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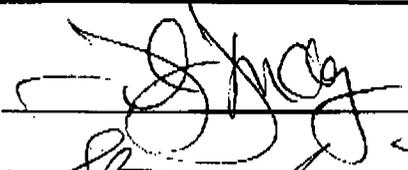
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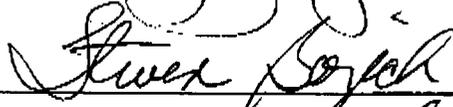
**Technical Specifications  
For  
Converted Aquifer Wastewater Treatment  
(CAWWT) Facility  
STAGE 2 CONSTRUCTION**

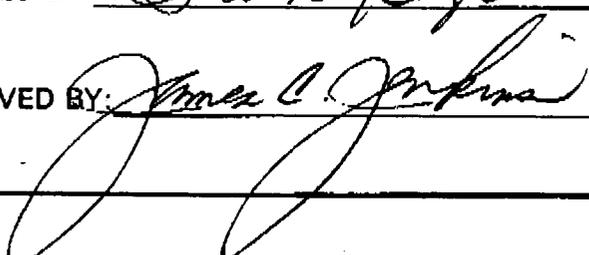
**Document 4518-TS-0002  
Final, Revision 0**

**EFFECTIVE DATE: DECEMBER 16, 2004**

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PREPARED BY:  12/16/04

CHECKED BY:  12/16/04

APPROVED BY:  12/16/04

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**U.S. DEPARTMENT OF ENERGY  
FERNALD CLOSURE PROJECT**

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**U.S. DEPARTMENT OF ENERGY  
FERNALD CLOSURE PROJECT**

**Converted Aquifer Wastewater Treatment (CAWWT) Facility Stage 2  
Technical Specifications**

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Technical specifications contained in this document detail requirements for the  
Converted Aquifer Waste Water Project to be self performed by Fluor Fernald.

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**SPECIFICATION REVISION RECORD**

Spec. No./Rev.	Description	Approval	Date
01010, Rev. 0	Functional Requirements		
02225, Rev. 0	Minor Demolition for Remodeling		
02311, Rev. 0	Rough Grading		
02315, Rev. 0	Excavation and Fill		
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**SECTION 01010**

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**FUNCTIONAL REQUIREMENTS**

**PART 1 GENERAL**

**1. Objectives**

The objective of the CAWWT Project is to provide for Fernald Closure Project (FCP) wastewater treatment within a centralized small physical area. Stage 1 of the project will convert the water treatment equipment and utilities. Stage 2 of the project will provide a finished facility.

**2. Functional Requirements**

Five basic functions were identified for the CAWWT Project. They were:

- A. Treat groundwater
- B. Treat storm and remediation wastewater
- C. Handle solid waste
- D. House supporting functions
- E. Relocate utilities and piping allowing for AWWT Phases I and II D&D

Functions A and B were fulfilled by the Stage 1 design.

**3. Handle solid waste**

The two main solid wastes in this project are suspended solids in the incoming groundwater, stormwater, and remediation wastewater and spent media (primarily ion exchange resin).

Use of the SWRB for storage, settling, and recycle of backwash water has worked successfully in the IAWWT. The CAWWT will rely on the SWRB to perform the same functions. Current plans are to clean and remove the SWRB near the end of the Fernald remediation (in late 2005). A Technical Assistance Team was formed and provided recommendations for handling the incoming wastewater and recycled backwash water for the time period after the SWRB is taken out of service. Close communications between Soils and AWWT personnel, control of suspended solids at the source, and use of an excavation near AWWT for backwash water recycle were the key recommendations of the Team. It was anticipated that after the Fernald remediation was finished that backwash water from the CAWWT groundwater treatment system would be direct discharged. The EPA/OEPA disagreed with this concept and also with the use of an unlined excavation for backwash water recycle.

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It was agreed to install a lined excavation near CAWWT. The lined excavation would be used for backwash water recycle and also for potentially contaminated stormwater from an uncertified area near CAWWT.

Preliminary engineering parameters indicate a basin of approximately 250,000 gallon holding volume - A pair of pumps rated at 125 gpm @ 75 feet TDH would be installed in the basin.

Detailed design for this installation will be completed at a later date when soil excavation plans are more certain.

The finished CAWWT facility will need to have adequate space for ion exchange resin replacement and preparation of spent resin for disposal. Drawing 51D-5500-A-01371 shows the layout of the finished CAWWT building.

#### 4. House supporting functions

Support functions include enclosed structures for a laboratory, control room, break room, office, and restroom. See drawings 52D-5500-A-01371 through 01373.

Laboratory design is based on providing facilities to perform routine analyses whose results are needed in less than one week. Those tests include uranium (for process monitoring), and chlorine, BOD, and TSS (for NPDES reporting). Laboratory work that can accommodate less timely results will be sent off site. The CAWWT lab includes a sample preparation area for off site analyses.

The control room design is based on space for two process control computers (one is a redundant back up).

The break area is sized for use by 5 people. The office is a single person office. The unisex sanitary facility includes a single toilet and sink.

The structures will be purchased modular units rigged into place with module sections approximately 14 feet x 14 feet field assembled.

The eastern wall of the west low bay of Building 51 will be modified to serve as an outside wall.

#### 5. Relocate utilities and piping allowing for AWWT Phases I and II D&D

Much of this work is included in Stage 1 of the project. Work to be completed in Stage 2 includes providing an instrument air system, modifying potable water, natural gas, fire protection water systems, providing electric service to the new facilities, relocating phone and fire alarm service, and providing for sanitary sewage disposal.

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**6. Scope of Work**

1. Operations will take Phase I and II equipment in the CAWWT area out of service, and prepare it for removal. This includes decontaminating 17 filter and ion exchange units.
2. Demolition work will include the removal of Phase I and Phase II filter and ion exchange tanks, piping, valves, control wiring, insulation and miscellaneous structures, catwalks stairs, equipment pads
3. Site Work will include the extension of an existing asphalt paved road to connect to the Main Access Road, providing sidewalks adjacent to the building, adding aggregate fill for certain areas, and grading and seeding of the general CAWWT area in preparation for Legacy Operations.
4. Architectural and civil work will include modifications to tank farm stairs and catwalks, modifications to structural steel and new concrete work at the East end of the structure, installing insulated siding, addition of horizontal x-bracing at roof level on East end, installing siding and roof trim and seals, providing a roof access ladder and safety provisions, miscellaneous modifications to door and frames, and interior concrete curbing to accommodate lab and office areas.
5. Modular office and laboratory facilities will be purchased from a portable building vendor, with modular sections rigged, assembled and installed as work under these Specifications.
6. Mechanical Work will include the installation of potable water for lab and toilet areas, a new tank farm lift station, sewage system, stormwater system, natural gas piping and regulating station for existing gas fired heater, a new instrument air system consisting of air compressors one of which is standby, ISA instrument air dryers and a receiver tank. Office and lab spaces will have incremental type HVAC units with ducted supply air.
7. A wet pipe ordinary hazard fire suppression system will be designed and installed by a certified fire protection contractor
8. Electrical work will include service to lab and control room/break area/office/restroom, rework of building grounding, lightning protection, phones, fire alarm systems relocation of existing North Heating unit thermostat, and miscellaneous outside and building exit lighting.

**END OF SECTION**

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**SECTION 02225**

**MINOR DEMOLITION FOR REMODELING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Demolishing designated building equipment and fixtures.
  - 2. Demolishing designated construction.
  - 3. Cutting and alterations for completion of the Work.
  - 4. Protecting items designated to remain.
  - 5. Removing demolished materials.
  
- B. Maintain one copy of project document on site.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Mark location and termination of utilities.
- B. Erect, and maintain temporary barriers
- C. Erect and maintain weatherproof closures for exterior openings.
- D. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- E. Provide appropriate temporary signage including signage for exit or building egress.
- F. Do not close or obstruct building egress path.
- G. Do not disable or disrupt building fire or suppression system without notifying Safety & Health.

**3.2 SALVAGE REQUIREMENTS**

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- A. Coordinate with operations to identify building components and equipment required to be removed and appropriate disposal.
- B. Protect designated salvage items from demolition operations until items can be removed.
- C. Carefully remove building components and equipment indicated to be salvaged.
- D. Disassemble as required to permit removal from building.
- E. Package small and loose parts to avoid loss.
- F. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.

**3.3 DEMOLITION**

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Disconnect and remove designated piping and utilities within demolition areas. Cap remaining piping as directed.
- C. Demolish in orderly and careful manner. Protect existing facilities.
- D. Observe posted weight limits on overhead crane.

**END OF SECTION**

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**SECTION 02311**

**ROUGH GRADING**

**PART 1 GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Cutting, grading and filling site for paving and final grading.

**1.2 REFERENCES**

**A. American Society for Testing and Materials:**

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
9. ASTM D2487 - Classification of Soils for Engineering Purposes, (Unified Soil Classification System)

**1.3 QUALITY ASSURANCE**

- A. Perform Work in accordance with State of Ohio Highways Department Standards (ODOT).**

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**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Topsoil: Native Soil
- B. Subsoil Fill: Excavated and re-used material, free of lumps and rocks, larger than 2 inches.
- C. Granular Fill: ODOT Item 301

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify site conditions before starting work.
- B. Verify survey bench mark and intended elevations for the Work are as indicated.

**3.2 PREPARATION**

- A. Identify affected utilities before starting work.
- B. Mark location of utilities.
- C. Identify required lines, levels, contours, and datum.
- D. Protect utilities indicated to remain from damage.
- E. Protect bench marks, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

**3.3 TOPSOIL EXCAVATION**

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material until disposal.

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### 3.4 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.
- B. Place fill material in continuous layers and compact to 90 percent Proctor.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Slope grade away from building minimum -4 inches in 10 ft
- E. Make grade changes gradual. Blend slope into level areas.
- F. Repair or replace items indicated to remain damaged by excavation or filling.

### 3.5 TOLERANCES

- A. Compacted Fill:
  - 1. Compact to 90 percent Proctor.
- B. Topsoil Fill:
  - 1. Compact uniformly to minimum 90 percent of maximum density.

**END OF SECTION**

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## **SECTION 02315**

### **EXCAVATION AND FILL**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

**A. Section Includes:**

- 1. Excavating for paving, roads, and parking areas.**

##### **1.2 REFERENCES**

**A. American Society for Testing and Materials:**

- 1. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.**

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

##### **3.1 PREPARATION**

- A. Notify utility engineer before starting work and comply with their requirements.**
- B. Mark location of utilities.**
- C. Identify required lines, levels, contours, and datum.**
- D. Protect utilities indicated to remain from damage.**
- E. Protect bench marks, survey control points, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.**

##### **3.2 EXCAVATION**

- A. Excavate subsoil to accommodate building foundations and paving.**
- B. Grade top perimeter of excavation to prevent surface water from draining into excavation.**
- C. Trim excavation. Remove loose matter.**

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- D. Remove excess and unsuitable material and store as directed.
- E. Repair or replace items indicated to remain damaged by excavation.

**3.3 PROTECTION**

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation.

**END OF SECTION**

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**SECTION 02539**

**SANITARY SEWAGE SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  1. Sanitary sewage pipe.
  2. Lift Station.

**1.2 REFERENCES**

1. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
2. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
3. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
4. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

**1.3 SUBMITTALS**

- A. Product Data: Submit data for lift station.

**PART 2 PRODUCTS**

**2.1 SANITARY SEWAGE PIPE**

- A. Plastic Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and plain end, solvent welded.
  1. Fittings: PVC.
  2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. Plastic Pipe: ASTM D1785, Schedule 40 Poly Vinyl Chloride PVC material socket weld with solvent cement.
  1. Fittings: ASTM D2466, PVC.
  2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

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**2.2 LIFT STATION**

- A. Lift Station to be package unit with fiberglass basin and basin cover, simplex grinder pump automatically operated from float control, factor piped to discharge with check valve. Unit shall have high-level alarm. Lift Station to be Zoeller simplex 820 or equal with 24" dia. X 60" basin - 2Hp, 230v, 1ph, with control panel factory supplied.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Correct over excavation with fine, coarse aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

**3.2 BEDDING**

- A. Excavate for lift station, place bedding material in continuous layer.

**3.3 INSTALLATION - PIPE**

Flexible Plastic Pipe - ASTM D2321

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321.

**3.4 FIELD QUALITY CONTROL**

- A. Pressure Test: Test in accordance with Ohio Plumbing Code.

**END OF SECTION**

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**SECTION 02551**  
**NATURAL GAS PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Valves.
  - 3. Pressure regulating valves (existing relocated).
  - 4. Underground pipe markers.
  - 5. Bedding and cover materials.

**1.2 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B16.3 - Malleable Iron Threaded Fittings.
  - 2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
  - 3. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. American Society for Testing and Materials:
  - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - 3. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
  - 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- C. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.

**1.3 QUALITY ASSURANCE**

- A. Perform Work in accordance with ASME B31.3
- B. Welding Materials and Procedures: Conform to ASME Section IX.
- C. Welders Certification: In accordance with ASME Section IX.

**PART 2 PRODUCTS**

**2.1 PIPE AND FITTINGS**

- A. Steel Pipe Above Ground: ASTM A53, Schedule 40:
  - 1. Fittings: ASME B16.3, malleable iron, ASME B16.11, forged steel, or ASTM A234/A234M, forged steel welding type.
  - 2. Joints: Threaded. Welded for pipe sizes over 2 ½ inches.
- B. High Density Polyethylene (HDPE) pipe below ground, ASTM, D2513 SDR11 fusion welded joints:

**2.2 PRESSURE REGULATING VALVES**

- A. Relocate existing regulating valves as shown.

**2.3 UNDERGROUND PIPE MARKERS**

- A. Trace Wire: Magnetic detectable conductor, [clear] [brightly colored] plastic covering, imprinted with "Natural Gas Service" in large letters.

**2.4 BEDDING AND COVER MATERIALS**

- A. Bedding: Sand.
- B. Cover: Native Soil.
- C. Soil Backfill from Above Pipe to 6 inches below Finish Grade: Sand.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections with threading and unions.

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**3.2 BEDDING**

- A. Excavate pipe trench to minimum 3 foot depth.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches.
- C. Backfill around sides and to top of pipe with cover fill, tamped in place and compact.

**3.3 INSTALLATION - PIPING**

- A. Maintain separation of gas line from water piping in accordance with Ohio Department of Health.
- B. Group piping with other site piping work whenever practical.
- C. Route piping in straight line.
- D. Install piping to conserve space and not interfere with use of site space.
- E. Install piping to allow for expansion and contraction without stressing pipe or joints.
- F. Install valves and other fittings as indicated on Drawings.
- G. Lay pipe on bedding.
- H. Install trace wire continuous over top of pipe.
- I. Backfill trench with sand to 6 inches below finish grade. Complete backfill with native soil.
- J. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

**END OF SECTION**

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**Date: 12-16-04**

**Section 02630**

**Rev. 0**

## **SECTION 02630**

### **STORM DRAINAGE**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

###### **A. Section Includes:**

1. Storm drainage piping.
2. Catch basins and downspout boots.
3. Cleanouts.
4. Bedding and cover materials.

##### **1.2 REFERENCES**

###### **A. American Society for Testing and Materials:**

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
3. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

#### **PART 2 PRODUCTS**

##### **2.1 STORM DRAINAGE PIPING**

###### **A. Plastic Pipe: ASTM D2729, polyvinyl chloride (PVC) material; bell and plain end, solvent welded.**

1. Fittings: PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

##### **2.2 CATCH BASINS AND PLANT AREA DRAINS**

###### **A. Catch Basin Lid and Frame to be Neenah or equal:**

###### **B. Catch Basin Lid and Frame:**

1. Construction: Cast iron construction, hinged lid.
2. Lid Design: Checkerboard grill.
3. Nominal Lid and Frame Size: 24 x 28 inch.

##### **2.3 CLEANOUTS**

###### **A. Cleanout Lid and Frame to be Neenah or equal:**

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**2.4 BEDDING AND COVER MATERIALS**

- A. Bedding: Sand.
- B. Cover: Native Soil.
- C. Soil Backfill from Above Pipe to 6 inches below Finish Grade: Sand.

**2.5 PREPARATION**

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

**2.6 BEDDING**

- A. Excavate pipe trench not less than 3 feet deep. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches depth.

**2.7 INSTALLATION - PIPE**

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8.

**2.8 INSTALLATION - CATCH BASINS AND CLEANOUTS**

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.
- C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

**END OF SECTION**

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**SECTION 02731**  
**AGGREGATE BASE COURSE**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  1. Aggregate base course.

**1.2 REFERENCES**

1. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

**1.3 SUBMITTALS**

**1.4 QUALITY ASSURANCE**

- A. Furnish each aggregate material from single source throughout the Work.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Coarse Aggregate Fill No 1 or No 2 crushed limestone.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

**3.2 PREPARATION**

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

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**3.3 AGGREGATE PLACEMENT**

- A. Spread aggregate over prepared substrate to a total compacted thickness of 6 inches.

**3.4 TOLERANCES**

- A. Maximum Variation From Flat Surface: ½ inch measured with 10 foot straight edge.
- B. Maximum Variation From Thickness: ½ inch.
- C. Maximum Variation From Elevation: ½ inch.

**3.5 FIELD QUALITY CONTROL**

- A. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

**END OF SECTION**

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**SECTION 02740  
FLEXIBLE PAVEMENT**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  1. Asphaltic concrete paving, wearing, binder and base course.
  2. Surface sealer.
  3. Aggregate subbase course.

**1.2 SUBMITTALS**

- A. Product Data: Submit product information and mix design.

**1.3 QUALITY ASSURANCE**

- A. Obtain materials from same source throughout.
- B. Maintain one copy of each document on site.

**1.4 QUALIFICATIONS**

- A. Installer: Company specializing in performing work of this sections with minimum 10 years documented experience.
- B. Place bitumen mixture when temperature is not more than 15 degrees F below temperature at when initially mixed and not more than maximum specified temperature.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Asphalt Cement: ASTM D946. ASTM D3381. In accordance with State Highways standards.

**2.2 ASPHALT PAVING MIX**

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with Ohio State Highways Standards.
- C. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with Ohio State Highways Standards.

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**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify compacted subbase is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

**3.2 PREPARATION - PRIMER**

- A. Apply primer in accordance with Ohio State Highways Standards.

**3.3 PREPARATION - TACK COAT**

- A. Apply tack coat in accordance with Ohio State Highways Standards.

**3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE**

- A. Install Work in accordance with Ohio State Highways Standards.

**3.5 TOLERANCES**

- A. Flatness: Maximum variation of ½ inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within ½ inch
- C. Variation from Indicated Elevation: Within ½ inch.

**3.6 FIELD QUALITY CONTROL**

- A. Take samples and perform tests in accordance with Ohio State Highways Standards.

**3.7 PROTECTION OF FINISHED WORK**

- A. Immediately after placement, protect pavement from mechanical injury for 8 hours before traffic use.

**END OF SECTION**

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**Section 02821**

**Rev. 0**

## SECTION 02821

### CHAIN LINK FENCES AND GATES

#### PART 1 GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts (and center drop for gates)
4. Manual gates and related hardware.

##### 1.2 REFERENCES

###### A. American Society for Testing and Materials:

1. ASTM A121 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A569/A569M - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
8. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

###### B. Chain Link Fence Manufacturers Institute:

1. CLFMI - Product Manual.

##### 1.3 SYSTEM DESCRIPTION

- A. Fence Height: 8 feet.
- B. Line Post Spacing: At intervals not exceeding 10 feet.

##### 1.4 SUBMITTALS

- A. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

1.5 QUALITY ASSURANCE

- A. Perform installation in accordance with ASTM F567.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 10 years experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
  - 1. Anchor Fence Inc.
  - 2. Cyclone Inc.

2.2 MATERIALS AND COMPONENTS

- A. Materials and Components: Conform to CLFMI Product Manual.
- B. Fabric Size: CLFMI Heavy Industrial.
- C. Intermediate Posts: Type I round.
- D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.3 MATERIALS

- A. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 coating conforming to ASTM F1043 Type A on pipe exterior and interior.
- B. Fabric Wire Steel: ASTM A392 zinc coated wire fabric.
- C. Barbed Wire: ASTM A121 galvanized steel.
- D. Concrete: ASTM C94; Normal Portland Cement, 2,500 psi strength at 28 days.

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**2.4 COMPONENTS**

- A. Line Posts: 2.38 diameter.
- B. Corner and Terminal Posts: 2.88 inch diameter.
- C. Gate Posts: 3.5 inch diameter.
- D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
- E. Fabric: 2 inch diamond mesh interwoven wire, 9 gage thick, top selvage knuckle end closed, bottom selvage twisted tight.
- F. Tension Wire: 6 gage thick steel, single strand.
- G. Tie Wire: Aluminum alloy steel wire.

**2.5 ACCESSORIES**

- A. Caps: Cast steel galvanized sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.
- C. Gate Hardware: Suitable for padlock keying.

**2.6 GATES**

- A. General:
  - 1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
  - 2. Factory assemble gates.
- B. Swing Gates:
  - 1. Fabricate gates to permit 180 degree swing.
  - 2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

**END OF SECTION**

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**SECTION 02924**

**SEEDING AND SOIL SUPPLEMENTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  1. Preparation of subsoil.
  2. Placing topsoil.
  3. Seeding.
  4. Mulching.
  5. Soil testing and fertilizer.

**1.2 REFERENCES**

- A. American Society for Testing and Materials:
  1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

**1.3 DEFINITIONS**

- A. Weeds: Vegetative species other than specified species to be established in given area.

**1.4 QUALITY ASSURANCE**

- A. Perform Work in accordance with Ohio State Highways Standards.

**1.5 QUALIFICATIONS**

- A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years experience.

**PART 2 PRODUCTS**

**2.1 SEED MIXTURE**

- A. Furnish materials in accordance with Ohio State Highways Standards.
- B. Seed Mixture:
  1. Creeping Red Fescue Grass: 49.8 percent.

**2.2 SOIL MATERIALS**

- A. Topsoil: Excavated from site and free of weeds.

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**2.3 ACCESSORIES**

- A. **Mulching Material:** Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. **Fertilizer:** Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil
- C. **Lime:** ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
- D. **Water:** Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.
- E. **Stakes:** Softwood lumber, chisel pointed.
- F. **String:** Inorganic fiber.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. **Verify prepared soil base is ready to receive the Work of this section.**

**3.2 PREPARATION OF SUBSOIL**

- A. **Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.**
- B. **Remove foreign materials, weeds and undesirable plants and their roots.**
- C. **Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.**

**3.3 PLACING TOPSOIL**

- A. **Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.**
- B. **Place topsoil during dry weather and on dry unfrozen subgrade.**

- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

**3.4 FERTILIZING**

- A. Apply lime as directed. Work lime into top 6 inches of soil.
- B. Apply fertilizer at application rate as directed
- C. Apply after smooth raking of topsoil.
- D. Do not apply fertilizer at same time or with same machine used to apply seed.
- E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

**3.5 SEEDING**

- A. Apply seed at rate of 3 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- D. Roll seeded area with roller not exceeding 112 lbs/linear foot.
- E. Immediately following seeding, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.
- F. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

**END OF SECTION**

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Approved:

**SECTION 03001**

**CONCRETE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Cast-in-place concrete.
- B. Equipment pads.
- C. Formwork, shoring, bracing, and anchorage.
- D. Concrete reinforcement and accessories.

**1.2 REFERENCES**

- A. ACI 301 - Structural Concrete for Buildings.

**1.3 SUBMITTALS**

- A. Product Data: Provide data on joint devices, grout, attachment accessories, and admixtures.
- B. Submit shop drawings of reinforced steel. Indicate reinforcement sizes, spacings, locations, and quantities of reinforcing steel.
- C. Mix design shall be a FCP Standard Batch Mix

**1.4 QUALITY ASSURANCE**

- A. Perform Work in accordance with ACI 301.

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## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

- A. Conform to ACI 301.

### 2.2 REINFORCING STEEL

- A. Reinforcing Steel: ASTM A615, 60 yield grade billet steel deformed bars; uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ASTM A185; uncoated finish. Use flat sheets, not rolls.

### 2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

### 2.4 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Calcium Chloride: Not Permitted.
- C. Chemical: ASTM C494 Type A - Water Reducing, Type B - Retarding, Type C - Accelerating, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating.

### 2.5 ACCESSORIES

- A. Bonding Agent: Weld-Crete by Larson Products or approved equal.
- B. Vapor Barrier: 6 mil thick clear polyethylene film.
- C. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi in 28 days.
- D. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
- E. Tie Wire: No. 16 AWG black annealed or heavier.

- F. Anchor Bolts: Carbon steel material conforming to ASTM A36, national course threaded.
- G. Embedded Metal: All embedded metal shall have suitable anchors securely welded on centers not exceeding 2 feet. Anchors shall be within 6 inches of ends and corners. All joints, corners, splices, etc. shall be welded and exposed surfaces ground flush. Metal surfaces shall be free of rust, oil, or other contaminants. Surfaces not intended for contact with concrete shall be coated with inorganic zinc primer or approved equal.

**2.6 JOINT DEVICES AND FILLER MATERIALS**

- A. Joint Filler Type A ASTM D1751 Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.
- B. Joint Filler Type B ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.
- C. Joint Sealant: Single -part polyurethane, gray color.
- D. Waterstops: PVC, 6", serrated with center bulb type, heat sealed joints.

**2.7 CONCRETE MIX**

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Structural and Exterior Slab on Fill Concrete Exposed to Weather (FMPC #4):

Compressive Strength (28 day):	4000 psi
Water/Cement Ratio (maximum):	0.45
Aggregate Size (maximum):	1 inch
Slump:	4 inch, plus or minus 1 inch
Minimum Cement Content:	564 lbs. per cu. yd.
Flyash (maximum):	Not permitted.
Total Air Content:	5% plus or minus 1.5%

- C. Sidewalk, Service Pads and Miscellaneous Concrete Exposed to Weather:

Compressive Strength (28 day)	3000 psi
Water/Cement Ratio (maximum)	0.45
Aggregate Size (maximum)	1 inch
Slump:	4 inch, plus or minus 1 inches
Minimum Cement Content:	517 lbs. per cu. yd.
Flyash (maximum):	77 lbs. per cu. yd.
Total Air Content:	5% plus or minus 1.5%

- D. Use accelerating admixtures in cold weather only when approved by Fluor Fernald. Use of admixtures will not relax cold weather placement requirements.
- E. Use set retarding admixtures during hot weather only when approved by Fluor Fernald.
- F. Fly ash concrete is not recommended for cold weather concreting or where high early strength is required.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- C. Verify form joints are aligned.

#### 3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is dowelled to existing work, drill holes in existing concrete and insert steel dowels.

#### 3.3 PAVEMENT REPAIRS

- A. Existing roadway pavements to be repaired shall be sawed full depth.
- B. Disturbed base and/or subgrade material shall be recompact.

#### 3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Notify Fluor Fernald a minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

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- D. Sidewalks: Place sidewalk on 2 inch thick compacted sand base. Sidewalks to be 4 inches thick unless noted otherwise. All exposed edges and joints shall be edged with a ¼ inch radius tool. The surface shall be divided into equally spaced blocks at approximately 5 foot intervals. A ½ inch expansion joint filler shall be installed between the walk and any fixed structure, extended the full depth of the walk.
- E. Install joint devices in accordance with manufacturer's instructions.
- F. Install joint device anchors. Maintain correct position to allow joint cover to be flush.
- G. Apply sealants in joint devices.
- H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- I. Place concrete continuously between predetermined expansion, control, and construction joints.
- J. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.
- K. Screed floors and slabs on grade level. Maintain Class B tolerance according to ACI 301.

**3.5 CONCRETE FINISHING**

- A. Rough form finish for concrete surfaces not exposed to public view.
- B. Cement slurry form finish for concrete surfaces exposed to public view.
- C. Wood float finish for sidewalks.
- D. Finish concrete floor surfaces in accordance with ACI 301.

**3.6 CURING AND PROTECTION**

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Cure floor surfaces in accordance with ACI 301.

**3.7 SEALANTS**

- A. Seal edges between new and existing pavement.

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**3.8 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed in accordance with ACI 301.

**3.9 PATCHING**

- A. Excessive honeycomb or embedded debris in concrete is not acceptable.
- B. Patch imperfections in accordance with ACI 301.
- C. Repair or replacement of defective concrete will be determined by the Construction Manager.

**END OF SECTION**

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**SECTION 05120**

**STRUCTURAL STEEL**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes structural steel framing members, support members, anchor bolts for structural steel; purlins, and girts; bearing of steel for girders, bracing; connecting materials for framing structural steel to structural steel; fasteners for connecting structural steel items; and field bolts for permanent connections.

**1.2 REFERENCES**

- A. American Institute of Steel Construction:
  - 1. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges.
- B. American Society for Testing and Materials:
  - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
  - 2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. SSPC: The Society for Protective Coatings:
  - 1. SSPC - Steel Structures Painting Manual.

**1.3 SUBMITTALS**

- A. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

**1.4 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC S303.
- B. Perform Work in accordance with AISC S303, Section 10.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Structural Steel Members: ASTM A36/A36M.
- B. Structural Tubing: ASTM A500.
- C. Pipe: ASTM A53, Grade B.
- D. Bolts, Nuts, and Washers: ASTM A307.
- E. Anchor Bolts: ASTM A307.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 at 28 days.
- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

### 2.2 FABRICATION

- A. Fabricate connections for bolt, nut, and washer connectors.

### 2.3 FINISH

- A. Leave structural steel members un-primed.

## PART 3 EXECUTION

### 3.1 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on Drawings.
- C. Field connect members with threaded fasteners; torque to required resistance.
- D. Do not field cut or alter structural members without approval of Engineers.
- E. Grout as indicated. Trowel grouted surface smooth, splay neatly to 45 degrees.

### 3.2 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: ¼ inch per story, non-cumulative.
- B. Maximum Offset From Alignment: 1/4 inch.

**END OF SECTION**

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Approved:

**SECTION 05500  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Formed metal floor and stair tread grating.
- C. Handrails and stair stringers.

**1.2 REFERENCES**

- A. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.
- B. AWS D1.1 - Structural Welding Code.
- C. NAAMM MBG 531 - Metal Bar Grating Manual.
- D. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual.
- E. SSPC - Steel Structures Painting Council.

**1.3 SUBMITTALS**

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- B. Product Data: Provide span and deflection tables for grating.
- C. Manufacturer's Installation Instructions (Grating): Indicate special requirements of perimeter framing.
- D. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

#### 1.4 QUALIFICATIONS

- A. Welders Certificates: Certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

#### 1.5 FIELD MEASUREMENTS

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

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283 or ASTM A36.
- D. Pipe: ASTM A53, Grade B, Schedule 40.
- E. Steel Grating: Welded construction, rectangular shape bearing bars with serrated top surface spaced 1 3/16" on centers, cross bars 4" on centers, galvanized. Perimeter closure (banding) of same material as grating.
- F. Structural Fasteners: ASTM A325.
- G. Accessory Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.
- H. Saddle Clips, Flange Blocks and J-Hooks: Galvanized steel.
- I. Welding Materials: AWS D1.1; type required for materials being welded.
- J. Shop and Touch-Up Primer: Short-oil alkyd primer, VOC compliant, one coat at 2 mils dry film thickness. Carboline GP818 or equal.
- K. Touch-Up Primer for Galvanized Surfaces: Chlorinated rubber, zinc-rich coating, one coat at 5 mils dry film thickness. Carboline Galvanox Type I or equal.

#### 2.2 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.

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- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Fabricate grates and plates to sizes indicated.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

**2.3 FINISHES**

- A. Prepare surfaces to be primed in accordance with SSPC SP-6.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Galvanizing, Structural Shapes and Plates: Conform to ASTM A123. Provide minimum 1.25 oz/sq ft galvanized coating.
- D. Galvanizing, Assembled Items: Minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A386.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

**3.2 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

- C. Mechanically cut galvanized finish surfaces. Do not flame cut.
- D. Anchor grating by bolting through saddle clips.
- E. Secure flooring to prevent movement.
- F. Field weld components indicated on Drawings.
- G. Perform field welding in accordance with AWS D1.1.
- H. Obtain Fluor Fernald approval prior to site cutting or making adjustments not scheduled.
- I. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.3 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Grating: Conform to NAAMM MBG 531. Maximum spacing between adjacent sections to be 1/4 inch.

**END OF SECTION**

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## SECTION 05510

### METAL STAIRS AND LADDERS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section includes steel stair frame of structural sections, with open risers, open grating and handrail.

##### 1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. American Society for Testing and Materials:
  - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
  - 2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.

##### 1.3 DESIGN REQUIREMENTS

- A. Fabricate stair assembly to support uniform live load of 100 lb/sq ft and concentrated load of 300 lb/sq ft with deflection of stringer or landing framing not to exceed 1/180 of span.
- B. Railing assembly, wall rails, and attachments to resist lateral force of 75 lbs at any point without damage or permanent set.

#### PART 2 PRODUCTS

##### 2.1 METAL STAIRS

- A. Manufacturers:
  - 1. Chicago Ornamental Iron Co. or equal.

##### 2.2 COMPONENTS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283/A283M.

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- D. Pipe: ASTM A53, Grade B Schedule 40.
- E. Sheet Steel: ASTM A653/A653M.
- F. Bolts, Nuts, and Washers: ASTM A325.
- G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- H. Welding Materials: AWS D1.1; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- J. Gratings: NAAMM MBG 531.

**2.3 FABRICATION**

- A. Fit and shop assemble components in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION**

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Install anchors, and plates required for connecting stairs to structure.
- C. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.
- D. Field weld components indicated on Drawings. Perform field welding in accordance with AWS D1.1.
- E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible.
- F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.

**END OF SECTION**

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**SECTION 06114**

**WOOD BLOCKING AND CURBING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes roof curbs, cants, and perimeter nailers; blocking in telephone and electrical panel back boards; concealed wood blocking for support.

**1.2 REFERENCES**

- A. American National Standards Institute:

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Lumber Grading Rules: AP&PA.
- B. Miscellaneous Framing: Stress Group D.

**2.2 ACCESSORIES**

- A. Fasteners and Anchors:
  1. Fasteners: Hot dipped Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
  2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt fastener for anchorages to steel.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify substrate conditions are ready to receive blocking, curbing and framing.

**3.2 PREPARATION**

- A. Coordinate placement of blocking, curbing and framing items.

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**3.3 INSTALLATION**

- A. Set members level and plumb, in correct position.
- B. Place horizontal members, crown side up.
- C. Construct curb members of solid wood sections.
- D. Form corners by alternating lapping side members.
- E. Space framing and furring 16 inches on center unless otherwise indicated.
- F. Secure sheathing to framing members with ends over firm bearing and staggered.
- G. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back boards beyond size of electrical and telephone panel by 12 inches in both directions.

**END OF SECTION**

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**SECTION 07468**

**METAL SIDING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes pre-insulated metal siding with finished interior and exterior metal panels.

**1.2 SYSTEM DESCRIPTION**

- B. Preformed and prefinished metal siding system of vertical profile, site attached to building structure.

**PART 2 PRODUCTS**

**2.1 MANUFACTURED METAL SIDING**

- A. Siding to be Aluma Shield Industries AW-200, 42 inches wide, R of 15.9, color as selected.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Installed per manufacturers recommendations and details shown on drawings.

**END OF SECTION**

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**SECTION 07610**

**MANUFACTURED SHEET METAL ROOFING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section covers repair and replacement of any roofing material modified to relocate the building east exterior wall.

**PART 2 PRODUCTS**

- A. Furnish material to match existing sheet metal work.

**PART 3 EXECUTION**

- A. Conform to details of the National Roofing Contractors Association.

**END OF SECTION**

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**SECTION 07620**

**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Includes flashing and counterflashing as required for final weather protection of building.

**PART 2 PRODUCTS**

- A. Provide flashing and trim of galvanized steel, 26 gage, ASTMA924.

**PART 3 EXECUTION**

- A. Secure flashings in place using blind rivets and/or exposed fasteners.
- B. Fit flashings tight in place, make corners square, surfaces true and straight and lines accurate to profiles
- C. Seal metal joints weathertight.

**END OF SECTION**

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**SECTION 07714**

**GUTTERS AND DOWNSPOUTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Modify existing gutter at east end of building to slope to downspout.

**END OF SECTION**

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**SECTION 07900**

**JOINT SEALERS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes sealants and precompressed form sealers.

**PART 2 PRODUCTS**

**2.1 JOINT SEALERS**

- A. High performance exterior silicone, single component caulk as manufactured by Dow Corning or GE Silicones, color as selected.

**2.2 PRECOMPRESSED FOAM SEALS**

- A. Precompressed foam seals, shaped to profile of metal roofing or siding, sized as required to provide weathertight seal between surfaces

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Examine surfaces to assure they are clean and dry.
- B. Install per manufacturers recommendations.

**END OF SECTION**

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**SECTION 08110**

**STEEL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Existing doors to be modified using components available from site D&D work to provide:
1. 100 sq. inch maximum view lite
  2. Panic Hardware on interior with latch.
  3. Latch receiver in existing door frame.
  4. Outside door pull and latch release.
  5. Lock set on selected doors.

**END OF SECTION**

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**SECTION 13125**

**MODULAR OFFICE AND LABORATORY UNITS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Designed and shop fabricated office and laboratory units.
- B. Mechanical and electrical requirements.

**1.2 SYSTEM DESCRIPTIONS**

- A. One (1) Personnel Unit 12 feet by 42 feet: Consisting of: (1) Unisex Restroom – ADA compliant, containing one water closet and one lavatory w/mirror; (1) supervisor’s office; (1) break room / control room w/floor to ceiling interior partition provided by manufacturer. (See drawing 51D-5500-A-01362 for plan and elevations.)
- B. One (1) Analytical Laboratory Unit 14 feet by 24 feet: (1) room to be designed and furnished per owners’ floor plan. Casework, work surfaces and accessories to be ‘Fisher Hamilton’ or approved equal. (See drawing 51D-5500-A-01361 for plan and interior elevations.)

**1.3 WORK BY OTHERS**

- A. Installation of and wiring for smoke detectors and fire alarm equipment.
- B. Modular unit installation, which includes blocking, leveling, module assembly and anchoring.
- C. Mechanical and electrical tie-ins to site utilities.
- D. Exterior ramps and landings.
- E. Phone and data wiring installation.
- F. Purchase and install HVAC units, thermostats and interconnecting wiring and ducting.

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**1.4 SUBMITTALS**

- A. Submit floor plan for each unit within ten (10) business days after Contract award.**
- B. Submit complete set of shop drawings within thirty (30) days of Contract award. Submit five (5) full size copies and (1 set) electronic files in format compatible with Microstation V8.5. Submit for approval prior to fabrication.**
  - 1. Indicate recommended location of structural supports**
  - 2. Indicate the number and location of modular sections.**
  - 3. Indicate wall and roof system dimensions and general construction details.**
  - 4. Indicate type and location of all piping connections between module sections and external tie ins.**
  - 5. Indicate type and locations of all electrical connections between module sections and external connections.**
  - 6. Provide reflected ceiling plan.**
- C. Product Data: Provide data on mechanical components, including plumbing fixtures, water heaters and diffusers. Provide data on electrical components including panel boards, circuit breakers, devices, lighting fixtures, wire, junction boxes, wall plates. Provide data on flooring, doors, and door hardware.**
- D. Manufacturer's Installation Instructions: Indicate preparation requirements and assembly sequence.**
- E. Provide color charts for interior wall covering, counter tops, and floor tile.**

**1.5 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section.**

**1.6 REGULATORY REQUIREMENTS**

- A. Conform to the requirements of the Ohio Building Code (OBC).**

**1.7 WARRANTY**

- A. Provide a one-year warranty on materials and workmanship.**
- B. Warranty: Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.**

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**1.8 DESIGN REQUIREMENTS – STRUCTURAL & GENERAL**

- A. System and components to withstand dead load and live load, calculated in accordance with the Ohio Building Code, OBC. Selected design criteria shall be as follows:
  - 1. Building Classification for Importance Factors: Category I
  - 2. Exposure Category: Exposure C
  - 3. Seismic Use Group: Group I
  - 4. Floor Live Load: 50 psf
- B. Interior ceiling height to be 8'-0" minimum.
- C. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- D. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
- E. Maximum module size 14'-0" x 14'-0" due to rigging constraints.

**1.9 DESIGN REQUIREMENTS – MECHANICAL**

- A. Heating & Cooling: Heating and cooling equipment to be purchased and installed by owner. Provide diffusers and duct stubs for extension by owner.
- B. Diffusers and Stub Ducts: Design in accordance to the methods given by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
- C. Plumbing: Design cold potable water, hot water, and sanitary systems in accordance with the OBC.

**1.10 DESIGN REQUIREMENTS - ELECTRICAL**

- A. All electrical work shall be designed and installed in accordance with the National Electrical Code (NEC).
- B. All electrical equipment shall be Underwriter's Laboratories (UL) listed.
- C. The HVAC, including thermostats, will be owner installed. The lights and the remaining electrical requirements are to be serviced from the 120/240, single-phase 3-wire service panel.

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- D. A separate 120/240-breaker sub-panel shall be furnished and mounted outside each modular section in a NEMA 3R enclosure or better.
- E. The breaker panel shall have a 100 amp main breaker, minimum.
- F. The breaker panel location shall allow 3 feet of clearance at the panel face.
- G. Wire: Copper insulated wire shall be used in electrical circuits. Minimum wire size shall be 12 AWG, type THHN/THWN.
- H. Conduit: Electrical wiring to be installed in EMT conduit. Minimum size to be 1/2-inch conduit. A separate green grounding wire shall be installed. No conduit runs shall be used for equipment grounding.
- I. Receptacle circuits are to be rated at 20 amps. Receptacle and light switches shall be labeled identifying the appropriate circuit breaker and shall have fixed engraved labels to identify serviced circuits.
- J. Exit Signs: Install low energy consumption solid state (LED-RED) exit signs with battery back up at all exits.
- K. Emergency Lights: Provide emergency egress lighting with battery back up to illuminate the paths to all exits.
- L. A lighting level of 60 foot-candles shall be provided at a height of three feet above the floor.
- M. All lighting shall be controlled by wall switches, not by breakers.
- N. All aisle way and open area lighting to be operated by 3-way switches located at exterior doors.
- O. General interior lighting shall be 2 feet by 4 feet surface mounted fluorescent fixtures each with acrylic lens, electronic ballast and lights. Other interior lighting shall be incandescent.
- P. Grounding: Module frame and metallic sheathing shall be grounded to breaker panel.
- Q. Smoke detectors and fire alarm equipment will be installed by owner.
- R. Install flush mount phone/data boxes in walls at locations as shown on the Drawings. Stub conduit through flooring for wire, jack installation by owners. Phone/data boxes to be Raco #663 Handy Box with 3/4 inch knockout or equal.

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**PART 2 PRODUCTS**

**2.1 MANUFACTURERS - BUILDING SYSTEM**

- A. Porta-King.
- B. CMP Labfab, Inc.
- C. Other acceptable manufacturers offering equivalent systems.

**2.2 MATERIALS - MODULAR UNITS**

- A. Base Framing: Structural steel shapes, cold rolled steel or extruded aluminum shapes of structural alloy 6063T6.
- B. Floor Sheathing/Underlayment: Manufacturer's standard design.
- C. Flooring: Colors as selected from manufacturer's standard range. Flooring type by unit as follows:
  - 1. Personnel Module: Vinyl composite tile throughout.
  - 2. Laboratory Module: Vinyl composite tile throughout.
- D. Floor Tile: Vinyl composite, 1/8-inch gauge, 12 inch by 12-inch tile size, ASTM F1066 Composition 1 Class 2, Congoleum Selections or equal. Color as selected from manufacturer's standard range.
- E. Walls: Wall panel's 5/8" gypsum board or 5/8" insulating OSB w/high impact resistant and expansion resistant qualities. Framing to be manufacturer's standard. Interior wall finish to be vinyl clad minimum.
- F. Roofing: Manufacturer's standard design.
- G. Ceiling: Pre-finished gypsum or OSB panel fixed ceiling system. Provide fireproofing as required by the OBC.
- H. Exterior Siding: Manufacturer's standard. Color as selected from manufacturer's standard range.
- I. Foundations Pads will be installed by owner.
- J. Doors, metal type, 36"x 80", glass lite in door, closer type and handle to be ADA compliant.
- K. Windows: Manufacturer's standard glass horizontal slider with insect screen.

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**2.3 MATERIALS - HVAC**

- A. HVAC: Equipment to be purchased and installed by owner.
- B. HVAC System Description: Each module shall have ceiling stub ducts w/diffusers affording each respective module temperature control. Ceiling diffusers to be Titus or equal with neck damper. Duct extension by owner.
- C. Thermostats: To be supplied and installed by owner.
- D. Exhaust Fans: Provide grill and stub duct for exhaust by owner.

**2.4 MATERIALS - PLUMBING**

- A. Plumbing Fixtures: Siphon jet water closet, and lavatories vitreous china in accordance with Fed Spec. WWP-54-1. Water closets to be floor mounted. Lavatories wall mount – ADA compliant installation. Toilet seats to be black open front style.
- B. Water Heaters: To be electric, Point of Use type, (1) 2.5 gal. w/1500 watt element for restroom, (1) 10 gal w/3000 watt element for lab, manufacturer to be Rheem or approved equal.
- C. Flush Valves: Diaphragm type with single lever, integral vacuum breaker, and equal to or less than 1.6 gallons per flush.
- D. Faucets: Center set with spout and aerator, 4-inch wrist action handles.
- E. Waste and Vent Piping: ABS DWV with solvent welded joints.
- F. Water Piping: Type "L" copper with soldered sweat fittings. Solder shall contain no lead.
- G. Fixture Traps and Drains: Chromium plated brass traps with screen inlet drain in lavatory. Provide adapters for dissimilar materials where required.

**2.5 MATERIALS - FIRE PROTECTION**

- A. Fire Extinguishers: Furnished by Others.
- B. Smoke Detectors: Provided by owner.

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**2.6 MATERIALS - ACCESSORIES**

- A. Tables and Chairs: Furnished by Owner.
- B. Desks: Furnished by Owner, except built-in work space desks in lab module.
- C. File Cabinets: Furnished by Owners for personnel module and furnished by vendor for laboratory.
- D. Office Equipment: Furnished by Owner.
- E. Office Partitions: Floor to ceiling partition between control room and break room to be furnished by vendor.
- F. Counter Tops: Personnel Unit: None required. Laboratory Unit: Chemical Resistant Epoxy Resin (see Dwg.-51D-5500-A-01361).
- G. Toilet Paper Dispenser: Jumbo roll tissue dispenser, Scott Model JRT.
- H. Soap Dispenser: McMaster-Carr #2379K32 or equal.
- I. Grab Bars: To be 1 1/2" aluminum, located per design (see 51D-5500-A-01362), ADA compliant.
- J. Mirror: 1/4" float glass, 16 inch by 30-inch size minimum size.

**2.7 FINISHES**

- A. Framing Members: Clean, prepare, and coat with manufacturer's standard undercoating system.
- B. Exterior Surfaces of Wall Components and Accessories: Manufacturer's standard, color as selected from manufacturer's standard range.

**PART 3 EXECUTION**

Not Used

**END OF SECTION**

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**SECTION 13910**

**BASIC FIRE SUPPRESSION MATERIALS AND METHODS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes design and installation of ordinary hazard scheduled pipe size system, including but not limited to, pipe, fittings, valves, and connections for combination sprinkler and standpipe systems.

**1.2 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
  - 2. ASME B16.3 - Malleable Iron Threaded Fittings.
  - 3. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- B. American Society for Testing and Materials:
  - 1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
  - 2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 3. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. American Water Works Association:
  - 1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
  - 2. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
- E. National Fire Protection Association:
  - 1. NFPA 13 - Installation of Sprinkler Systems.
  - 2. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
  - 3. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

1.3 SUBMITTALS

- A. Shop Drawings: Provide floor plan showing head locations. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- B. Product Data: Submit manufacturers catalogue information. Indicate valve data and ratings.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for basic fire suppression materials and methods.

PART 2 PRODUCTS

2.1 VALVES

- A. Gate Valves:
  - 1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
  - 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid [rubber covered] bronze or cast iron wedge, [flanged] [grooved] ends.
  - 3. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.
- B. Check Valves:
  - 1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
  - 2. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends [with automatic ball check].
  - 3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.
- C. Drain Valves:
  - 1. Compression Stop: Bronze with hose thread nipple and cap.

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**2.2 BURIED PIPING**

- A. HDPE Pipe: Existing piping is HDPE, SDR is unknown, pipe is approved for fire service. Match existing to post indicator valve.
- B. Cast Iron Pipe: AWWA C151.
  - 1. Fittings: AWWA C110, standard thickness.
  - 2. Joints: AWWA C111, rubber gasket.
  - 3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

**2.3 ABOVE GROUND PIPING**

- A. Steel Pipe: ASTM A53.
  - 1. Steel Fittings: ASME B16.9, carbon steel, butt welded; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
  - 2. Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM 47.
  - 3. Alternate use of grooved pipe and proprietary couplings such as victaulic is acceptable.

**2.4 PIPE HANGERS AND SUPPORTS**

- A. Conform to NFPA 13.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

**3.2 INSTALLATION**

- A. Install piping in accordance with NFPA 13 for sprinkler systems, and NFPA 24 for service mains.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

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- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install pipe sleeve at piping penetrations through footings and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
  - 1. Install in accordance with NFPA 13.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- H. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. All fire protection piping to be painted red.
- J. Do not penetrate building structural members.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- L. Install gate valves for shut-off or isolating service.
- M. Install drain valves at main shut-off valves, low points of piping and apparatus.

**END OF SECTION**

**SECTION 13930**

**WET-PIPE FIRE SUPPRESSION SPRINKLERS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

**1.2 REFERENCES**

- A. National Fire Protection Association:
  - 1. NFPA 13 - Installation of Sprinkler Systems.

**1.3 SYSTEM DESCRIPTION**

- A. System to provide coverage for entire building.
- B. Provide scheduled pipe size system to NFPA 13 ordinary hazard, Group 1 occupancy requirements.
- C. Determine volume and pressure of incoming water supply from water flow test data and provide to FCP.
- D. Interface system with building fire alarm system.
- E. Provide fire department connections with 5 inch STORZ connection.

**1.4 SUBMITTALS**

- A. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- B. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

**1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with NFPA 13.
- B. Maintain one copy of each document on site.

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**1.6 QUALIFICATIONS**

- A. **Installer:** Company specializing in performing Work of this section with minimum three years documented experience.

**1.7 WARRANTY**

- A. **Furnish 5 year manufacturer warranty.**

**PART 2 PRODUCTS**

- 1. **Fusible Link:** Fusible solder link type temperature rated for specific area hazard.

- B. **Exposed Area Type:**

- 1. **Type:** Standard upright type.
- 2. **Finish:** Brass.
- 3. **Fusible Link:** Fusible-solder link type temperature rated for specific area hazard.

**2.2 PIPING SPECIALTIES**

- A. **Wet Pipe Sprinkler Alarm Valve:** Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric flow switch with pressure retard chamber and variable pressure trim; with test and drain valve.
- B. **Water Motor Alarm:** Hydraulically operated impeller type alarm with aluminum alloy red enameled gong and motor housing, nylon bearings, and inlet strainer.
- C. **Water Flow Switch:** Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. **Fire Department Connections:**
  - 1. **Type:** Flush mounted wall type with chrome plated.
  - 2. **Outlets:** 5 inch Storz connection. Threaded dust-cap and chain of matching material and finish.
  - 3. **Label:** "Sprinkler - Fire Department Connection"

**2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. **Section 16150 - Wiring Connections:** Requirements for electrical characteristics.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. **Install in accordance with NFPA 13.**

**END OF SECTION**

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**SECTION 15050**

**PIPE, FITTINGS, VALVES, AND ACCESSORIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Mechanical requirements for the installation of potable water, instrument air, natural gas, storm and sanitary piping.
- B. Fittings.
- C. Specialty items.

**1.2 RELATED SECTIONS**

- A. Section 09900 - Painting.
- B. Section 15060 - Hinges and Supports.

**1.3 REFERENCE, CODES, AND STANDARDS**

- A. American Society of Mechanical Engineers (ASME):
  - 1. ASME A13.1 Scheme for the Identification of Piping Systems (R1993).
  - 2. ASME B16.25 Buttwelding Ends.
  - 3. ASME B31.3 Chemical Plant and Petroleum Refinery Piping.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
  - 2. ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 3. ASTM A194 Standard Specification for Carbon and Alloy Steel nuts for Bolts for High-Pressure and High-Temperature Service.
  - 4. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

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C. American Welding Society (AWS):

1. AWS A5.1-91 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.

1.4 SUBMITTALS

- A. Product data for valves and accessories as directed.
- B. Installation, maintenance, and operation instruction manuals, as appropriate.
- C. Welder, procedure, and examiner qualifications, qualification records, and welding procedure specifications.

1.5 QUALITY ASSURANCE PROGRAM

- A. Except where more stringent requirements are specified or indicated, the work specified herein shall conform to ASME 31.3
- B. Welding Procedures and Qualifications
  1. Fabrication, assembly, and erection shall be in accordance with ASME B31.3.
- C. Testing
  1. Testing shall be in accordance with ASME B31.3, in service tests.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging
  1. Materials shall be cleaned to remove chips, slag, weld spatter, oil, grease, debris, and other foreign material prior to packaging for shipment. All openings shall be covered, capped, or plugged shipment and storage.
- 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.

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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.

## PART 2 PRODUCTS

### 2.1 PRODUCTS/EQUIPMENT

#### A. Piping and Valve Specification

1. All piping materials, valves, and appurtenances shall meet the requirements specified in the applicable work section.
2. All valves shall be inherently capable of accepting a lock without use of extra equipment or devices.
3. Provide handwheel extensions or chain operators for valves not accessible from floor or platforms.

### 2.2 LABELING

#### A. Valve Identification

1. Each valve shall be identified with unique valve number and description, as shown on Piping and Instrumentation Diagrams. All field run valving not shown on Piping and Instrumentation Diagrams shall also be labeled in a similar manner.
2. 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, 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.

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### PART 3 EXECUTION

#### 3.1 ERECTION/INSTALLATION/APPLICATION

##### A. Layout, Cutting, and Fitting Up

1. Piping 2 inches in diameter and smaller shall be field routed and supported
2. All piping shall be normal 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. Springing of pipe is not acceptable. 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 made to protect against a tripping hazard.
7. Penetration, and flashing shall be provided as required. Flashing shall be placed around both sides of wall penetrating pipe.
8. Threading of steel pipe shall be done preferably after bending, forging, heat treating, or welding operations. Where subsequent threading is very difficult and treads are cut first, they shall be fully protected during the above-mentioned operations. Threads shall be concentric with the outside of the pipe.
9. Pipe dope shall be applied to male treads only. Teflon tape, when used as thread dope, shall not be applied to the first two threads.
10. Branch connections shall not intersect the longitudinal seam of Electric Resistance Weld headers.

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**B. Welding.**

1. All welding electrodes shall be in accordance with AWS A5.1.

**C. Flanged Joints**

1. The mating surfaces of the flanges shall be in a plane that is perpendicular to the axis of the pipe. Flanges shall be rotated so that the bolt holes straddle the vertical flange centerline. All gaskets shall be evenly centered between the flange faces. 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 manufacture's recommended range and tightening sequence.
2. All flanged joints shall be made with new gasket and bolting materials. Bolts and nuts damaged during installation shall be replaced.
3. 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.
4. Provide ASTM A307 Grade B cap screws for bolting flanges to lug type Butterfly valves or equivalent.

**3.2 QUALITY CONTROL**

**A. Inspections and Tests**

1. Piping shall be visual leak checked with service medium at normal operating pressure.
2. All connections/joints (including welds) shall be left uninsulated and exposed for examination for leakage during testing.

**END OF SECTION**

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**SECTION 15060**

**HANGERS AND SUPPORTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe and equipment hangers and supports.
- B. Equipment bases and supports.

**1.2 REFERENCES**

- A. ASME B31.3 - Process Piping
- B. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

**1.3 SUBMITTALS**

- A. Product Data: Provide manufacturers catalog data including load capacity.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

**PART 2 PRODUCTS**

**2.1 PIPE HANGERS AND SUPPORTS**

**A. Piping Systems:**

1. Conform to ASME B31.3.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple Hangers: Welded steel bracket with U-bolt guides or clevis hangers as required.
5. Wall and fabricated Supports: Welded steel bracket with U-bolts.

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- 6. Vertical Support: Steel riser clamp.
- 7. Floor Support: Pipe leg with floor flange.

**2.2 ACCESSORIES**

- A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

**2.3 FLASHING**

- A. Metal Flashing: 26 gage galvanized steel.
- B. Metal Counterflashing: 22 gage galvanized steel.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

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

**3.2 PIPE HANGERS AND SUPPORTS**

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 24 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Where several pipes can be installed in parallel and at same elevation, provide multiple hangers.
- F. Support riser piping independently of connected horizontal piping.

**3.3 FLASHING**

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls.

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3.4 SCHEDULES

A. Metal Piping

<b>PIPE SIZE</b>	<b>MAX. HANGER SPACING</b>	<b>HANGER ROD DIAMETER</b>
<u>Inches</u>	<u>Feet</u>	<u>Inches</u>
1/2 to 1-1/4	7	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	12	1/2
4 to 6	14	5/8

**END OF SECTION**

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**SECTION 15160**

**STORM DRAINAGE PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Storm water piping buried beyond 5 feet of building.
2. Storm water piping buried within 5 feet of building.
3. Downspouts.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

- A. Modifying existing piping as indicated.**

**END OF SECTION**

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**SECTION 15195**

**PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Domestic Water Piping.
  - 2. Miscellaneous Utility Piping.
  - 3. Flanges, unions, and couplings.
  - 4. Pipe hangers and supports.
  - 5. Valves.
  - 6. Strainers.
  - 7. Insulation.

**1.2 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. American Society for Testing and Materials:
  - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. ASTM B31.3 Process Piping

**1.3 QUALITY ASSURANCE**

- A. Piping work in accordance with ASTM B31.3.

**PART 2 PRODUCTS**

**2.1 DOMESTIC WATER PIPING**

- A. Copper tubing, ASTM B88 type most with ASME B16/22 wrought copper fittings and lead free solder joints.

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**2.2 MISCELLANEOUS UTILITY PIPING**

- A. Steel pipe, ASTM A53, schedule 40 black steel, with screwed fittings and malleable iron class 150 fittings.
- B. PVC pipe, ASTM D1785, schedule 40 with ASTM D2665 PVC fittings, solvent welded.

**2.3 INSULATION**

- A. Provide Armstrong Armaflex flexible elastomeric thermal insulation, ½ inch thick, for all exposed cold domestic water piping, and cooling water piping for compressors.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

**3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS**

- A. Install pipe hangers and supports in accordance with Section 15060.

**3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS**

- A. Install domestic water piping in accordance with ASTM B31.3.

**END OF SECTION**

## **SECTION 15214**

### **COMPRESSED AIR SYSTEMS**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

###### **A. Section Includes:**

1. Compressed air piping.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Flexible connectors.
6. Relief valves.
7. Compressed air outlet.
8. Oil free air compressor.
9. Compressed air after cooler.
10. Desiccant compressed air dryer.
11. Air receiver.
12. Air pressure reducing valve.
13. Pressure regulators.
14. Compressed air filters.

##### **1.2 SUBMITTALS**

- A. **Shop Drawings:** Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels.
- B. **Product Data:**
  1. **Piping:** Submit data on pipe materials, fittings, and accessories.
  2. **Valves:** Submit manufacturers catalog information with valve data and ratings for each service.
  3. **System Components:** Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes. When applicable, include electrical characteristics and connection requirements.
  4. **Compressors:** Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.
- C. **Product Data:** Submit manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

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- D. **Manufacturer's Installation Instructions:** Submit hoisting and setting requirements, starting procedures.
- E. **Manufacturer's Certificate:** Certify products meet or exceed specified requirements.

### 1.3 CLOSEOUT SUBMITTALS

- A. **Project Record Documents:** Record actual locations of equipment piping, valves, outlets and components.
- B. **Operation and Maintenance Data:** Submit assembly views, lubrication instructions, replacement part numbers and availability.

### 1.4 QUALITY ASSURANCE

- A. **Perform Work in accordance with ASME B31.3 code** for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. **Perform Work in accordance with AWS D1.1 for welding hanger and support attachments** to building structure.

## PART 2 PRODUCTS

### 2.1 COMPRESSED AIR PIPING

- A. **Steel Pipe:** Electric-resistance welded steel, ASTM A53/A53M, carbon steel grade B seamless, Schedule 40.
  - 1. **Fittings:** Class 150, ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
  - 2. **Joints:** Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.
- B. **Copper Tubing:** ASTM B68 or ASTM B75, 3/8 inch dia.
- C. **Stainless Steel Pipe:** ASTM 269, .5 inch OD by 0.035 inch Wall, certified for use with compression joint system.
  - 1. **Fittings and Joints:** Compression type unless otherwise noted.

### 2.2 UNIONS AND FLANGES

- A. **Unions for Pipe 2 inches and Smaller:**
  - 1. **Ferrous Piping:** Class 150, malleable iron, threaded.
  - 2. **Copper Piping:** Class 150, bronze unions with soldered joints.

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- 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
  - 4. Stainless Steel Piping: 300 psig, threaded type with compression type ends.
- B. Flanges for Pipe 2-1/2 inches and Larger:
- 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
  - 2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

**2.3 BALL VALVES**

- A. Manufacturers:
- 1. Apollo Valve, Model 73-140.
  - 2. Substitutions: Approved equal
- B. 2 inches and Smaller: MSS SP 110, Class 200, Carbon Steel body, type 316 stainless steel ball, full port, Teflon seats, blowout proof stem, threaded ends with locking lever handle.

**2.4 CHECK VALVES**

- A. Horizontal Swing Check Valves:
- 1. Manufacturers:
    - a. Crane Valve, class 200, Model 36.
    - b. Substitutions: Approved equal
  - 2. 2 inches and Smaller: MSS SP 80, Class 200, bronze body and cap, bronze seat, brass disc, threaded ends.

**2.5 PIPE HANGERS AND SUPPORTS**

- A. Conform to ASME B31.3 – 2002 Process Piping, MSS SP 58 – 1993 Hangers and Supports
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch : Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

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- F. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

**2.6 SAFETY/RELIEF VALVES**

- A. Manufacturers:
  - 1. Anderson Greenwood, Series 80
  - 2. Dresser Consolidated, Series 1900
  - 3. Substitutions: Approved Equal
- B. Furnish materials in accordance with ASME Section VIII.
- C. Safety/Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

**2.7 COMPRESSED AIR OUTLETS**

- A. Compressed Air Outlets: Quick Connector: 3/8 inch brass, snap on connector with self closing valve.

**2.8 AIR COMPRESSOR**

- A. Manufacturers:
  - 1. Atlas Copco Model: AQ30-10 Sullair, or equal.
  - 2. Substitutions require approval of engineering.
- B. Air Compressor: Duplex Compressor units consisting of water-cooled screw compressor, air receiver, after cooler, separator and operating controls.
- C. Screw Compressors:
  - 1. Unit: Direct drive, open drive, 3600 RPM, fixed compression, rotary screw compressor with control panel.
  - 2. Features: Water cooled and lubricated pump, separator and compressor bearings.
  - 3. Motor: Induction, close coupled to compressor.
  - 4. Control Panel: Factory mounted and wired 'ELEKTRONIKON' microprocessor based control/monitor operating system with an alphanumeric user interface.
    - a. Non-fused molded-case, disconnect switch.
    - b. Single point power connection and grounding lug.
    - c. Anti-recycle timer.

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- d. Solid state overload relay for each compressor.
- e. Phase loss-reversal monitor.
- f. Cycle counter and hour meter for each compressor.
- g. Automatic shutdown on compressor overload. (See Safety/monitoring)
- 5. Automatic Capacity Reduction: Load/No Load Operatic through slide valve.
  
- D. Thermostatic Water Valve: To maintain water temperature through compressor at 104 degrees F to 122 degrees 125 F.
  
- E. Capacity:
  - 1. Continuous Delivery: 125 cfm at #6 psig.
  
  - 2. Water Cooled:
    - a. Water flow: 9.5 gpm.
    - b. Entering water temperature: 104 degrees F.
    - c. Leaving water temperature: 122 degrees F.
    - d. Pressure drop: 2.2 psi.
  
- F. Electrical Characteristics:
  - 1. 40 hp
  - 2. 480 volts, three phase, 60 Hz.
  
- G. Controls:
  - 1. Provide a complete load regulation and control system with the compressor. Provide additional electrical, electro-pneumatic, or solid state electronic controls for other specified control and monitor functions. All electrical controls shall conform to NEMA ICS 2 as selected by the compressor manufacturer. Control system enclosure shall conform to NEMA ICS 6. Controls shall be suitable for individual operation of the compressor or parallel operation with one or more other compressors.
  
- H. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.
  
- I. Disconnect Switch: Factory mount in control panel.
  
- J. Compressor Start-up: The compressor shall start unloaded. The manual starting circuit for the compressor shall have interlocks to prevent the compressor drive motor from starting until cooling water pump water flow has been established to the required values for safe operation as determined by the compressor manufacturer.

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- K. **Load Regulation:** The compressor shall operate continuously at constant speed after being started. Provide means to load and unload the compressor automatically at preset minimum and maximum pressure settings. Minimum pressure shall be 100 psig and maximum shall be 125 psig. Unloading shall be accomplished by a combination of closing the inlet valve and bypassing or venting the outlet of the compressor; however input power at fully unloaded operation shall not exceed 20 percent of the full load input.
  
- L. **Safety and Monitoring Controls:** Solid state electronic controls to provide alarm and shutdown requirements, plus interlocks with accessories.  
Requirements are as follows:
  - 1. Shutdown requirements shall cause the controlled compressor to shut down, energize alarms, and light labeled red lights.
  - 2. Alarm only requirements shall not cause the controlled compressor to shut down, but shall sound the same alarm and light labeled amber lights.
  - 3. Light only requirements shall not cause the controlled compressor to shut down, but shall light labeled amber lights.
  - 4. The individual monitor and safety controls shall be as follows:
    - a. High Discharge Air Temperature (275 deg F/ 135 deg C) – Controlled compressor shuts down, alarm goes off, and lights go on.
    - b. High Aftercooler Discharge Water Temperature – Controlled compressor does NOT shut off, but lights go on.
    - c. High Cooling Water Supply Temperature - Controlled compressor does NOT shut off, but lights go on.

**2.9 COMPRESSED AIR AFTER COOLER**

- A. **Manufacturers:** Atlas Copco, furnished as part of Air Compressor unit.

**2.10 FLUID COOLER**

- A. **Manufacturers:**
  - 1. AirTek Model: SF2040
  - 2. Substitutions: Require Approval of Engineering.
  
- B. **Fluid Cooler:** Self-contained fluid cooler, expansion tank and pump, pre-piped and pre-wired.
  
- C. **Standard Equipment:**
  - 1. Connections: Inlet and outlet connections NPT.
  - 2. Pump: Close coupled centrifugal
  - 3. Gauges: Temperature in and out, Pressure in and out.
  - 4. Safety Relief valve
  - 5. Controls: NEMA one junction box

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- 6. Electric: 230/460 V, 3 phase, 60 HTZ
- 7. Wiring: 460 V
- 8. Controls to have provisions to interlock with compressors so pump runs on compressor start-up.

D. Coolant: Mix 30 percent glycol and 70 percent water solution by volume of distilled water and Dowfrost HD propylene glycol. Fill cooler system with mixture.

**2.11 DESICCANT COMPRESSED AIR DRYER**

- A. Manufacturers:
  - 1. Van Air Systems Inc. Model: HI-150
  - 2. Substitutions: Require Approval of Engineering.
- B. Desiccant Compressed Air Dryer: Self contained, dual tower type containing absorbent desiccant, complete with drain connection, and controls.
- C. Operation: Solid state controller automatically switches operation between towers; NEMA Type (1) enclosure.
- D. Towers: ASME Section VIII designed and constructed pressure vessels. Design Working Pressure: 150 psig Flange - 150# or threaded inlets and outlets.
- E. Components:
  - 1. Automatic float drain valve.
  - 2. Single coalescing-particulate pre-filter.
  - 3. Dual particulate after-filter.
  - 4. Air inlet temperature gage mounted on each tower.
  - 5. Air inlet pressure gage mounted on each tower.
  - 6. On-off switch.
  - 7. Pressure gage mounted on each tower.
  - 8. Pressure/Safety valve mounted on [each] tower.
  - 9. Adjustable air purge control.
  - 10. Purge air flow indicator.
  - 11. Purge muffler.
- F. Capacity:
  - 1. Incoming Air: 100 degrees F atmospheric dew point.
  - 2. Rated Air Flow: 150 at 100 psig.
  - 3. Inlet Air Pressure: 125 psig.
  - 4. Discharge Air - minus 40 degrees F pressure dew point.
- G. Electrical Characteristics:
  - 1. 460 volts, three phase, 60 Hz.
  - 2. 115 Volt - control power

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**2.12 COMPRESSED AIR FILTERS – to be skid mounted with Dryer**

- A. **Manufacturers:**
  - 1. Van Air Model:F200-150-1-C for Dryer Inlet side
  - 2. Van Air Model: F200-150-1-RD for Dryer outlet side
  - 3. Substitutions: Approved equal
  
- B. **Coalescing Filters:** Furnish with activated carbon capable of removing water and oil aerosols, with color-change dye indicating when carbon is saturated and warning light indicating when maximum pressure drop has been exceeded.

**2.13 AIR RECEIVER**

- A. **Manufacturers:**
  - 1. Hanson Model: 36-VA-400-R
  - 2. Substitutions: Approved equal
  
- B. **Air Receiver:** Vertical, built to ASME Section VIII regulations for working pressure of 125 psi. Flange or screw inlet and outlet connections.
  
- C. **Fittings:** Adjustable pressure regulator, safety valve, pressure gage, drain valve, and automatic float actuated condensate trap.
  
- D. **Tank Finish:** Shop primed.
  
- E. **Size:**
  - 1. Diameter: 36 inches.
  - 2. Length: 98 inches.
  - 3. Capacity: 400 gallons.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. **Verify connection to existing piping system, size, location, and invert are as indicated on Drawings. (P&ID – 51D-5500-N-01368)**

**3.2 PREPARATION**

- A. **Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.**
- B. **Remove scale and dirt on inside and outside before assembly.**
- C. **Prepare piping connections to equipment with flanges or unions.**
- D. **Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.**

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**3.3 INSTALLATION - HANGERS AND SUPPORTS**

- A. Install hangers and supports in accordance with ASME B31.3 and MSS SP 58.

**3.4 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS**

- A. Install drip connections with valves at low points of piping system.
- B. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.
- C. Install compressed air couplings, female quick connectors, and pressure gages [where outlets are indicated] [as indicated on Drawings].
- D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- E. Cut pipe and tubing accurately and install without springing or forcing.
- F. Slope piping in direction of flow.
- G. Stainless Steel Pipe with press-type Joints: Square cut ends to plus or minus 0.030 inches tolerance. Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting during assembly. Press joint using manufacturer's tool with proper sized jaw.
- H. Copper Pipe with press-type Joints: Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting. Check alignment against mark to assure tubing is fully inserted. Press joint using manufacturer's tool.
- I. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Refer to Section 15050.
- J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Install pipe identification in accordance with Section 15050.
- K. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.
- L. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.
- M. Install strainers on inlet side of pressure regulators .

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### INSTALLATION - EQUIPMENT

- A. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side.
- B. Install air compressor unit on vibration isolators. Level and bolt in place.
- C. Install air valve and drain connection on horizontal casing.
- D. Install line size shut-off valve and check valve on compressor discharge.
- E. Install replaceable cartridge type filter silencer for each compressor.
- F. Install shut-off valve on water inlet to after cooler. Pipe drain to floor drain.
- G. Install condensate drain piping to nearest floor drain.
- H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.
- I. Provide bypass with valves, around receivers.

### 3.6 FIELD QUALITY CONTROL

- A. **Compressed Air Piping Leak Test:** Prior to initial operation, clean and test compressed air piping using a test pressure of 220 psig in accordance with ASME B31.3. Test gauges shall be calibrated within six months of use and calibration shall be traceable to NIST standards. Test media to be dry, compressed air.
- B. **Preliminary Leak Test Procedure:** Gradually pressurize piping system to 25 psig. Maintain 25 psig pressure for a minimum of 10 minutes. Visually examine joints and connections for major leaks.
- C. **Final Leak Test Procedure:** Gradually pressurize piping system to 50 percent of test pressure. Increase pressure in increments of 10 percent of test pressure until test pressure is reached. Maintain test pressure for a minimum of 10 minutes. Reduce pressure to design pressure. Soap welds, joints and connections while system is at test pressure, Depressurize system.
- D. **Acceptance Criteria:** No continuous bubble formation is allowed.
- E. **Instruments:** Reconnect instruments and equipment and retest connections at maximum operating pressure.

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**3.7 CLEANING**

- A. Isolate compressors and other equipment that could be harmed by purging or flushing action. Block control valves in open position. Remove instruments or other equipment that could be adversely affected by flow or accumulation of particles cleaned by purge procedure.
- B. Introduce dry, oil-free compressed air at remote end of piping system. Where possible, flow from upstream side of globe or check valves. If not possible, remove globe or check valves and replace with spool pieces.
- C. Open each branch or drop of piping system to purge entire system for specified minimum period.
- D. Purging: Flow dry, oil-free compressed air through piping system at a minimum inlet pressure of 50 psig until a -40 deg F dew point at outlet points is reached. Hold for a minimum of 10 minutes.
- E. Reconnect isolated, removed or bypassed items after completion of purge.

**END OF SECTION**

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**SECTION 15733**

**PACKAGED TERMINAL AIR CONDITIONING UNITS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  1. Packaged terminal heat pump units.

**1.2 REFERENCES**

- A. Air-Conditioning and Refrigeration Institute:
  1. ARI 310/380 – Packaged Terminal Air-Conditioners and Heat Pumps.

**1.3 SUBMITTALS**

- A. Product Data: Submit data indicating capacity, dimensions, rough-in connections, and electrical characteristics and connection requirements.

**1.4 QUALITY ASSURANCE**

- A. Test and rate packaged terminal heat pumps in accordance with ARI 310/380.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Accept units on site in factory packaging Inspect for damage.
- B. Protect units from damage by providing temporary covers until construction is complete.
- C. Protect items shipped loose with units in original packaging and store in secured area.

**PART 2 PRODUCTS**

**2.1 PACKAGED TERMINAL HEAT PUMP UNITS**

- A. Self-Contained Wall Mount Heat Pump units with independent heat exchanger coil in supply air to provide dehumidification circuit.
- B. Office Unit (AC-1) to be Bard WH 302DC-09, 460 Volt, 3 phase with accessory Bard 8403-047 dehumidistat and Bard 84303-049 programmable thermostat.
- C. Lab Unit (AC-2) to be Bard WH 362DC-09, 460 Volt, 3 phase with accessory Bard 8403-047 dehumidistat and Bard 8403-049 programmable thermostat.

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2.2 SCHEDULES

PACKAGED TERMINAL AIR CONDITIONING UNITS

Drawing Code	AC-1	AC-2
Location	Office	Lab
Manufacturer	Bard	Bard
Model Number	WH302DC-09	WH362DC-09
Supply Air		
Air flow	1,000	1,100
Outside air flow	150	175
Cooling		
Rated cooling output	30,000	35,400
Entering air temperature (dry bulb)	80	80
Entering air temperature (wet bulb)	67	67
Condenser ambient air temperature	95	95
Electric Heating		
Electric resistance heating capacity	9 kw	9 kw
Heat Pump Heating		
Rated heating output	28,000	34,200
Electrical		
Voltage	460	460
Phase	3	3

END OF SECTION

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**SECTION 16050**

**BASIC ELECTRICAL MATERIALS AND METHODS**

**PART 1 GENERAL**

**1.1 GENERAL**

- A. The Drawings and Specifications determine the general arrangement and locations of the equipment, conduit, and associated wiring of the electrical systems as covered in these Specifications.
- B. With the approval of Fluor Fernald, make all reasonable modifications as may be needed to prevent conflict with the Work of other trades and for proper execution of this Work.
- C. Inspect the area in which the Work is to be performed and note any obstructions to the placement of equipment or other material to be installed.

**1.2 DESCRIPTION OF WORK**

- A. The Work covered by these Specifications consists of the installation of all electrical equipment and systems, or partial systems, as shown on the Drawings and as specified herein. Furnish all labor and material required for the complete installation of the electrical equipment, systems and partial systems unless otherwise specified.
- B. Whenever the Drawings or Specifications require the installation of any apparatus or equipment, furnish any apparatus or equipment and, unless otherwise specified, connect same, test and leave it ready for operation.
- C. The installation shall be in strict accordance with the latest edition of the National Electrical Code (NFPA 70).

**1.3 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.
- B. NECA "Standard of Installation."
- C. UL - Underwriter's Laboratories
- D. OSHA - Occupational Safety and Health Administration

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57.93 1.4 QUALITY ASSURANCE

- A. The Work shall be in strict conformance with these Drawings and Specifications. Follow the Drawings in routing out the Work where specific locations are given for conduits or equipment. Refer to all architectural, heating and ventilating, mechanical, piping, and structural drawings to verify the spaces in which all other Work will be installed.
- B. Unless otherwise noted on the Drawings or specified, all materials furnished shall be new, of industrial grade, and shall conform to the standards of the Underwriter's Laboratories, where such a standard has been established for the particular type of material.
- C. Installation workmanship shall be of the best quality and skill. The completed installation shall present a neat mechanical appearance.
- D. Gauges: Unless otherwise specified, all wire and cable sizes given in this Specification or on the Drawings shall be understood to be in American Wire Gauge, and thickness of metal in U.S.S. Sheet Steel Gauge.

1.5 SUBMITTALS

- A. Submit product data for materials and equipment.

1.6 PROJECT RECORD DOCUMENTS

- A. Provide "red lined" drawings showing "as-built" changes to the original drawings. They shall be given to Fluor Fernald at the time of contract completion.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site.
- B. Inspect for damage.

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## 1.9 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- C. Do any cutting necessary for proper installation of electrical work and repair same.
- D. All penetrations through or removal of any asbestos materials shall be handled according to current Site rules and permits.
- E. Cutting, drilling, or tapping of building structural members shall not be permitted, except where approved by Fluor Fernald.

## PART 2 PRODUCTS

### 2.1 MATERIAL - GENERAL

- A. Furnish and install all materials required for the complete installation called for on the Drawings and in the Specifications except where otherwise noted. Upon receipt of electrical material and equipment, inspect, test, sign for, and assume full responsibility for damage or loss.
- B. All parts have generic description on the Drawings. Certain vendor part numbers are noted as aids to obtaining the correct materials and are not to imply that this is the only material acceptable. All materials are to be approved by Fluor Fernald.

### 2.2 CONDUIT - GENERAL

- A. Conduit shall be supported by approved conduit hangers.
- B. Conduit connections to motors on sliding bases or other electrical equipment subject to movement for position adjustment or subject to excess vibration shall be made with liquid-tight flexible conduit or Type SO cable.
- C. Liquid-tight flexible conduit termination shall be made with a liquid-tight connector.
- D. Type SO cable shall be terminated in a sealing grip connector.

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5793 2.3 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Rigid Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit, aluminum fittings may be used with steel conduit.
- D. Electrical Metallic Tubing (EMT): ANSI C80.3; galvanized tubing.
- E. EMT Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, compression or set screw type.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel or aluminum construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1.

2.5 NONMETALLIC CONDUIT

- A. Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 FITTINGS, JUNCTION BOXES, AND PULL BOXES

- A. Fittings, junction boxes, and pull boxes installed outdoors and in indoor process areas shall be water-tight with rubber gasketed covers.
- B. Sheet metal junction boxes and pull boxes shall be galvanized steel unless otherwise shown or specified.
- C. Nuts, bolts, screws or other fastening devices used in the fabrication or installation shall be brass or cadmium plated steel unless otherwise noted.

2.7 WIRE AND CABLE

- A. All wires and cables shall be of the size shown on the Drawings and shall comply with the material specifications on the Drawings or as herein specified. All wires and cables shall be 600 volt rating, copper, type THWN unless otherwise shown on the Drawings or Specifications.

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- B. Power wiring shall be stranded unless otherwise shown or specified.
- C. Control wiring shall be stranded and shall be marked at each terminal with a permanent tag or adhesive marker and shall be marked in accordance with wiring diagram identification.
- D. Splices and taps shall be made with solderless cable connectors. Where cable connectors are used, it is important that all contact surfaces shall be cleaned to insure maximum conductivity.
- E. Stranded wire shall be terminated in screw type or crimped pressure lugs.

2.8 MOTOR CONTROL

- A. Motor starters shall be equipped with the proper sized overloads in accordance with motor nameplate data (obtained by field inspection) and the starter manufacturer's recommendations. Fluor Fernald approval is to be obtained for the overloads selected prior to their installation.
- B. Fuses for switches and combination starters and control circuits shall be dual element type of the voltage and ampere ratings indicated on the Drawings.

2.9 EQUIPMENT GROUNDING

- A. Equipment grounding conductors shall be copper, either bare or green color insulated. Where aluminum conduit is used, only green color insulated conductor is acceptable.

2.10 IDENTIFICATION

- A. Each item of electrical equipment, circuit breakers, switches, transformers, existing panels (T-189), etc., shall be identified by means of a white and black laminated plastic nameplate with black letters on white background. All wires shall be numbered with circuit breaker number and equipment with panel ID and circuit number.

2.11 INSPECTION AND TESTING

- A. Receptacle circuit tester: Leviton Model 6185 or approved equal.
- B. Insulation resistance test: 1,000 volt Biddle megger test set or approved equal.

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**579 PART 3 EXECUTION**

**3.1 INSTALLATION - GENERAL**

- A. Install work in accordance with the National Electric Code, NFPA 70.
- B. Comply with OSHA safety requirements during construction operations.

**3.2 CONDUIT INSTALLATION**

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Conduits shall be continuous from outlet to outlet, and from fitting to fitting.
- E. Conduits shall be secured to all boxes and fittings in such a manner that each system shall be electrically continuous and mechanically secure from point of service to all outlets.
- F. Terminations of heavy wall conduit ends shall be furnished with two lock nuts and one insulating bushing, except where threaded into hubs.
- G. Hangers shall be attached with cinch anchors, toggle bolts or threaded connectors, as required by the prevailing conditions. Existing conduit supports shall be used wherever practicable.
- H. Conduits shall in no case be secured directly to any piping or ducts, except where specifically noted as shown.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route conduit parallel and perpendicular to walls using right angle bends, except where specifically shown or noted on Drawings.
- K. Route conduit in and under slab from point-to-point.
- L. Do not cross conduits in slab.
- M. Maintain 3 inches minimum clearance between conduit and piping.
- N. Maintain 12 inches clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

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- O. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- R. The length of flexible conduit or SO cable shall be held to the minimum required to provide the necessary movement.
- S. When SO cable is used, one conductor (green) is to be utilized for a ground.
- T. Use conduit bodies to make sharp changes in direction, as around beams.
- U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- W. Provide suitable pull string in each empty conduit except sleeves and nipples.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. Right angle turns or tees shall consist of symmetrical bends or cast fittings. Bends and offsets shall be avoided wherever possible. Field bends shall be made so as to avoid changing the internal diameter of the conduit and so as not to damage the internal or external protective coating. Bends and offsets shall be free from kinks, indentations, or flattened surfaces and shall be made with approved conduit bending machines or devices. The use of heat in bending metallic conduits shall not be permitted.
- Z. Extreme care shall be exercised to prevent the accumulation of water, concrete or other foreign materials in conduits during execution of the Work. Conduits in which foreign material has accumulated shall be thoroughly cleaned. Where such accumulations cannot be removed by methods approved by Fluor Fernald, the conduit run shall be replaced.
- AA. Conduit unions or other threaded couplings shall be used where required. Split and welded couplings, running threads or other makeshift methods of joining heavy wall conduits shall not be permitted except where specifically shown on the Drawings.

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### 3.3 FITTINGS, JUNCTION BOXES, AND PULL BOXES

- A. All necessary fittings, junction boxes, and pull boxes required for complete installation shall be installed whether shown on the Drawings or not.

### 3.4 WIRE AND CABLE

- A. Wires and cables shall be installed in a conduit system after the conduit system has been completely installed. Wires and cables shall not be taped or tied together, except for pulling purposes, prior to pulling in conduit unless otherwise shown on the Drawings or specified.
- B. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet boxes, junction boxes, or wiring troughs.  
**Exception:** Fixture drops from "T" type conduit fittings, ground wire, and in junction fittings adjacent to small coil devices without splice box.
- C. Splices shall be properly insulated and shall provide insulation not less than that of the insulation of the conductors.
- D. The best care shall be exercised while installing wire in conduit so as not to injure the conductor insulation. No oil, grease, or compound other than an approved wire pulling compound shall be used in pulling conductors.
- E. Panel wiring shall be done in neat and workmanlike manner. Control wiring shall be installed in a wiring channel or formed and tied to present a neat mechanical appearance.
- F. Wire insulation may be any color with the exception that white or gray shall be used for neutrals only and green shall be used for equipment grounding only.

### 3.5 MOTOR CONTROL

- A. Adjustable circuit breakers of combination starters so equipped shall be adjusted to the lowest setting which will permit the motors to start. All poles shall be set to the identical set point.

### 3.6 EQUIPMENT GROUNDING

- A. All electrical equipment, including panelboards, junction boxes, safety switches, etc., shall be securely grounded. Existing grounding systems shall be retained and utilized as appropriate.
- B. Under no circumstances shall conduit be used as an equipment grounding conductor.

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- C. Equipment grounding conductors, where not otherwise specified, shall be sized in accordance with the National Electric Code. Grounding electrode conductor shall be sized per NEC Table 250-94.
- D. In all buildings, the conduit system, piping, metallic tubing and all other members which may act as a current carrying path to ground shall be effectively bonded together to keep the electrical potential differential essentially at or very near zero.

**3.7 IDENTIFICATION**

- A. Nameplates shall be properly attached to equipment and so located as to be visible from the front. Nameplates shall be attached by screws where practical.
- B. Furnish and install all nameplates where Drawings call for labeling equipment.

**3.8 INSPECTION AND TESTING**

- A. All electrical equipment, materials and systems installed in the facility shall be thoroughly tested for satisfactory operation in accordance with applicable industry standards and as herein specified to determine compliance with the Drawings and Specifications.
- B. Wire and cable shall be visually inspected prior to installation for faulty insulation. Before connection to equipment, all wire shall be tested for resistance to ground.
- C. Visually inspect all field connections for proper phasing and connections. Phasing to be A, B, C clockwise at all three phase disconnects.
- D. Furnish all test equipment for the proper and safe conductance of all tests. Repair or replace all circuit components where test values are unacceptable. The repair or replacement of circuit components damaged during testing will not constitute a reason for Contract revision.
- E. All testing shall be performed in the presence of and with the approval of Fluor Fernald QC and, where applicable, the manufacturer's service engineer. All parties shall be notified in writing seven (7) days in advance of any tests to be performed to allow ample time for them to arrange their schedule for witnessing the test.
- F. Perform continuity and operational tests on receptacle, power and control circuits.
- G. Check all control and interlocking wiring for proper operation. Perform operational tests with Fluor Fernald to assure that wiring has been properly installed.

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- H. Perform insulation resistance test on 480 volt circuits and on motors phase to ground after installation and before energizing. Investigate causes and take remedial action when insulation resistance tests indicate a significant downward trend in the resistance readings. Insulation resistance shall be one megohm or greater.
  
- I. Do not perform insulation resistance test of circuits operated at or below 120 volts, on solid state equipment, static ground fault devices, including ground fault circuit interrupters, or on any circuit connected to equipment containing solid state devices, unless such test is authorized by, and is performed in strict accordance with equipment manufacturer's recommendations.
  
- J. All test and calibration data must be recorded on approved data sheets and submitted to Fluor Fernald for review. All gauges must be calibrated and traceable to the National or NIST Standards.

**END OF SECTION**

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**SECTION 16095**

**MINOR ELECTRICAL DEMOLITION**

This section includes basic methods for demolition and repair of disrupted existing electrical work.

This section includes performance, proprietary, and description type specifications.

**PART I – GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
2. Disposal of materials
3. Storage of removed materials
4. Identification of utilities
5. Salvaged items.
6. Protection of items to remain (as scheduled at end of section) (as indicated on Drawings).
7. Relocate existing equipment to accommodate construction.

**1.2 QUALITY ASSURANCE**

- A. Perform Work in accordance with Site Standards.**

**1.3 SCHEDULING**

- A. Schedule work to coincide with new construction.**

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#### 1.4 COORDINATION

- A. Conduct demolition to minimize interference with adjacent (and occupied) building areas.
- B. Coordinate demolition work with Fluor Fernald personnel.
- C. Coordinate and sequence demolition so as not to cause shutdown of operations of surrounding areas.
- D. Identify salvage items in cooperation with Owner.

#### PART 2 – PRODUCTS

Not Used

#### PART 3 – EXECUTION

##### 3.1 EXAMINATION

- A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- B. Verify termination points for demolished services.

##### 3.2 PREPARATION

- A. Erect, and maintain temporary safeguards, (including warning signs and lights,) (barricades,) (and similar measures,) for protection of the employees, and existing improvements to remain.
- B. Install temporary egress signage and emergency lighting when required.

##### 3.3 DEMOLITION

- A. Remove exposed abandoned conduit. Cut conduit flush with walls and floors and patch surfaces.
- B. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- C. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

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- D. Reconnect equipment being disturbed by renovation work and required for continued service to electrical panels with site construction manager's approval.
- E. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring, which are not part of final project.
- F. Install temporary wiring and connections to maintain existing system in service during construction.
- G. Perform work on energized equipment or circuits with experienced and trained personnel.
- H. Remove, relocate, and extend existing installations to accommodate new construction.
- I. Repair adjacent construction and finished damaged during demolition and extension work.
- J. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components (including abandoned components above accessible finished ceiling). Cut embedded support elements flush with walls and floors.
- K. Clean and repair existing equipment to remain or to be installed.
- L. Protect and retain power to existing active equipment remaining.
- M. Cap abandoned empty conduit at both ends.

**3.4 EXISTING PANELBOARDS**

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse available circuits. Install new breakers.
- B. Tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or circuits not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where more than three circuits have been modified or rewired.

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**3.5 SALVAGE ITEMS**

- A. Remove and protect items indicated on Drawings to be salvaged and turn them over to construction manager.
- B. Items of salvageable value may be removed as work progresses.

**3.6 REUSABLE ELECTRICAL EQUIPMENT**

- A. Carefully remove equipment, materials, or fixtures which are to be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
- C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test each fixture to see if it is in good working condition before installation at new location.

**3.7 CLEANING**

- A. Keep workplace neat.

**3.8 SCHEDULES**

- A. Remove, store and protect the facility materials and equipment to maintain construction schedule:

**END OF SECTION**

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Approved:

**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 11010 - General Requirements
- B. Section 01011 - Submittals.
- C. Section 13401 - Process Control System.
- D. Section 16370 - Overhead Power Distribution.

**1.3 REFERENCES 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 455-60-89<br>FOTP-60   | Measurement of Fiber or Cable Length<br>Using and OTDR.                      |
| 2. EIA/TIA 455-61-89<br>FOTP-61   | Measurement of Fiber or Cable<br>Attenuation Using and OTDR.                 |
| 3. EIA/TIA 526-14A-98<br>OFSTP-14 | Optical Power Loss Measurements of<br>Installed Multimode Fiber Cable Plant. |

**B. Institute of Electrical and Electronics Engineers (IEEE):**

- 1. IEEE 812-84                      Standard Definition of Terms Relating  
to Fiber Optics.

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**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. 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**

**C. General**

1. One hundred percent all-dielectric, loose-tube fiber optic cable assembly suitable for use in aerial and direct burial 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 cores, 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 electronically nonconductive, homogeneous, and free from dirt and other foreign matter.
5. A dielectric rip cord shall be provided under the outer jacket to permit jacket removal without damage to the optical fibers. The rip cord shall be continuous in any length of cable.
6. Individual fibers shall be enclosed in color-coded, plastic buffer tubes (loose buffer construction) which 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.

<u>Fiber or Buffer Tube No.</u>	<u>Color</u>
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 within splices.
9. Cable shall be Belden catalog no. 225442.

**B. Multimode Optical Fiber**

1. Fiber Type: Graded-index, dual window, multimode fiber.
2. Cord Diameter:  $62.5 \pm 3.0$  microns.
3. Core Noncircularity:  $< 6.0$  percent.
4. Cladding Outside Diameter:  $125 \pm 2.0$  microns.
5. Cladding Noncircularity:  $\pm 2.0$  percent.
6. Concentricity Error:  $< 6.0$  percent.
7. Protective Coating Diameter:  $250 \pm 15$  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.

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**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  $\pm 1$  percent of the length as indicated by the length markings.
  - c. "OPTICAL CABLE."

**F. 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.

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**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 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 and new aerial messengers in accordance with manufacturer's installation instructions.

**3.3 FIELD QUALITY CONTROL**

- A. Provide all test equipment, power meters, LED sources, laser sources, connector adapters, launch and receive cable, attenuators, and other devices necessary for these tests. All sources shall operate within the range of  $850 \pm 30$  nm and  $1,300 \pm 20$  nm.
- B. Before installation and while the fiber optic cable is still on the reel, submit the manufacture's certified inspection and test report.
- C. 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 ( $P_{ref.}$ ).

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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 of 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.
- D. Prepare a separate Fiber Optic Test Report for all tests. Refer to Attachment A for the insertion loss test report (Link Loss Certification Test Report). Assemble all test reports and any electronic traces, in a complete, bound manual.

**END OF SECTION**

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**ATTACHMENT A**

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**LINK LOSS CERTIFICATION TEST REPORT**

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**ATTACHMENT A  
LINK LOSS CERTIFICATION TEST REPORT**

PROJECT: \_\_\_\_\_

TEST PERFORMED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

PAGE: \_ OF

CABLE NO.: \_\_\_\_\_

FROM (TRANSMIT): \_\_\_\_\_

TO (RECEIVE): \_\_\_\_\_

<b>CALCULATED LOSS VALUE</b>	<b>MEASURED LOSS VALUE</b>	<b>DIFFERENCE</b>
----------------------------------	--------------------------------	-------------------

FIBER NO.	TYPE (MM/SM)	CALCULATED LOSS VALUE		MEASURED LOSS VALUE		DIFFERENCE	
		850 nm	1300 nm	850 nm	1300 nm	850 nm	1300 nm
1	mm						
2	mm						
3	mm						
4	mm						
5	mm						
6	mm						

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Approved:

**SECTION 16170**  
**GROUNDING AND BONDING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

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

**1.2 RELATED SECTIONS**

- A. Section 16050 - General Electrical Requirements

**1.3 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.

**1.4 GROUNDING ELECTRODE SYSTEM**

- A. Existing Metal underground water pipe.
- B. Existing Metal frame of the building.
- C. Existing Ground ring
- D. Rod electrode.

**1.5 PERFORMANCE REQUIREMENTS**

- A. Grounding System Resistance: 5 ohms.

**1.6 SUBMITTALS**

- A. Submit under provisions of Section 16001.
- B. Product Data: Provide data for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

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D. **Manufacturer's Instructions:** Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 16001.
- B. Accurately record actual locations of grounding electrodes.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

### PART 2 PRODUCTS

#### 2.1 ROD ELECTRODE

##### A. Manufacturers:

- 1. Copperweld
- 2. Joslyn #J8350
- 3. Burndy
- 4. Substitutions: Approved Equal.

B. Material: Copper.

C. Diameter: 3/4 inch.

D. Length: 10 feet.

#### 2.2 MECHANICAL CONNECTORS

##### A. Manufacturers:

- 1. Erico.
- 2. Burndy.
- 3. IlSCO.
- 4. Substitutions: Approved Equal by the Electrical Engineer.

B. Material: Bronze.

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**2.3 EXOTHERMIC CONNECTIONS**

**A. Manufacturers:**

1. Erico - Cadweld
2. Substitutions: Approved Equal by the Electrical Engineer.

**2.4 WIRE**

- A. Material: Stranded copper.**
- B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.**

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.**

**3.2 INSTALLATION**

- A. Install Products in accordance with manufacturer's instructions.**
- B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.**
- C. Provide bonding to meet NFPA 70 Requirements.**
- D. Permanent grounding shall be provided for all stationary metal tanks. This grounding shall consist of a bare grounding conductor, #2 AWG, tinned copper attached to tank as shown in detail on drawing and extended to:**
1. First Preference - Existing building ground station or earth electrode subsystem utilizing a thermic connector such as Cadweld.
  2. Second Preference - New ground rod installation as per detail shown on drawings.
- E. Clean all surfaces to bright metal before making thermic weld connections.**
- F. Pipe insulation shall be sealed with weather-seal around grounding lugs. Benjamin foster foam seal #30-45.**

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- G. Where metal structures exist above paved areas the grounding conductor from the vertical steel column shall extend to either an existing ground grid or to an adjacent unpaved area where ground rods shall be driven.
- H. Transformer Neutral Grounding, the secondary neutrals of all 120/240VAC, single-phase, and 208Y/120VAC, three-phase lighting transformers shall be grounded in accordance with section 250-26 of the NEC.
- I. Electrical plans will show structures to be grounded and ground cable runs when necessary.
- J. If additional ground rods are necessary to achieve the required 5 ohms resistance, then the spacing between rods shall be a minimum of 6 feet. Preferably in the shape of a triad.
- K. Bond together reinforcing steel and metal accessories in structures. All underground connections shall be made by the thermic method such as Cadwell.
- L. Bond together each metallic raceway, pipe, duct and other metal object associated with the sludge removal system. Any other metal objects within 6 feet shall be bonded to the sludge removal system. Use #2 AWG bare copper conductor.
- M. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

### 3.3 FIELD QUALITY CONTROL

- 1. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- 2. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

**END OF SECTION**

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**SECTION 16470**

**PANELBOARDS**

**PART 1 GENERAL**

**1.1 SCOPE**

- A. Extent of panelboard, and enclosure work, including cabinets and cutout boxes is indicated by Contract Drawings and schedules.
- B. Types of panelboards and enclosures in this section include lighting and power distribution panelboards.

**1.2 QUALITY ASSURANCE**

**A. Codes and Standards**

- 1. **NEC Compliance:** Comply with NEC for panelboards, cabinets, and cutout boxes. Comply with NEC requirements pertaining to installation of wiring and equipment in industrial/process locations.
- 2. **UL Compliance:** Comply with requirements of Std No. 67, "Electric Panelboards," and Stds No.'s 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Units shall be UL listed and labeled
- 3. **NEMA Compliance:** Comply with NEMA Stds Pub/No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub/No. PB12, "Panelboards," and Pub/No. PB1.1, "Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or less."
- 4. **Federal Specification Compliance:** Comply with FS W-P-115, "Power Distribution Panel," pertaining to panelboards and accessories.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- A. Square D Co.

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## 2.2 PANELBOARDS

- A. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials. Design and construction shall be in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated
- B. Lighting, Panelboards: Provide dead-front safety type panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown. Panelboards shall be provided with anti-burn solderless pressure type lug connectors approved for copper conductors. Provide units for connecting feeders at top of panel. Equip panel with copper bus bars, full-sized neutral bar, with plug in type heavy-duty, quick-make, quick-break, single-pole circuit breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare uninsulated grounding bars suitable for bolting to enclosures except in conditioned load panels where the grounding bar shall be manufactured as panelboards, which mate properly with enclosures.
- C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16 gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Provide enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards to be enclosed.
- D. Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, circuit breakers, ground-fault protection units, etc., as recommended by panelboard manufacturer for ratings and applications indicated.
- E. Bus: The bus in each panelboard shall be the size noted on the drawing. Each panel board shall accept branch circuit breakers of the same rating as the panelboard bus size.
- F. Lighting panelboards to Square D NQOD as basis of design.

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**PART 3 EXECUTION**

**3.1 INSPECTION**

- A. Installer must examine areas and conditions under which panelboards and enclosures are to be installed and notify Fluor Fernald in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to FF.
- B. Fasten circuit breakers without mechanical stress, twisting, or misalignment being exerted by clamps, supports, or cabling.

**3.2 INSTALLATION**

- A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC Standards and NECA's "Standard of Installation," and in compliance with recognized industry practices to ensure that products fulfill requirements.

**3.3 METHOD**

- A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- B. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- C. Provide properly wired electrical connections within enclosures.
- D. Type panelboard's circuit directory card upon completion of installation work.
- E. Provide insulated copper equipment grounding conductors to all panelboards. Tighten connections to comply with tightening torques specified in UL Stds 486A and B to assure permanent and effective grounds.
- F. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
- G. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

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- H. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.
  
- I. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

**END OF SECTION**

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**SECTION 16475**

**OVERCURRENT PROTECTIVE DEVICES**

**PART 1 GENERAL**

**1.1 SCOPE**

A. This specification covers fuses and circuit breakers.

**1.2 CODES AND STANDARDS**

- A. **NEC Compliance:** Comply with NEC requirements pertaining to overcurrent protective devices.
- B. **UL Compliance:** Comply with UL 489, "Molded Case Circuit Breakers and Circuit Breakers Enclosures," and UL 198D, "High Interrupting Capacity Class K Fuses." Provide overcurrent protective devices which are UL listed and labeled.
- C. **NEMA Compliance:** Comply with NEMA Std Pub/No.'s AB1, AB2, and SG3 pertaining to molded case and low voltage power type circuit breakers.
- D. **ANSI Compliance:** Comply with ANSI C97.1 pertaining to low voltage cartridge fuses.
- E. **FS Compliance:** Only with Federal Specification W-C-375B/GET pertaining to molded case circuit breakers.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- A. Provide overcurrent protective devices of one of the following (for each type and rating of overcurrent protective device):
  - 1. **Circuit Breakers:**
    - a. Square D Co.
  - 2. **Fuses:**
    - a. Bussman Div.
    - b. McGraw-Edison
    - c. General Electric Co.
    - d. Gould, Inc.

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**2.2 CIRCUIT BREAKERS**

- A. Install circuit breakers and ancillary components, of types, sizes, ratings, and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation.

**2.3 MOLDED CASE CIRCUIT BREAKERS**

- A. Install factory assembled, molded case circuit breakers of frame size, rated amperes, voltage and poles, with symmetrical ampere interrupting rating as indicated on Contract Drawings. Install breakers with permanent thermal and instantaneous magnetic trips in each pole and ampere ratings as indicated. Construct with overcenter, trip free, toggle type operating mechanisms with quick make, quick break action and positive handle trip indication. Install push to trip button on cover for mechanical tripping circuit breakers. Construct breakers for mounting and operating in any physical position and for operating in an ambient temperature of 40 degrees C. Install breakers with mechanical screw type removable connector lugs, AL/CU rated. Breakers shall be plug in type

**PART 3 EXECUTION**

**3.1 METHODS**

- A. Install overcurrent protective devices as indicated on Contract Drawings, in accordance with manufacturer's written instructions and with recognized industry practices. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Fasten circuit breakers without mechanical stress, twisting, or misalignment being exerted by clamps, supports, or cabling.
- C. Set field adjustable circuit breakers for trip settings as indicated, subsequent to installation of units. Deliver and store units so test settings are not altered.
- D. Install fuses, if any, in fused disconnect switches.
- E. Inspect circuit breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

**3.2 TESTS**

- A. Test devices for continuity of circuitry and for short circuits prior to energization of overcurrent protective devices. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units and proceed with retesting.

**END OF SECTION**

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Approved:

**SECTION 16710**

**COMMUNICATIONS CIRCUITS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes arrangement with Telecommunications Utility Company for telecommunication service; and backboards, termination devices, outlets, and premises wiring.
- B. Related Sections:
  - 1. Section 16050 - Basic Electrical Materials and Methods.

**1.2 REFERENCES**

- A. EIA/TIA 568 (Electronic Industries Association/Telecommunications Industries Association) - Commercial Building Telecommunication Wiring Standard.
- B. EIA/TIA 569 (Electronic Industries Association/Telecommunications Industries Association)- Commercial Building Standard for Telecommunications Pathways and Spaces.
- C. NFPA 70 - National Electrical Code

**1.3 SYSTEM DESCRIPTION**

- A. Telephone Service Entrance Pathway: EMT conduit shall be installed by Contractor. Conduit sizes and routing shall be as shown on the Drawings.
- B. Premise Wiring: By telephone utility.
- C. Backboard & Shelf: Installed by Contractor in location shown on the Drawings.
- D. Entrance Wiring: By Telephone Utility Company.

**1.3 SUBMITTALS**

- A. Product Data: Submit catalog data for each product specified.

**1.4 PROJECT RECORD DOCUMENTS**

- A. Record actual locations and sizes of conduits.

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1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with telephone utility's rules and regulations.

1.6 REGULATORY REQUIREMENTS

- A. Conform to the requirements of NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratory, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

- A. Material: Plywood.
- B. Size: 3 x 3 feet, 3/4 inch thick.

2.2 TELEPHONE CONDUIT

- A. Above Ground Conduit: EMT.
- B. Underground Conduit: Rigid PVC.
- C. Bends: Elbows shall be sweeping type.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install conduit in accordance with the Drawings. All 90 degree elbows to have a 36 inch minimum radius. No more than two (2) 90 degree elbows in each run.
- B. Finish paint termination backboards with durable white fire retardant latex enamel prior to installation of telephone equipment.
- C. Install termination backboards plumb, and attach securely to building wall at each corner.
- D. Install polyethylene pulling string in each empty telephone conduit over 10 feet in length or containing bends.
- E. Ground and bond pathways, cable shields, and equipment in accordance with Section 16050.

END OF SECTION

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Approved:

**SECTION 16721**

**FIRE AND EVACUATION ALARM SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fire alarm components wire and cable.
- B. Evacuation alarm components wire and cable.

**1.2 RELATED SECTIONS**

- A. Section 16050 – Basic Electrical Materials & Methods Electrical.

**1.3 REFERENCES**

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - Installation, Maintenance, and Use of Protective Signaling Systems.
- C. NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.
- D. NFPA 101 - Life Safety Code.

**1.4 SYSTEM DESCRIPTION**

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to the central fire alarm equipment.
- B. Install all equipment specified herein and indicated on the Drawings. Honeywell, Fluor Fernald's alarm systems Subcontractor, will make final terminations and perform acceptance testing of the new panel.

**1.5 SUBMITTALS**

- A. Shop Drawings: Provide control panel layout and system wiring diagram showing each device and wiring connection required.
- B. Product Data: Provide electrical input power and connection requirements.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections.

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- D. Manufacturer's Installation Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.
- E. Certificate of Conformance: Provide manufacturer's statement certifying that the product supplied meets or exceeds contract requirements.
- F. Certification: Prior to start of Work, personnel installing the fire alarm systems shall submit the State of Ohio fire alarm systems certification number and date of certification to Fluor Fernald. The certification number shall appear on all materials submitted for review and approval.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Operating instructions.
- B. Maintenance Data: Maintenance and repair procedures.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section.
- B. Installer: Company specializing in installing the products specified in this section and certified by the State of Ohio as fire alarm installer.

#### 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, NFPA 72 and NFPA 101.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT MANUFACTURERS

- A. *Existing fire and evacuation alarm systems are by Honeywell.*

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## 2.2 FIRE AND EVACUATION ALARM WIRE AND PARTS

- B. Fire Alarm Circuit Conductors: 18/2 wire; Initiating device circuit insulation color coded red and yellow; Signal device circuit insulation color coded brown and yellow.
- B. Evacuation Alarm Circuit Conductors: 16/2 wire; Insulation color code of black and white.
- C. Wiring (Safety Devices): Fire Alarm Horns/Strobes – 18/2 yellow/brown wire; EMS Speakers – 16/2 black/white wire, Belden 1118A; All input zones – 18/2 yellow/red wire.
- D. Manual Pull Stations: Honeywell S464A or approved equal.
- E. End of Line Resistors: 4.7 K ohms.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Equipment connections and other necessary work within the existing Data Gathering Panel (DGP) shall be coordinated with Fluor Fernald's (FF) fire alarm service company at the direction of FF. FF shall arrange and pay for the services of the fire alarm service company for performing necessary DGP work.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use 18 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in EMT conduit.
- C. Use 16 AWG minimum size conductor for evacuation alarm circuit conductors. Install wiring in EMT conduit unless otherwise noted.
- D. Check that end-of-line device is with last device or in a separate box adjacent to last device in circuit.

### 3.3 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72H and local fire department requirements. Test to be witnessed by FF QA and FF Fire Protection.

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**3.4 MANUFACTURER'S FIELD SERVICES**

- A. Prepare and start systems.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

**3.5 DEMONSTRATION**

- A. Provide systems demonstration. FF QA and FF Fire Protection to witness.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

**END OF SECTION**