issued by Fluor Fernald.
5. All connections/joints (including weld) shall be left uninsulated, unpainted, and exposed for examination for leakage during testing.
6. The piping system shall be inspected prior to any pressure tests to ensure that all connections are tight.
7. Test pressure gauges shall be calibrated no more than 30 days prior to the test.
8. Every precaution shall be taken during pressure testing to ensure personnel safety. Systems to be pressurized shall be provided with appropriate gauges and pressure relieving devices set at 10

percent above the test pressure.

9. All pressure vessels, equipment, in-line instruments, gauge glasses, flow meter pots, and all other pressure parts of instruments shall not be included in these tests if they will be damaged by the test pressure.
10. 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.
11. Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment with no indicated test pressure, or with test pressures below the piping system test pressure, shall be excluded from these tests.
12. Control valves (unless being tested) shall be set and maintained in the full open position.
13. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.
14. Joints found to be defective shall be repaired and retested. Retest pressures shall be the same as those originally specified for the test.
15. Measurement and test equipment shall be calibrated and traceable to NIST. Gauges shall be selected so that test pressures are at the midrange of the gauge.

B. Hydrostatic Testing

1. Potable water or other approved fluids shall be used for hydrostatic pressure testing in accordance with ASME B31.3, Chapter VI.
2. Hydrostatic test pressures shall be 1.5 times the design pressure as shown in the following table:

Service	Medium Code	Design Pressure (psig)	Test Pressure (psig)
Groundwater	GW	100	150

3. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.
4. High-point vents and low-point drains shall be provided as required for hydrostatic tests.

C. Test Reports

1. A report for each piping system tested shall be provided containing the following information:
   a. Date of test
   b. Line designation number
   c. Test fluid
   d. Type of test
   e. Pressure applied
   f. Start time
   g. Completion time
   h. Total time at test pressure
   i. Certification by examiner of acceptability
   j. Fluid test temperature
   k. Gauge number

3.4 CLEANING

A. System Cleaning and Flushing

1. The interior and exterior of all pipe shall be kept clean at all times. Piping shall be free from loose mill scale, sand, dirt, slag, weld spatter, rust, fins, burrs and other foreign matter when erected. Burrs shall be removed by reaming. Other defects shall be removed by machining, chipping, filing, or grinding.
2. After erection and welding of piping, all lines except air shall be flushed with potable water prior to leak testing. Upon completion of

flushing, lines shall be drained at all low points.

B. Sandblasted surfaces shall be free of residual quantities of cleaning media such as grit, aluminum oxide, or silicon prior to installation.

C. The use of cleaning fluids containing free chlorine shall be prohibited.

END OF SECTION

SECTION 15160
PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submersible motor-driven well pumps (Nos. PMP-28 & PMP-33.

1.2 RELATED SECTIONS

A. Section 16483 - Variable Frequency Drives.

B. Section 15060 - Pipe, Fittings, Valves and Accessories

C. Section 15171 - Motors Driven by Variable Frequency Drives.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. Hydraulic Institute Standards.

1.5 SUBMITTALS

A. Product Data: Submit a typical performance curve for each pump model supplied. After testing, submit certified pump curves, showing performance characteristic with pump and system operating point plotted including minimum and maximum sustainable flow for all pumps. Include net positive suction head curve. Pump curves shall be in accordance with Hydraulic Institute Standards.

B. Certificates: Alignment certification, certificates of conformance to specification requirements, and certificates guaranteeing performance at design point.

ATTACHMENT A
PIPING MATERIAL DATA SHEETS

PIPING MATERIAL DATA SHEET	MAT'L CODE A PAGE 1 OF 4

RATING: CLASS 150
MATERIAL:CARBON STEEL

CORROSION ALLOWANCE: 0.125"
PRESSURE LIMIT: PER ASME/ANSI B16.5
TEMPERATURE LIMIT: -20°F TO 200°F

CODE NUMBER	ENCODER	SIZE FROM	TO	DESCRIPTION	NOTES	REV
				PIPE		
		3/8" - 2"		SEAMLESS CARBON STEEL, ASTM A53 GRADE B, EXTRA STRONG. PLAIN ENDS.		
		2-1/2" - 20"		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" - 20"		CLASS 150, CARBON STEEL, RFSF, ASTM A105, WELD NECK (STD WT BORE).		
		1/2" - 20"		CLASS 150 BLIND, CARBON STEEL, ASTM A105, RFSF.		
				ORIFICE FLANGES		
		2-1/2" - 20"		CLASS 300, CARBON STEEL, ASTM A105, RF WITH 1/2" SCREWED TAPS AND JACK SCREWS, WELD NECK, (STD WT BORE).		
				FITTINGS		
		3/8" - 2"		CLASS 3000, CARBON STEEL, ASTM A105; SOCKETWELD.		
		3/8" - 2"		CLASS 3000, SCREWED CARBON STEEL, ASTM A105 THREADOLET.		
				PLUG, SQUAREHEAD.	1	
				CAP.	1	
				PLUG, HEX HEAD.	1	
		2-1/2" - 20"		SEAMLESS CARBON STEEL, BUTT WELD ENDS, ASTM A234 GRADE WPB.	3	
				SWAGES		
		3/8" - 4"		SCHEDULE 80 CARBON STEEL, ASTM A234, GRADE WPB, PREPARE ENDS AS REQUIRED (BEVELED, PLAIN OR THREADED).	2	
				GASKETS		
		1/2" - 20"		RED RUBBER, 1/8" THICK		

PIPING MATERIAL DATA SHEET				MAT'L CODE A OF 4	
CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			BOLTING		
		1/2" - 20"	STUD BOLTS WITH 2 HEAVY HEX NUTS, ASTM A193 GRADE B7/ASTM A194 GRADE 2H.		
			BRANCHES		
			SEE CHART		
			BALL VALVES		
		3/8" - 2"	CLASS 300 CARBON STEEL, ASTM A105, SOCKETWELD, CHROME PLATED BALL, FEP SEATS, WRENCH OPERATOR.	4	
			BALL VALVES		
		2-1/2" - 8"	CLASS 150 CARBON STEEL, ASTM A216, GRADE WCB RF FLG, CHROME PLATED BALL, FEP SEATS, WRENCH OPERATOR FOR 4" AND SMALLER, GEAR OPERATOR FOR 6" AND LARGER.	4	
			BUTTERFLY VALVES		
		1" - 20"	CLASS 150, CAST IRON, ASTM A126, CLASS B, WAFER STYLE, 316 SS STEM AND DISC, EPDM SEAT, INTEGRAL FLANGE SEALS, LEVER HANDLE OPERATOR FOR 1-4", GEAR OPERATOR FOR 6" AND LARGER.	4,5	
			CHECK VALVES		
		1/2" - 2"	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, SWING TYPE, 11-13 CR TRIM.		
		2-1/2" - 20"	CLASS 150, CAST STEEL, ASTM A216, WAFER STYLE, BRONZE TRIM, STAINLESS STEEL SPRING, SILENT CHECK VALVE.		
			GLOBE VALVES		
		1/2" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD, BOLTED BONNET, OS&Y, 12% CHROME TRIM, HANDWHEEL OPERATOR	4	
		2-1/2" - 8"	CLASS 150, CARBON STEEL, ASTM A216 GRADE WCB,RF FLANGE, 12% CHROME TRIM, HANDWHEEL OPERATOR	4	
			GATE VALVES		
		1/2" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD ENDS, OS&Y, BOLTED BONNET, SOLID WEDGE, 12% CR TRIM.	4	
		21/2" - 6"	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, 11-13 CR TRIM, O.S. & Y	4	

PIPING MATERIAL DATA SHEET				MAT'L CODE A PAGE 3 OF 4	
CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			PIPE NIPPLES ---------- CARBON STEEL, ASTM A53, GRADE B		
		1/2" - 2"	SCH 80, TBE, SMLS 3" LONG		
		1/2" - 2"	SCH 80, TBE, SMLS 6" LONG		
		1/2" - 2"	SCH 80, POE-TOE, SMLS 3" LONG		
		1/2" - 2"	SCH 80, POE-TOE, SMLS 6" LONG		
		1/2" - 2"	SCH 80, PBE, SMLS 3" LONG		
		1/2" - 2"	SCH 80, PBE, SMLS 6" LONG		
		3"	SCH 40, BOE - TOE, SMLS 3" 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.USE FOR PROCESS DRAIN. 4.EQUIP VALVE WITH LOCKING DEVICE WITH NOT LESS THAN 3/8" DIAMETER HOLE FOR LOCK. 5.PROVIDE VALVE WITH POSITION LIMIT SWITCHES AS FOLLOWS: A. ENCLOSURE SHALL BE NEMA TYPE 4. B. MECHANICAL ARM SHALL BE LEVER TYPE WITH C. OUTPUT CONTACTS SHALL BE "DRY" CONTACTS " SPDT RATED 5A CONTINUOUS CURRENT, 120 V AC, 60		

PIPING MATERIAL DATA SHEET

MATERIAL CODE A

BRANCH CONNECTION CHART

Run Size

1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	
SWT	SRT	SRT	SRT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1/2
	SWT	SRT	SRT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				3/4
		SWT	SRT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1
			SWT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1 1/2
				SWT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				2
					WT	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL				2 1/2
						WT	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL				3
							WT	WOL	WOL	WOL	WOL	WOL	WOL	WOL	WOL				4
								WT	WOL	WOL	WOL	WOL	WOL	WOL	WOL				6
									WT	WOL	WOL	WOL	WOL	WOL	WOL				8
										WT	WOL	WOL	WOL	WOL	WOL				10
											WT	WOL	WOL	WOL	WOL				12
												WT	WOL	WOL	WOL				14
													WT	WOL	WOL				16
														WT	WOL				18
															WT				20
																			24
																			30
																			36

Legend

SOL = Sockolet
SRT = Socketweld Reducing Tee
STI = Sockolet Tee w/Insert
SWT = Socketweld Tee
WOL = Weldolet
WT = Buttweld Tee

SECTION 15090
PIPING SUPPORTS AND ANCHORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping supports, anchors, and accessories.

1.2 RELATED SECTIONS

A. Section 09900 - Painting.

B. Section 15060 - Pipe, Fittings, Valves, and Accessories.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM A36/A36M-97 Standard Specification for Carbon Structural Steel.

B. American Welding Society (AWS):
1. AWS A5.1-91 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
2. AWS D1.1-98 Structural Welding Code - Steel.

C. Manufacturers Standardization Society (MSS):
1. MSS SP-89-98 Pipe Hangers and Supports - Fabrication and Installation Practices.

1.5 QUALITY ASSURANCE

A. All pipe supports and auxiliary steel shall be of bolted or welded construction complying with MSS SP-89. Welded construction shall comply with AWS D1.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling

1. Piping support materials and piping hanger systems shall be stored off the ground and handled with care so that physical damage to the materials does not occur.
2. Care shall be taken in the storage and handling of all piping support materials and pipe hanger systems so that corrosion or contamination by grease, moisture, or other foreign matter does not occur.
3. Welding rods and electrodes shall be stored, handled, and identified at all times to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods must be used to maintain storage humidity.

PART 2 PRODUCTS

2.1 PRODUCTS/EQUIPMENT

A. All furnished materials and equipment shall be delivered clean, undamaged, and in good condition.

2.2 MATERIALS

A. ASTM A36 steel shall be used for all plate and structural shape support components.

2.3 FABRICATION

A. Welding

1. All welding shall be in accordance with AWS D1.1.

B. Shop Assembly

1. Any parts made in the supplier's shop shall be completely shop assembled, as far as practical, prior to shipment to the site.

C. Shop/Factory Finish

1. All carbon steel parts shall be painted in accordance with the requirements of Section 09900.

2.4 LABELING

A. Product Marking

1. All welding rods and electrodes shall be identified with at least one imprint per rod showing an AWS classification number 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 be clearly distinguishable and shall include the classification number of the welding rod and the trade designation of the manufacturer. Filler metal requirements shall conform to AWS A5.1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Installer shall perform all quality control visual examinations. Installer shall give FLUOR FERNALD notice before a visual examination can be performed.

3.2 PREPARATION

A. Protection

1. All welding/fabricating activities shall be protected from inclement weather at all times.

B. Primer Application

1. All structural steel pipe support material systems shall be prime coated after fabrication. The items

that are painted as standard by the manufacturer do not require prime coating. Primer shall be in accordance with Section 09900.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Installation

1. Support components shall be installed in accordance with details shown on the piping drawings.
2. Supports shall be installed at the locations shown on the piping drawings.

END OF SECTION

SECTION 15160
PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submersible motor-driven well pumps (Nos. PMP-28 & PMP-33.

1.2 RELATED SECTIONS

A. Section 16483 - Variable Frequency Drives.

B. Section 15060 - Pipe, Fittings, Valves and Accessories

C. Section 15171 - Motors Driven by Variable Frequency Drives.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. Hydraulic Institute Standards.

1.5 SUBMITTALS

A. Product Data: Submit a typical performance curve for each pump model supplied. After testing, submit certified pump curves, showing performance characteristic with pump and system operating point plotted including minimum and maximum sustainable flow for all pumps. Include net positive suction head curve. Pump curves shall be in accordance with—Hydraulic Institute Standards.

B. Certificates: Alignment certification, certificates of conformance to specification requirements, and certificates guaranteeing performance at design point.

C. Installation instructions, start-up and troubleshooting instructions, operational and maintenance data, lubrication instructions, and spare parts list.

D. Shop testing procedures and test reports.

1.6 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 a standard commercial package. The package 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 of the pumps.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Byron Jackson, Submersible Motor Pumping Unit, Model #10MQL, 5 stage

2.2 EQUIPMENT

A. General Construction Requirements
   1. The balancing of the rotating parts, statically and dynamically, shall be in accordance with the manufacturer's standards.

B. Pumps
   1. See Attachment A, Pump Data Sheet.

2.3 FABRICATION

A. Prior to shipment, the pump/motor assembly shall be cleaned of all dirt, dust, grease, grime, weld spatter,

and other foreign material. Pumps shall be primed and painted in accordance with manufacturer's standard finish. Any open end connections shall be sealed to prevent the entrance of foreign material.

2.4 SOURCE QUALITY CONTROL

A. Each pump shall be tested in the manufacturer's shop in accordance with Hydraulic Institute Standards.

B. All test results will be provided to FLUOR FERNALD.

PART 3 EXECUTION

3.1 SCHEDULES

A. For pump data, see Attachment A.

3.2 ERECTION/INSTALLATION/APPLICATION

A. The installation of the equipment specified and shown on the drawings shall be in accordance with the manufacturer's instructions.

B. A copy of the manufacturer's installation instructions, start-up and troubleshooting instructions, operation and maintenance data, lubrication instructions, and spare parts list shall be available at the site.

C. Pump manufacturer shall provide services of Service Engineer during installation, start-up, and testing.

3.3 FIELD QUALITY ASSURANCE

A. Tests: Acceptance operating tests shall be performed after installation. If the results are unsatisfactory, adjust or replace the equipment to meet the specification requirements and retest the equipment.

B. Inspection: Installer shall notify FLUOR FERNALD of testing and inspection activities prior to the start of all tests and inspections.

C. Testing shall not start until the testing procedure has been provided by FLUOR FERNALD.

3.4 DEMONSTRATION

A. Demonstrate ability to meet full range of operating flow rates and operating point as shown on pump curves. Vibration shall be within manufacturer's acceptable range.

END OF SECTION

ATTACHMENT A

SUBMERSIBLE PUMP DATA SHEET

PUMP NAME:	Submersible Pump	EQUIP. NO.:	PMP's-28, & 33	PROJECT NUMBER:	58110
PROJECT TITLE:	Waste Storage Area Extraction System, Phase II			QUANTITY:	3
DRAWING NO.:	95X-5500-N-02142; 95X-5500-G-02133				
TYPE PUMP:	Submersible	TYPE DRIVER: Submersible Byron Jackson Electric motor w/var. freq. Drive		SUPPLY W/PUMP:	(Note 7)

OPERATING CONDITIONS

FLUID PUMPED:	Groundwater	pH Range:	7 to 9	TSS:	3 mg/L
DESIGN CAPACITY:	500 gpm	Range:	300 gpm to 500 gpm		
HEAD AND WELL DATA:	200 ft				

PUMP SPECIFICATIONS

TYPE PUMP:	Submersible pump, aboveground discharge, variable speed (Note 5)		
STAGES:	Multistage	RPM:	Maximum 3,600
EFFICIENCY:	Minimum 70%	TYPE IMPELLER:	Closed

CONNECTIONS

DISCHARGE:	6" Flanged, aboveground (Well #28 requires Pitless Adaptor)

CONSTRUCTION MATERIALS

DISCHARGE COLUMN:	6" 304 Stainless Steel, threaded and coupled connections (Note 1)		
COLUMN LINE SHAFT:	N/A		
BEARINGS:	Water lubricated rubber/bronze for bowl; grease or oil lubricated thrust bearing.		
BOWL ASSEMBLY:	Enameled cast iron (Note 2)		
IMPELLER:	Bronze	IMPELLER SHAFT:	Stainless Steel
INLET STRAINER:	Corrosion-resistant (Note 3)		
SURFACE PLATE:	Steel with 90° elbow, 6"discharge, well vent and 1-inch opening for ¾-inch chlorine injection tube. (Pumps 33 only)		
WATER LEVEL INDICATOR:	(Note 4)		
PITLESS ADAPTOR:	Applicable to Pump 28 only (See note 8).		

ELECTRIC MOTOR

VOLTS	PHASE	HERTZ	HP	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE
460	3	60	40	YES			Variable Max 1800	Totally Enclosed for Submersible Service (Note 6)

REMARKS:

Note 1: Discharge column shall be supplied in maximum 10-foot-long interchangeable sections with threaded and coupling connections; plus one spare 5-foot-long section for each pump to allow for field adjustment. Column shall be constructed of 304 Stainless Steel.

Note 2: Bowl assemblies shall be interchangeable for all pumps.

Note 3: Net inlet area of strainer shall be greater than or equal to four times suction area.

Note 4: Provide 2-inch NPT Connection for water level instrument in top of surface plate.

Note 5: There shall be no critical speeds within the normal operating range.

Note 6: Motor shall be controlled by a variable frequency drive. For additional details, see Sections 16170 and 16483.

Note 7: Pump , motor, and VFD may be procured from various vendors.

Note 8: Provide carbon steel Pitless Adapter unit with 6" flanged discharge and provide opening for ½ inch chlorine injection tubing.

SECTION 15170
MOTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage, three phase induction motors.

B. Low-voltage, single phase induction motors.

1.2 RELATED SECTIONS

A. Section 15500 - Heating, Ventilating, and Air Conditioning.

B. Section 16050 - Basic Electrical Materials and Methods.

C. Section 16170 - Grounding and Bonding.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

The latest edition of the following references shall be used:

A. American Bearing Manufacturers Association (ABMA):
   1. ABMA 9-90 — Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11-90 — Load Ratings and Fatigue Life for Roller Bearings.

B. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE 112-96 — Standard Test Procedure for Polyphase Induction Motors and Generators.

C. National Electrical Manufacturers Association (NEMA):
1. NEMA MG 1-93 Motors and Generators, Rev.4-June 1997.
2. NEMA MG 13-84 Frame Assignments for AC Integral-Horsepower Induction Motors, R(1990).

D. National Fire Protection Association (NFPA):
1. NFPA 70-2005 National Electrical Code.

E. Underwriters Laboratories, Inc. (UL):
1. Electrical Construction Materials Directory.

1.5 SUBMITTALS

A. Product Data: Provide full load amps, impedances, normal and short-circuit current ratings, NEMA frame size, and additional standard nameplate data. Provide efficiency and power factor for each of 1/2, 3/4, and full load. Provide dimensional enclosure details.

B. Test Reports: Indicate satisfactory completion of required tests and inspections. Submit results verifying performance in accordance with IEEE 112.

1.6 QUALITY ASSURANCE

A. Conform to NFPA 70 and NEMA MG1.

B. Motors shall be listed in the UL, Electrical Construction Materials Directory, for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Reliance Electric.
2. U. S. Motors.
3. General Electric.

2.2 EQUIPMENT

A. General Construction and Requirements

1. Electrical Service: Refer to related sections of the specifications and the drawings for required characteristics. Motors shall be suitable for driven equipment.
2. Motors: Design for continuous operation at a temperature of 40 degrees C ambient, and for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
3. Visible Nameplate: Indicating motor horsepower, voltage, phase, frequency, rpm, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, serial number, and bearing numbers. Nameplate shall be stainless steel, permanently attached to the motor frame.
4. Electrical Connection: Conduit connection boxes, threaded for conduit and designed to allow for 90-degree step rotation of the conduit entrance. Oversize conduit boxes shall be provided.
5. Motor Service Factor: Furnish motors with service factors required herein. Motor size in hp shall be selected to serve the driven equipment over its full performance range as though the service factor were 1.0.
6. Motor voltage shall be 115 V, single-phase for motors 1 hp or less. Other motors shall be 460 V, three phase.
7. Motors drawing less than 250 W that are intended for intermittent service may be germane to equipment manufacturer and need not conform to these specifications.
8. Provide vertical pump motors with non-reverse ratchets. Note that these pumps have hollow shafts.

B. Three Phase - Squirrel Cage Induction Motors

1. Motors shall be 460 V, three phase, 60 Hz.
2. Motors shall have a 1.15 service factor or higher.

3. The motor connection diagram shall be stainless steel, permanently stamped and attached to the motor either inside the conduit box or on the same side as the conduit box.
4. Starting Torque: To be matched to the driven equipment.
5. Starting Current: Not to exceed six times full-load current.
6. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics or as required by the driven equipment.
7. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors or as required by the driven equipment.
8. Insulation System: Non-hygroscopic NEMA Class F or better.
9. Testing Procedure: In accordance with IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and for compliance with performance data.
10. Motor Frames: NEMA MG 13 standard T-frames of steel, or cast iron with end brackets of cast iron.
11. Bearings: Grease lubricated, anti-friction ball bearings with housings equipped with plugged provision for prelubrication, rated for minimum ABMA 9 and 11, L-10 life of 20,000 hours.
12. Sound Power Levels: To NEMA MG 1.
13. Motors shall be high-efficiency type.
14. Motors shall be totally enclosed fan cooled (TEFC).
15. Nominal Efficiency: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.
16. Nominal Power Factor: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.

C. Performance Schedule: Three Phase - Standard efficiency, TEFC.

Horse Power (HP)	Speed (RPM)	Min. NEMA Frame	Min Percent Efficiency (%)	Power Factor
1.5	3600	143T	82	85
2	3600	145T	82	87
3	3600	145T	84	85
5	3600	182T	85	86
7.5	3600	184T	86	88
10	3600	213T	87	86
15	3600	215T	89	89
20	3600	254T	90	89
25	3600	256T	90	92
30	3600	284T	91	91
40	3600	286T	92	92
50	3600	324T	93	89
60	3600	326T	93	91
75	3600	364T	93	88
100	3600	365T	92	88
1	1800	143T	82	84
1.5	1800	145T	84	85
2	1800	145T	84	85
3	1800	182T	86	86
5	1800	184T	87	87
7.5	1800	213T	88	86
10	1800	215T	89	85
15	1800	256T	91	85
20	1800	256T	91	86
25	1800	284T	91	85
30	1800	286T	92	88
40	1800	324T	92	83
50	1800	326T	93	85
60	1800	364T	93	88
75	1800	365T	93	88
100	1800	404T	93	83

For motors larger than 100 hp, provide manufacturer's standard high-efficiency motor.

D. Service Factor Schedule

Horse Power	3600 rpm	1800 rpm	1200 rpm	900 rpm
1/6 - 1/3	1.35	1.35	1.35	1.35
1/2	1.25	1.25	1.25	1.15
3/4	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15
>1	1.15	1.15	1.15	1.15

E. Single phase motors shall conform to the following respective requirements. The driven equipment supplier shall furnish motor starter, motor type, and motor enclosure type suitable for the application.

1. Single Phase Power - Split Phase Motors
   a. Starting Torque: Less than 150 percent of full load torque.
   b. Starting Current: Up to seven times full load current.
   c. Breakdown Torque: Approximately 200 percent of full load torque.
   d. Drip-Proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA service factor, prelubricated sleeve or ball bearings.
   e. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 service factor, prelubricated ball bearings, TEFC.
2. Single Phase Power - Permanent-Split Capacitor Motors
   a. Starting Torque: Exceeding 1/4 of full load torque.
   b. Starting Current: Up to six times full load current.
   c. Multiple Speed: Through tapped windings.
   d. Open Drip-Proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 service factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

3. Single Phase Power - Capacitor Start Motors
   a. Starting Torque: Three times full load torque.
   b. Starting Current: Less than five times full load current.
   c. Pull-Up Torque: Up to 350 percent of full load torque.
   d. Breakdown Torque: Approximately 250 percent of full load torque.
   e. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
   f. Drip-Proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA service factor, prelubricated bearings.
   g. Enclosed Motors: Class A (50 degrees C temperature rise).

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

A. Install motors in accordance with manufacturer's instructions.

B. Motors shall be aligned with the respective driven equipment as specified in related sections.

C. External metal frames of motors and their respective driven equipment shall be connected to ground as specified in Section 16170.

END OF SECTION

SECTION 15171
MOTORS DRIVEN BY VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low voltage, three-phase induction motors for submersible motor-driven well pumps PMP-28 and 33.

1.2 RELATED SECTIONS

A. Section 15160 - Pumps.

B. Section 16483 - Variable Frequency Drives.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):
1. IEEE 112-96 Standard Test Procedure for Polyphase Induction Motors and Generators.

B. National Electrical Manufacturers Association (NEMA):
1. NEMA MG 1-93 Motors and Generators.
2. NEMA MG 13-84 Frame Assignments for AC Integral Horsepower Induction Motors.

C. National Fire Protection Association (NFPA):
1. NFPA 70-2005 National Electrical Code.

D. Underwriter's Laboratories, Inc., (UL):
1. Electrical Construction Materials Directory.

1.4 SYSTEM DESCRIPTION

A. This section covers electrical motors required for the

operation of turbine pumps PMP-28, and -33 as described in Section 15160. Each motor shall be served and operated by a Variable Frequency Drive as described in Section 16483. Motor connections from the Variable Frequency Drives shall be accomplished by the Installer.

1.5 SUBMITTALS

A. Submit manufacturer's installation instructions.

B. Submit operation and maintenance data. Include assembly drawings; bearing data, including replacement sizes; and lubrication instructions.

C. Product Data: Provide full load amps, impedances, normal and short-circuit current ratings, NEMA frame size, and additional standard nameplate data. Provide efficiency and power factor for each of 1/2, 3/4, and full load. Provide dimensional enclosure details.

D. Test Reports: Indicate satisfactory completion of required tests and inspections. Submit results verifying performance in accordance with IEEE 112.

1.6 QUALITY ASSURANCE

A. Conform to NFPA 70 and NEMA MG 1.

B. Motors shall be listed in the UL, Electrical Construction Materials Directory, for the purpose specified and indicated.

1.7 WARRANTY

A. Warranty: Motors shall be warranted by the manufacturer covering materials and labor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Motor: Byron Jackson, 10-inch type M, 40 hp 4 pole, 460v, 3 phase, 60 cycle, 1770 rpm.

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

A. Install motors in accordance with manufacturer's instructions.

3.2 QUALITY ASSURANCE

A. Performance Schedule: Three Phase - energy efficient.

B. Tests: Acceptance operating tests shall be performed by the Installer. If the results are unsatisfactory, adjust or replace the equipment to meet the specification requirements and retest the equipment.

C. Inspection: The Installer shall notify the Fluor Fernald Construction Manager of testing and inspection activities at least 24 hours prior to the start of all tests and/or inspections.

END OF SECTION

SECTION 15250
INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe Insulation.

1.2 RELATED SECTIONS

A. Section 15060 - Pipe, Fittings, Valves, and Accessories.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM C534-94	Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
2.	ASTM D1056-98	Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Insulation Materials

1. Insulation materials shall be identified, inspected, controlled, and protected in a manner that will ensure conformance with the referenced codes and standards.
2. Care shall be taken in the storage and handling of all insulation material so that contamination by grease, moisture, or other foreign matter does not occur. Insulation materials shall be stored off the ground, protected from the weather, and handled so that physical damage to the insulation material does not occur.

PART 2 PRODUCTS

2.1 MATERIALS

A. Anti-condensation flexible cellular elastomeric insulation: Slit pipe or sheet insulation in accordance with ASTM C534 Type 1 - Tubular and ASTM D1056, RE - 41.

2.2 ACCESSORIES

A. Wire: B&S Gage No. 16, annealed, 302 or 304 stainless steel.

B. Adhesives: Fire-resistant adhesive shall be compatible with insulation.

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

A. Piping, which includes valves, fittings, and flanges, shall be insulated for all piping containing the suffixes "IC" in the pipe line number as indicated on the drawings.

B. Install materials in accordance with the manufacturer's instructions.

C. Flanges shall have removable insulation to permit servicing of take-down joints. Removable covers may be fabricated from segments of block insulation or from preformed sectional pipe covering and premolded components.

D. Fill joints and seams with bedding compound to form smooth surface.

E. All insulation shall be stopped at a sufficient distance from flanges to permit ease of bolt removal. Insulation shall be beveled at a 45-degree angle at this point.

F. Labels indicating "asbestos-free" shall be attached to the outside of all insulation, adjacent to all piping identification labels.

G. Pipe Insulation

1. All piping shall be tested in accordance with Section 15060 before installing insulation.
2. Piping, fittings, valves, and flanges shall be insulated as follows:

Pipeline Number Suffix	Type	Material	Minimum Thickness (inches)	Jacketing
IC	anti-condensation	flexible elastomeric	1	None

3. Insulation shall be applied in a single layer with joints tightly butted and shall be secured in place with wire on 12-inch centers.
4. Finish insulation at supports, protrusions, and interruptions. At pipe supports, remove only enough insulation to provide a snug fit.
5. Inserts shall be the same thickness, material, and contour as adjoining piping insulation. For intersection at tees or other equipment, use block or curved segments. Miter cut to fit neatly on the surface, with joints tightly butted.
6. All insulated valves and piping systems shall be labeled in accordance with Section 15060.

END OF SECTION

SECTION 15500
HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, materials, equipment, and services necessary to construct, install, and test the complete and operable heating and ventilation systems as defined in this specification and as shown on the Mechanical Utilities drawing.
   1. Propeller fans.
   2. Inlet air damper.
   3. Electric unit heater.
   4. Controls.

B. Items furnished and installed by others:
   1. Electric power supply.

1.2 RELATED SECTIONS

A. Section 10211 - Metal Wall Louvers.

B. Section 15170 - Motors.

C. Section 16050 - Basic Electrical Material and Methods.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. Air Movers and Controllers Association (AMCA):
   1. AMCA 99-86 Standards Handbook.
   2. AMCA 210-85 Laboratory Methods of Testing Fans for Rating.
   3. AMCA 300-85 Reverberant Room Method for Sound Testing of Fans, Revised 1987.

4. AMCA 301-90 Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

B. American Bearing Manufacturers Association (ABMA):
1. ABMA 9-90 Load Ratings and Fatigue Life for Ball Bearings.

C. National Fire Protection Association (NFPA):
1. NFPA 70-2005 National Electrical.
2. NFPA 90A-96 Standard for Installation of Air Conditioning and Ventilating System (National Fire Code, Vol.4).

D. Underwriters Laboratories, Inc. (UL):
1. UL 705-94 UL Standards for Safety Power Ventilators, 5-th Edition.

1.5 SYSTEM DESCRIPTION

A. The design basis for ventilation is to provide air for cooling in summer to maintain a maximum of 100 degrees F summer design temperature in the buildings. The design basis for heating is to maintain a minimum of 50 degrees F winter design temperature in the buildings.

1.6 SUBMITTALS

A. Data on propeller fans and accessories, including fan curves, sound power levels, and electrical characteristics and connection requirements.

1.7 QUALITY ASSURANCE

A. All equipment operations and testing of materials shall be in compliance with NFPA 70 and UL 705.

B. All internal components shall be labeled with manufacturer's name, serial number, and/or power rating information.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be stored in a clean, dry place and protected from weather prior to shipment. Provide protection from weather and from damage during transit.

B. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather; climate conditions including temperature and humidity variations; dirt and dust; and other contaminants that could adversely affect assembly and operation of the fans.

C. Protect motors, shafts, and bearings from weather and construction dust or any other physical damage.

1.9 PROJECT CONDITIONS

A. The design is based on the following outdoor design conditions:
   1. Summer: 92 degrees F Db/73 degrees F Wb.
   2. Winter: 1 degree F Db.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Sidewall Propeller Fans (for Fan Data see Attachment A)
   1. General
      a. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
      b. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
      c. Fabrication: Conform to AMCA 99.
      d. Performance Base: At 580 feet elevation.
      e. Temperature Limit: Maximum 150 degrees F.
      f. Performance: See attached data sheet.
   2. Wheel and Housing
      a. Heavy-duty stamped steel propeller, consisting of six steel blades securely attached to a heavy-gage spider by means of steel rivets, heavily reinforced on each side. The fan frame and venturi

shall be constructed of heavy-gage painted steel with the fan assembly bolted to the venturi for ease of removal and service.

3. Bearings and Drives
   a. Bearings: ABMA 9, L-50 life at 100,000 hours, heavy-duty pillow block type, self-aligning, grease-lubricated ball bearings.
   b. Shafts: Hot-rolled steel, ground and polished, with key-way, protectively coated with lubricating oil, and shaft guard.
4. Accessories
   a. Backdraft Damper: Frame shall be galvanized steel, and blades shall be aluminum with felt strips on closing edges.
   b. Wall-Mounted Collar: Heavy-gage steel with thermally fused polyester finish.
   c. Fan Guard: OSHA motor side guard.
5. Inlet Air Damper: Heavy-duty motor operated. Frame shall be galvanized steel, and blades shall be aluminum with felt strips on closing edges. Motor shall be operated from 120-volt source.
6. Electrical Characteristics and Components (see attached data sheet)
   a. Motor: Shall conform to Section 15170.
   b. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized according to NFPA 70.
   c. Wiring terminations shall be sized to conform to NFPA 70.
7. Manufacturers
   a. Cook, Inc.
   b. Hartzell, Inc.
   c. Greenheck, Inc.

B. Electric Horizontal Discharge Unit Heaters
   1. Electric Unit Heaters Data Sheet

Tag Number	**UH-(33)**
Heater capacity, kw	3.3

Air flow, cfm	400
Fan motor, hp	1/125
Electric power Volts/phase/Hz	480/3/60
Arrangement	Horiz.
Built-in thermostat	yes
Hand-off-auto switch w/heater contactor	yes
Wall mounting bracket	yes

2. Manufacturers:
   a. Berko, HUH Series, Horizontal Unit Heater, Model #HUH-AA-348.

C. Controls and Instrumentation
1. Thermostats (T):
   Single-stage room thermostats with temperature operating range 50 degrees F to 100 degrees F shall be provided. Thermostats shall have heavy-duty contacts suitable for 5 amp, 120V, single phase, 60 Hz operation. Contacts shall be dry contact isolated from ground. Units shall include integral thermometer. Enclosure shall be indoor type. Units shall be bellows actuated and shall have removable set point adjust knob.
   a. Manufacturers
      1) Honeywell, Inc.
      2) Johnson Control, Inc.
      3) Mercoid Corporation.
2. Motor for dampers:
   Two position spring-return motors to operate dampers are normally closed, operate on line voltage (120 V) with internal transformer.
   a. Manufacturers
      1) Honeywell, Inc.
      2) Johnson Control, Inc.
      4) Mercoid Corporation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all equipment as shown on the contract drawings and in strict accordance with manufacturer's installation instructions. Ventilation system shall comply with the requirements of NFPA 90A.

B. Unit heaters shall be started by thermostat set at 50 degrees F, or manually. Exhaust fans shall be started by thermostat set at 100 degrees F, or manually, and shall be interlocked with intake air dampers.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD Subcontract No. DE-AC24-010H20115

TECHNICAL SPECIFICATIONS

WASTE STORAGE AREA EXTRACTION SYSTEM - PHASE 2

Division 16 - Electrical

Fluor Fernald, Inc.

Prepared by: Jay Thompson 2/9/06
DATE:

Checked By: Will G. Hartel 2/27/06
DATE:

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. Cabinets.

E. Molded Case Circuit Breakers.

F. Disconnect Switches.

G. Conduit.

H. Wire and cable.

I. Instrument cable.

J. Nameplates.

K. Wire markers and cable tags.

L. Wireway and auxiliary gutters.

M. Splicing and termination components.

N. Boxes.

O. Supporting Devices.

P. Underground Warning Tape.

Q. Electrical Testing, General.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 15160 - Pumps.

C. Section 15170 - Motors.

D. Section 16118 - Underground Ductbanks.

E. Section 16170 - Grounding and Bonding.

F. Section 16370 - Overhead Power Distribution.

G. Section 16462 - Dry Type Transformers/Panelboards.

H. Section 16500 - Lighting.

I. Section 16855 - Heating Cables.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):

1.	NFPA 70	National Electrical Code, 2005 Edition.

B. American National Standards Institute (ANSI):

1.	ANSI C80.1-94	Rigid Steel Conduit-Zinc Coated.

C. National Electrical Testing Association (NETA):

1.	NETA ATS-95	Acceptance Testing Specification for Electrical Power Distribution Equipment.

D. Underwriters Laboratories Inc. (UL):

1.	UL 360-96	UL Standard for Safety Liquid-Tight Flexible Steel Conduit.
2.	UL 486A-97	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 854-01	Service-Entrance Cables.
5.	UL 870-95	Wireways, Auxiliary Gutters, and Associated Fittings.
6.	Electrical Construction Materials Directory - 2005.	

E. National Electrical Manufacturers Association (NEMA):

1.	NEMA AB 1-99	Molded Case Circuit Breakers and Molded Case Switches.
2.	NEMA ICS 1-01	Industrial Control and Systems General Requirements.
3.	NEMA ICS 2-00	Industrial Control and System Controllers, Contractors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
4.	NEMA ICS 4-00	Industrial Control and Systems Terminal Blocks.
5.	NEMA ICS 6-01	Industrial Control and Systems Enclosures.
6.	NEMA KS 1-96	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
7.	NEMA OS 1-96	Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
8.	NEMA WD 1-99	General Requirements for Wiring Devices.
9.	NEMA WD 6-02	Wiring Devices - Dimensional Requirements.
10.	NEMA 250-91	Enclosures for Electrical Equipment (1,000 Volts Max).

1.5 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 3R or 4, outdoor; or Type 12, indoor.
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 3R or 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 in Section 13401.
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 freestanding 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.

E. Molded Case Circuit Breakers
1. NEMA AB 1 with integral thermal and instantaneous magnetic trip in each pole. Provide common trip handle for all poles.
2. Breaker enclosures shall be type 3R or 4, conforming to NEMA 250.

F. Disconnect Switches
1. Nonfusible Switch Assemblies: NEMA KS 1, Type HD quick-make, quick-break, visible blade, load interrupter knife switch in NEMA 3R or 4, outdoors, and 12, indoors, enclosures with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Ratings as indicated.

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 drawings.
3. Conduit connections shall be threaded.

B. Wire and Cable
1. Single conductor, 600 volt insulated copper conductor. Conductors for power and lighting branch circuits shall not be smaller than No. 12

AWG. Conductors No. 12 AWG and No. 10 AWG may be stranded. Conductors No. 8 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.
4. Splices and junctions of conductors of dissimilar metals shall be treated with No-Lox, Penetrox or other compounds at least as suitable for the application of inhibiting corrosion.
5. Splices and junctions of copper and aluminum conductors shall be made with connectors rated for that service and shall be stamped with CU-AL on the connector as required by NFPA 70, Article 110-14, inclusive.

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 project design 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 to eliminate 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 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. Molded Case Circuit Breakers
   1. Mounting supports shall not be fastened to or penetrate wall panels.

F. Disconnect Switches
   1. Mounting supports shall not be fastened to or penetrate wall panels.

G. Receptacles
   1. Install convenience receptacles 48 inches above finished floor. Receptacle mounting supports shall not be fastened to or penetrate wall panels.
   2. Label receptacles with panelboard and circuit number from which they are served.

H. Combination Magnetic Motor Starters
   1. Install motor controllers where indicated on

drawings.

2. Install motor controller with center line of disconnect operator 54 inches above finished floor.
3. Install overload heater element in motor controller to match motor characteristics.
4. Provide engraved nameplate identifying motor served.

I. Selector Switches

1. Mount selector switches at a mounting height of 54 inches above the floor adjacent to the equipment controlled. Provide slotted channel mounting supports where building column or wall is not suitable for support.

J. 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.

K. 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.

L. Cabinets

1. Install cabinet fronts plumb.

M. 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 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 is 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 FLUOR FERNALD.

END OF SECTION

SECTION 16118
UNDERGROUND DUCTBANKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Underground Ductbanks.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork.

B. Section 03001 - Concrete.

C. Section 16050 - Basic Electrical Materials and Methods.

D. Section 16170 - Grounding and Bonding.

E Section 16370 - Overhead Power Distribution.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI C80.1-94 Rigid Steel Conduit - Zinc-Coated.

B. Institute of Electrical and Electronic Engineers (IEEE):
1. IEEE C2-02 National Electrical Safety Code.

C. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 2005 Edition.

D. National Electrical Manufacturers Association (NEMA):

1.	NEMA TC 3-99	PVC Fittings for Use with Rigid PVC Conduit and Tubing.
2.	NEMA TC 6&8-99	PVC Plastic Utilities Duct for Underground Installation.
3.	NEMA TC 9-99	Fittings for PVC Plastic Utilities Duct for Underground Installation.

E. Underwriters Laboratories, Inc. (UL):
1. Electrical Construction Materials Directories, 2005.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and IEEE C2.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.7 PROJECT CONDITIONS

A. Verify routing and termination locations of ductbank prior to excavation for rough-in.

PART 2 PRODUCTS

2.1 MATERIALS

A. Rigid Steel Conduit: ANSI C80.1.

B. Plastic Utilities Duct: NEMA TC 6; PVC.

C. Plastic Utility Duct Fittings: NEMA TC 3 and 9.

2.2 ACCESSORIES

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavation, base material installation, and compaction are completed.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Underground Duct:

1. Install power ductbank 36 inches (minimum) to top of ductbank below finished grade.
2. Install duct with minimum slope of 4 inches per 100 feet.
3. Cut duct square using saw or pipe cutter; de-burr cut ends.
4. Insert duct to shoulder of fittings; fasten securely.
5. Join nonmetallic duct using adhesive as recommended by manufacturer.
6. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
8. Provide suitable fittings to accommodate expansion and deflection where required.
9. Stagger duct joints vertically in concrete encasement 6 inches minimum.
10. Use suitable separators and chairs installed not greater than 4 feet on centers.
11. Band ducts together before placing concrete.
12. Securely anchor duct to prevent movement during concrete placement.
13. Place concrete under provisions of Section 03001. Use mineral pigment to color concrete red.
14. Provide minimum 3-inch concrete cover at bottom, top, and sides of ductbank.

15. Provide pull rope in each duct except sleeves and nipples. Minimum 1/2-inch, 4,000 psi tensile strength polypropylene.
16. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
17. Perform excavations and backfill trenches under provisions of Section 02200 of this specification package.
18. Coordinate installation of underground warning tape with backfilling. Install tape 6 inches below finished grade (or surface).
19. All exposed portions (stub-ups) of duct above grade shall be rigid galvanized steel. All final 90-degree bends from underground to stub-ups shall be rigid steel. Stub-ups shall be 3 inches above grade or floor.
20. Direct-buried duct, not encased in concrete, shall conform to the above requirements, except those pertaining to concrete, and to the following requirements:
    a. Excavate trenches for the duct, depths as indicated, not less than 12 inches wide. Bends in trenches shall have a radius of not less than 36 inches.
    b. When rock is encountered, remove to a depth of at least 3 inches below the duct and fill the space with sand or clean earth free from particles larger than 1/4 inch.
    c. Use PVC conduit under concrete slabs; use rigid galvanized steel conduit for portions not covered by slabs.

END OF SECTION

SECTION 16121
MEDIUM-VOLTAGE CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Medium-voltage cable.

B. Cable terminations.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C2-02 — National Electrical Safety Code.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 — National Electrical Code, 2005 Edition.

C. Institute of Electrical and Electronic Engineers, Inc. (IEEE):
   1. IEEE 48-96 — Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations.

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA WC 8-88 — Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. Underwriters Laboratories, Inc. (UL), Electrical Construction Materials Directories, 2005.

F. National Electrical Testing Association (NETA):
   1. NETA ATS-95 Acceptance Testing Specification for Electrical Power Distribution Equipment.

1.5 QUALITY ASSURANCE PROGRAM

A. See Section 01000.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept cable and accessories on site in manufacturer's packaging. Inspect for damage.

B. Store and protect in accordance with manufacturer's instructions.

C. Protect from weather. Provide adequate ventilation to prevent condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Medium-Voltage Cable
   1. Okonite.
   2. Houston Wire & Cable.
   3. Kerite.
   4. Rome.

B. Cable Terminations and Cable Splices
   1. 3M.
   2. Raychem.
   3. RTE.

2.2 MATERIALS

A. Medium-Voltage Cable
   1. Description: NEMA WC 8; ethylene propylene rubber

insulated cable.

2. Voltage: 15 kV, ungrounded.
3. Conductor: Copper, concentric, stranded with foil conductor shield.
4. Construction: Single conductor with metal tape insulation shielding.
5. Insulation Level: 133 percent.
6. Insulation Jacket: PVC, 80 mils minimum thickness.

B. Cable Terminations and Cable Splices

1. Description: IEEE 48; Class 1, cable termination in kit form with stress cone, shield ground connection, and accessories and molds required for proper application.

C. Tape Termination and Splices

1. Description: IEEE 48; Class 1, tape termination kit with semi-conductive tape, stress control tape, splicing tape, vinyl plastic tape, stress cone, mechanical ground straps, and cable preparation kit.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Verify existing conditions prior to beginning installation. Notify FLUOR FERNALD if conditions affect the work specified or indicated on drawings.

3.2 PREPARATION

A. Use swab to clean ducts before pulling cables.

B. Run mandrel through duct to confirm absence of pinch points or obstructions.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Conform to requirements of NFPA 70 and ANSI C2.

B. Install cable and accessories in accordance with manufacturer's instructions.

C. Avoid abrasion and other damage to cables during installation.

D. Use suitable lubricants and pulling equipment.

E. Do not exceed manufacturer's recommended maximum cable pulling tensions and minimum bending radius.

F. Ground cable shield at each termination and splice.

G. Label each cable on both ends with phase A, B, or C as determined by testing required herein.

3.4 QUALITY CONTROL

A. Furnish products listed and classified by UL as suitable for purpose specified and shown.

B. Inspect exposed cable sections for physical damage.

C. Inspect cable for proper connections as shown on the contract drawings.

D. Inspect shield grounding, cable supports, and terminations for proper installation.

E. Perform DC high potential test of each conductor in accordance with NEMA WC 8 and/or NETA ATS. Ground other conductors in the circuit during the test. Perform test on existing cable after installation. Perform test on new 15kV cable before making tap onto existing cable.

F. Apply test voltage in at least 10 equal incremental increases to maximum test voltage.

	Maximum Voltage	10 Increments of:
New Cables 15 kV	65 kV	6.5 kV
Existing Cables 13.2 kV	49 kV	4.9 kV

G. Record leakage current at each increment, allowing for charging current decay.

H. Hold maximum test voltage for 10 minutes.

I. Test Reports: Record results of cable test in tabular form, in plots of current versus voltage for incremental voltage steps, and current versus time at 30-second intervals at maximum voltage. Submit for approval.

J. Prior to connection to pole mounted bare conductors, test phase rotation of cables to assure that phase A, B, and C are aligned as indicated.

K. Inspection and testing shall be by Installer and may be observed by FLUOR FERNALD.

END OF SECTION

SECTION 16129

FIBER OPTIC CABLE AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Loose-tube fiber optic cable and accessories (multimode).

1.2 RELATED SECTIONS

A. Section 13401 - Process Control System.

B. Section 16370 - Overhead Power Distribution.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA):

1.	EIA/TIA 455-60A-00 FOTP-60	Measurement of Fiber or Cable Length Using an OTDR.
2.	EIA/TIA 455-61A-00 FOTP-61	Measurement of Fiber or Cable Attenuation Using an OTDR.
3.	EIA/TIA 526-14A-98 OFSTP-14	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 812(Latest Rev) Standard Definition of Terms Relating to Fiber Optics.

C. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640-99 Fiber Optic Outside Plant Communications Cable

1.5 SUBMITTALS

A. Submit product data for information with each reel of cable. Include the customer purchase order number, cable part number, weight of cable and reel length of cable, beginning and ending length markings, and manufacturer's certified inspection and test report.

1.6 DEFINITIONS

A. Terms shall be as defined by IEEE 812.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siecor Corporation.

B. Chromatic Technologies.

C. Belden Wire and Cable.

2.2 MATERIALS

A. General

1. One hundred percent all dielectric, loose-tube fiber optic cable assembly suitable for use in aerial applications. Assembly shall consist of two multimedia fibers cabled into a single multifiber cable.
2. Each fiber shall have a glass optical core, a core cladding of low-density glass concentric

about the optical core, and a protective acrylate buffer coating to protect the outer surface of the fiber.

3. The core assembly of the cable shall consist of a single layer of the gel-filled loose buffer tubes stranded around an all-dielectric, antibuckling central member. The core assembly shall be wrapped with a binder tape to maintain the alignment of the buffer tubes. An aramid fiber tensile strength member shall be applied over the binder tape, followed by an outer jacket of black polyethylene. The outer jacket shall be medium- or high-density polyethylene (MDPE or HDPE).
4. The interstices in the cable core shall be filled with a water-blocking compound to prevent water penetration and migration. The filling compound shall be electrically nonconductive, homogeneous, and free from dirt and other foreign matter.
5. A dielectric ripcord shall be provided under the outer jacket to permit jacket removal without damage to the optical fibers. The ripcord shall be continuous in any length of cable.
6. Individual fibers shall be enclosed in color-coded, plastic buffer tubes (loose buffer construction) that are filled with a stable viscosity gel throughout the entire cable length.
7. The cable shall contain individual buffer tubes with each buffer tube containing no more than six multimode fibers. Both the buffer tubes and the individual fibers within a single buffer tube shall be color coded in accordance with the following table.

Fiber or Buffer Tube No.	Color
1	Blue
2	Orange

3	Green
4	Brown
5	Slate
6	White

8. Splices are not permitted within the cable. The fiber optic cable shall be shipped on reels from the manufacturer in continuous lengths without splices.
9. Cable shall be Belden Catalog No. 225812.

B. Multimode Optical Fiber

1. Fiber Type: Graded-index, dual window, multimode fiber.
2. Core Diameter: 62.5 ± 3.0 microns.
3. Core Noncircularity: < 6.0 percent.
4. Cladding Outside Diameter: 125 ± 2.0 microns.
5. Cladding Noncircularity: ± 2.0 percent.
6. Concentricity Error: < 6.0 percent.
7. Protective Coating Diameter: 250 ± 15 microns.
8. Numerical Aperture: 0.27 - 0.29.
9. Maximum Attenuation: 3.75 dB/km @ 850 nm, 1.5 dB/km @ 1,300 nm.
10. Minimum Bandwidth: 160 MHz-km @ 850 nm, 500 MHz-km @ 1,300 nm.

C. Cable Mechanical Specifications

1. Nominal Jacket Wall Thickness: 0.055 in.
2. Maximum Tensile Loading - Installation: > 600 lbs.
3. Maximum Tensile Loading - Maintained: > 100 lbs.
4. Minimum Bending Radius - Installation: < 20 x Cable OD.
5. Minimum Bending Radius - Maintained: < 12 x Cable OD.

D. The attenuation of the multimode fibers shall not vary more than 0.50 dB/km at 1,300 nm, and the attenuation of the single-mode fibers shall not vary more than 0.20 dB/km at 1,550 nm for the following environmental conditions:

1. Operation: -40 degrees C to +65 degrees C.
2. Installation: -30 degrees C to +60 degrees C.
3. Storage: -50 degrees C to +70 degrees C.

E. Cable Markings

1. Cable markings shall be imprinted with white characters on the outer cable jacket.
2. The cable markings shall be permanent, insoluble in water, and legible for the cable life.
3. The following identification markings shall be imprinted on the cable jacket at intervals of not more than 1 meter:
   a. Manufacturer.
   b. Year of manufacture.
   c. "OPTICAL CABLE."
   d. Manufacturer's part number.

4. All cables shall have sequentially numbered feet or meter length markings imprinted on the jacket.
   a. The length markings shall not be reset to zero along the length of the cable.
   b. Actual cable length shall be within ±1 percent of the length as indicated by the length markings.

F. Approximately 2 meters of cable on the inboard of each cable shall be accessible for optical time domain reflectometer (OTDR) testing of the cable.

G. Cable Termination

1. Fiber optic cable shall be terminated with a ST-style physical contact (PC) 2.5 mm bayonet connector with a strain relief boot.
2. The ferrule material shall be zirconia ceramic, and the connector housing shall be nickel-plated zinc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that new and existing conduit is suitable for use.

B. Verify that new and existing aerial messenger cable is suitable for use.

3.2 INSTALLATION

A. Install cable in new and existing conduit where indicated.

B. Install wall-mounted and pole-mounted fiber optic cable pull boxes.

C. Install fiber optic cables in accordance with manufacturer's installation instructions.

D. Spin fiber optic cables to existing aerial messengers in accordance with manufacturer's installation instructions.

3.3 FIELD QUALITY CONTROL

A. Provide all test equipment, including the OTDR, power meters, LED sources, laser sources, connector

adapters, launch and receive cable, attenuators, and other devices necessary for these tests. All sources and OTDRs shall operate within the range of 850 ± 30 nm and 1,300 ± 20 nm. A high-resolution OTDR shall be used for providing signature traces.

B. Before installation, use an OTDR to test the fiber optic cable after it is delivered to the site and while it is still on the reel. Each fiber in each reel of cable shall be tested; fibers shall be tested at the 1,300 nm wavelength. A hard copy and an electronic copy of the OTDR trace shall be provided as part of the overall testing documentation; the OTDR trace shall show the placement of measurement cursors and shall include the measured fiber length, the measured attenuation (dB/km), the operating wavelength, the cable reel number, and the specific fiber in the cable being tested. Test as required by EIA/TIA FOTP-60 and -61.

C. After installation/before splicing, a second OTDR test shall be performed for each installed length of cable to ensure that no damage was done to the fibers during installation. Perform the test on each single fiber in each buffer tube for each link of cable. OTDR traces of these tests are not required.

D. After splicing, a third OTDR test shall be performed for each completed fiber optic link. Every fiber in each cable, including spares, shall be tested, and a hard copy and an electronic copy of the OTDR trace shall be provided as part of the overall testing documentation. The OTDR trace shall show the placement of measurement cursors and shall include the measured fiber length, the measured attenuation (dB/km), the operating wavelength, the cable identification

numbers, and the specific fiber in the cable being tested. Test as required by EIA/TIA FOTP-60 and -61.

E. Insertion loss tests conforming to EIA/TIA Standard 526-14A-90 (Method B) shall be performed for each installed fiber optic link (i.e., after the pigtails are spliced to the trunk cable fibers). Multimode fibers shall be tested with an LED source at the 850 nm and 1,300 nm wavelengths. The effects of modal distribution on connector and fiber loss shall be minimized. Each fiber will be tested in both directions. Launch and receive cables, which match the fiber type being tested, shall be used to connect the test instrumentation to the fiber link. The launch and receive cables shall be 3 meters in length. The test procedure is described below. Replace all dust caps after testing is completed.

1. Attach one end of the launch cable to the sources and the other end to the fiber optic power meter. Adjust the source power to a convenient value such as 0 dBu (-30 dBm); this is the reference power level ($P_{ref.}$).
2. Disconnect the launch cable from the power meter and reconnect it to a test connector coupling. Do not disconnect the launch cable from the source after recording P_{ref}. Connect one end of the receive cable to the other side of the test connector coupling, and attach the other end to the fiber optic power meter. Verify that the attenuation added by the receive cable is not greater than 1.0 dB.
3. Remove the test connector coupling. Attach the launch cable to the fiber link to be tested by connecting it to the appropriate connector coupling in the local distribution frame. Attach the receive cable to the opposite end of the

fiber link under test by connecting it to the appropriate connector coupling in the remote distribution frame. Record the link loss (i.e., the measured power level, P_{test}, minus P_{ref}, in dB) on the accompanying form (Attachment B).

4. Compare the measured values to the maximum losses specified. If a fiber fails to meet these specifications, the connectors shall be cleaned, inspected with a microscope, and retested. If the fiber still fails the insertion loss test, an OTDR test will be performed to determine the corrective action necessary.

F. Prepare a separate Fiber Optic Test Report (Attachment A) for each type of test performed (i.e., the before installation OTDR test, the after installation/before splicing OTDR test, the after splicing OTDR test, and the insertion loss test). Refer to Attachment B for the insertion loss test report (Link Loss Certification Test Report). Assemble test reports and OTDR traces, including electronic traces, in a complete, bound manual.

END OF SECTION

ATTACHMENT A

FIBER OPTIC TEST REPORT

Date: 04/06/01 16129

Rev.: 0 RES4528/58110

ATTACHMENT A
FIBER OPTIC TEST REPORT

Project Title: _____ Page __ of

Date: _____

Type of Test: _____

Section of 16129 Defining Test: _____

Test Instrument: _____

Model No.: _____ Serial No.: _____ Calibration Date:
Test Instrument: _____

Model No.: _____ Serial No.: _____ Calibration Date:
Source (Type): _____ Wavelength: _____

Model No.: _____ Serial No.: _____ Calibration Date:
Source (Type): _____ Wavelength: _____

Model No.: _____ Serial No.: _____ Calibration Date:
Source (Type): _____ Wavelength: _____

Model No.: _____ Serial No.: _____ Calibration Date:

Test Performed By: _____ Organization:
Test Supervised By: _____ Organization:
Test Witnessed By: _____ Organization:
Construction Engineer: _____

ATTACHMENT B

LINK LOSS CERTIFICATION TEST REPORT

Date: 04/06/01 16129

Rev.: 0 RES4528/58110

ATTACHMENT B

LINK LOSS CERTIFICATION TEST REPORT

PROJECT: _____

TEST PERFORMED BY: _____ DATE:

PAGE: __ OF

CABLE NO.: _____

FROM (TRANSMIT): _____

TO (RECEIVE): _____

		CALCULATED LOSS VALUE		MEASURED LOSS VALUE		DIFFERENCE	
FIBER NO.	TYPE (MM/SM)	850 nm	1300 nm	850 nm	1300 nm	850 nm	1300 nm
1	mm						
2	mm						
3	mm						
4	mm						
5	mm						
6	mm						

SECTION 16170
GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

D. Grounding test well.

1.2 RELATED SECTIONS

A. Section 03001 - Concrete.

B. Section 13123 - Pre-Engineered Building.

C. Section 15170 - Motors.

D. Section 16050 - Basic Electrical Materials and Methods.

E. Section 16118 - Underground Ductbanks and Ducts.

F. Section 16311 - Primary Switchgear.

G. Section 16370 - Overhead Power Distribution.

H. Section 16462 - Panelboards.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 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, 2005 Edition.

C. Underwriters Laboratories, Inc. (UL):
   1. UL 467-01 UL Standard for Safety Grounding and Bonding Equipment.

   2. Electrical Construction Materials Directory- 2005.

D. Institute of Electrical and Electronics Engineers (IEEE)
   1. IEEE Std 81-83 Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System (Part 1).

1.5 SYSTEM DESCRIPTION

A. Rod electrode and grounding connections.

B. Grounding System Resistance: 5 ohms maximum.

1.6 SUBMITTALS

A. Provide certification of ground testing instrumentation.

B. Provide record of as-built locations of grounding electrodes, if grounding electrodes are required.

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.

E. Grounding Test Well
   1. Well Pipe: Clay tile pipe with belled end, 12-inch I.D. by 24 inches long.
   2. Well Cover: Cast iron with legend "GROUND" embossed on cover, with recessed lifting handle.

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. Drive ground rods until the top is even with the grade.

G. Install grounding test well pipe with cover at a location outside each building, as indicated on the drawings. Install well pipe top flush with finished grade.

H. Ground pole-mounted equipment and static line conductors as indicated on the drawings.

3.3 QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation as defined by design documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes if required, and submit to FLUOR FERNALD. 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. As a minimum, measure resistance at each pole and at each 480 V service. 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 SECTION INCLUDES

A. Poles.

B. Crossarms.

C. Pole hardware.

D. Insulators.

E. Line conductors.

F. Arresters and cut-outs.

G. Pole-mounted load interrupting disconnect switches.

H. Fuses for cut-outs and switches.

I. Pole-mounted distribution transformers.

J. Anchors.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

B. Section 16170 - Grounding and Bonding.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):

1.	NFPA 70	National Electrical Code, 2005 Edition.

B. American National Standards Institute (ANSI):

1.	ANSI C2-02	National Electrical Safety Code.
2.	ANSI C29.2-99	Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.
3.	ANSI C29.4-95	Wet-Process Porcelain Insulators - Strain Type.
4.	ANSI C29.5-95	Wet-Process Porcelain Insulators - Low and Medium Voltage Types.
5.	ANSI C29.7-96	Wet Process Porcelain Insulators - High Voltage Line-Post Type.
6.	ANSI C135.1(Latest Ed)	Galvanized Steel Bolts and Nuts for Overhead Line Construction.
7.	ANSI C135.22-88	Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction.
8.	ANSI O5.1-02	Wood Poles-Specifications and Dimensions.

C. American Society for Testing and Materials (ASTM):

1.	ASTM A36/A36M-97	Standard Specification for Carbon Structural Steel.
2.	ASTM A475-98	Standard Specification for Zinc-Coated Steel Wire Strand.

3.	ASTM A675/A675M Rev. A-90	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
4.	ASTM B231/B231M-95	Concentric-Lay-Stranded Aluminum 1350 Conductors.
5.	ASTM B232/B232M-01	Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
6.	ASTM B2-94	Standard Specification for Medium-Hard Drawn Copper Wire.
7.	ASTM D698-91	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).

D. American Wood-Preservers Association (AWPA):

1.	AWPA C4-99	Poles- Preservative Treatment by Pressure Process.
2.	AWPA C25-95	Crossarms- Preservative Treatment by Pressure Process.

E. Institute of Electrical and Electronics Engineers (IEEE):

1.	IEEE C37.30-97	Standard Requirements for High-Voltage Switches.
2.	IEEE C62.11-93	Standard for Metal-Oxide Surge Arresters for AC Power Circuits.
3.	IEEE Std 81-83	Guide for Measuring

F. National Electrical Manufacturers Association (NEMA):

1.	NEMA LA 1-92	Surge Arresters.

2. NEMA WC 7(Latest Ed) Cross-Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

G. Underwriters Laboratories, Inc. (UL):

1. UL 96-94 UL Standard for Safety Lightning Protection Components.
2. Electrical Construction Materials Directory-95.

1.5 SYSTEM DESCRIPTION

A. Poles and pole-mounted distribution transformers specified herein shall be furnished by FLUOR FERNALD.

1.6 QUALITY ASSURANCE PROGRAM

A. Installing Subcontractor: Company specializing in manufacturing products specified in this section with a minimum of 3 years experience. Experience of the past 3 years shall include 3 different medium voltage aerial pole line installations each of at least 5,000 circuit feet. The installing subcontractor, for this element of the work, shall be an industrial construction contractor and shall use electricians that have been classified as a journeyman for five years and have worked on medium to high voltage aerial pole line installations as a lineman for at least three years. Additionally, these electricians shall have performed an aerial pole line installation of at least 5,000 circuit feet.

B. Conform to requirements of NFPA 70 and ANSI C2.

C. Furnish products, where available, listed in the UL Electrical Construction Materials Directory, as suitable for the purpose specified and indicated.

D. Installation shall comply with ANSI C2, Heavy Loading District, Grade B Construction.

1.7 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 that 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/ft^3. Obtain complete sapwood penetration.

B. Crossarms

1. Crossarms: Straight-grained southern pine, free of twists to within 0.1 inch per foot of length, with bends and twists in only one direction.
2. Apply preservative to crossarms as required by AWPA C25 with minimum net retention of 8 lbs/cu ft.
3. Crossarm Dimensions: as indicated.

C. Pole Hardware

1. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.
2. Crossarm Braces: Flat structural steel zinc coated to ASTM A675, span, as indicated, formed in one piece from 1/4 by 1-1/4 inch steel.
3. Eye Bolts and Nuts: ANSI C135.1.
4. Ground Rods: Copperweld 3/4 inch O.D. by 10 foot - 0 inches long.
5. Butt Plate: Copper.
6. Pole-top Insulator Pins: ANSI C135.22.
7. Hot-line Clamps: Screw type with concealed threads. Fill thread chamber with corrosion-resistant compound.
8. Bail Clamps: Self clamping type. Fill contact grooves corrosion-resistant compound.
9. Guy Strand: High strength, seven-strand steel cable galvanized to ASTM A475, Class A or B.
10. Guy Termination: Preformed wire type.
11. Guy Guards: 8-foot long plastic, colored yellow.
12. Ground Wire: Soft drawn solid copper conductors, 4 AWG minimum size.
13. Air Terminal: UL 96; 18-inch copper air terminal.
14. Guy Adapter: Tripleye.

D. Insulators

1. Insulators: Radio interference free wet process porcelain insulators with minimum wet flashover rating of 80 kV.
2. Line Post Insulators: ANSI C29.7; Class 57.1.
3. Suspension Insulators: ANSI C29.2; Class 52.9.
4. Pin Insulators: ANSI C29.5; Class 55.5.

5. Guy Strain Insulators: ANSI C29.4; Class 54.1.

E. Line Conductors

1. Medium-voltage Line Conductors: Bare aluminum conductor steel reinforced, size as indicated: ASTM B232. Bare aluminum conductor, size as indicated: ASTM B231. Medium drawn copper wire, size as indicated: ASTM B2.

F. Arresters and Cutouts

1. Combination Surge Arresters/ Fuse cutouts: arranged for crossarm mounting. Arresters, IEEE C62.11, metal oxide, RMS rating shall be 15 kV. Fused Cutouts, ANSI C37.42, drop-out type, rated 110 kV BIL, 200 A continuous current and adequate for interrupting rating of fuses specified herein. Where indicated, arresters or cut-outs may be used and furnished individually. Flashover rating shall be 10KV.

G. Pole-mounted load interrupting disconnect switches

1. Pole-mounted switch shall be vertical or horizontal as indicated, three-pole gang operated, with a padlock arrangement for locking in both open and closed positions. Steel parts shall be hot-dip galvanized. Operating rods shall be isolated from the switch by an insulating link or section located as close to the switch as possible. Switch shall be designed for double crossarm mounting and for breaking a 3/4-inch coating of ice before contacts are opened or closed. Switch shall be rated 110 kV BIL and comply with ANSI C37.30 for voltage and current requirements indicated. Provide S&C Electric Co. Alduti-rupter line switches.

H. Fuses for cut-outs and pole mounted load interrupting disconnect switches.

1. Fuses: Type K, rated as indicated; minimum symmetrical interrupting rating at 13.2 kV, 10 kA for cut-outs and 12.5 kA for disconnect switches.

I. Pole-Mounted Distribution Transformers

1. ANSI C57.12.20, single phase, oil filled, self-cooled with primary bushings and secondary terminations, Basic Impulse Level of 125 kV, temperature rise of 65 degrees C above 30 degrees C ambient, ratings as indicated. Transformers shall be rated for 14.4 kV minimum in the delta primary configuration indicated. Provide standard primary taps with externally-operated tap changer. Taps shall be full current, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage. Provide standard accessories with dial type thermometer.

J. 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. Contact FLUOR FERNALD prior to excavation.

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 pack to 95 percent density per ASTM D698.

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 FLUOR FERNALD.

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"
60'	8'-0"	8'-6"

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.

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
AND PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dry type, two-winding transformer integrated with primary and secondary main breaker and feeder breaker. The power center will be tagged LP-33 for Well House 33.

B. Panelboard, 480 Vac, three phase, with 100 amp main breakers. These one Distribution Panels will be tagged DP-33 for Well Houses 33.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

B. Section 16170 - Grounding and Bonding.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 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 1-99	Molded Case Circuit Breakers and Molded Case Switches.
2.	NEMA PB 1-00	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, 2005 Edition.

D. Underwriters Laboratories, Inc. (UL):

1. Electrical Construction Materials Directory- 2005.

1.5 SUBMITTALS

A. 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.

B. Transformer Test Reports:

1. Factory Test: NEMA ST 20. Indicate loss data; at 25, 50, 75, and 100 percent rated loads; and sound level.

2. Field Test: Indicate primary and secondary voltages as measured.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Accept transformers/panelboards, 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', panelboards' internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens.
   1. Transformer/Panelboard - Sentron Mini-Power Center- Catalog No. 3LPC015
   2. Panelboard - Distribution Panel - Catalog Number S2E18FX100CTS.

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

A. Install transformer/panelboards, and panelboards in accordance with NEMA PB 1.1.

B. Install plumb, and in accordance with manufacturer's instructions, and as indicated on contract drawings.

C. Installation Height: 6 feet, 6 inches (maximum) to top of transformer section; 6 feet to top of distribution panel.

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 FLUOR FERNALD.

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

SECTION 16483
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable Frequency Drives (VFDs) compatible with submersible pump motor for well pump PMP-33).

Note: Pump PMP-28 does not require a new Variable Frequency Drive; a VFD has previously been installed in the existing wellhouse.

1.2 RELATED SECTIONS

A. Section 15160 - Pumps.

B. Section 15171 - Motors Driven by Variable Frequency Drives.

C. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):

1.	NFPA 70	National Electrical Code, 2005 Edition.

B. National Electrical Manufacturers Association (NEMA):

1.	NEMA AB 1-99	Molded Case Circuit Breakers and Molded Case Switches.
2.	NEMA ICS 7.1-95	Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

3. NEMA 250 - 91 Enclosures for Electrical Equipment (1000 Volts Maximum).

C. Underwriter's Laboratories, Inc. (UL):
1. Electrical Construction Materials Directories, 2005.

1.5 SYSTEM DESCRIPTION

A. Design Requirements: Provide Cutler-Hammer Model SV9, VFDs suitable for operating the turbine pump motor loads indicated in Section 15160 and in accordance with the motor requirements defined in Section 15170. The electrical connections for incoming service and between the VFDs and the motors shall be accomplished by the Installer. VFD'S, motors, and pumps shall be compatible, providing a functional unit and shall be tested and started up by a supplier-trained field service engineer.

B. Variable Speed Drive, Model SV9030ADV5M0A00C, shall be complete with components, software, and other features to perform as specified in this section. Installation and testing requires a supplier-trained field service engineer.

1.6 SUBMITTALS

A. Shop drawings shall include:
1. Name of drive manufacturer.
2. Assembly drawing and nomenclature.
3. System schematic and interconnection diagrams.
4. Temperature rise and class of insulation.
5. Maximum heat dissipation capacity, in horsepower.
6. Normal field excitation of full load.
7. Percent slip of unit at maximum output speed when transmitting a load equal to nameplate rating of driving motor with normal field excitation applied to unit, as well as guaranteed overall efficiency for same load condition.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.8 WARRANTY

A. Warranty: Motors shall be warranted by the manufacturer, Cutler-Hammer, covering materials and labor.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. The variable frequency drive shall be manufactured by Cutler Hammer, Model Number SV9040ADV5M0A00CM9.

2.2 EQUIPMENT

A. Components:

1. Converter: Three phase, full wave, phase controlled rectifier to convert incoming AC power to variable voltage DC.
2. Inverter: Shall construct an AC wave from minimum harmonic content at any frequency between 0 and 60 Hz to control speed. Inverter shall be pulse width modulated type. Motor terminal voltage shall be controlled in proportion to output frequency such that the voltage to frequency ratio remains essentially constant.
3. Main Circuit Breaker: NEMA AB 1. Rated 42,000 amperes, symmetrical at 480 V, three phase. Mechanically interlock breaker with enclosure door.
4. Filtering devices: DC bus capacitors and/or inductors necessary to filter rectification ripple.
5. Enclosure: Type 4X, NEMA 250, with digital display (minimum seven segment) for programming, operation, fault codes, and diagnostic

information. Provide a local-off-remote switch on panel. Cabinet shall include internal air conditioning for any drive of 60 hp or greater capacity.

6. Programmable Logic: Internal to the unit, capable of providing logic and programming control of the drive.

B. Performance:

1. The VFD shall vary both AC voltage and frequency simultaneously to provide the constant volts/Hz ratio necessary to operate the motor at the desired variable speed.
2. The VFD shall be designed for use with variable torque equipment (pumping loads).
3. Speed range: 10-to-1 infinitely adjustable speed range.
4. Control frequency range: 0 to 60 Hz.
5. Soft start: VFD shall limit starting inrush current to 100 percent of motor full load current under all conditions or modes of operation.
6. Efficiency, minimum: 95 percent at 100 percent speed and 85 percent at 50 percent speed.
7. Power Factor: Minimum 95 percent at 100 percent speed without correction capacitors.
8. VFD shall be designed for continuous operation of the driven equipment at 15 percent above rated load.

C. Protection: VFD controller shall provide protection as noted or as required against the following conditions. All conditions shutting down the drive or motor shall be in an orderly manner that minimizes damage to the equipment. Each condition shall trigger a common amber light on cabinet face.

1. Single phasing.
2. Reverse phase rotation.
3. Undervoltage or overvoltage - Restart upon restoration of normal voltage.
4. Loss of power - Shut down in an orderly fashion. Upon restoration of normal power, the motor shall automatically restart sequentially and operate at a rate defined by external interface parameters.

5. Motor overvoltage.
6. Short Circuit Protection - Provide fault protection including phase to ground without using isolation transformer for current limiting impedance.
7. Internal inverter fault.
8. Thermal overload protection for motor.
9. VFD internal power supply failure.
10. Overtemperature of VFD components - Shut down upon detection.
11. Overfrequency.

D. Interface requirements:
1. Remote start-stop via Local-Off-Remote switch.
2. 4-20 milliamp DC signal input from remote digital control system.
3. Common alarm output for all VFD or motor malfunctions.
4. Motor running status output contact.

E. The microprocessor based controls of the VFD shall include the following features with function/access keyboard.
1. Motor rpm.
2. Minimum/maximum speed.
3. Acceleration/deceleration rate.
4. Overcurrent/overvoltage protection.
5. Signal span/gain adjustment.
6. Volts.
7. Hertz.
8. LED/LCD display.

2.3 FABRICATION

A. Fabrication Requirements
1. Wiring Terminations: Match conductor materials, sizes, and ratings.
2. Enclosure: NEMA 250, Type 4X.
3. Finish: Manufacturer's standard.

B. VFD shall be programmed and operated at Supplier's factory for the interface and motor parameters specific to this application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

3.2 PREPARATION

A. Obtain performance requirements for driven loads as defined in the sections listed in Article 1.2.

B. Verify that surfaces and arrangements are suitable for drive installation.

C. Provide typed label inside each motor drive door, identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Installation shall be accomplished under direction of a field service engineer trained by the VFD supplier.

B. Select and install overload heater elements in motor drive to match installed motor characteristics.

3.4 FIELD QUALITY ASSURANCE

A. Perform operational testing on drive control systems to verify operation and field wiring connections.

3.5 ADJUSTING

A. Tighten accessible connections and mechanical fasteners after placing drive.

B. Make final adjustments to the installed drive to ensure proper operation of associated driven equipment.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match the original finish.

3.7 DEMONSTRATION

A. Demonstrate operation of drive.

END OF SECTION

SECTION 16500
LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Luminaires and lampholders.

B. Ballasts.

C. Lamps.

D. Exit signs.

E. Emergency lighting units.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):

1.	NFPA 70	National Electrical Code, 2005 Edition.
2.	NFPA 101-00	Code for Safety to Life from Fire in Buildings and Structures.

B. American National Standards Institute (ANSI):

1.	ANSI C78.1-98	Fluorescent Lamps- Rapid Start Types- Dimensional and Electrical Characteristics
2.	ANSI C82.1-98	Electric Lamp Ballast- Line Frequency Fluorescent Lamp

C. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 6-02 Wiring Devices - Dimensional Requirements.

D. Underwriters Laboratories, Inc. (UL):
   1. Electrical Construction Materials Directory-2005.
   2. UL 542-99 Lampholders, Starters, and Starter Holders for Fluorescent Lamps.
   3. UL 924-01 Emergency Lighting and Power Equipment.
   4. UL 1570-99 Fluorescent Lighting Fixtures

1.5 SUBMITTALS

A. Product Data: Provide dimensions, ratings, and performance data including photometric and beamspread plots.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Luminaires
   1. Furnish fixtures as indicated on drawings.
   2. Factory install ballasts, lamps, and accessories.
   3. Pendant luminaires: Provide swivel hangers, pendant rods, tubes, and chains as required to install luminaires at appropriate height.

B. Exit Signs; Manufacturer: EMERGI-LITE
   Catalog No. 6-LEDPXN2RWVREI
   1. Description: LED type exit sign fixture suitable for use as emergency lighting unit.
   2. Housing: Extruded aluminum.
   3. Face: Translucent face with red letters on white background.
   4. Directional Arrows: Universal type for field adjustment.
   5. Mounting: Universal for field selection.
   6. Battery: 6 volt, nickel-cadmium type, with 1.5 hour capacity.

7. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within 12 hours.
8. Input Voltage: 120 volts, 60 Hz.

C. Emergency Lighting Units; Manufacturer: EMERGI-LITE Catalog No. JSC25-2
1. Description: Self-contained emergency lighting unit with rechargeable battery.
2. Input voltage: 120 volts.
3. Battery: Nickel-cadmium type with 1.5 hour capacity.
4. Battery Charger: Dual rate type capable of recharging discharged battery to full charge within 12 hours.
5. Lamps: 12 watt, sealed-beam type.
6. Electrical connection: 6-foot cord with NEMA WD 6-type 5-15 plug cap.

2.2 ACCESSORIES

A. Ballasts
1. Fluorescent Ballast:
   a. Description: ANSI C82.1, high-efficiency electronic ballast with low harmonic distortion.
   b. Provide ballast suitable for lamps specified.
   c. Voltage: 120 volts.
   d. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
   e. Outdoor Ballasts: Provide ballast suitable for temperatures above -20 degrees F.

B. Lamps
1. Indoor Fluorescent Lamps: Four (4), 48-inch, 32 watt T-8 cool white.
2. Outdoor Fluorescent Lamps: quad tube, cool white.

C. Photoelectric Control
1. Control above maximum footcandles: Provide with adjustable cutoff point.

2. Load control: Sized for fixture, 120 volts.
3. Provide photoelectric controls for exterior lighting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 ERECTION/INSTALLATION/APPLICATION

A. Install in accordance with manufacturer's instructions.

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at height indicated on drawings.

C. Support luminaires independent of ceiling framing.

D. Install surface-mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

3.3 FIELD QUALITY ASSURANCE

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Adjust exit sign directional arrows.

B. Relamp luminaires that have failed.

3.5 CLEANING

A. Clean electrical parts to remove conductive and

deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 DEMONSTRATION

A. Provide minimum of 2 hours demonstration of luminaire operation.

B. Record actual footcandles at 3-1/2 feet above grade or floor on 10-foot grid submitted earlier.

END OF SECTION

SECTION 16855
HEATING CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Heating cable and accessories.

1.2 RELATED SECTIONS

A. Section 15060 - Pipe, Fittings, Valves, and Accessories.

B. Section 15250 - Insulation.

1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 2005 Edition.

B. National Electrical Manufacturers Association (NEMA):
1. NEMA ICS 6-93 Industrial Controls and Systems Enclosures.

1.5 SUBMITTALS

A. Record Drawings: Submit after installation and testing of freeze protection equipment and materials.

1.6 SYSTEM DESCRIPTION

A. Heat tracing for pipe and any other outdoor equipment requiring freeze protection with outside temperature at -30 degrees F. Pipes to be protected are indicated on

design P&ID drawings. Work includes products and execution herein specified.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate installation of heating cable with installation of piping and piping insulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer:
1. Raychem.
2. Nelson.

2.2 MATERIALS

A. Heating Cable
1. Self-limiting, parallel resistance electric tracing cable with grounding shield around conductors. Maximum output temperature 150 degrees F.
2. Rating: 120 V or as required.

2.3 ACCESSORIES

A. Thermostat: Type 4X according to NEMA ICS 6, adjustable set point, suitable for -30 degrees F to 140 degrees F.

B. Power termination kits, splice kits, tee kits, and end seals supplied by heating cable manufacturer and suitable for use with the heating cable provided shall be utilized.

C. Provide stainless steel identification tags for all devices. Include assembly and circuit numbers.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Verify that the piping system is complete, tested, and ready for heating equipment.

B. Verify field measurements shown on drawings. Where installation differs from drawings, annotate drawings and submit for approval before installation.

C. Verify that required utilities is available, in proper locations, and ready for use.

D. Follow these guidelines for cable wattage and maximum circuit length, or provide Supplier information to support alternate lengths:

Pipe OD	Cable Wattage	Max. Length, ft. (20 A, 120 V)	Max. Length, ft. (30 A, 120 V)
1-1/2 inch or less	3 watts/ft	265	330
1-1/2 to 3 inch	5 watts/ft	185	270
3 inch to 6 inch	8 watts/ft	130	200
8 inch	10 watts/ft	105	160
10 inch	15 watts/ft	80	120
12 inch	15 watts/ft	80	120

3.2 ERECTION/INSTALLATION/APPLICATION

A. Install heat trace material on piping system as indicated on drawings. Installation to allow for heat trace cable to be moved aside during maintenance of piping system.

B. Install in accordance with manufacturer's instructions and NFPA 70. Serve cable circuits from GFCI circuit breakers as manufacturer's instructions and NFPA

require for the use.

C. Avoid pinching and making sharp bends in cable.

D. Prevent damage by sharp objects during installation.

E. Do not install electric tracing cables across expansion joints.

F. Electric heat trace cables shall be installed in the 7 and 8 o'clock positions or in the 4 and 5 o'clock positions on horizontal runs of pipes.

G. Accurately record actual locations of heating cable, thermostats, and branch circuit connections.

3.3 FIELD QUALITY ASSURANCE

A. Test continuity of heating cable.

B. Measure insulation resistance to manufacturer's recommended values. Use test instruments in accordance with manufacturer's instructions.

C. Perform continuity and insulation resistance test on completed cable installation prior to installation of thermal insulation.

3.4 DEMONSTRATION

A. Demonstrate operation of heating cable controls.

3.5 RECORD DRAWINGS

A. Provide drawings showing actual heating cable installation. Include cable lengths, cable catalog numbers, indicating lights, and other similar details.

END OF SECTION