



STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
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**VIA WEBSITE POSTING**

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March 11, 2014

Contract No. T201080101.01  
Magnolia Yard Vehicle Maintenance Shop  
Kent County

Ladies and Gentlemen:

Enclosed is Addendum No. 4 for the referenced contract consisting of the following:

**NOTE: Questions received after noon on March 19, 2014 may not be addressed.**

1. Two (2) pages, Appendix A, Table of Contents, page 1 and 2, revised, to be substituted for the same pages in the Proposal.
2. Six (6) pages, Appendix A, 096723 - Resinous Flooring, pages 096723 - 1 through 096723 - 6, new, to be added to the Proposal.
3. Eleven (11) pages, Appendix A, 11143 - Lubrication Equipment, pages 11143 - 1 through 11143 - 11, new, to be added to the Proposal.
4. Ten (10) pages, Appendix A, 221113 - Facility Water Distribution Piping, pages 221113 - 1 through 221113 - 10, new, to be added to the Proposal.
5. Eighteen (18) pages, Appendix A, 221116 - Piping, Fittings & Valves, Etc, pages 221116 - 1 through 221116 - 18, revised, to be substituted for the same pages in the Proposal.
6. Eight (8) pages, Appendix, 221313 - Facility Sanitary Sewers, pages 221313 - 1 through 221313 - 8, new, to be added to the Proposal.
7. Twenty three (23) pages, Appendix A, 224213 - Plumbing Fixtures, pages 224213 - 1 through 224213 - 23, revised, to be substituted for the same pages in the Proposal.
8. One (1) page, Breakout Sheet, page Breakout Sheet - 1, revised, to be substituted for the same page in the Proposal.
9. One (1) page, Shower Bench Detail, Drawing SK-1, new, to be added to the Proposal.
10. Five (5) sheets, Construction Plans, sheets 9, 36, 54, 55, and 57, revised, to be substituted for the same sheets in the Plan Set.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,

*signature on file*

James H. Hoagland  
Contract Services Administrator

:jhh  
Enclosures

**TABLE OF CONTENTS (Revised 3/04/14)**

<b>DIVISION 03 - CONCRETE</b>	
033000	CAST-IN-PLACE CONCRETE
<b>DIVISION 04 - MASONRY</b>	
042000	UNIT MASONRY
<b>DIVISION 05 - METALS</b>	
051200	STRUCTURAL STEEL FRAMING
052100	STEEL JOIST FRAMING
053100	STEEL DECKING
055000	METAL FABRICATIONS
055100	METAL STAIRS
055300	METAL GRATINGS
<b>DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES</b>	
061000	ROUGH CARPENTRY
<b>DIVISION 07 - THERMAL AND MOISTURE PROTECTION</b>	
071113	BITUMINOUS DAMPPROOFING
071800	TRAFFIC COATINGS
072100	THERMAL INSULATION
072200	ROOF AND DECK INSULATION
074113	METAL ROOF PANELS
074213	METAL WALL PANELS
078413	PENETRATION FIRESTOPPING
<b>DIVISION 08 - OPENINGS</b>	
081113	HOLLOW METAL DOORS AND FRAMES
083323	OVERHEAD COILING DOORS
083613	SECTIONAL DOORS
084113	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
085113	ALUMINUM WINDOWS
087100	DOOR HARDWARE
<b>DIVISION 09 - FINISHES</b>	
092900	GYPSUM BOARD
093000	TILING
096513	RESILIENT BASE AND ACCESSORIES
096519	RESILIENT TILE FLOORING

096723	RESINOUS FLOORING (Added Section)
099123	INTERIOR PAINTING
099600	HIGH-PERFORMANCE COATINGS
<b>DIVISION 10 - SPECIALTIES</b>	
102213	WIRE MESH PARTITIONS
102800	TOILET, BATHROOM, LAUNDRY ACCESSORIES
104416	FIRE EXTINGUISHERS
105113	METAL LOCKERS
<b>DIVISION 11 – EQUIPMENT</b>	
11143	LUBRICATION EQUIPMENT (Added Section)
<b>DIVISION 12 - FURNISHINGS</b>	
123530	RESIDENTIAL CASEWORK
<b>DIVISION 13 - SPECIAL CONSTRUCTION</b>	
133419	METAL BUILDING SYSTEMS
<b>DIVISION 22 - PLUMBING</b>	
220719	MECHANICAL AND PLUMBING INSULATION
221113	FACILITY WATER DISTRIBUTION PIPING (Added Section)
221116	PIPING, FITTINGS & VALVES, ETC. (Revised Section)
221313	FACILITY SANITARY SEWERS (Added Section)
224213	PLUMBING FIXTURES (Revised Section)
<b>DIVISION 23 – HEATING, VENTILATING &amp; AIR CONDITIONING</b>	
230513	COMMON REQUIREMENTS FOR HVAC EQUIPMENT
230548	VIBRATION CONTROL FOR HVAC
230593	PERFORMANCE TESTING AND BALANCING
233113	METAL DUCTS
233423	HEATING, VENTILATING AND AIR CONDITIONING
<b>DIVISION 26 - ELECTRICAL</b>	
260500	BASIC ELECTRICAL MATERIALS AND METHODS
260501	GENERAL ELECTRICAL REQUIREMENTS
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
260543	UNDERCURRENT DUCTBANKS
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS

## SECTION 096723 - RESINOUS FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Industrial resinous flooring systems.

B. Related Sections:

1. Section 079200 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

D. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: For each resinous flooring component, from manufacturer.

C. Material Test Reports: For each resinous flooring system.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- A. Basis-of Design Product: Econo-Surf ES-2565 Resurfcer Composite system. Contact: John Pennington, Floor Coating ECT., Inc., 302-322-4177 or [info@econo-surf.com](mailto:info@econo-surf.com)
- B. Or approved equal: Subject to compliance with requirements, available manufacturers providing similar products include, but are not limited to the following:
  1. General Polymers.
  2. Stonhard.

#### 2.2 MATERIALS

- A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 INDUSTRIAL RESINOUS FLOORING **RES-1**

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, industrial-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor.
- B. System Characteristics:
  - 1. Color and Pattern: As selected by Architect from manufacturer's full range.
  - 2. Wearing Surface: Textured for slip resistance.
  - 3. Overall System Thickness: 1/4 inch.
- C. Body Coats:
  - 1. Resin: Epoxy.
  - 2. Formulation Description: 100 percent solids.
  - 3. Application Method: Troweled.
    - a. Thickness of Coats: 3/16 inch.
    - b. Number of Coats: Two.
  - 4. Aggregates: Natural silica.
- D. Topcoat: Sealing or finish coats.
  - 1. Resin: Urethane.
  - 2. Type: Clear.
  - 3. Finish: Gloss.
  - 4. Number of Coats: One.
- E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
  - 1. Compressive Strength: 15,100 psi per ASTM C 579.
  - 2. Tensile Strength: 2,560 psi per ASTM C 307.
  - 3. Water Absorption: 0.18% per ASTM C 413.
  - 4. Indentation: None per MIL-D-3134F.
  - 5. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
  - 6. Abrasion Resistance: 72 mg per ASTM D 1044.
  - 7. Flammability: Self-extinguishing per ASTM D 635.
  - 8. Hardness: 84 min, Shore D per ASTM D 2240.
  - 9. Bond Strength: 400 psi minimum, 100 percent concrete failure per ACI 503R.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Roughen concrete substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
  - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
  - 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

### 3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
1. Integral Cove Base: 4 inches high.
- D. Apply body coats in thickness indicated for flooring system.
1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- E. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.
- F. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.
- G. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

### 3.3 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may at any time and any number of times during resinous flooring application require material samples for testing for compliance with requirements.
1. Engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
  2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
  3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.4 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

**END OF SECTION**

## SECTION 11143

### LUBRICATION EQUIPMENT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Piping Materials
  - 2. Compressed Air Powered Linear Reciprocating Lube Pump – General
  - 3. Compressed Air Powered Linear Reciprocating Lube Pumps
  - 4. Pump accessories and Piping System Accessories
  - 5. Hose Reel Accessories
  - 6. Dispensing Valve
  
- B. Related Sections
  - 1. Basic Mechanical Materials and Methods: Section 15050.
  - 2. Hangers and Supports: Section 15060.
  - 3. Mechanical Identification: Section 15075

##### 1.02 REFERENCES

- A. The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic definition only. Use latest edition of publication.
  
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 30 – Flammable and Combustible Liquids Code
  
- C. The American Society of Mechanical Engineers (ASME):
  - 1. ASME B31.9; Specification for Building Services Piping.
  
- D. American Welding Society (AWS):
  - 1. AWS D1.1 – Code for Structural Welding – Steel
  - 2. AWS D10.12M/D10.12 – Guide for Welding Mild Steel Pipe
  
- E. American National Standards Institute (ANSI):
  - 1. ANSI B16.10; Face-to-Face and End-to-End Dimensions of Ferrous Valves.
  
- F. American Society for Testing and Materials (ASTM):
  - 1. ASTM B 209; Standard specification for aluminum and aluminum-alloy sheet and plate.
  - 2. ASTM C 335, Steady state heat transfer properties of horizontal pipe insulation.
  - 3. ASTM C 547; Standard specification for mineral fiber pipe insulation.
  
- G. Manufacturer's Standardization Society (MSS) of the Valve and Fittings Industry, MSS-SP-70 and MSS-SP-71.

## H. SYSTEM PERFORMANCE REQUIREMENTS

- I. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements:
1. Low Pressure Piping (0 – 300 PSIG)
  2. Medium Pressure Piping (300 – 2000 PSIG)
  3. High Pressure Piping (2000 – 10,000 PSIG)

### 1.03 SUBMITTALS

- A. Product data including size, dimension, capacity, pressure rating, settings, and operating characteristics of selected models, for the following:
1. Air operated reciprocating pumps
  2. Air Operated Diaphragm Pump
  3. Pump Accessories
  4. Piping and Accessories
  5. Hose Reels and Accessories
  6. Dispensing Valves
- B. Coordination drawings for piping systems, including required clearances and relationships to other services that serve the same work area.
- C. Maintenance data for each type and size of equipment specified to include in the “Operating and Maintenance Manual”.

### 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with a minimum of 5 years experience.
- B. Installer Qualifications: Experience on at least 5 projects of a similar nature in past 5 years, and acceptable to the Owner.
- C. Regulatory Requirements: Comply with provisions of the following:
1. NFPA 30 and 31 for oil piping materials, components, installations, inspection, and testing.
  2. Provide listing/approval stamp, label, or other marking on equipment made specified standards.
  3. Listing & Labeling: Provide equipment and accessories that are listed and labeled.
  4. UL 778 “Standard for Motor Operated Water Pumps” for construction requirements. Include UL listing and labeling.
  5. NFPA 70 “National Electrical Code” for electrical components and installation.
- D. Materials used: In all cases the materials, seals, packing, hoses, valves, etc. used in these systems will be compatible with the fluids being handled and dispensed.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment in a clean, dry location.
- B. Retain shipping protective covers and protective coatings during storage.
- C. Protect bearings and couplings against damage from sand, grit, or other foreign matter.
- D. Comply with equipment manufacturer's rigging instructions for handling.

## 1.06 WARRANTY

- A. Extended Warranties:
  - 1. Provide two (2) year warranty for equipment and installation covering parts and on-site labor against defects in materials or workmanship.
- B. Submit manufacturer's warranty and verify that forms are completed in Owner's name and registered with manufacturer.
- C. Date warranties to date of Substantial Completion for Project.

## 1.07 OWNER'S INSTRUCTION

- A. Provide a minimum of eight (8) hours of owner training by the equipment manufacturer's representative. Training will consist of both operation and maintenance of equipment.

## PART 2 - PRODUCTS

### 2.01 MOTOR OIL (MO) ABOVEGROUND INSIDE BUILDING

- A. Service Requirements:
  - 1. Motor Oil: Supply maximum operating pressure of 1200 psig.
  - 2. Gear Lube: Supply maximum operating pressure of 1200 psig.
- B. Pipe: Black steel, Schedule 80 ASTM A53.
  - 1. Joints: Butt welded per ANSI B16.11
  - 2. Fittings: Wrought carbon steel standard weight welding ASTM A234, grade WPB or WPC, ANSI B16.9
- C. Valves:
  - 1. Acceptable Manufacturers:
    - a. Apollo; Model 83R-240
    - b. Conbraco
    - c. Nibco
    - d. Or Approved Equal
  - 2. Ball Valves: MSS SP-110, 1500 psig WOG, blow-out proof stem, 3-piece carbon steel body, stainless steel ball and stem, threaded ends.

- D. Tube: SAE 1010, dead soft, cold drawn, seamless steel,
  - 1. Tubing wall thickness: minimum 0.065 inches.
  - 2. Joints: Mechanically joined with fittings rated at a 4:1 safety factor of burst over operating pressures. Materials to be compatible with fluids being transported.
  - 3. Fittings: Steel or stainless steel, butt-joint mechanical fittings meeting the following industry standards:
    - a. JIC Pneumatic and Hydraulic Standards.
    - b. ANSI Code for Pressure Piping.
    - c. ASME Code for Pressure Piping.
    - d. MIL-F-18280E
  
- E. Valves:
  - 1. Acceptable Manufacturers:
    - a. Apollo; Model 83R-240
    - b. Conbraco
    - c. Nibco
    - d. Or Approved Equal
  - 2. Ball Valves: MSS SP-110, 1500 psig WOG, blow-out proof stem, 3-piece carbon steel body, stainless steel ball and stem, threaded ends.

## 2.02 AUTOMATIC TRANSMISSION FLUID (ATF), ABOVEGROUND INSIDE BUILDING

- A. Service Requirements:
  - 1. Automatic Transmission Fluid: Supply maximum operating pressure of 1200 psig.
  
- B. Pipe: Black steel, Schedule 80 ASTM A53.
  - 1. Joints: Butt welded per ANSI B16.11
  - 2. Fittings: Wrought carbon steel standard weight welding ASTM A234, grade WPB or WPC, ANSI B16.9
  
- C. Valves:
  - 1. Acceptable Manufacturers:
    - a. Apollo; Model 83-440
    - b. Conbraco
    - c. Nibco
    - d. Or Approved Equal
  - 2. Ball Valves: MSS SP-110, 1500 psig WOG, blow-out proof stem, 3-piece carbon steel body, stainless steel ball and stem, socket welded ends.
  
- D. Tube: SAE 1010, dead soft, cold drawn, seamless steel,
  - 1. Tubing wall thickness: minimum 0.065 inches.
  - 2. Joints: Mechanically joined with fittings rated at a 4:1 safety factor of burst over operating pressures. Materials to be compatible with fluids being transported.
  - 3. Fittings: Steel or stainless steel, butt-joint mechanical fittings meeting the following industry standards:
    - a. JIC Pneumatic and Hydraulic Standards.
    - b. ANSI Code for Pressure Piping.

- c. ASME Code for Pressure Piping.
- d. MIL-F-18280E

E. Valves:

- 1. Acceptable Manufacturers:
  - a. Apollo; Model 83-440
  - b. Conbraco
  - c. Nibco
  - d. Or Approved Equal
- 2. Ball Valves: MSS SP-110, 1500 psig WOG, blow-out proof stem, 3-piece carbon steel body, stainless steel ball and stem, socket welded ends.

2.03 CHASSIS GREASE (GR), ABOVEGROUND INSIDE BUILDING

A. Service Requirements:

- 1. Chassis Grease: Supply maximum operating pressure of 6000psig.

B. Pipe: Black steel, Schedule 160 ASTM A53, seamless, Grade B.

- 1. Joints: Socket welded per ANSI B16.11, with fittings rated at a 4:1 safety factor of burst over operating pressures.
- 2. Fittings: Forged Class 6000.

2.04 WASTE OIL (WO), ABOVEGROUND INSIDE BUILDING

A. Service requirements:

- 1. Waste Oil: Supply maximum operating pressure of 100 psig.

B. Pipe: Black steel, Schedule 40 ASTM A53.

- 1. Joints: Threaded.
- 2. Fittings: Malleable iron, 150 lb, threaded, ASTM A47 and ANSI B16.3.

C. Valves:

- 1. Acceptable Manufacturers:
  - a. Apollo; Model 83R-100
  - b. Conbraco
  - c. Nibco
  - d. Or Approved Equal
- 2. Ball Valves: MSS SP-110, 1000 psig WOG, blow-out proof stem, 3-piece carbon steel body, stainless steel ball and stem, threaded ends.

2.05 PUMP MANUFACTURERS

A. Acceptable Manufacturers:

- 1. Graco
- 2. Lincoln
- 3. ARO
- 4. Balcrank
- 5. Samson

6. Or Approved Equal

2.06 COMPRESSED AIR POWERED LINEAR RECIPROCATING LUBE PUMP -  
GENERAL

- A. Design all lubricant pumps to pump grease or oil to within one inch of the bottom of the product container to ensure maximum use of purchased material.
- B. Design all pumps to stand free of the bottom of the container to allow unobstructed flow of product to the pumping tube.
- C. All pumps of the self-priming design. Pumps so designated for use in bulk supply tanks shall be equipped with a low oil shut off device to prevent free cycling of the pump in the event the product supply is exhausted.
- D. Equip all pumps with an overrun air control valve to disable the pump in the event of a catastrophic failure of the piping system.
- E. All pumps shall have an air motor design with no metal-to-metal seals to prevent air leakage in the stalled condition. The air motor cylinder shall be of aluminum construction to prevent corrosion in the presence of a contaminated air supply. The air piston shall be of one-piece molded NBR construction to give a long trouble free service life. The air valve shall be of simplified construction with no more than three moving parts. The piston rod shall be finished to a surface tolerance of 0.25 $\mu$ m and hard electroless nickel coated for maximum seal life and low friction. Oil and Grease pumps shall be of the centerline design, for even wear distribution and minimal repair costs.
- F. All pumps shall be equipped with bronze non-wearing, non-fouling, and non icing mufflers to meet and exceed OSHA recommendations for noise generation.
- G. All pumps shall be double acting to provide continuous even flow and pressure and maximum utilization of the compressed air supply.
- H. Primary and secondary self-lubricating throat seals constructed of copper impregnated Turcon™ number 46 with Nitrile back up rings.
- I. All pumps shall have case hardened seats and ball checks for maximum service life and resistance to damage from contaminated product.
- J. All pumps easily serviceable with no special tools required.
- K. Pumps individually factory tested and verified for proper function. This test shall consist of a minimum of one-hour intermittent operation pumping product against full operating pressure.

## 2.07 COMPRESSED AIR POWERED LINEAR RECIPROCATING LUBE PUMPS

- A. Service Requirements:
1. Motor Oil (MO)
  2. Automatic Transmission Fluid (ATF)
- B. In addition to meeting all of the general pump specifications, this pump shall also have the following features.
- C. The 10:1 ratio positive displacement oil pump with pneumatically operated 4 ¼" diameter air motor, a 4" pumping stroke length and cycle on demand only. External muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor to incorporate a valve in piston design durability and longevity. Air motor cylinder material is hard coated aluminum and corrosive resistant steel. The air motor shall feature a non-metallic poppet valve. The air motor and lower pump section of the in-line design. The pump to be tank mounted and to include hose & fitting kit, FRL, air & fluid shutoff valves, and mounting bracket. Model #205626
1. Pump ratio: 10:1
  2. Continuous duty flow rate: 4.1 gpm
  3. Maximum fluid pressure: 1,800 psi
  4. Maximum air inlet pressure: 180 psi
  5. Fluid outlet size: 3/4" NPT
  6. Air inlet size: 1/2" NPT
  7. Air Consumption: 32 cfm per 4.1 gpm
- D. Provide the following with each pump:
1. Thermal Relief Kit
  2. Hose and Fitting Kit
  3. Low Level Cut Off
  4. Bleed Type Air
  5. Shut-Off Valve
  6. Air Filter/Regulator
  7. Lubricator, ½" ports
  8. Automatic Drain Valve for filter
  9. ¾" fluid shut-off valve
  10. Pump runaway valve
  11. ½" Air Coupler
  12. ½" Air Coupler
- E. Service Requirements:
1. Chassis Grease (GR)
- F. The 50:1 ratio positive displacement grease pump pneumatically operated 4 1/4" diameter air motor, a 4" pumping stroke length and cycle on demand only. External muffler that operates below OSHA noise standards, and equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design. Air motor cylinder hard coated aluminum and corrosive resistant steel. Air motor and lower

pump section of the in-line design. The pump of the "Topper" type with down tube for a 400 pound drum, an integral inductor plate, hose and fitting kit and a pump elevator model # 226018.

1. Pump ratio: 50:1
2. Continuous duty flow rate: 5 pounds per minute
3. Maximum fluid pressure: 7,500 psi
4. Maximum air inlet pressure: 150 psi
5. Fluid outlet size: 3/8" NPT
6. Air inlet size: 1/2" NPT
7. Air Consumption: 13 cfm per gallon

G. Provide the following at each pump:

1. 1/2" Filter/Reg./Lubricator
2. Automatic drain for air filter
3. 1/2" Air shut-off Valve
4. 1/2" Fluid shut-off, HP
5. Air Motor Muffler
6. Pump runaway valve
7. 1/2" air coupler
8. 1/2" air connector

## 2.08 HOSE REELS ASSEMBLIES

A. Acceptable Manufacturers:

1. GRACO
2. Lincoln
3. ARO
4. Balcrank
5. Samson
6. Or Approved Equal

B. Service Requirements:

1. Motor Oil (MO)
2. Automatic Transmission Fluid (ATF)

C. Hose reel with 50 feet of 1/2" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing, anti-galling and easy service, repairable guide rollers and a long life return-spring life. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and delrin bearings and seals. Designed to mount on ceilings, wall or floors. The reel shall be complete with Electronic Meter, hose inlet kit, fluid shut off. Model # 224058.

1. Hose length-oil: 50' x 1/2" ID
2. Reel outlet: 1/2" npsm

3. Reel inlet: 1/2" npsm
4. Pressure rating oil: 1,800 psi

D. Provide the following for each motor oil, ATF and hydraulic fluid reel:

1. Hose Inlet Kit
2. 1/2" Fluid Shut-Off Valve
3. Digital preset metered dispense valve

E. Service Requirements

1. Chassis Grease (GR)

F. Hose reel with 50 feet of 3/8" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, a ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing, anti-galling and easy service, repairable guide rollers return spring. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and Delrin bearings and seals designed to mount on ceiling, wall or floors. Complete with hose inlet kit, 3-way swivel, high pressure shut-off valve, dispense valve.

1. Hose length-grease: 50' x 3/8" ID
2. Reel outlet: 3/8" npsm
3. Reel inlet: 3/8" npsm
4. Pressure rating grease: 8,000 psi for bare reel

G. Provide the following for each reel:

1. Hose Inlet Kit
2. HP Shut-Off Valve
3. Grease dispense valve
4. 3/8" three way swivel

H. Service Requirements

1. Compressed Air

I. Hose reel with 50 feet of 1/2" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, a ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing anti-galling and easy service, repairable guide rollers return spring. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and Delrin bearings and seals. The reel will be designed to mount on ceilings, wall or floors complete with hose inlet kit, air inlet valve.

1. Hose length: 50' x 1/2" ID
2. Reel outlet: 1/2" npsm
3. Reel inlet: 1/2" npsm

4. Pressure rating: 1,800 psi for bare reel

J. Provide the following for each reel:

1. Hose Inlet Kit
2. 1/2" Air Shut-Off Valve
3. Air Coupler

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine areas, equipment foundations, and conditions with Installer present for compliance with requirements for installation and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine roughing-in of plumbing piping systems to verify actual locations of piping connections prior to equipment installation.

### 3.02 INSTALLATION

- A. General: Comply with equipment manufacturer's written installation instructions.
- B. Install equipment in locations indicated and arrange to provide access for periodic maintenance.
- C. Support piping so that weight of piping is not supported by equipment.
- D. Clean all strainers after pump start-up.

### 3.03 CONNECTIONS

- A. General: Connect piping to equipment as indicated. Install valves that are same size as piping connecting to equipment.
- B. Install pipe sizes as specified in the Project Drawings.
- C. Install specified shut off valves on each pump discharge and component inlet.
- D. Install electrical connections for power, controls, and devices.
- E. Electrical power and control wiring and connections are specified in Division 16 Sections.

### 3.04 ADJUSTING

- A. Controls: Set controls for operation as required for system application.

### 3.05 COMMISSIONING

- A. Final Checks Before Startup: Perform the following preventive maintenance operations and checks before startup:
  - 1. Flush all fluid lines to remove all assembly and manufacturing debris and contamination.
  - 2. Check that pump controls are correct for required application.
- B. Starting procedure for pumps:
  - 1. Open discharge valves slowly.
  - 2. Start pumps at low air pressure until primed.
  - 3. Check general mechanical operation of equipment and adjust for maximum performance.

END OF SECTION

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

- E. NSF Compliance:
  - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

## 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
  - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2. Copper, Pressure-Seal Fittings:
  - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Viega; Plumbing & Heating Systems.
  - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
- B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## 2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron.

## 2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Split-Sleeve Pipe Couplings:
  1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
    - a. Standard: AWWA C219.
    - b. Sleeve Material: Stainless steel.
    - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
    - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
    - e. Pressure Rating: 150 psig minimum.
    - f. Metal Component Finish: Corrosion-resistant coating or material.

C. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

D. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 125 psig minimum at 180 deg F.
    - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Factory-fabricated, bolted, companion-flange assembly.
    - 3) Pressure Rating: 125 psig minimum at 180 deg F.
    - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
  - a. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple. complying with ASTM F 1545.
    - 3) Pressure Rating: 300 psig at 225 deg F.
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves:

- a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
  - 1) Standard: AWWA C509.
  - 2) Minimum Pressure Rating: 200 psig.
  - 3) End Connections: Mechanical joint.
  - 4) Interior Coating: Complying with AWWA C550.

B. UL/FMG, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. American Cast Iron Pipe Co.; American Flow Control Div.
- b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
- e. McWane, Inc.; Kennedy Valve Div.
- f. McWane, Inc.; M & H Valve Company Div.
- g. Mueller Co.; Water Products Div.
- h. NIBCO INC.
- i. U.S. Pipe and Foundry Company.

2. UL/FMG, Nonrising-Stem Gate Valves:

- a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
  - 1) Standards: UL 262 and FMG approved.
  - 2) Minimum Pressure Rating: 175 psig.
  - 3) End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.

- a. Standard: MSS SP-60.
- b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
- c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 CORPORATION VALVES

A. Manufacturers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- a. Amcast Industrial Corporation; Lee Brass Co.
  - b. Ford Meter Box Company, Inc. (The); Pipe Products Div.
  - c. Jones, James Company.
  - d. Master Meter, Inc.
  - e. McDonald, A. Y. Mfg. Co.
  - f. Mueller Co.; Water Products Div.
  - g. Red Hed Manufacturing & Supply.

- B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

2.7 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
- a. Standards: UL 246, FMG approved.
  - b. Pressure Rating: 250 psig.
  - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
  - d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
  - e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
  - f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Refer to DeIDOT Standard Specifications for Road and Bridge Construction, Section 208, for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
  - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings.

### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal resilient-seated gate valves with valve box.

### 3.4 PIPING INSTALLATION

- A. Make connections larger than NPS 2 with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
  - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- B. Make connections NPS 2 and smaller with drilling machine according to the following:
1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
  2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
  3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
  4. Install corporation valves into service-saddle assemblies.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
  2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- D. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches cover over top.
  2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.
- E. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- F. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping 5 feet from building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- H. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.
- 3.5 JOINT CONSTRUCTION
- A. Make pipe joints according to the following:
1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
  2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

### 3.6 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  - 1. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.7 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

### 3.8 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. UL/FMG Fire Hydrants: Comply with NFPA 24.

### 3.9 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve or service clamp and corporation valve.

### 3.10 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per

100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

- C. Prepare reports of testing activities.

### 3.11 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate 12 inches below finished grade, except 6 inches below Subgrade under pavements, directly over piping.

### 3.12 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
  - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116 – PIPING, FITTINGS, VALVES, ETC.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, General and Supplementary Provisions of the contract, including but not limited to Section 100 of the DelDOT Standard Specifications for Road and Bridge Construction apply to this section.

1.2 SUMMARY

- A. Provide all labor and materials necessary to furnish and install all piping systems on this project, including storm, sanitary, interior plumbing, heating water systems, steam and condensate system, and pumped condensate systems.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local and insurance authorities having jurisdiction. Valves shall be manufactured by Crane, Stockham, Nibco, Milwaukee, Jamesburry, Hammond, DeZurick, Keystone, Walworth, Jenkins, or as approved equal unless noted otherwise.

- 1. Domestic Hot, Cold, and Recirculating Water Piping Outside of Building Below Ground:

Pipe: 2-1/2" & smaller, soft temper type "K". ASTM B88-83a - No joints below grade except as approved by the Engineer.

3" & larger, ductile iron pipe for water, ANSI 21.50 & 21.51 with double thickness cement mortar lining, ANSI 21.4.

Fittings: Wrought copper solder joint fittings, ANSI B16.22.

Cast iron pressure fittings, ANSI 21.10, ASTM 377-66 Class 250. Mechanical Specification for mechanical joint for cast iron pressure pipe & fittings ANSI A21.11.

- 2. Domestic Hot, Cold, and Recirculating Water Piping and Anti-freeze Inside Buildings:

Pipe: All cold water and all domestic hot and recirculating water, all water lines soft temper Type "K" below ground, hard temper Type "L" above ground, ASTM B88.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

Fittings:	Solder type wrought copper ASTM B16.18 - 95-5 silver solder or braze (lead and antimony based solders are prohibited).
Ball Valves:	2" and smaller – Class 150, brass construction, 3-piece, full port, threaded end. Type 316 stainless steel ball and stem, extended handle and Durafill seats, Watts B-6800 Series or as approved equal.  2-1/2" through 4" -- 150 SWP, two-piece, standard-port bronze construction with stainless steel Type 316 ball and extended stem, threaded ends. Watts No. B-6000 or equal.
Unions:	3" & larger - 250 lb. brass companion flanges.  3" & smaller - wrought copper, ground joint solder ends.
Check Valves:	4" & larger - IBBM, 125 lb. std. flanged swing check, with metal disc; 3" and smaller - 125 lb. std. screwed.

**3. Motor Oil, Grease Lube Piping:**

<b>Service Requirements:</b>	<b>Motor Oil: Supply maximum operating pressure if 1200 psig. Gear Lube: Supply maximum operating pressure if 1200 psig.</b>
<b>Pipe:</b>	<b>Schedule 80 Black Steel, ASTM A53, seamless.  a. Joints: Butt welded per ANSI B16.11</b>
<b>Fittings:</b>	<b>Wrought carbon steel standard weight welding ASTM A234, grade WPB or WPC, ANSI B16.9</b>
<b>Ball Valves:</b>	<b>MSS SP-110, 1500 psig WOG, blow-out proof stem, 3 piece carbon steel body, stainless steel ball and stem, threaded ends.</b>
<b>Tubing:</b>	<b>SAE 1010, dead soft, cold drawn, seamless steel.  a. Tubing wall thickness: 0.065 inches, minimum. b. Joints: Mechanical joined with fittings rated at a 4:1 safety factor of burst over operating pressures. Materials to be compatible with fluids being transported. c. Fittings: Steel or stainless steel, butt joint</b>

mechanical fittings meeting the following industry standards:

- i. JIC Pneumatic and Hydraulic Standards.
- ii. ANSI Code for Pressure Piping.
- iii. ASME Code for Pressure Piping
- iv. MIL-F-18280E

**Valves for Tubing:** MSS SP-110, 1500 psig WOG, blow-out proof stem, 3 piece carbon steel body, stainless steel ball and stem, threaded ends.

**4. Automatic Transmission Fluid (ATF) Piping:**

**Service Requirements:** Automatic Transmission Fluid: Supply maximum operating pressure if 1200 psig.

**Pipe:** Schedule 80 Black Steel, ASTM A53, seamless.

- a. Joints: Butt welded per ANSI B16.11

**Fittings:** Wrought carbon steel standard weight welding ASTM A234, grade WPB or WPC, ANSI B16.9

**Ball Valves:** MSS SP-110, 1500 psig WOG, blow-out proof stem, 3 piece carbon steel body, stainless steel ball and stem, socket welded ends.

**Tubing:** SAE 1010, dead soft, cold drawn, seamless steel.

- a. Tubing wall thickness: 0.065 inches, minimum.

- b. Joints: Mechanical joined with fittings rated at a 4:1 safety factor of burst over operating pressures. Materials to be compatible with fluids being transported.

- c. Fittings: Steel or stainless steel, butt joint mechanical fittings meeting the following industry standards:

- i. JIC Pneumatic and Hydraulic Standards.
- ii. ANSI Code for Pressure Piping.
- iii. ASME Code for Pressure Piping
- iv. MIL-F-18280E

**Valves for Tubing:** MSS SP-110, 1500 psig WOG, blow-out proof stem, 3 piece carbon steel body, stainless steel ball and stem, socket welded ends.

**5. Chassis Grease Piping:**

**Service Requirements:** Automatic Transmission Fluid: Supply maximum operating pressure if 6000 psig.

**Pipe:** Schedule 160 Black Steel, ASTM A53, seamless, grade B.

**a. Joints:** Socket welded per ANSI B16.11, with fittings rated at a 4:1 safety factor over operating pressures.

**Fittings:** Forged class 6000.

**6. Condensate Drain Piping:**

**Pipe:** Seamless copper hard temper Type "L" ASTM B88-83A.

**Fittings:** Wrought copper ASTM 16.18 95-5 solder type fittings.

**7. Natural Gas Pipe (Above-Ground):**

**Pipe:** Schedule 40 uncoated black steel pipe conforming to ASME B36.10M.

**Fittings:** 2" and Less -- 150 lb. screwed galvanized malleable iron conforming to ASME 16.3 with joints sealed with litharge and glycerine. Pipe threads shall conform to ASME B.20.1. Joint sealing compound shall be listed in UL-06, Class 20 or less. All joints concealed in walls shall be welded. For piping 2" and less: Socket-welded joints; for piping 2-1/2" and larger: Butt-welded joints as specified hereinafter.

**Shut-Off Valves:** Dezurik Series 400, 125 pound, double seal, tight shut-off, UL listed eccentric valves, Figure 425.

1/2" to 2" -- Screwed ends, ASME b16.33.

Over 2" -- Flanged ends, cast iron body, RS49 resilient plug seal, with lever: Figure 483.

**Gas Solenoid Valve:** Equal to ASCO Series 8315 two-way normally closed valve. Valve shall be explosion-proof and operate on 120 volts. Provide for gas lines with automatic shut-off requirements (i.e., Kitchen, Science Rooms, etc.).

Contractor's Option: For piping 2-1/2" and less, Contractor may use socket-welded joints with threaded forged steel fittings conforming to ASME B16.11 in lieu of screwed joints.

For shut-off valves, the Contractor may use UYL listed, AGA-Certified and NFPA-approved ball valves, Maxitrol Model BV250.

**8. Sanitary and Vent Underground – Within Building to 5 Feet Outside Foundation Wall:**

**Pipe & Fittings: Service weight, Commercial Standard CS188, ASTM 74-82, 10 foot lengths where possible. Provide bell and spigot pipe with neoprene gasket compression joints ASTM C564-76.**

**9. Sanitary and Vent Above Floor Inside Building:**

**Pipe & Fittings: Cast iron "No-Hub" pipe and fittings, Cast Iron Soil Pipe Institute Standard No. 301-85. Installation and support shall be in accordance with Cast Iron Soil Pipe Institute recommendations. Joints shall be made with stainless steel clamps.**

- B. Steel pipe shall be similar and equal to National Tube Company, Grinnell, Wheatland, Stockham, Weldbend, Republic, or Bethlehem black or zinc-coated (galvanized) as hereinafter specified. Pipe shall be free from all defects that may affect the durability for the intended use. Each length of pipe shall be stamped with the manufacturer's name.
- C. Copper pipe shall be Revere, Anaconda, Chase, or approved equal, with approved solder fittings.
- D. Welded fittings for steel pipe shall meet the requirements of ASTM Standard A-23 and shall be standard catalog products. Fittings fabricated by mitering and notching pipe will not be accepted.

**2.2 PIPE HANGERS, ROLLER SUPPORTS, AND SADDLES**

- A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260 for pipe 3/4" and larger, and Figure 65 for pipe 1/2" and smaller, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271. Provide pipe covering protection saddles for hot temperature service, black steel piping systems, similar to Grinnell, figures 160-165. Provide insulation protection shields for all piping systems. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Provide riser clamps for vertical piping, Grinnell Figure 261, for black steel piping and Figure CT-121, for copper piping. Provide pipe hanger flange, Grinnell Figure 153, for piping located in exposed areas (except for Mechanical Equipment Rooms. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following for horizontal piping:

Nominal Pipe Size Inches	Maximum Span Feet		Minimum Rod Diameter inches of ASTM A36 Steel Threaded Rods
	Standard Steel Pipe	Copper Tube	
3/4 & 1	6	5	3/8
1 - 1/4	6	6	3/8
1-1/2	8	5	3/8
2	8	8	3/8
2-1/2	10	9	1/2
3	12	10	1/2
4	14	12	5/8
5	14	12	5/8
6	16	12	3/4
8	18	12	7/8
10	20	12	7/8
12	20	12	7/8

For cast iron soil pipe support at five (5) foot intervals except that where ten-foot lengths of cast iron soil pipe are used, ten foot intervals between supports are acceptable and at each hub.

- B. For vertical piping of the following materials shall be supported according to the manufacturer's recommendations but not less than the distances listed below:
  - a. Cast Iron Soil Pipe - At base and at each story height.
  - b. Steel Threaded Pipe - At base and at each story height.
  - c. Copper Tube - At each story height but not more than 10-foot intervals.

2.3 VALVES

- A. Refer to Paragraph 2.10 A. Provide parts list and assembly drawings (exploded view) for all valves in shop drawing submittals. Provide valves of the same type by the same manufacturer.
- B. Check valves in base mounted pump discharges shall be of the vertical type and shall be Miller "non-slam" check valves or approved equal suitable for service intended. Check valves in circulator discharges shall be horizontal type.

- C. Multi-Purpose Valve: Multi-purpose valve (non-slam check valve, throttling valve, shut-off valves and calibrated balancing valve) shall be provided at discharge side of each base mounted pump. Multipurpose valve shall be suitable for horizontal or vertical installation. The valve shall be a bubble tight shut-off with plug type flow control and spherical brass clapper. The valve shall be provided with memory stops, pointer and scale. The valve shall be of heavy-duty cast iron construction bronze fitted with standard ANSI flanged connections for sizes 4 inch and larger and threaded for sizes 3 inches and smaller. Multipurpose valve shall be rated for a maximum working pressure of 175 psig at 240EF. The valve shall be fitted with a stainless steel stem or stem sleeve and brass seat with "O" ring seal. Valve shall be Taco "Plus One" Number 300-4.2 or Bell and Gossett 3DS Triple Duty Valve, Amtrol, Mueller, or Wheatley.

#### 2.4 BACKFLOW PREVENTERS

- A. Furnish and install backflow preventers at all cold water make-up connections to HVAC water systems and the domestic cold water service.
- B. Backflow preventers shall be of bronze body construction for sizes 3 inches and less, cast iron body construction for sizes 4 inches and greater, inlet and discharge gate valves, shut-offs-non rising stem for sizes 2 inches and less, OS&Y for sizes 2 1/2 inches and larger, stainless steel check and relief valve seats, stainless steel relief valve shafts and flange bolts. Ball valve test cocks shall be bronze body. Backflow preventers shall be provided with FDA approved epoxy coated strainers for sizes 2 1/2 inches and larger and bronze strainer for sizes 2 inches and smaller.
- C. Pressure ratings shall be up to 175 psi and temperature ratings shall be up to 210°F.
- D. Install unit per local code requirements and authorities having jurisdiction.
- E. Units shall be approved by ASSE No. 1013, AWWA C506, UPC, UL, SBCCI, and shall be Series 909 with air gap fitting No. 909 AG Series for HVAC make-up and domestic water; and Series 909RPDA-054-GPM-RW for fire protection (FM approved) as manufactured by Watts Regulator, Conbraco, Wilkens, CLA VAL, Febco, or Ames. Air gap fitting discharge shall be piped to closest floor drain.

#### 2.5 STRAINERS

- A. Strainers shall be of the basket or "Y" type and shall be heavy and durable, constructed of best grade gray iron with the bottoms drilled and plugged. Bodies shall have arrows clearly cast on the sides to show flow direction. Strainers shall be equipped with easily removable covers. Total area of basket perforations shall be not less than four times the cross section of the entering pipe. Flow shall be into basket, and then out through the perforations. Strainers shall be suitable for water or the intended fluid. Strainers 2 inches and smaller shall have threaded ends, 2 1/2 inches and larger shall have flanged ends.
- B. Strainer screens shall be stainless steel. Perforations in water lines shall be 1/16" diameter for pipe sizes 5 inches and less, 1/8" diameter (40% open area) perforations for pipe sizes 6" and greater. Perforations in steam lines shall be 0.033" through 2" pipe size and 0.045" for pipe sizes greater than 2".
- C. Provide valved and capped (with chain) blowdowns in each strainer. Blowdown valves shall be Apollo 78-100/200 series or as approved equal.

- 1. Schedule of Service:

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

a.	Domestic Water	2" and smaller 2-1/2" and larger	Mueller No. 351-M Mueller No. 758
b.	Non-Potable Water	2" and smaller 2-1/2" and larger	Mueller No. 11-M Mueller No. 758

- D. Strainers shall be manufactured by Mueller, Watts, Armstrong, Yarway, Spirax/Sarco, StreamFlo, or as approved equal.

## 2.6 UNIONS

- A. Unions in steel pipe shall be malleable iron with brass inserted seats designed for a working pressure of 150 psig.
- B. Unions in copper pipe shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.
- C. Unions shall be manufactured by Watts, Flowset, or as approved equal.

## 2.7 MANUAL AIR VENTS

- A. Manual air vents shall be similar to gauge valves specified hereinafter. Provide 1/4" size on 3/4" pipe and smaller, 1/2" size on 1" pipe and larger. Install at all high points of piping. Valves shall be Crane No. 88, or as approved equal, with threaded ends, bronze body, bronze or brass bonnet and bronze stem.

## 2.8 THERMOMETERS

- A. Unless otherwise indicated, thermometers shall be in a glass type, mercury filled, 9-inch scale size, corrosion-resistant metal case, with "any-angle" mounting: Terice Industrial Thermometers, Weksler Instruments, Ernst Gage Co., Weiss, or approved equal. Insertion stem length shall suite the pipe size and configuration. Thermometer wells shall be brass with brass union hubs in copper and in ferrous piping. Where piping is insulated or otherwise covered, use wells with lagging extension. Where wells are installed in pipe tees at turns, increase pipe size so that well does not restrict flow.
- B. Unless otherwise indicated, thermometer ranges shall be as follows:
- |                         |                         |
|-------------------------|-------------------------|
| 1. Domestic Hot Water.  | 30°F to 240°F, 2°F Div. |
| 2. Domestic Cold Water: | 0°F to 100°F, 1°F Div.  |
- C. Provide heat conducting compound in wells.

## 2.9 PRESSURE GAUGES

- A. Unless otherwise indicated, pressure gauges shall be the bronze bourdon tube type, 4-1/2" dial, stem mounting, cast aluminum adjustable pointer, 1% accuracy over middle half of scale range, 1-1/2% over balance: Terice Model 600C; Weksler Instruments, Ernst Gage Co., Ashcroft or Wiess Instruments.
- B. Gauges shall have pressure, vacuum, compound, or retard ranges as required, select ranges so that the normal readings are at the approximate midpoint and maximum system pressures do not exceed full scale.

- C. Furnish and install a gauge valve at each pressure gauge. Gauge valves shall be Crane Model No. 88, Needle Valve, Ernst Gage Co. FLG 200, Weksler Instrument Corp. Type BBV4, or approved equal, rated for pressure intended.
- D. Gauge connections for pressure gauges, thermometers, or control instruments shall be made using tee fittings, except that gauge connections up to 1-inch size in steel may be using threaded extra heavy pipe couplings welded directly to the main, provided that the main is at least 2-inch size for 1/2-inch connections, 3-inch size for 3/4-inch connections, and 4-inch size for 1-inch connections. Minimum gauge connection shall be 1/2" ips.
- E. Provide snubbers on all gauges. Snubbers shall be No. 872 by Trerice, RS1/RS6 by Weksler Instruments or as approved equal.

#### 2.10 PIPING SPECIALTIES

- A. Water pressure safety relief valves shall be provided in the number and sizes required to relieve 110% the full input to the systems. Valves shall be ASME rated. Pipe discharge full size to floor drain, with flexible joint between valve and supported discharge pipe. Water safety relief valves shall be Watts Series 740 or Watts Series 174A for capacities not available in Series 740, Conbraco Series 154A, Bell and Gossett, or as approved equal.
- B. Pressure and temperature relief valves shall be provided in the number and sizes required to relieve 110% of the full input to the system. Provide pressure and temperature relief valves on domestic water heaters and where shown on the drawings. Each valve shall be provided with a nameplate indicating pressure setting, A.G.A. rating, type number and date of manufacture. Valve shall be tested under ANSI Z21.22 "RELIEF VALVES AND AUTOMATIC GAS SHUT-OFF DEVICES" with ratings certified and listed by A.G.A. and C.G.A.; and the pressure discharge capacities by steam rated pressure relief in accordance with requirements of Section IV ASME Code as tested and certified by the National Board. Valve thermostat must be immersed in tank water and located in top six (6) inches of tank. Pipe discharge to floor drain full size of valve connection. Manufacturer shall be Watts Regulator No. 40XL, 40 Series Model M12 thermostat for 3/4 inch size and Series N240, 340 Model M-14, M2 and M4 thermostat for one (1) inch size and larger.

#### 2.11 ESCUTCHEONS

- A. Provide chromium-plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.

#### 2.12 DIELECTRIC CONNECTIONS

- A. Furnish and install electrically insulated dielectric unions or flanges, as manufactured by Watts Regulator, EPCO Sales, Inc., Flowset, or as approved equal, at the following locations:
  - 1. Where steel piping systems join copper piping.
  - 2. Where copper tube connects to domestic water storage tanks, expansion tanks, and other steel vessels.
  - 3. Avoid the installation of steel nipples, cast iron or steel valves and specialties, or other ferrous components in predominately copper piping systems. Where such installation is necessary, isolate the component with dielectric connections. Do not mix steel pipe and copper tube in the same run of pipe or in the same section of a piping system.

2.13 SLEEVES

- A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.
- B. Sleeves through floors shall be flush with the floor except for sleeves passing through Equipment Rooms that shall extend 3/4" above the floor. Refer to Section 15950 VIBRATION ISOLATION for mechanical equipment room penetrations additional requirements. Space between the pipe and sleeve shall be caulked. Escutcheon plates shall be constructed to conceal the ends of sleeves. Each trade shall be responsible for drilling existing floors and walls for necessary sleeve holes. Drilling methods and tools shall be as specified in Paragraph 1.7 hereinbefore.
- C. Sleeves through walls and floors shall be sealed with graphite packing and molten lead and sealed with a waterproof caulking compound.

2.14 PRESSURE-REDUCING VALVES

- A. Provide pressure reducing valves for the incoming domestic water service as indicated on the Drawings, of size and capacity selected by the installer to maintain operating pressure on the system. Body shall be cast-iron or bronze construction, renewable stainless steel seat, non-corrosive disc, water-tight cage assembly, adjustable pressure ranges and inlet strainer Watts Regulator Model 223-S, Wilkens, Armstrong, Bell and Gossett, Wilkens, or as approved equal.

2.15 BELOW-GRADE PIPE SLEEVES/SEALS

- A. Sleeve Inside Diameters: The inside diameters indicated for sleeves are approximate only. Before ordering, fabricating, or installing these sleeves, Contractor shall determine the required inside diameter of each individual sleeve, and shall provide each sleeve accordingly. The actual inside diameter of each sleeve shall be as required to accommodate the pipe entering or passing through the sleeve, and to assure the watertight installation of the seal specified below.
- B. Seals: For pipe sleeves, seals shall be "Link-Seal", as manufactured by Thunderline Corporation, 5495 Treadwell Road, Wayne, Michigan, or as approved equal. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve, with zinc phosphate plated carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe, with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a strictly watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

2.16 PRESSURE/TEMPERATURE TEST PORT (P/T PLUS)

- A. Manufacturers:
  - 1. Flow Design, Inc, SuperSealJ.
  - 2. Pete's Plug.
  - 3. Sisco.

- B. Design: Ports shall be suitable to accept a 1/8" diameter thermometer stem or pressure gauge adapter and shall have dual EDPM internal seals. Device shall have a threaded cap with internal seal and a plastic or metal retainer strap. Ports for insulated pipe or equipment shall be 1/2" MPT by 2-3/4" long. Ports for uninsulated pipe or equipment shall be 1/2" MPT by 1-1/2" long.
- C. Construction: Brass body with dual EDPM seals and brass cap with a retainer strap.
- D. Minimum Ratings: 1000 psi at 270 deg F.
- E. Readout Meter Kit: Provide a portable readout meter kit by the Manufacturer of the P/T ports. The kit shall include two thermometers, a pressure gauge and adapters. The kit shall include silicone lubricant and all components supplied in a molded plastic case.
- F. Installation:
  - 1. Install pointing vertically up or in a horizontal plane. Do not have the test port pointing downward.
  - 2. Install in accordance with the Manufacturer's instructions.

#### **2.17 COMPRESSED AIR POWERED LINEAR RECIPROCATING LUBE PUMP - GENERAL**

- A. Design all lubricant pumps to pump grease or oil to within one inch of the bottom of the product container to ensure maximum use of purchased material.**
- B. Design all pumps to stand free of the bottom of the container to allow unobstructed flow of product to the pumping tube.**
- C. All pumps of the self-priming design. Pumps so designated for use in bulk supply tanks shall be equipped with low oil shut off device to prevent free cycling of the pump in the event the product supply is exhausted.**
- D. Equip all pumps with an overrun air control valve to disable the pump in the event of a catastrophic failure of the piping system.**
- E. All pumps shall have an air motor design with no metal-to-metal seals to prevent air leakage in the stalled condition. The air motor cylinder shall be of aluminum construction to prevent corrosion in the presence of a contaminated air supply. The air piston shall be of one-piece molded NBR construction to give a long trouble free service life. The air valve shall be of simplified construction with no more than three moving parts. The piston rod shall be finished to a surface tolerance of 0.25µm and hard electroless nickel coated for maximum seal life and low friction. Oil and Grease pumps shall be of the centerline design, for even wear distribution and minimal repair costs.**
- F. All pumps shall be equipped with bronze non-wearing, non-fouling, and non icing mufflers to meet and exceed OSHA recommendations for noise generation.**
- G. All pumps shall be double acting to provide continuous even flow and pressure and maximum utilization of the compressed air supply.**
- H. Primary and secondary self-lubricating throat seals constructed of copper impregnated Turcon™ number 46 with Nitrile back up rings.**

I. All pumps shall have case hardened seats and ball checks for maximum service life and resistance to damage from contaminated product.

J. All pumps easily serviceable with no special tools required.

K. Pumps individually factory tested and verified for proper function. This test shall consist of a minimum of one-hour intermittent operation pumping product against full operating pressure.

## 1.02 COMPRESSED AIR POWERED LINEAR RECIPROCATING LUBE PUMPS

A. Service Requirements:

1. Motor Oil (MO)
2. Automatic Transmission Fluid (ATF)

B. In addition to meeting all of the general pump specifications, this pump shall also have the following features.

C. The 10:1 ratio positive displacement oil pump with pneumatically operated 4 ¼" diameter air motor, a 4" pumping stroke length and cycle on demand only. External muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor to incorporate a valve in piston design durability and longevity. Air motor cylinder material is hard coated aluminum and corrosive resistant steel. The air motor shall feature a non-metallic poppet valve. The air motor and lower pump section of the in-line design. The pump to be tank mounted and to include hose & fitting kit, FRL, air & fluid shutoff valves, and mounting bracket. Model #205626

1. Pump ratio: 10:1
2. Continuous duty flow rate: 4.1 gpm
3. Maximum fluid pressure: 1,800 psi
4. Maximum air inlet pressure: 180 psi
5. Fluid outlet size: 3/4" NPT
6. Air inlet size: 1/2" NPT
7. Air Consumption: 32 cfm per 4.1 gpm

D. Provide the following with each pump:

1. Thermal Relief Kit
2. Hose and Fitting Kit
3. Low Level Cut Off
4. Bleed Type Air
5. Shut-Off Valve
6. Air Filter/Regulator
7. Lubricator, ½" ports
8. Automatic Drain Valve for filter
9. ¾" fluid shut-off valve
10. Pump runaway valve
11. ½" Air Coupler
12. ½" Air Coupler

E. Service Requirements:

1. Chassis Grease (GR)

F. The 50:1 ratio positive displacement grease pump pneumatically operated 4 1/4" diameter air motor, a 4" pumping stroke length and cycle on demand only. External muffler that operates below OSHA noise standards, and equipped with a grounding lug. The design

of the air motor shall incorporate a valve in piston design. Air motor cylinder hard coated aluminum and corrosive resistant steel. Air motor and lower pump section of the in-line design. The pump of the "Topper" type with down tube for a 400 pound drum, an integral inductor plate, hose and fitting kit and a pump elevator model # 226018.

1. Pump ratio: 50:1
2. Continuous duty flow rate: 5 pounds per minute
3. Maximum fluid pressure: 7,500 psi
4. Maximum air inlet pressure: 150 psi
5. Fluid outlet size: 3/8" NPT
6. Air inlet size: 1/2" NPT
7. Air Consumption: 13 cfm per gallon

G. Provide the following at each pump:

1. 1/2" Filter/Reg./Lubricator
2. Automatic drain for air filter
3. 1/2" Air shut-off Valve
4. 1/2" Fluid shut-off, HP
5. Air Motor Muffler
6. Pump runaway valve
7. 1/2" air coupler
8. 1/2" air connector

### 1.03 HOSE REELS ASSEMBLIES

A. Acceptable Manufacturers:

1. GRACO
2. Lincoln
3. ARO
4. Balcrank
5. Samson
6. Or Approved Equal

B. Service Requirements:

1. Motor Oil (MO)
2. Automatic Transmission Fluid (ATF)

C. Hose reel with 50 feet of 1/2" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing, anti-galling and easy service, repairable guide rollers and a long life return-spring life. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and delrin bearings and seals. Designed to mount on ceilings, wall or floors. The reel shall be complete with Electronic Meter, hose inlet kit, fluid shut off. Model # 224058.

1. Hose length-oil: 50' x 1/2" ID
2. Reel outlet: 1/2" npsm
3. Reel inlet: 1/2" npsm
4. Pressure rating oil: 1,800 psi

D. Provide the following for each motor oil, ATF and hydraulic fluid reel:

1. Hose Inlet Kit

2. 1/2" Fluid Shut-Off Valve
  3. Digital preset metered dispense valve
- E. Service Requirements
1. Chassis Grease (GR)
- F. Hose reel with 50 feet of 3/8" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, a ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing, anti-galling and easy service, repairable guide rollers return spring. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and Delrin bearings and seals designed to mount on ceiling, wall or floors. Complete with hose inlet kit, 3-way swivel, high pressure shut-off valve, dispense valve.
1. Hose length-grease: 50' x 3/8" ID
  2. Reel outlet: 3/8" npsm
  3. Reel inlet: 3/8" npsm
  4. Pressure rating grease: 8,000 psi for bare reel
- G. Provide the following for each reel:
1. Hose Inlet Kit
  2. HP Shut-Off Valve
  3. Grease dispense valve
  4. 3/8" three way swivel
- H. Service Requirements
1. Compressed Air
- I. Hose reel with 50 feet of 1/2" ID hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs. Fully ported hub with little flow restriction for fast dispense, guide-arms adjustable to 15 different mounting positions, double pedestal arms support hose guides on both sides, a ZA12 (zinc alloy) ratchet for anti-sparking applications, external brass swivel housing anti-galling and easy service, repairable guide rollers return spring. The hose guide roller assembly will be the full width of the spool, with 1-1/8" diameter rollers, a one-piece roller support and Delrin bearings and seals. The reel will be designed to mount on ceilings, wall or floors complete with hose inlet kit, air inlet valve.
1. Hose length: 50' x 1/2" ID
  2. Reel outlet: 1/2" npsm
  3. Reel inlet: 1/2" npsm
  4. Pressure rating: 1,800 psi for bare reel
- J. Provide the following for each reel:
1. Hose Inlet Kit
  2. 1/2" Air Shut-Off Valve
  3. Air Coupler

## PART 3 - EXECUTION

### 3.1 PIPING, GENERAL

#### PIPING, FITTINGS, VALVES, ETC.

221116 - 14

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- A. All pipes shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All pipes shall be so installed as to permit free expansion and contraction without causing damage. All horizontal mains shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. Horizontal sanitary and storm water piping shall pitch a minimum of 1/4 inch per foot. All open ends of pipe lines, equipment, etc., shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system. All pipes shall be run parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, with proper pitch. All piping shall be arranged so as not to interfere with removal of other equipment on devices not to block access to doors, windows, manholes, or other access openings. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment, coils, etc., and installed so that there will be no interference with the installation of the equipment, ducts, etc. All valves and specialties shall be placed to permit easy operation and access and all valves shall be regulated, packed and glands adjusted at the completion of the work before final acceptance. All piping shall be installed so as to avoid air or liquid pockets throughout the work. Ends of pipe shall be reamed so as to remove all burrs.
- B. All piping shall be run to provide a minimum clearance of 1/2" between finished covering on such piping and all adjacent work.
- C. All valves, strainers, caps, and other fittings shall be readily accessible.
- D. Rough-in and final connections are required to all equipment and fixtures provided under this Contract.
- E. Drain valves with hose connections shall be provided at low points for drainage of piping systems. Blow down valves shall be provided at the ends of all mains and branches so as to properly clean by blowing down the lines throughout in the direction of normal flow. Blow down valves shall be provided with cap and chain.
- F. Discharge lines from all relief valves shall be piped to within 4" of floor and extend to floor drains wherever floors are not pitched to drains.
- G. All branches from water mains shall be taken from the top of the supply mains at an angle of forty-five (45) degrees above the horizontal, unless otherwise directed. Branches feeding down shall be taken from the side or bottom of the main on water mains only. All connections shall be carefully made to insure unrestricted circulation, eliminate air pockets or trapped condensate, and permit the complete drainage of the system.
- H. Cutoff valves shall be provided on each branch line from the mains on all plumbing and heating/air conditioning lines.
- I. Shut-off valves shall be installed at the inlet and outlet of each coil, control valve and piece of equipment to permit isolation for maintenance and repair.
- J. Balancing valves shall be installed in all pumps, where required for balancing, and where indicated on the drawings.
- K. Unions shall be installed on all bypasses, at all connections to equipment and where shown on drawings or where required to facilitate removal of equipment whether shown or not.

- L. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.
- M. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies exist within the drawings, the larger pipe size shall govern.

### 3.2 PIPE JOINTS

- A. Where copper piping joins steel piping, approved bronze adapters shall be used.
- B. Prohibited Connections: No direct weld, soldered, or brazed connections, without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.
- C. Mechanical specification for mechanical joint for cast iron pressure pipe & fittings, ANSI A21.11.
- D. When installing gas piping which is to be concealed (i.e., in walls), unions, tube fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combination of fittings shall not be used.
- E. Gas Piping:
  - 1. Final Gas Connections: Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings.
  - 2. Pipe Joints:
    - a. Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.
    - b. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL-approved graphite joint sealing compound for gas service. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.
    - c. Welded Metallic Joints: Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.
    - d. Special Requirements: Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall comply with NFPA 54.

### 3.3 HANGERS, SUPPORTS, ANCHORS, GUIDES

- A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide

protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Grinnell's Figure 173/273 or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shield shall be Grinnell's Figure 167, or as approved equal.

- B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.
- C. Vertical Lines: Shall be supported at their bases, using either a suitable hanger placed in a horizontal line near the riser, or a base type fitting set on a pedestal, foundation or support. All vertical lines extending through more than one floor level shall be supported at each floor with a riser clamp. Riser clamp shall be Grinnell Co.'s Figure 261, or approved equal. All vertical drops to pump suction elbows shall be supported by floor posts.
- D. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Grinnell or as approved equal. All exterior hanger and bracket systems in their entirety shall be galvanized.
- E. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist.

3.4 DIRT POCKETS

- A. Dirt pockets shall be installed at the base of all gas risers and at each piece of gas fired equipment, and as indicated on the drawings.

3.5 PIPING AND DUCTWORK IDENTIFICATION

- A. All piping and ductwork shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with OSHA and ANSI Standards A13.1-1981. Scheme for the Identification of Piping Systems and ASHRAE Chapter 34 of the 1989 Fundamentals Handbook.
- B. Markings shall use letters of standard style (Sans Serif Gothic bold lettering) letters, stenciled on pipes and ductwork, and shall be located near each branch connection, near each valve or flanges, where pipes or ducts pass through walls or floors, adjacent to changes in direction, and at least every 30 feet on straight runs of pipe or ductwork. Where pipes or ductwork are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor.

Outside Diameter of Pipe or Covering (Inches)	Length of Color Field (Inches)	Size of Letters (Inches)
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4

Outside Diameter of Pipe or Covering (Inches)	Length of Color Field (Inches)	Size of Letters (Inches)
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10 & Ductwork	32	3-1/2

For piping less than 3/4 inch, provide a permanently legible tag as specified hereinafter for valve identification.

- C. For buried piping, provide 2" minimum with plastic identification/detection tape with metallic core. Install 4-6 inches below-grade.

3.6 VALVE IDENTIFICATION

- A. All valves shall be identified with the appropriate service designation and valve number identification on brass valve tags. Each valve tag shall be 19 gauge brass and 2" diameter with 1/4" black-filled letters over 1/2" black filled numbers. Tags shall be fastened to valves with brass jack chains. Brass tags and fasteners shall be manufactured by Seton Name Plate Company, Champion-America, Inc. or as approved equal.
- B. Valve tag numbers shall agree with valve numbers on diagrammatics hereinbefore specified.
- C. Provide a minimum of one (1) valve chart with valve numbers indicating valve number, location, purpose, valve type, size, manufacturer and service.
- D. Valve charts shall be mounted behind glazed wooden or aluminum frames (style A116) and be hung in the mechanical equipment room. Three (3) additional charts shall be provided for use outside of the equipment room in a plastic protective envelope. Additional copies shall be provided in each copy of the O&M manuals. Valve chart frames and envelopes shall be manufactured by Seton Name Plate Company or as approved equal.

3.7 CLEANING PIPING AND EQUIPMENT

- A. The domestic water system and waste piping shall be flushed clean with fresh water. See 15400 for domestic potable water cleaning and sterilization.

END OF SECTION 221116

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Oil grit separator.
  - 3. Simplex grinder pump station.
  - 4. Valve vault.
  - 5. Cleanouts.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Gravity sewer piping.
  - 2. Pressure sewer piping.
  - 3. Oil grit separator.
  - 4. Grinder pump station.
  - 5. Valve vault.
- B. Shop Drawings:
  - 1. Gravity sewer piping.
  - 2. Pressure sewer piping.
  - 3. Oil grit separator.
  - 4. Grinder pump station.
  - 5. Valve vault.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- B. Field quality-control reports.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Sewer Piping:
  - 1. Pipe: ASTM D 2665, Schedule 40, Drain, Waste and Vent Pipe, and Fittings with solvent cement joints.
  - 2. Fittings: ASTM D 3311, PVC with bell ends.
- B. HDPE Pressure Sewer Piping:
  - 1. Pipe: ASTM 3035, SDR 11, cell Classification for PE1404, PE2406, PE2408 per ASTM D 3350.
  - 2. Fittings:
    - a. All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Engineer.
    - b. The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.
    - c. All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters and must be approved by the Engineer.

2.2 OIL-GRIT SEPARATOR

- A. The oil-grit separator shall be a three component, precast concrete, having a nominal 100 gallon capacity with 4-inch PVC inlet and outlet piping.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

1. The oil-grit separator shall be furnished with a heavy traffic top containing two (2) no. 24 x 4 castings with grade rings as required to meet finished grade conditions.
2. Oil-grit separator shall be Category 253-T-SA-HD as manufactured by Oldcastle Precast, utility Vault or approved equal.

2.3 SEWAGE GRINDER PUMPING STATION

- A. Sewage Pumping Station shall include a complete Grinder Pump System consisting of a simplex submersible grinder pump, stainless steel lift out rail system, stainless steel lifting chain, pump sealing plate elbow, structural plastic basin cover installed in a 36-inch fiberglass wet well enclosed as shown on the Contract Drawings.
  1. The Grinder Pump Station shall be a model WGL20 capable of meeting the operating conditions shown on the Contract Drawings and as specified herein: Size: 2 HP, Pump Speed: 3600 rpm, 208 V, 3 PH, 60 HZ.
  2. The pumping station shall be furnished with a NEMA 4X, 14 Ga. galvanized steel enclosure with padlock hap. Simplex control panel shall be Catalog No. CGL-23SW for 208V service as manufactured by F.E. Meyers or equal. Control panel options furnished shall include the following:
    - a. Elapsed Time Meter
    - b. Alarm Horn with Silence Switch
    - c. Convenient Outlet
    - d. 115 Volt Control Circuit Transformer
    - e. Low-Level Cut-Off and Alarm
    - f. Cycle Counter
    - g. Condensation Heater
    - h. Lightning Arrestor
    - i. Red Lexon Alarm Light
- B. Equivalent Grinder Pumping Stations may be Series SGV Grinder as manufactured by Barnes Pumps, Inc., Piranha S Series by ABS Pumps, Inc., or equal.
- C. Fiberglass wet well shall be provided with an antifoatation collar at or near the base of the wet well for attaching or constructing a concrete antifoatation ring. Shop Drawing shall include engineering calculations for sizing the concrete collar necessary to prevent floatation.

2.4 VALVE VAULT

- A. Valve vault shall be a 48-inch precast concrete manhole conforming to ASTM C 478 sized as shown on the Contract Drawings.
- B. Valve vault shall be furnished with stainless steel manhole steps spaced at 12-inches on center.
- C. Valve vault cover shall be 24-inch cast iron, Catalog No. 2800, eight duty with solid cover marked Sanitary Sewer as manufactured by East Jordon Iron Work or approved equal.

## 2.5 CLEANOUTS

### A. PVC Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Canplas LLC.
  - b. IPS Corporation.
  - c. NDS.
  - d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.
2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.6 CONCRETE

### A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

### B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- #### A.
- Refer to DelDOT Standard Specification for Road and Bridge Construction, Section 208, for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- #### A.
- General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- B. Install gravity piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install fittings for changes in direction. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install force-main, pressure piping according to the following:
  - 1. High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instructions of the manufacturer, as shown on the Drawings and as specified herein. A qualified joining technician shall perform all heat fusion joints.
  - 2. HDPE shall be installed wither by Open Trench Construction or Directional Bore Method.
  - 3. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back".
  - 4. Pipe shall be laid to lines and grade shown on the drawings.
  - 5. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.
  - 6. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:
    - a. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
    - b. A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
    - c. 316 stainless steel bolts and nuts shall be used.
  - 7. Flange connections shall be provided with a full-face neoprene gasket.
  - 8. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.
  - 9. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
  - 1. Join PVC, DWV sewer piping using solvent cement joints.
  - 2. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- B. Join force-main, pressure piping according to the following:
1. The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657 and conform to the Generic Butt Fusion Joining Procedure for Field joining of Polyethylene Pipe, Technical Report TR-33/2005, published by the Plastic Pipe Institute (PPI). All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by pipe manufacturer or experienced, trained technician shall perform all heat fusion joints.
- C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    - a. Unshielded flexible couplings for pipes of same or slightly different OD.
    - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
  2. Use pressure pipe couplings for force-main joints.

### 3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

### 3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth areas in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads areas with tops flush with pavement surface.

### 3.6 IDENTIFICATION

- A. install green warning tapes directly over piping. Locate 12 inches below finished grade, except 6 inches below subgrade under pavements.
1. Use warning tape over ferrous piping.
  2. Use detectable warning tape over nonferrous piping.

3.7 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
  7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
- C. Leaks and loss in test pressure constitute defects that must be repaired.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA MAINTENANCE FACILITY  
NEW SHOP #21, TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 221313

SECTION 224213 – PLUMBING FIXTURES

PART 1 – GENERAL

1.1 GENERAL

- A. For General Mechanical Requirements, see Section 230513 & Division 1 – General Requirements.
- B. All exposed bolts, screws, etc., shall be vandal-proof.
- C. All plumbing materials, equipment and fixtures shall be new and of best grade, free of defects and complete with all required appurtenances and accessories.
- D. Piping and insulation are specified under the other sections.
- E. Use “Sani-Sett” setting compound for fixtures.
- F. Provide all materials, equipment and perform all labor required to install plumbing system complete as specified, as drawings indicated and as required by the State of Delaware, National Standard Plumbing Code, International Plumbing Code, local code, and all other Authorities Having Jurisdiction.
- G. Provide stops for all plumbing fixtures and equipment. Stops are to be accessible.
- H. Provide P traps on fixtures for which traps have not been included as part of furnished equipment. Trap size to equal size of fixture tailpiece.
- I. All exposed metal parts of fixtures shall be chromium plated brass. Piping, fittings, valves, traps and accessories including escutcheons for piping shall be chromium plated where exposed in finished areas.
- J. All faucets for residential kitchen sinks, lavatories, commercial kitchen sinks, drinking fountains, bubblers, and ice makers shall be listed for drinking-water or commercial applications by the National Sanitation Foundation (NSF) or Underwriters Laboratory (UL). All required faucets shall comply with NSF Standard 61 for both lead content and leaching rate. Submit documentation indicating compliance for all required faucets.
- K. Provide pumps with manufacturer’s name, model number, and rating/capacity identified.
- L. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
  - 1. American Gas Association (AGA).
  - 2. National Sanitation Foundation (NSF).
  - 3. American Society of Mechanical Engineers (ASME).
  - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
  - 5. National Electrical Manufacturer’s Association (NEMA).
  - 6. Underwriters Laboratories (UL).
- M. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.
- N. Provide trap priming where floor drains are connected to sanitary systems.

- O. Plumbing fixtures shall comply with Delaware Water conservation Act.

## 1.2 REFERENCES

- A. ANSI/ASME A112.6.1 – Supports for Off-the-floor Plumbing Fixtures for Public Use.
- B. ASME A112.18.1 – Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI/ASME A112.19.1 – Enameled Cast Iron Plumbing Fixtures.
- D. ANSI/ASMI A112.19.2 – Vitreous China Plumbing Fixtures.
- E. ANSI/ASME A112.19.3 – Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- F. ANSI/ASME A112.19.4 – Porcelain Enameled Formed Steel Plumbing Fixtures.
- G. ANSI/ASME A112.19.5 – Trim for Water-Closet Bowl, Tanks, and Urinals (Dimensional Standards).
- H. IAPMO/ANSI Z124.1 – Plastic Bathtub Units.
- I. IAPMO/ANSI Z124.2 – Plastic Shower Receptors and Shower Stalls.
- J. ANSI Z358.1 – Emergency Eyewash and Shower Equipment.
- K. ANSI/ARI 1010 – Drinking Fountains and Self Contained, Mechanically Refrigerated Drinking Water Coolers.
- L. ANSI/ASSE 1011 – Hose Connection Vacuum Breakers.
- M. ANSI/ASSE 1012 – Backflow Preventers with Immediate Atmospheric Vent.
- N. ANSI/ASSE 1013 – Backflow Preventers, Reduced Pressure Principle.
- O. ANSI/ASE 1019 – Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- P. ANSI A112.21.1 – Floor Drains.
- Q. ANSI A112.21.2 – Roof Drains.
- R. ANSI A112.26.1 – Water Hammer Arrestors.
- S. AWWA C506 – Backflow Prevention Devices – Reduced Pressure Principle and Double Check Valve Types.
- T. PDI WH-201 Water Hammer Arresters.
- U. ANSI/ASHRAE 90A – Energy Conservation in New Building Design.
- V. ASME Section VIII D – Pressure Vessels: Boiler and Pressure Vessel Codes.
- W. ANSI/NFPA 30 – Flammable and Combustible Liquids Code.
- X. ANSI/NFPA 54 – National Fuel Gas Code.

- Y. ANSI/NFPA 58 – Storage and Handling of Liquefied Petroleum Gases.
- Z. ANSI/NFPA 70 – National Electrical Code.
- AA. ANSI/UL 1453 – Electric Booster and Commercial Storage Tank Water Heaters.
- BB. ANSI/UL 174 – Household Electric Storage Tank Water Heaters.
- CC. ANSI/NEMA 250 – Enclosure for Electrical Equipment (1000 Volts Maximum).
- DD. UL732 – Safety Standards – Oil Water Heaters.
- EE. IBC – International Building Code.

### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of General Requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

### 1.4 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings and per the manufacturer.
- B. Confirm that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

### 1.5 EXTRA MATERIALS

- A. Provide two sets of faucet washers and flush valve service kits to the Owner. Provide correspondence to Engineer that extra materials have been turned over to the Owner.

### 1.6 GRAB BAR COORDINATION

- A. For handicapped plumbing fixtures coordinate location of flush valves with grab bars prior to installation.

## PART 2 – PRODUCTS

### 2.1 GAS FIRED DOMESTIC WATER HEATERS (CONDENSING, HIGH EFFICIENCY TYPE), A.O. SMITH

- A. Water Heater(s) shall be made BTH as manufactured by A.O. Smith, Lochinvar, State, Bradford White, or approved equal. Water Heater(s) shall be of the seamless glass lined steel tank construction in which the glass coating is applied to the water side surfaces of the tank after the

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

tank has been assembled and welded. The condensing flue coil shall be coated on the flue gas side with A.O. Smith's proprietary or equal acid resistant glass lining designed for use in condensing heaters.

- B. The heater shall be suitable for sealed combustion direct venting PVC air intake pipe and PVC exhaust pipe for a total distance of (50') equivalent feet of vent and 50' equivalent feet of intake. The heater shall be factory assembled and tested. The power burner shall be of a design that requires no special calibrations or start up. The heater(s) shall be approved for 0-inch clearances to combustibles.
- C. The control shall be an integrated solid state temperature and ignition control device with integral diagnostics, LED fault display capability and digital display of temperature settings.
- D. The tank shall be foam insulated and equipped with an ASME-rated temperature pressure relief valve. The water heater shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992.
- E. The heater shall be listed by SCAQMD, Rule 1146.2 Low NOx. Water Heater shall comply with ASME CSD-1.
- F. Provide unit with brass drain valve and install on 4-inch high housekeeping pad as detailed on the contract drawings.
- G. The water heater shall be tested at start-up by a qualified representative of the manufacturer. Provide a check list outlining start-up procedures to Engineer for review. A start-up report as provided by the manufacturer shall be completed and submitted before final acceptance of the domestic hot water heater system. Include copy of start-up report in O&M Manuals.
- H. Conduct flue gas analysis on unit as required by water heater manufacturer.
- I. Where multiple units are indicated furnish manifold kits to balance water flow through each heater.

## 2.2 FLOOR AND ROOF DRAINS

- A. Provide Nikaloy strainers on all floor drains unless specified otherwise.
- B. Provide flashing clamps on all drains penetrating waterproofing membrane.
- C. Provide suitable flashing material and clamping collar for drains which are not set in place when slab is poured.
- D. Provide backwater valves for all floor drains connecting directly to the storm water system. Depending on conditions of the particular installation backwater valves may be an integral part of the drains or a separate device. Accessibility to valve must be maintained for maintenance. Provide an adequately sized extension sleeve up to floor or grade as required.
- E. Backwater valves normally closed, flapper type with bronze or brass seat and disc and stainless steel pin.
- F. Provide traps for all floor drains connected to the sanitary system.

G. Trap Priming

1. Provide automatic trap primer valve (one valve per trap, per floor drain) for each floor drain, where distance from primary water source to drain is less than 15 feet. Automatic primer valve shall have integral vacuum breaker, gasketed access cover, all bronze-polished chrome-plate and 1/2" union connection. Primer valve shall be installed per Manufacturer's recommendations. When installed on fixture in finished area, primer valve shall be concealed behind an access door with stainless steel or chrome plated bronze frame and secured cover (vandal-proof) screws, 8"x8" minimum opening size, nickel bronze cover with polished top (or stainless steel). In lieu of primer valves, priming lines may be connected to Sloan VBF-72-A1 trap primer connection in flush valve tail piece.

Access Door

Josam Series No. 58650  
Zurn Series No. ZANB-1460-VP  
Wade Series No. W-8480-59-5  
Jay R. Smith Series No. 4735

Trap Seal Primer Valve

Josam Series No. 88250  
Zurn Series No. Z-1022  
Wade Series No. W-2400  
Jay R. Smith Series No. 2699

- I. In lieu of joints specified in piping section, neoprene gaskets may be used if designed for use with the drains and cleanouts employed and if approved by the local plumbing authority.
- J. Traps for floor drains shall be the deep seal type.
- K. Provide drains equal to catalog numbers listed below:

FDR-1: Floor Drain: Josam Series No. 32220 coated cast iron floor drain, two-piece body with double drainage flange, non-puncturing flashing adjustable clamp collar, weepholes, bottom outlet inside caulk connection, 1/2" trap priming connection round top and removable shallow sediment bucket which supports a heavy-duty loose-set anti-tilting ductile iron grate with perimeter drainage slots and vandal-proof secured top.

FDR-2: Floor Drain: Josam Series No. 30000-A coated cast-iron floor drain, two-piece body with double drainage flange, invertible non-puncturing flashing collar, weepholes, bottom outlet inside caulk connection, 1/2 " trap priming connection, sediment bucket and adjustable 5" diameter satin nickel bronze round, heel-proof strainer with vandal-proof secured top.

FDR-3: Trench Drain: Josam Type Number 5D, coated cast iron drain and integral deep drum 'P' trap with round Nikoloy dome strainer.

2.3 CLEANOUTS

- A. Provide cleanouts in sanitary and drainage systems at ends of runs, at changes in direction, near the base of stacks, every 50 feet in horizontal runs, of 4-inch diameter or less, every 100 feet in horizontal runs over 4-inches, and where indicated.
- B. Cleanouts shall be full size of pipe up to 4-inches and shall be 4-inches for larger sizes. Where installed in finished floors inserts shall match adjacent floor construction.
- C. In lieu of joints specified in piping, section, neoprene gaskets may be used if designed for use with the drains and cleanouts employed and if approved by the Authority Having Jurisdiction.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

1. Floors: Cast iron body, tapered bronze plug, nickel bronze scoriated vandal-proof cover, adjustable.
2. Walls: Cleanout tee with brass plug, stainless steel or polished nickel bronze access cover with vandal-proof screws.

E. Materials and Approved Manufacturers: Josam, J.R. Smith, Zurn, Wade or Ancon, equal to Josam numbers given below:

- |    |                                |                  |
|----|--------------------------------|------------------|
| 1. | <u>Concealed Piping</u>        | <u>C.I. Pipe</u> |
| 2. | <u>Unfinished Areas</u>        |                  |
|    | Floors                         | 56070            |
|    | Walls                          | 58790            |
| 3. | <u>Finished Areas – Floors</u> |                  |
|    | Composition Tile               | 56000-12         |
|    | Ceramic Tile                   | 56000            |
| 4. | <u>Finished Areas – Walls</u>  |                  |
|    | Plaster/Dry Wall               | 58770            |
|    | Tile/CMU                       | 58790            |

## 2.4 PLUMBING FIXTURES

### A. GENERAL:

1. Provide fixtures equal to catalog numbers listed below. Catalog numbers and manufacturers shall be indicated for each.
2. Fixtures shall be vitreous china unless otherwise noted. Cast iron fixtures shall have acid-resisting enamel finish unless noted otherwise. Color shall be white.
3. Flush valves shall be self-closing, non-hold-open type with vacuum breaker and perform satisfactorily when subjected to inlet water pressure varying from 15 to 75 psi.
4. Provide Dole flow fittings on lavatories.
5. Provide flexible risers and wheel stops, 17 gauge chrome-plated brass tail piece and trap with cleanout for all lavatories and sinks. Manufacturers: McGuire, Engineered Brass, Brass Craft, or specified fixture manufacturer.
6. Fittings for fixtures supplied by others, such as built-in sinks in counters and laboratory furniture, are provided under these specifications including strainer and tailpiece, except as hereinafter specified. Rough-in and final connections of these fixtures to the plumbing system are provided under this section.
7. All faucets shall comply with ANSI/NSF 61, Section 9, (except those excluded from compliance in the standard itself) and shall not have a lead leach rate in excess of 11 parts per billion at 1 liter dilution.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Water Closets, Urinals and Laboratories: Kohler, Crane, American Standard, Eljer, Toto, Zurn.
2. Faucets: Chicago Faucet, Kohler, Speakman, Symmons, T&S Brass, Zurn.
3. Drains: Chicago Faucet, Engineered Brass Co., Kohler, McGuire
4. Stops & Supplies: Chicago Faucet, T&S Brass, McGuire.
5. Flush Valves: Sloan, Delany, Zurn, Toto.
6. Traps: Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge min.)
7. Carriers & Supports: Zurn, Josam, Ancon, Smith
8. Washfountains: Bradley, Acorn.
9. Sinks: Elkay, Just, American Standard, CECO.
10. Service Sinks: Kohler, Crane, American Standard
11. Mop Sinks: Stern-Williams, Flat
12. Showers: Powers, Leonard, Speakman, Symmons.
13. Electric Water Coolers/Drinking Fountains: Haws, Elkay, Oasis, Halsey Taylor.
14. Emergency Fixtures: Bradley, Haws, Speakman, Chicago Faucet.

C. P-1

1. Watercloset (Handicapped): (floor mounted, flush valve) Floor Mounted, flush valve (handicapped); Cran Model 3H701 Hymont floor-mounted, flush valve (Handicapped) or Kohler Model K-4368 "Highcliff" lite toilet. Toilet, vitreous china, elongated bowl design, siphon jet flushing, floor mounted with bolt caps, seat, carrier, supplies and stops.
2. Flushometer: Sloan Model Regal #111-YB, Delany, Zurn or approved equal, low consumption (1.6 GPF), exposed diaphragm type, chrome plated brass closet flushometer. Unit shall include the following features and accessories: ADA compliant non-hold open handle, 1-inch I.P.S. screwdriver bak check angle stop, spud coupling and flange for [1-1/2" top spud], adjustable tail piece, vacuum breaker flush connection, sweat solder adapter with cover tube and wall flange. Supply with Sloan Model J-212-A split ring wall support.
3. Seat: Beneke Model 523 or Kohler Model K4670-C solid plastic white seat with open front and check hinge.
4. ADA: Fixture rim shall be mounted 17-inches above finished floor. Unit and installation shall comply with the American Disabilities Act Guidelines (ADA) and ANSI A11 7.1 requirement for people with disabilities.

D. P-2

1. Lavatory (Handicapped): (wall hung) (deck mount [Chicago] faucet, Crane 1412-20V Harwich or Kohler Model K-2032 Greenwich wall mount lavatory, vitreous china with 20-inch x 18 bowl, and 4-inch faucet centers. Provide concealed arm Carrier. Lavatory mounting height to be 34-inches above finished floor.
2. Faucets: Chicago Faucet 802-A317CP deck mounted lavatory faucets with wrist blade handles, E12 soft-flow outlet, polished chrome finish. Unit shall operate in either direction at less than 5 lbs. push at 80 psi water pressure. Certification to comply with ADA shall be furnished.
3. Strainer: Chicago Faucet Model 372A with 1-1/4-inch tailpiece, non removable brass strainer, grid strainer waste, chrome-plated finished.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

4. P-Trap: Cast Brass 1-1/4-inch "P" trap. Unit shall be offset drain assembly with under lavatory insulation.
5. Stops: Chicago Faucet Model 1005 valve stops with 3/8-inch loose key cap and removable tee handle, wall flange, chrome plated finished. All piping to be insulated with under lavatory insulation.
6. Insulation: See this Section.
7. Tempering Valve: Where indicated, provide and install (tempering valve) below fixture.
8. Carrier: Zurn, Josam, or Ancon cast iron and steel carrier. ANSI/ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

E. P-3

1. Kitchen Sink 8-inch Deep Bowl, Single Bowl: Just Model SL2225AGR3 or Elkay Model LR2522 deep single bowl sink. Unit shall be manufactured of 18 gauge, type 302 stainless steel with fully coated underside. Sinks shall be counter mounted complete with 8-inch faucet centers.
2. Faucets: Chicago Faucet Model 786-E3CP Deck mounted lavatory faucet with GN2A swing/rigid gooseneck spout with E3 aerator and Model 317 wrist blade handles. Faucets shall be 8-inches on center with chrome plated finish.
3. Strainer: Just J35 basket strainer or Jomar Model SS-306 Snap-N-Loc basket strainer and brass locknut and tailnut. Deep cup body and basket shall be 300 series stainless steel. Provide 1-1/2 tailpiece.
4. P-Trap: EBC TA 150. Cast Brass 1-1/2 "P" Trap.
5. Stops: EBC LAH11KC or Chicago Faucets Model 1005 valve stops with riser supply 3/8 Loose key cap and removable tee handle, wall flange, chrome plate finish.
6. Tempering Valve: Provide and install (P-7) below fixture.

F. P-4

1. Electric Water Cooler (Single Height/Handicapped Surfaced Mounted): Haws Model HWBFA8F, Barrier Free, single height with mounting frame. Air cooled electric water cooler shall be capable of delivering 8 GPH at 90 degrees F ambient, 80 degrees F inlet water and 50 degrees F outlet drinking water. Top shall be stainless steel; bubbler valve shall be electronically controlled and be activated by touch pads for electrically timed period of flow. Cabinet shall be baked enamel on heavy gauge steel, color to be selected by Architect. Unit shall be supplied with plug-in, 3-wire grounding type service and for operation on 120 volt/1 phase/60 HZ. Spout outlet shall be mounted 36-inch maximum above floor. Water cooler and installation shall conform to all requirements of American Disabilities Act Guidelines and ANSI A117.1.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

G. P-5

1. Shower (Handicapped): Enclosure by others. Provide floor drains as specified on contract drawings. Provide rough-in and final connections of cold water, hot water and waste. Provide and install Powers Process Controls P902H pressure balance shower valve with check stops and 3 ports for shower application. Unit shall include showerhead, arm and flange. Include Delaney Model SH 5000 shower head. In addition, provide 60-inch long hose that can be used as a fixed shower head or as a hand held shower. Provide round face plate with re/blue indication inset. Escutcheon shall be chrome plated stainless steel. Hand held shower shall include in-line vacuum breaker. Shower and installation shall conform to all requirements of American Disabilities Act Guidelines and ANSI A117.1.

H. P-6

1. Service Sink: 32-inch x 32-inch unit Flat Model TSBC 1611 or Stern Williams Model SBC-1725 or approved equal, size 32-inch x 32-inch x 12-inch terrazzo unit. Unit shall have 6-inch drop at threshold. Drain shall be cast brass with stainless steel strainer cast integral and shall provide for a caulked lead connection. Receptor composed of pearl grey marble chips and white Portland unit, ground smooth, grouted, and sealed to resist stains. Stainless steel cap of one piece 20 gauge, 302 stainless steel cast integral on threshold. Provide and install stainless steel BP splash Catcher panels on adjacent walls.
2. Faucets: Fiat 830 AA Faucet or Chicago faucet 897-RCF, Speakman SC-5811-RCD or approved equal (rough chrome finish) with cast brass, chrome plated body, vacuum breaker spout, stops in arms. Faucet shall include 3/4-inch hose thread outlet, Pail Hook, and wall brace. Provide unit with Stern Williams T-35 hose and bracket and mop hanger.

I. P-7

1. **Wash Fountain (Handicapped): Accommodates 3 users at a time, using less water, energy and space than lavatories equipped with conventional faucets. The sectional spray head module is controlled by a push button, which actuates an infra-red sensor-actuated solenoid valve. Flow restrictor keeps flow rate constant at 0.5 gpm per station for all pressures. Operating range is 20-80 PSI.**
2. All exposed materials are type 304 stainless steel polished to a #4 finish. Bowl, pedestal and access panels, frame, foot control housing; support tube; and spray head are heavy gauge stainless steel. Exposed fittings are chrome plated. Bowl and support tube are an integrally welded assembly, with the support tube welded to an extruded flange from bowl. Spray head nozzles and push buttons/infrared sensors are secured to unit from inside the spray head module. Solenoid valves are safely concealed inside the wash fountain. Access panels are removable. All supply and waste connections are concealed within the pedestal.
3. In addition to the bowl and pedestal, the following valves and fittings are standard: manual mixing valve, check stops and strainers. Check valves are 1/2" NPT female.
4. Each of the stream formers is controlled by a separate solenoid valve. Hands placed within the bowl are detected by an infrared sensor module, which activates a flow of tempered water from one spray nozzle. Shut-off is automatic after hands are removed from the detection area. The infrared sensor module uses two zone-focused infrared transmitting beams, having a detection area that does not exceed the bowl perimeter. The detection range projects 6-9 inches forward at a 30° angle to each side and reaches 15° below horizontal. The infrared sensor is not affected by varying color tones or darkness. Direct sunlight or bright washroom

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

lights will not activate the system. Infrared models shall include solenoid valves and a low voltage transform as standard equipment.

- \* Solenoid – 24V, 50/60 Hz, 5/16” tube fitting. Few moving parts, and resistant to most chemicals, minerals and impurities often present in municipal water supplies.
  - \* Low-Voltage Transformer – Class II UL/CSA listed, 110/24 VAC hard-wire transformer designed to mount on a conduit box. Location of transformer per local electrical code.
  - \* Each low-voltage button actuates a non-hold-open, slow-closing anti-hammer solenoid valve that is timed from an electronic potted assembly. Each push button activates one valve which, in turn activates one station. Solenoid valves control water flow at each station through the use of solid state, digital circuitry. Timing is electronically controlled at 15 seconds (adjustable). Push button requires less than five pounds of pressure.
5. Wash fountains are Uniform Plumbing Code (UPC), International Plumbing Code (IPC) and National Plumbing Code of Canada (CPC) approved through the International Association of Plumbing and Mechanical Officials (IAPMO). Manufactured in compliance with IGC 156-2009, CSA B45 Series-2002 (RO8) & ASME A112.18.1-2005/CSA B125.1-2005.
  6. All floor mounted standard height models, with hand or infrared control, comply with all ADA guidelines on reaches, clearances and operation.

J. P-8

1. Self Contained Gravity-Fed Portable Eyewash Station: Bradley Model No. S19-921H, or equal. Comply with American National Standard Z358. 1-2009. Shall include Wall-Mounting bracket, universal identification sign and inspection tag. Insulated heater jacket shall thermostatically control water temperature at 75 deg F. High limit manually reset thermostat at 95 deg F. Provide with tank, pedestal, one bottle of concentrated water preservative, stainless steel wall bracket, yellow high visibility waterproof insulated jacket, and LED indicator lights (green, amber and red).

K. P-9

1. Urinal (Handicapped): Exposed flush valve, Crane Model 7397 Cromwell or Kohler model K-4960-ET Bardon water guard urinal, vitreous china, washout design, 3/4 –inch top spud inlet, 2-inch outlet and carrier. Fixture lip mounted 17-inch above finished floor. Unit and installation shall comply with the American Disabilities Act Guidelines and ANSI A117.1 requirements for people with disabilities.
2. Flushometer: Sloan Model Regal #186-1-YB, Delaney, Zurn or approved equal, low consumption (1.0 GPF), exposed diaphragm type, chrome plated brass urinal flushometer. Unit shall include the following features and accessories: ADA compliant non-hold open handle, 3/4-inch I.P.S. screwdriver back check angle stop, adjustable tail piece, vacuum breaker flush connection with one-piece bottom hex coupling nut, spud coupling and flange for 3/4-inch [tope spud],sweat solder adapter with cover tube and wall flange. Sloan Model J-212-A split ring wall support.

3. Carrier: Zurn, Josam or Ancon cast iron urinal carrier with fittings as required. ANSI/ASME A112.6.1A; cast iron and steel frame with tubular legs, legs for floor and wall attachment, threaded fixtures studs for fixture hanger, bearing studs.

**L. P-10**

1. Service Sink: The service sink shall be 22-1/4" by 18-1/4". Sink shall be made of cast iron with acid resistant enamel finish. Sink shall be single compartment with drilled back K. Sink shall have stainless steel rim guard. Sink shall be Kohler Model K-K-6714-0, or equal.
2. Faucets: Chicago Faucet Model 305-VBRCF fixture mounted faucet with short vacuum breaker spout, pail hook, 3/4" inch hose thread outlet, R adjustable stop supply arms, 320 wrist blade handles and chrome finish.
3. Strainer: Jomar Model SS-306 Snap-N-Loc basket strainer with brass lock nut and tail nut. Deep cup body and basket shall be 300 series stainless steel.
4. Drain: Provide with Kohler K-6672 adjustable trap standard for 2" pipe connection with cleanout plug and strainer.

2.5 WALL HYDRANTS

- A. Wall Hydrant (Exterior): Woodford Model B65 or B67 [Josam 71000 Series Hydrasan] anti-siphon wall hydrant, 3/4-inch non-freeze, key operated wall hydrant with hinged locking cover, polished bronze box and cover and bronze casing and integral vacuum breaker. Seat and disc shall be removable from front of the hydrant. Wall thickness; see architectural drawings. Wall hydrants shall conform to ANSI/ASSE 1019 with wall plate, lock shield and removable key.
- B. Approved Manufacturers: Josam, Wade, Zurn, J.R. Smith, or approved equal.

2.6 BACKFLOW PREVENTER (DOUBLE CHECK VALVE ASSEMBLY TYPE)

- A. Furnish and install double check valve assembly backflow preventers at all cold water make-up connections to incoming water services and where else indicated on contract documents.
- B. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module sets and seat discs shall be replaceable.
- C. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall include two resilient seated isolation valves and four top mounted, resilient seated test cocks.
- D. Furnish each backflow preventer with the following accessories and options:
  1. bronze strainer
  2. quarter turn, full port, resilient seated ball valve shut-off
  3. union connections
- E. Provide minimum 18-inch clearance for servicing and testing.

- F. The assembly shall meet the requirement of ASE Std 1015 and AMCA Std C510.
- G. Double check valve backflow preventers shall be Ames Silver Bullet Model 2001SS or Watts, Conbraco, Wilkens, Ancon, or approved equal.
- H. Furnish test kit for field testing units. Watts Model TK-9A Analog Differential Gauge or approved equal.

## 2.7 DOMESTIC WATER EXPANSION TANKS

- A. Provide and install domestic water expansion tanks of size, capacity and as indicated on contract drawings. Domestic water expansion tanks shall be THerm-X-TROL as manufactured by AMTROL, Inc., Flexcon, Wessels, Taco or approved equal. Mount tank as detailed on the drawings.
- B. Domestic water expansion tanks shall be specifically designed for use in portable water systems. Tanks shall be pre-charged to require pressure at the factory. The maximum working pressure shall be 150 psig. The maximum operating temperature shall be 200 degrees F. Expansion tanks shall contain removable FDA approved butyl bladder.
- C. Before installation, Contractor shall adjust the tank air pre-charge pressures to equal city water pressure.
- D. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped 150 psig working pressure.
- E. Accessories: Pressure gauge and air charging fitting, tank drain, pre-charge as indicated on contract drawings and factory installed clip angles.

## 2.8 SHOP COMPRESSED AIR SYSTEMS

- A. Furnish and install all components, piping, fittings, gauges, relief valves, flexible connectors valves, drains, filters, air dryer, regulators, necessary to form a complete and operating a shop compressed air systems to the extent indicated on the contract drawings utilizing new air compressor(s) and tank. This contractor is responsible for all equipment, rough-in and final connections as detailed on the contract drawings/specifications.
- B. Contractor shall mount air compressor/receiver on vibration isolation material and bolt to concrete housekeeping pad. Flexible piping shall be provided between receiver and piping systems. Contractor shall provide and install piping from each compressors tank drain and refrigerated air dryer drain to adjacent floor drain. Compressed air piping shall be pitched to drain at suitable locations in the system. Refer to Section 15200 for pipe material and installation requirements.
- C. Air compressors: Furnish and install lubricated, reciprocating air compressors of the size, capacity, arrangement, and electrical characteristics as detailed on the contract drawings. Air compressors shall be Champion, Gardner Denver, Quincy, Ingersol Rand, Kaeser or approved equal. Air compressors shall include the following performance features:
  - 1. Provide factory assembled and tested, packaged and assembled, 100 percent continuous duty rated, belt driven, splash or pressure lubricated, two stage reciprocating, piston type, centrifugal air compressors as indicated, of capacities and electrical characteristics indicated on contract drawings.
  - 2. Compressors shall be cast iron construction with multi-finned cylinders for maximum cooling, gasket free integral cylinder/head, ductile iron crankshaft, aluminum or cast iron pistons and

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

connecting rods, Swedish steel disc type valves, balanced flywheel with fan cooling blades, large diameter, finned inter-coolers, positive acting centrifugal un-loader, tapered roller bearings, inter-stage pressure relief valves, heavy duty 5 micron inlet filter/mufflers, oil sight gauge and drain low oil shutdown switch, enclosed OSHA belt guards, EPACT '92 energy efficient open drip proof motor, and UL listing.

3. Air compressors shall be tank mounted. Tank mounted compressors shall include ASME Code 200 PSIG horizontal air receiver. Air receiver shall include 0-300 PIG liquid filled pressure gauge with snubber and needle valve, bucket high drain valve, ASME code bronze pressure relief valve, hand operated ball valve, factory set pressure switched. The receiver shall have base ring or support legs for mounting to concrete housekeeping pad. Vibration isolators shall be provided for the receiver. Receiver shall include automatic timed solenoid drain as specified. Tank shall be fully primed and finished in manufacturer's standard finish.
  4. The air compressors shall be supplied with an air cooled after-cooler. After cooler shall bring compressed air discharge temperature to within 20 degrees F of ambient air temperature. Unit shall be finned radiator type and packaged directly on compressor. A packaged moisture separator and trap shall be provided to remove all condensate removed from compressed air.
  5. Compressed air systems shall be supplied with unit mounted and wired control panel as follows:
    - a). Control panel shall be NEMA 1 general purpose indoor enclosure
    - b). Combination Magnetic motor starters with individual thru-the-door disconnects, motor overloads and external reset buttons
    - c). Hand-off Automatic Selector Switches
    - d). Control voltage transformers – Primary & Secondary
    - e). Low oil monitor with shutdown
    - f). Power on light
    - g). Compressor run light
  6. Compressor package shall have one year parts warranty from date of start-up, or (18) months from date of shipment. Compressed air end shall have (60) month warranty from date of start up or (66) months from date of shipment. This shall include parts and labor on compressor air end.
- D. Refrigerated Air Dryer: Furnish and install a cycling refrigerator air cooled dryer with the capacity and electrical characteristics as scheduled on the contract drawings. Refrigerated air dryer shall be Heatsink Model HSE as manufactured by Zeks. Arrow Pneumatics, Ingersoll-Rand or approved equal. Furnish refrigerated air dryer with the following performance features:
1. Unit shall be heat sink type and consist of a mechanical refrigeration system, equipped with automatic temperature control that will cycle the refrigerated system to match variable loads from 0 percent to 100 percent capacity.
  2. Specially formulated heat sink material shall surround a smooth bore copper tube on tube evaporative section. The heat sink material shall be cooled by the refrigeration system which in turn shall cool the tubes to cool the dry compresses air. Refrigeration compressor horsepower shall be as specified on contract documents and shall be hermetic type equipped with automatic start-stop capacity control.
  3. Moisture separator shall be low velocity centrifugal type.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

4. Unit shall be controlled by micro-processor controller including exchanger temperature, % savings digital display, dew point temperature, adjustable dew point setting, automatic solenoid drain with drain open/closed adjustment, drain test switch, anti-rapid cycle timer, high temperature alarm light with relay for remote, low temperature alarm light with relay for remote, Fahrenheit and Centigrade temperature display, refrigerant suction pressure gauge, installed drain trap, on/off switch with power on light.
  5. Unit shall be UL listed and furnished with packaged automatic solenoid drain. Pipe condensate trap to floor drain and install dryer on a 4-inch high housekeeping pad.
- E. Compressed Air Filters: Furnish and install particulate and coalescing filters of capacity and quantity as indicated on the contract drawings. Filters shall be as follows:
1. 3-Micron Particulate filters – Units shall have corrosion resistant cast aluminum ally head and aluminum alloy bowl. Bowl assembly shall have threaded connections with "O" ring seal for easy access for cartridge replacement. Unit shall have durable enamel finish. Filter shall have pressure drop indicator to indicate filter replacement and installed internal automatic drain. Unit shall have 3-micron absolute removal. Unit shall be Zeks "PT" series, Arrow, Ingersoll-Rand Kaeser or approved equal.
  2. 0.3 Micron Coalescing Filter – Unit shall have corrosion resistant cast aluminum alloy head and aluminum alloy bowl. Bowl assembly shall have threaded connections with "O" ring seal for easy access for cartridge replacement. Unit shall have durable enamel finish. Filter shall have pressure drop indicator to indicate filter replacement and installed internal automatic drain. Unit shall have 0.3-micron absolute removal. Unit shall be Zeks "LT" series, Arrows, Ingersoll-Rand, Kaeser or approved equal.
  3. All filters and housings shall be constructed to withstand 250 psig maximum working pressure.
- F. Compressed Air Pressure Regulators: Provide and install pressure regulator where indicated with built-in safety relief valve. Outlet pressure is to be set as specified and to remain constant regardless of inlet air pressure and changes in downstream flow requirements. Unit to be provided with high pressure gauge on outlet and high pressure gauge on inlet. Provide a three (3) valve bypass around pressure-reducing station as detailed on contract drawings. Pressure regulator shall be constructed of aluminum alloy or zinc, diaphragm operated, direct acting, spring loaded design with manual adjustment knob and rated 300 psig maximum. Unit shall be relieving type with balanced valve design. Main pressure regulator shall be Arrow, Hankison, Kaeser, Wilkerson or approved equal.
- G. Compressed Air Combination Pressure Regulator/Filter/Lubricator: Furnish and install combination pressure regulator/filters/lubricators of the capacity and quantity as indicated on the contract drawings. Units shall be provided with built-in safety relief valve. Outlet pressure to be maintained at scheduled value regardless of inlet air pressure and changes in downstream flow requirements. Unit to be provided with high pressure gauge on outlet and inlet. Valve body shall be constructed of zinc. Assembly shall be diaphragm operated, direct acting, spring loaded design with balanced valve design. Filter shall be constructed of sintered polypropylene. Lubricator shall be equipped with drip chamber and sight dome for observing oil drop entering airstream, with an oil-feed adjustment screw and quick-release collar for easy bowl removal. Lubricant shall be non-detergent, petroleum base oil no heavier than SAE 10. The maximum oil droplet flow rate shall be one drip of oil for every SCFM air delivered at 80 psig. Combination units shall be Model C as manufactured by Wilkerson, Arrow, Hankison, Kaeser, or approved equal.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- H. Each compressed air system shall be equipped with a main safety relief valve. Safety relief valves shall be ASME BPVC Section VIII DI and ASME BPVC Section IX Code stamped safety valve, for unfired pressure vessels, bronze, with threaded or flanged connectors; factory set and sealed.
  - I. Provide and install pressure gauges at all locations shown on contract drawings. Pressure gauges shall be ANSI/ASME B40.1 rated, Accuracy Grade A, for air, with steel or brass case, and non-shatterable safety glass, and a pressure blowout back to prevent glass from flying out in case of an explosion. Gauges shall have a 3 ½-inch minimum diameter dial and a dial range of approximately twice working pressure.
  - J. Furnish and install as indicated on drawings, times automatic condensate drain. Unit shall be 200 PSIG working pressure. Unit shall consist of condensate reservoir, timer operated solenoid drain. Unit shall have fully adjustable drain cycle time, fully adjustable valve open duration, power on light, valve open light, NEMA 4 UL/CSA approved housing, solid state timer, and eight foot, three prong power cord. Units shall be as manufactured by Arrow Pneumatics, Hankison, Zeks, Sparten or approved equal.
  - K. Furnish and install adjustable pressure regulators at each compressed air drop, hose reel and equipment as detailed on the contract drawings. Pressure regulators shall include balanced valve design, spring loaded diaphragm, adjustment knob, built-in pressure gauge, drain plug and zinc body. Units shall be selected and constructed to withstand a maximum working pressure of 250 psig.
  - L. Provide and install quick disconnect couplings at all drops and wherever indicated on contract drawings. Quick disconnect coupling shall be all brass and suitable for a working pressure of not less than 200 psig. Female side of coupling shall (fixed end) have male thread connection with automatic shutoff. Provide male side of coupling with hose stem and ball check to bleed pressure from hose and prevent hose whipping. Provide two (2) quick disconnects at compressed air drops where indicated on contract drawings. Quick connect/disconnect hose couplings shall be as manufactured by Aero-Quip, Champion, Hansen, Schrader or approved equal.
  - M. Provide and install compressed air hose reel assemblies at all locations shown on the contract drawings. Hose reel assemblies shall be Model HRL 35-35 as manufactured by Appleton or approved qual. Each hose reel shall be complete with 35 ft of ½-inch diameter hose rated for a minimum of 250 psig. Hose reels shall in clued ball stop, locking ratchet, four roller hose guides with adjustable arms, orange epoxy/polyester finish, and Model SHRL-A swivel base for full 360° rotation. Hose reels shall be mounted as approved by Structural Engineer.
  - N. Where indicated on contract drawings, contractor shall provide rough-in and final connection to equipment provided by owner or under another Division of these specifications.
  - O. Factory start-up shall be provided by manufacturer's representative. Start-up shall include a minimum (4) hours and should include complete operational check of compressed air system, pressure switch adjustments, motor amp draw, and correct operation of all system components. Manufacturer's representative shall also instruct owner's personnel on operation and maintenance of the compressed air system components.
- 2.9 TEMPERING VALVES
- A. Furnish and install mechanical mixing valves where indicated and below all lavs that are provided with hot water temperatures above 130 degrees F.
  - B. Tempering valves shall be Symons Model #4-10, Powers, Lawler or approved equal for installation under lavs. Provide in-line check valves, chrome finish, escutcheon plates and insulation as

required. Mixing valves shall be adjusted to deliver 110 degrees F hot water when supplied with 140 degrees F delivering hot water.

#### 2.10 PLUMBING FIXTURE SUPPORTS

- A. Wall mounted urinal supports, Josam 17810 plate type with cast iron headers, box steel stanchions, block type cast iron feet with bearing plate.
- B. Support for wall mounted urinals, lavatories, sinks, drinking fountains, etc.:
  - 1. Where fixtures are supported from concrete or cinder block walls, install No. 10 USSG Steel plate on the opposite side of the wall and bolt hangers or supports through plate. Where opposite side of wall is exposed to view, place bolts in core of blocks and fill core with cement.
  - 2. Where lavatories with wall hangers have been specified and fixtures are supported from metal stud frame partitions, fixture brackets for mounting lugs shall be through bolted to steel channel crosspieces not less than 1-1/2-inch wide anchored to studs. Bolt heads shall be welded to channel web.
  - 3. Concealed arm type lavatory supports, Josam 17100 with case iron headers, box steel stanchions, block type cast iron feet and header; and chrome plated cast brass threaded escutcheons for slab type lavatories.

#### 2.11 LIQUEFIED PETROLEUM GAS SYSTEM

- A. Contractor shall arrange for a LP gas supplier to provide and install above ground propane tank. Complete tank excavation, backfill, and installation up to main shut-off shall be provided and installed by the propane supplier. All piping, valves, fittings, downstream of main shut-off shall be provided and installed by contractor.
- B. System shall be complete with relief valves, regulators, shut-off valves, vents, cathodically protected tanks, (underground installations) and all other accessories for a complete installation. Contractor shall coordinate with propane vendor. All system valves and accessories shall be suitable for 250 psig. Complete system shall meet all requirements of NFPA-54 and NFPA-58.
- C. After installation, the contractor shall instruct the Owner on the proper maintenance and operation of the complete system.
- D. Contractor is responsible for a complete operable system in accordance with NFPA, local authorities and gas supplier (utility).
- E. Install above ground tanks on concrete support pads and as detailed on the contract drawings.

#### 2.12 HANDICAPPED LAVATORY/SINK INSULATION

- A. All handicapped lavatories and sinks shall be provided with under counter pipe and trim insulation.
- B. Insulation shall be fully molded "P" trap and angle valve insulated Hand-I-Lav Guard, Truebro Model #101, 102, and 105 to suit.
- C. Insulation to meet ADA #4 19.4 ANSI A117.1 and BOCA P-1203.4.

- D. Self extinguishing ASTM D635 burn characteristics, thermal conductivity ASTM C177 K-Value ' 1.17.
- E. Insulation thickness to be minimum 2 inch.

#### 2.13 THERMOSTATIC MIXING VALVES

- A. Furnish and install thermostatic controller valves of the size, capacity and arrangement as scheduled on the contract drawings.
- B. Each unit shall consist of a thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows element mounted out of water.
- C. All equipment and piping shall be finished in rough bronze and/or copper. Bottom supplies and top outlet. Field insulate all piping within the cabinet as specified in Section 15300.
- D. Thermostatic mixing valves shall be Symmons, Lawler, Powers, Leonard or approved equal.
- E. Thermostatic mixing valves must be piped per the manufacturer's recommendations.

#### 2.14 GAS SPECIALITIES

- A. Pressure Regulators: Maxitrol 210 series or approved equal. Maximum emergency pressure exposure of 25 psi, balanced valve design to eliminate hunting and inlet pressure effects.
- B. Gas Pressure Relief Valves: Fisher 289 Series throttling relief valve, spring-loaded, aluminum spring and body, nitrile or viton diaphragm, neoprene gaskets.

### PART 3 – EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install all equipment in accordance with manufacturer's instructions.
- B. Setting heights of lavatories, drinking fountains, etc., shall be as directed prior to installation.
- C. Install floor mounted fixtures only after finished floor has been installed.
- D. Provide rubber concussion washers between vitreous china fixtures and supporting brackets.
- E. Protect chromium plated trim from corrosive solutions used to clean tile work.
- F. Provide white, silicon caulking where fixtures come in contact with walls and floors. Sealant shall be mildew resistant type in accordance with ANSI A136.1.
- G. Install components plumb and level.
- H. Install and secure fixtures in place with wall supports, wall carriers and bolts.
- I. Solidly attach water closets to floor with lug screws. Lead flashing is not intended to hold fixture in place.

DELAWARE DEPARTMENT OF TRANSPORTATION  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP,  
TRUCK AND STORAGE SHEDS  
CONTRACT NO. 30-801-01

- J. Fixtures shall be vitreous china unless otherwise noted. Cast iron fixtures shall have acid resisting enamel finish unless noted otherwise, color shall be white.
- K. Flush valves shall be self-closing, non-hold open type with vacuum breaker and perform satisfactorily when subject to inlet water pressure varying from 15 to 75 psi.
- L. Provide flexible risers and loose key stops for all lavatories and sinks. Provide 17 ga. Chrome plated brass tail piece and trap with cleanout for all lavatories and sinks.
- M. In lieu of joints specified in piping section, neoprene gaskets may be used if designed for use with the drains and cleanouts employed and if approved by the BOCA Basic Plumbing Code.
- N. Cleanouts in vertical pipes shall be installed in tees near floor. Cleanouts in horizontal pipes shall be installed with wyes on long sweep quarter beds. Cleanouts punching water proofing membranes shall have flashing clamps. Cleanout access covers in dry wall or gypsum board shall be painted to match walls.
- O. Unless otherwise noted, drains are to be installed at the low point of floors. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- P. Install floor drains in low points so the top of grates are at or below the finished floor level.
- Q. Drains not functioning properly shall be removed and re-installed properly at the expense of the contractor.
- R. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.
- S. Extend cleanouts to finish floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- T. Encase exterior cleanouts in concrete flush with grade.
- U. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, ANSI/NFPA 54, UL requirements and Delaware Boiler and Pressure Vessel Safety Act and Regulations. For gas or oil fired water heaters, conduct a combustion flue gas analysis. Submit flue gas analysis report to Engineer for review. Record and submit design and actual draft at appliance vent connection.
- V. Coordinate with plumbing piping and related fuel piping, gas venting and electrical work to achieve a complete operating system.
- W. Support piping adjacent to all pumps such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches (100 mm) and over.
- X. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- Y. Field test all emergency eyewash units and combination eyewash/shower units per ANSI Z358.1 latest edition.

### 3.2 DOMESTIC WATER HEATER INSTALLATION REQUIREMENTS

- A. Install units on concrete bases, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- B. Anchor units to substrate.
- C. Install combustion air and flue vents as detailed on contract drawings. Terminate and install combustion air and flue vent piping per manufacturer's requirements.
- D. Install condensate hose below exhaust elbow per manufacturer's requirements. Extend condensate hose continuous downward pitch and discharge onto closest floor drain.
- E. Install temperature and pressure relief valves in top portion of storage tank shells of units with storage. Use relief valves with sensing elements that extend into shells. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.
- F. Install pressure relief valves in water piping for units without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain. Install vacuum relief valves in cold-water-inlet piping.
- G. Install unit drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section *Piping, Fittings and Valves* for drain valves.
- H. Install thermometers on unit inlet and outlet piping. Refer to Division 15 Section *Piping, Fitting and Valves* for thermometers. Install pressure gages on unit piping.
- I. Fill unit with water. Install domestic water expansion tank and charge with air. Install piping adjacent to units to allow service and maintenance.
- J. Connect hot and cold water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.
- K. Make connections with dielectric fittings where piping is made of dissimilar metal.
- L. Electrical Connections: Power wiring is specified in Division 16 Sections. Arrange wiring to allow unit servicing.
- M. Ground Equipment
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Engage a factory-authorized service representative to perform startup service.
- N. In addition to manufacturer's written installation and startup checks, perform the following:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
  - 2. Verify that piping system tests are complete.

3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping. Check operation of circulators.
5. Test operation of safety controls, relief valves and devices. Energize electric circuits.
6. Adjust operating controls.
7. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F 60 deg C unless piping system application requires higher temperature.

### 3.3 PLUMBING SPECIALTY INSTALLATION REQUIREMENTS

- A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.
- B. Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer. Label all piping downstream of backflow preventers as "non-potable" water.
- C. Field test all backflow preventers and submit test reports to Engineer. Furnish test kits as required for field testing.
- D. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- E. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.
- F. Install hose bibs with integral or field-installed vacuum breaker.
- G. Install wall hydrants with integral or field-installed vacuum breaker.
- H. Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow. Install trap priming stations plumb and level with adequate access for servicing and maintenance.
- I. Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- K. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.
- L. Secure supplies to supports or substrate.
- M. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve as appropriate is not indicated.
- N. Install water-supply stop valves in accessible locations.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

- P. Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

### 3.4 TESTING

- A. After plumbing fixtures are connected, all piping and fixtures shall be tested for operation and a smoke or peppermint test shall be made on all soil, waste and vent piping.
- B. After the building has been occupied and the various equipment is in actual use, the Contractor shall make an operating test of all equipment at a time directed by the Engineer to determine that all contract requirements are met.

### 3.5 CLEANING AND STERILIZATION

- A. After final testing for leaks, all potable water lines shall be thoroughly flushed, by plumbing contractor, to remove foreign material. Before placing the systems in service, sterilize the new water lines in accordance with local health department codes and at a minimum according to the following procedure:
  1. Through a ¾-inch hose connection in each branch main and building main, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine into system.
  2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
  3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 ppm chlorine, retain this water in the system for at least three (3) hours.
  4. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system. It is not necessary to retain chlorine in any system for twenty-four hours to achieve sterilization. AWWA states that 200 ppm chlorine for three hours is sufficient.
  5. At the end of retention period, no less than 100 ppm of chlorine shall be present at the extreme end of the system.
  6. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 ppm.
  7. Obtain representative water sample from the system for analysis by an independent and recognized bacteriological laboratory.
  8. If the sample tested for coliform organisms is negative, a letter and laboratory report shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization. Additionally, this report shall be forwarded to the Owner as well as be included in the O&M Manual.
  9. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

10. Take precautions to avoid use of plumbing fixtures and domestic water systems during sterilization period. Place signs on all plumbing fixtures and outlets during sterilization period.

### 3.6 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.

### 3.7. PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### 3.8 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

### 3.9 ADJUSTING

- A. Adjust stops, valves for intended water flow rate to fixtures without splashing, noise, or overflow.

### 3.10 CLEANING

- A. At completion, clean plumbing fixtures and equipment. Polish all chrome plated faucets, accessories, equipment, and piping.

### 3.11 FIXTURE HEIGHTS

- A. Install fixtures to heights above finished floor as required by local Plumbing Code, Americans with Disabilities Act (ADA) and authority having jurisdiction. In the absence of a local code requirements, install fixtures to heights above finished floor as follows:

#### B. Water Closet

1. Standard 15 inches to top of bowl rim.
2. Handicapped 18 inches to top of seat.

#### C. Urinal

1. Standard 22 inches to top of bowl rim.
2. Handicapped 17 inches to top of bowl rim.

#### D. Lavatory

1. Standard 31 inches to top of basin rim.
2. Handicapped 34 inches to top of basin rim.
3. Child height 27 inches to top of basin rim.

#### E. Drinking Fountain

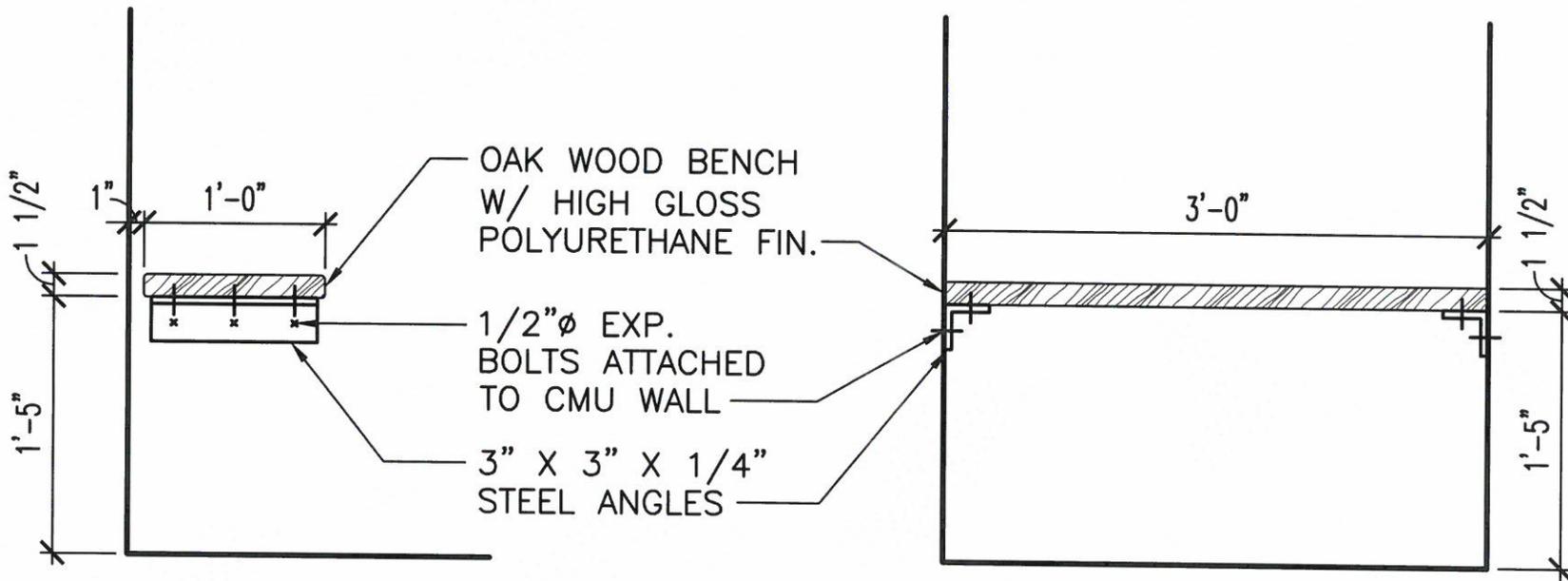
1. Standard 36 inches to top of basin rim.
2. Handicapped 34 inches to top of basin rim.

- F. Water Closet Flush Valves
  - 1. Standard 11 inches min above bowl rim.
- G. Shower Heads
  - 1. Handicapped (unisex) 76 inches to top of head arm.
- H. Emergency Eye Wash: Handicapped 38-inches to receptor rim.

END OF SECTION

SECTION 1	BREAKOUT SHEET - 1		CONTRACT NO. T201080101	
ITEM 211503 - DEMOLITION				
ITEM NO.	Location - Description	Unit of Measurement	UNIT PRICE	AMOUNT
1	Remove existing macadam ramp to include light and bollards in the immediate vicinity	LS	\$	\$
2	Remove building 5 and accessory pads, services, slabs and macadam paving (to include sawcutting)	LS	\$	\$
3	Relocate existing ground macadam stockpile	LS	n/a	N/a
4	Remove existing water line and yard hydrant and cap at tee (note D-18)/salvage fire hydrant	LS	\$	\$
5	Remove existing concrete pad under storage tanks	LS	\$	\$
6	Remove and relocate existing water tank	LS	\$	\$
7	Sawcut and remove all macadam paving around building 11 and all adjacent pavement (to existing millings pile)	LS	\$	\$
8	Remove building 9 and accessory structures, pads, tanks, services, bollards, slabs and macadam paving (to include sawcutting)	LS	\$	\$
9	Remove building 1 and accessory pads, services, slabs and macadam paving (to include sawcutting)	LS	\$ N/A	\$ N/A
10	Salvage gas tank north of building 9	LS	\$	\$
TOTAL ITEM 211503 - DEMOLITION \$ _____ (LUMP SUM BID PRICE FOR ITEM 211503)				

P:\2008\08012101\Drawings\01 - Arch\Magnolia Maintenance Yard\Magnolia Shop Building\A4 1.dwg



1 SHOWER BENCH DETAIL  
SK-1 | SK-1 SCALE: 1" = 1'-0"



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DELAWARE DEPARTMENT OF  
TRANSPORTATION

MAGNOLIA YARD VEHICLE MAINTENANCE SHOP

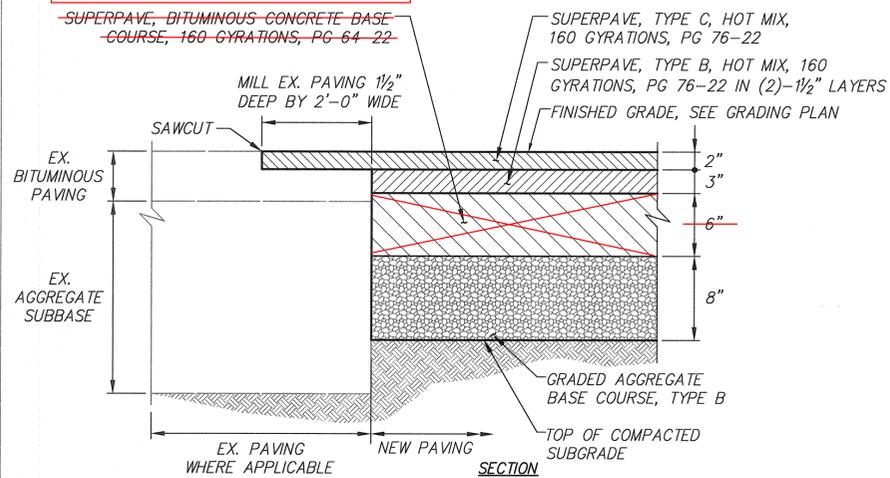
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DRAWING NO.  
SK-1

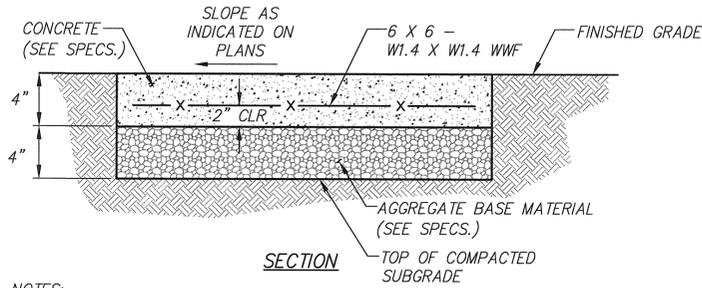
WBCM NO.  
20080121.01

Addendum No. 4  
March 11, 2014

BCBC NOT INCLUDED IN PROPOSED SECTION

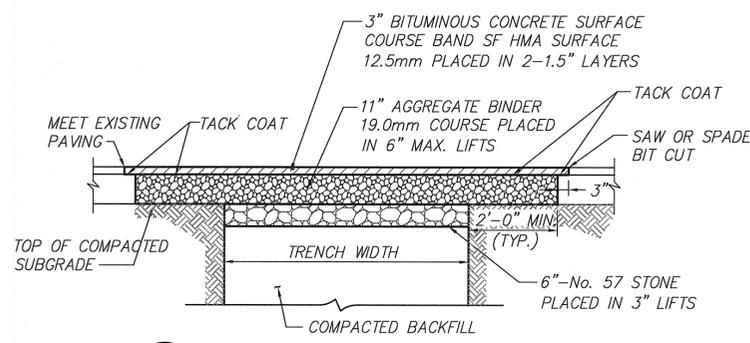


**1 HOT MIX ASPHALT PAVING DETAIL**  
NOT TO SCALE

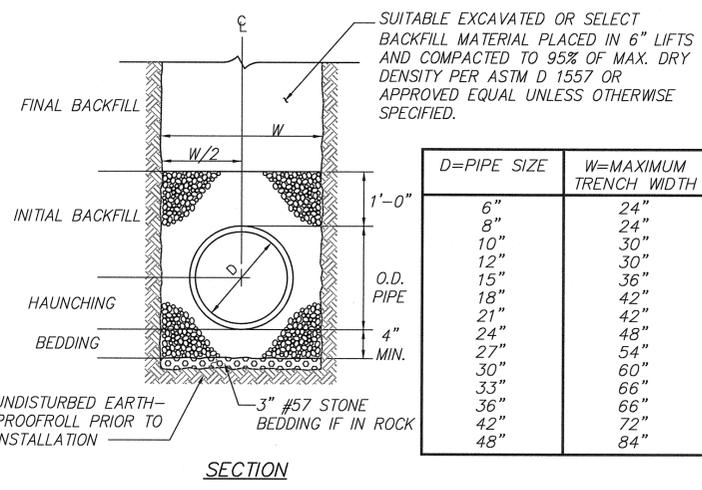


NOTES:  
1. 1/2" PREMOLDED EXPANSION JOINT MATERIAL TO BE PLACED WHERE WALKS ABUT CURBS, STEPS, BUILDINGS, OTHER WALKS, ETC. AND AT A MAXIMUM OF 20' INTERVALS ALONG THE WALK.  
2. SCORING SHALL BE PROVIDED AT 4' ON-CENTER FOR 4' & 8' WALKS, 5' ON-CENTER FOR 5' & 10' WALKS, AND 6' ON-CENTER FOR 6' AND LARGER NOT PREVIOUSLY MENTIONED.

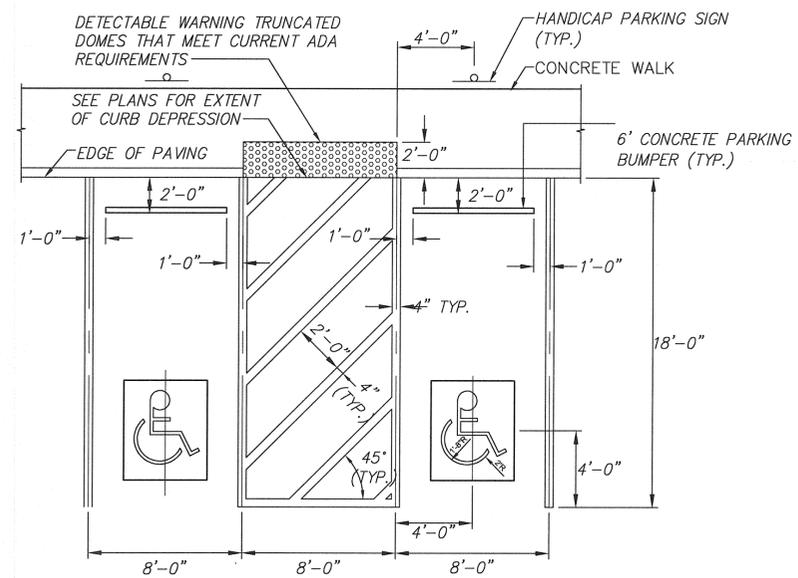
**4 CONCRETE WALK**  
NOT TO SCALE



**2 BITUMINOUS PAVING REPAIR**  
NOT TO SCALE

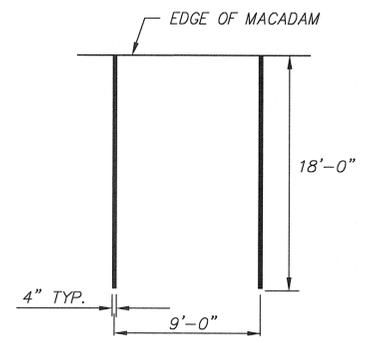


**5 PIPE TRENCH DETAIL**  
NOT TO SCALE



NOTES:  
1. PAINT TO BE WHITE TRAFFIC PAINT APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. TWO (2) COATS REQUIRED.  
2. SEE PLAN TO DETERMINE IF MULTIPLE HANDICAP SPACES ARE REQUIRED.  
3. HANDICAPPED SYMBOL TO BE WHITE TRAFFIC PAINT ON BLUE TRAFFIC PAINT BACKGROUND APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. TWO (2) COATS REQUIRED.

**3 HANDICAP PAVEMENT MARKING**  
NOT TO SCALE



NOTE: PAINT TO BE WHITE TRAFFIC PAINT APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. TWO (2) COATS REQUIRED.

**6 PARKING STRIPING**  
NOT TO SCALE

SEE SHEET C4.0/5 FOR DETAIL 7

SITE DETAILS

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO.	TOTAL SHETS
30-801-01	KENT	SEE TITLE SHEET	C6.0 9	59

**DELAWARE DEPARTMENT OF TRANSPORTATION**  
MAGNOLIA YARD VEHICLE MAINTENANCE SHOP

**REVISIONS**

04/11/11 - COUNTY SUBMISSION	05/16/12 - REVISED PER KENT CO. COMMENTS
10/28/11 - 100% SUBMISSION	08/07/13 - REV. FINAL PLANS PER COMMENTS
01/30/12 - REVISED HOPPER RACKS	
04/12/12 - REVISED PER KENT CO. COMMENTS	

**PHILIP DEER**  
REGISTERED PROFESSIONAL ENGINEER  
No. 9554  
DELAWARE  
8/13

**WBCM**  
ARCHITECTURE ENGINEERING CONSTRUCTION  
WHITNEY BAILEY COX & MAGNANI, LLC  
849 Fairmount Ave. Suite 100 Baltimore, MD 21286  
MAIN 410.512.4500 FAX 410.524.4100 www.wbcm.com

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LAST REVISED: 08/12/2013  
Aug 08, 2013 - 9:44am  
PREL. TRACING  
DESIGN  
CHKD.

# MECHANICAL GROUND FLOOR PLAN - HVAC

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO.	TOTAL SHTS
30-801-01	KENT	SEE TITLE SHEET	M1.1	36

## DELAWARE DEPARTMENT OF TRANSPORTATION MAGNOLIA YARD VEHICLE MAINTENANCE SHOP REVISIONS

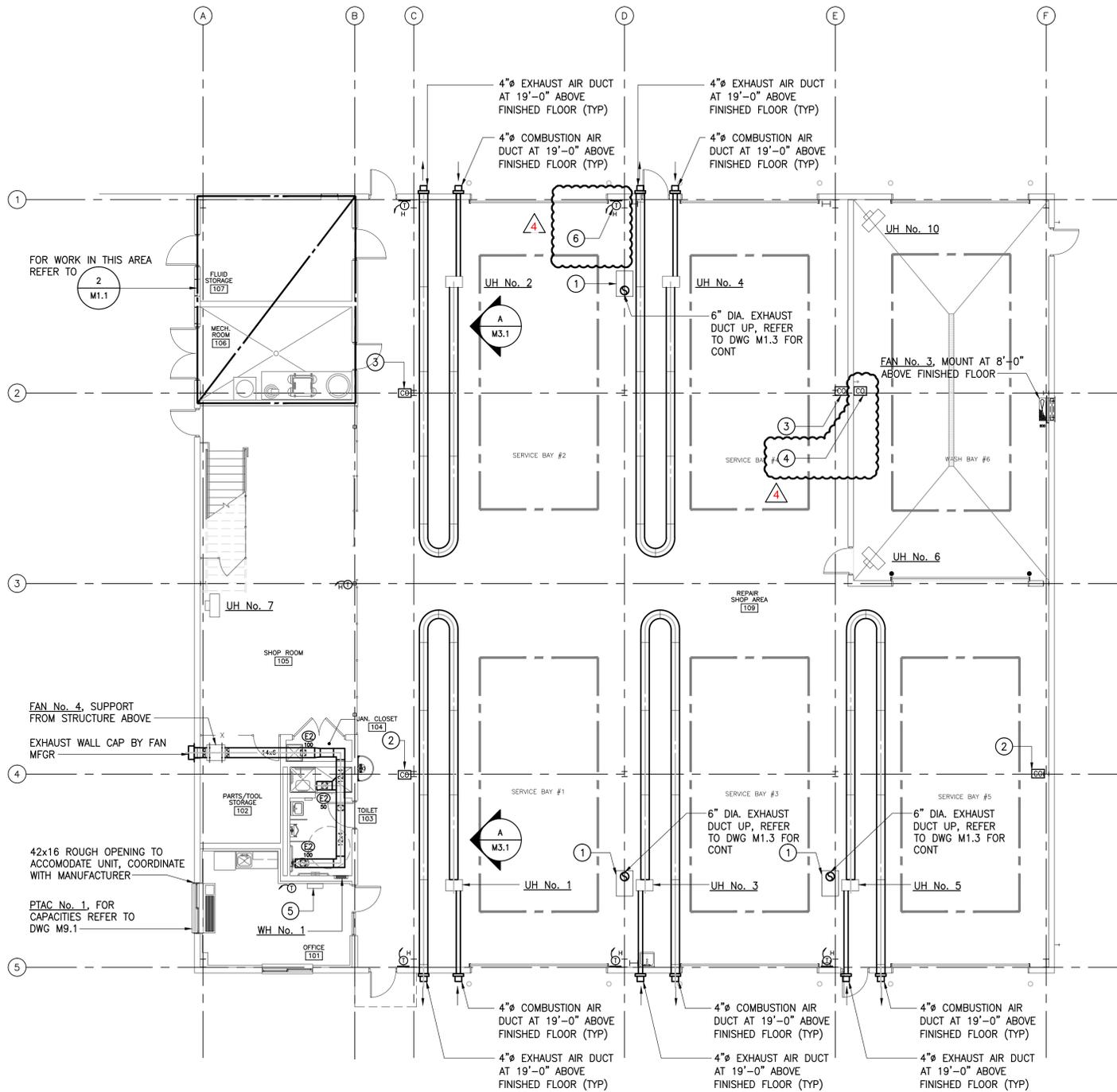
04/12/12 - REVISED PER KENT CO. COMMENTS



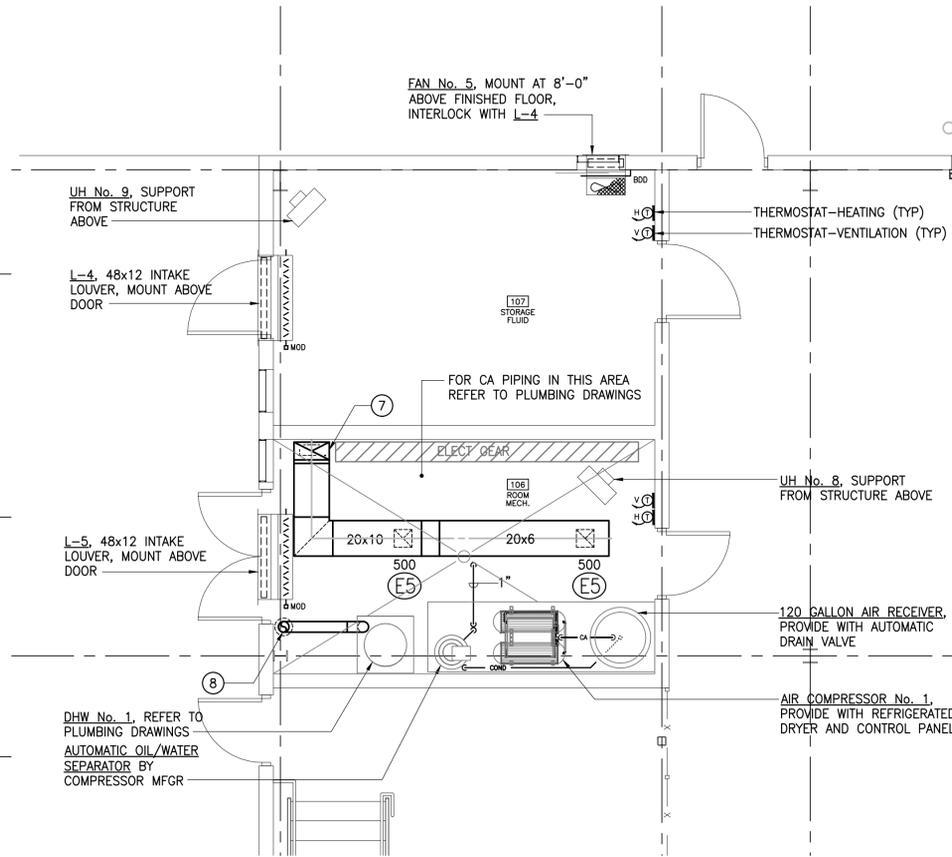
**Gipe Associates Inc.**  
Consulting Engineers  
849 Fairmount Ave Suite 102 Baltimore, MD 21286  
Baltimore, Maryland (410)832-2420  
Easton, Maryland (410)822-8688  
W.O.# 09035E

### DRAWING NOTES:

- VEHICLE EXHAUST HOSE REEL, MOUNT 8'-0" ABOVE FINISHED FLOOR
- CARBON MONOXIDE DETECTOR MOUNT AT 5'-0" ABOVE FINISHED FLOOR, INTERLOCK WITH FAN No. 1
- CARBON MONOXIDE DETECTOR MOUNT AT 5'-0" ABOVE FINISHED FLOOR, INTERLOCK WITH FAN No. 2
- CARBON MONOXIDE DETECTOR MOUNT AT 5'-0" ABOVE FINISHED FLOOR, INTERLOCK WITH FAN No. 3
- CARBON MONOXIDE DETECTOR CONTROL PANEL, MOUNT ON WALL
- THERMOSTAT WITH INSULATION BOARD, TYPICAL
- 20x10 EA UP THRU FLOOR, FOR CONTINUATION REFER TO DRAWING M1.2
- 6" PVC FLUE UP THRU FLOOR, FOR CONTINUATION REFER TO DRAWING M1.2



**1 MECHANICAL GROUND FLOOR PLAN - HVAC**  
SCALE: 1/8" = 1'-0"



**2 PART PLAN - MECH AND FLUID STORAGE AREA**  
SCALE: 1/4" = 1'-0"



**SPECIAL NOTES:**  
1. REFER TO PLUMBING DRAWING P1.1 FOR GAS SERVICE PIPING TO UNIT HEATERS, PTAC'S, ETC....

User: mnelson P:\Jobs\2009\09035-E Del DOT Magnolia Drawings\Mech\09035E\_M1.1.dwg

PREL. TRACING

DESIGN

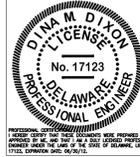
CHKD.

# GROUND FLOOR PLAN - PLUMBING

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO.	TOTAL SHTS
30-801-01	KENT	SEE TITLE SHEET	P1.2	59

## DELAWARE DEPARTMENT OF TRANSPORTATION MAGNOLIA YARD VEHICLE MAINTENANCE SHOP

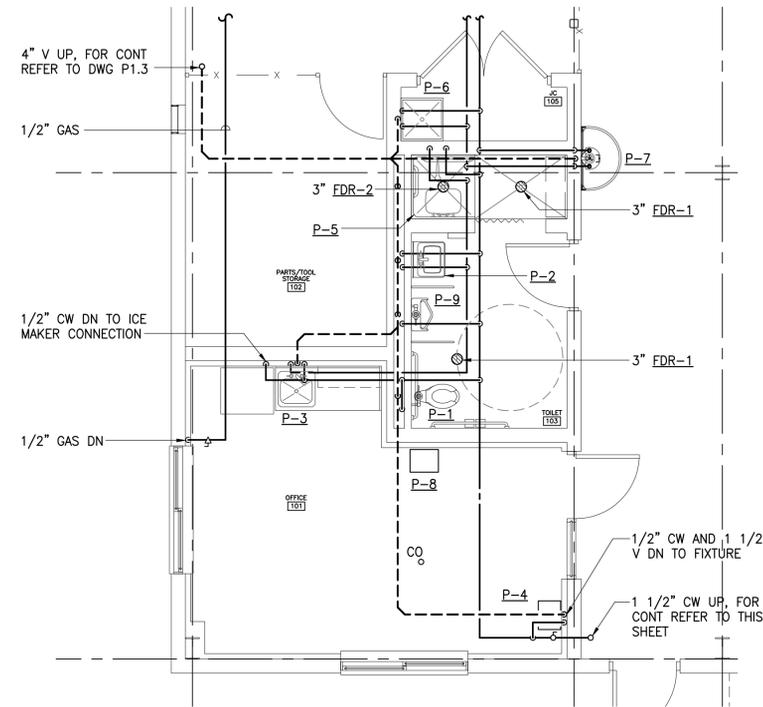
REVISIONS	
△ DELETE FLOOR DRAIN	10/8/12
04/12/12 - REVISED PER KENT CO. COMMENTS	



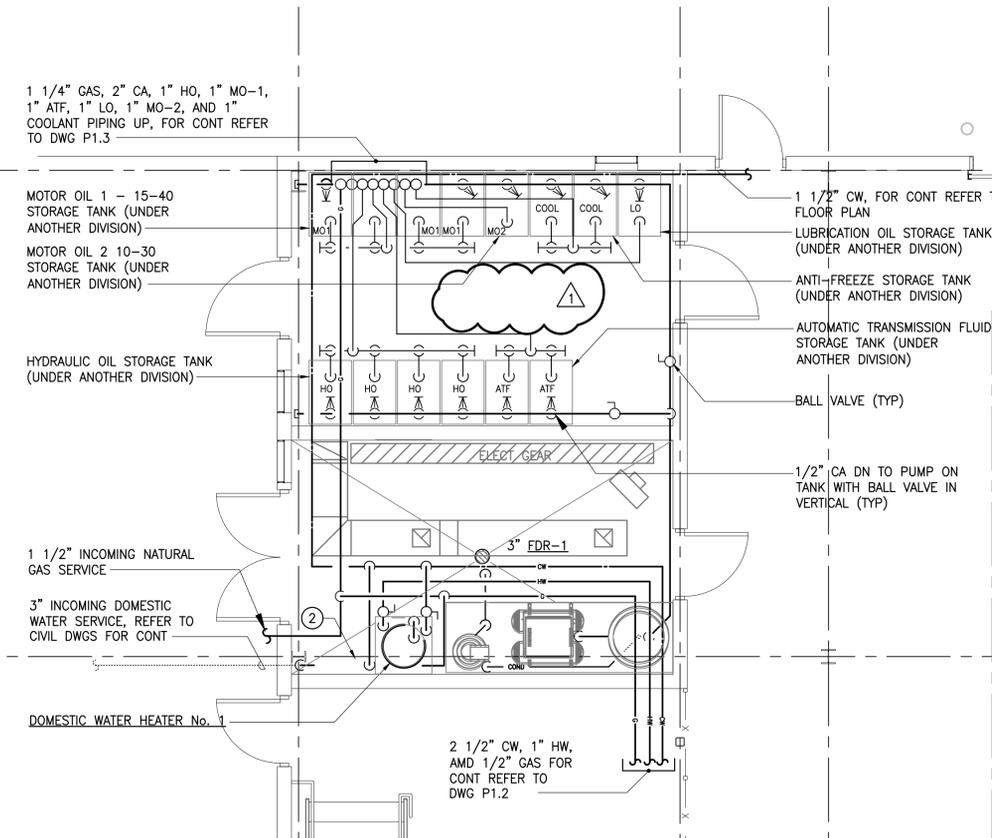
**Gipe Associates Inc.**  
Consulting Engineers  
849 Fairmount Ave Suite 102 Baltimore, MD 21286  
Baltimore, Maryland (410)832-2420  
Easton, Maryland (410)822-8688  
W.O.# 09035E

### DRAWING NOTES:

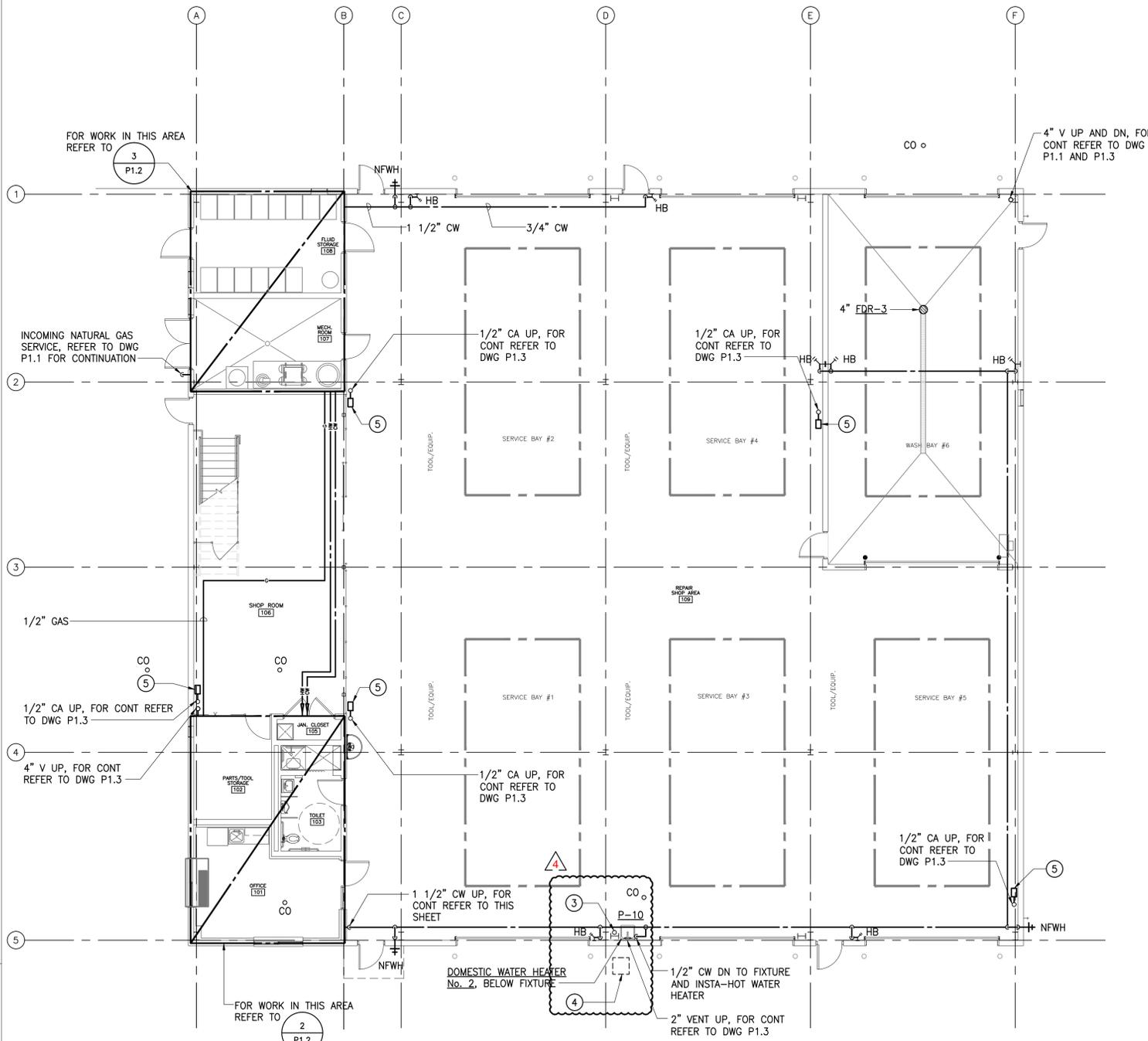
- ① NOT USED
- ② INCOMING DOMESTIC WATER SERVICE VALVE ASSEMBLY, REFER TO DETAIL ON DRAWING P7.1
- ③ 1/2" COMPRESSED AIR DN. TO WASTE OIL SUMP PUMP.
- ④ 2'x2'x2' CONCRETE WASTE OIL SUMP WITH NON-SKID STEEL GRATE. INSTALL WASTE OIL COLLECTION TANK AND SUMP PUMP, FURNISHED BY OTHERS, INSTALLED BY CONTRACTOR
- ⑤ COMPRESSED AIR STATION DROP (MOUNT AT 48" AFF), PROVIDE WITH FILTER/REGULATOR, REFER TO DRAWING DETAIL ON SHEET P7.1



2 PART PLAN - TOILET ROOMS  
SCALE: 1/4" = 1'-0"



3 PART PLAN - MECH AND FLUID STORAGE RM. PLAN  
SCALE: 1/4" = 1'-0"



1 GROUND FLOOR PLAN - PLUMBING  
SCALE: 1/8" = 1'-0"

2 P1.2 FOR WORK IN THIS AREA REFER TO



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# MEZZANINE FLOOR PLAN - PLUMBING

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO.	TOTAL SHTS
30-801-01	KENT	SEE TITLE SHEET	P1.3	59

## DELAWARE DEPARTMENT OF TRANSPORTATION MAGNOLIA YARD VEHICLE MAINTENANCE SHOP REVISIONS

04/12/12 - REVISED PER KENT CO. COMMENTS

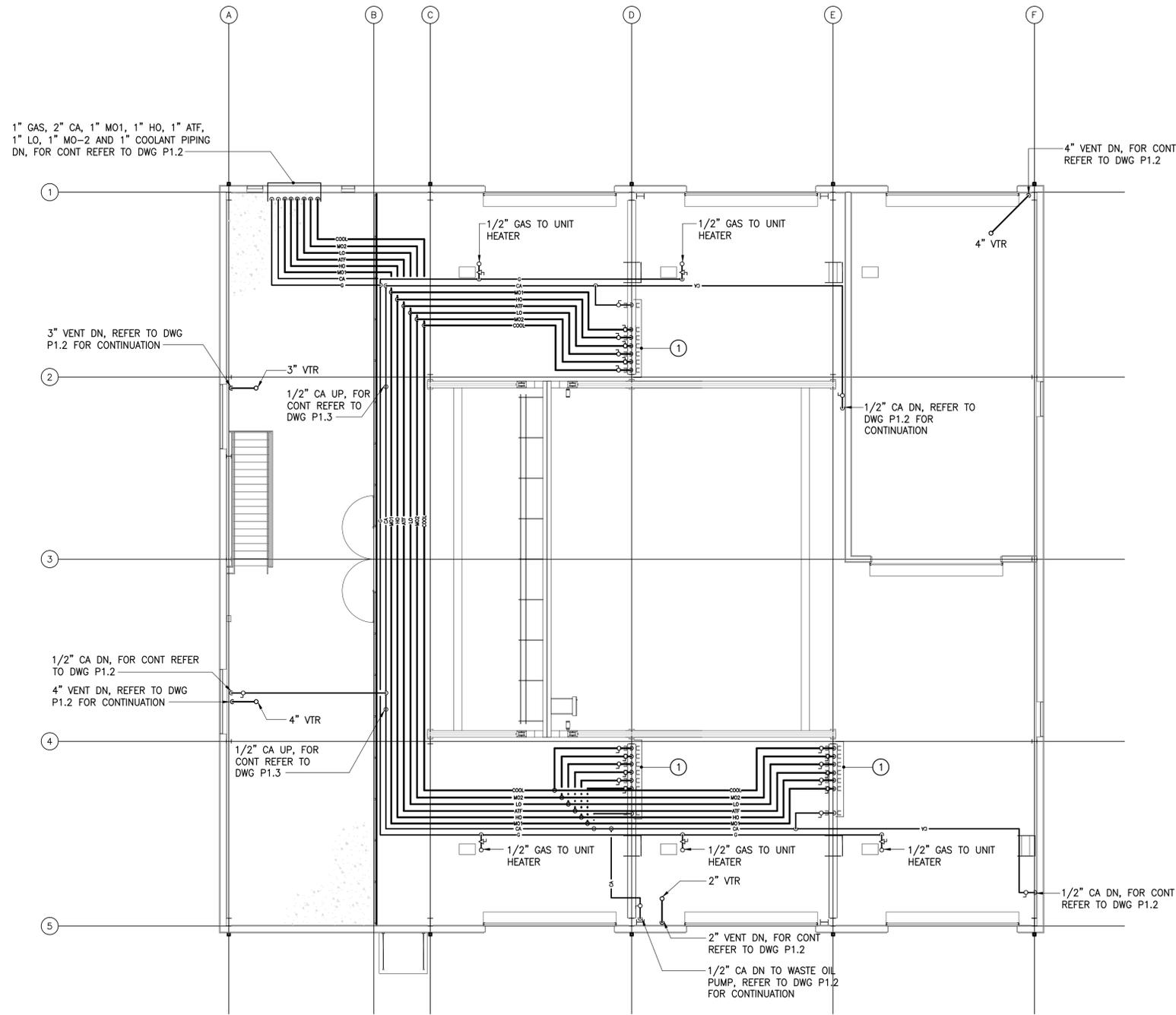


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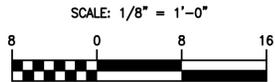
PROFESSIONAL ENGINEER AND ARCHITECTURE ACTS OF 1967 AS AMENDED AND REGULATIONS THEREUNDER. THIS DRAWING AND THE DESIGN AND CONSTRUCTION PLANNING INCLUDED ARE HEREBY REPRESENTED TO BE THE SOLE PROPERTY OF GIPE ASSOCIATES, INC. AND SHALL NOT BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN PERMISSION OF GIPE ASSOCIATES, INC. PENALTY \$500.

**DRAWING NOTES:**

① 3/4" COOLANT, 3/4" MOTOR OIL 2, 3/4" LO, 3/4" ATF, 3/4" HO, 3/4" MOTOR OIL 1, AND 3/4" CA PIPING DN TO HOSE REELS, ETC...



① P1.3 MEZZANINE FLOOR PLAN - PLUMBING  
SCALE: 1/8" = 1'-0"



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 DESIGN  
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# PLUMBING RISER DIAGRAMS

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO.	TOTAL SHTS
30-801-01	KENT	SEE TITLE SHEET	P3.1	59

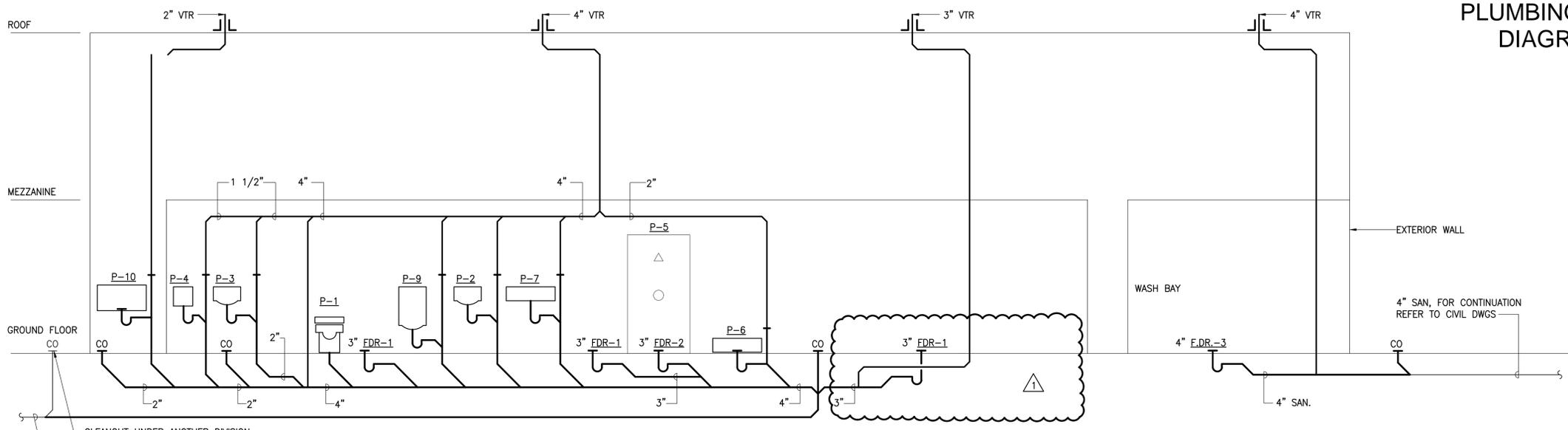
## DELAWARE DEPARTMENT OF TRANSPORTATION MAGNOLIA YARD VEHICLE MAINTENANCE SHOP

### REVISIONS

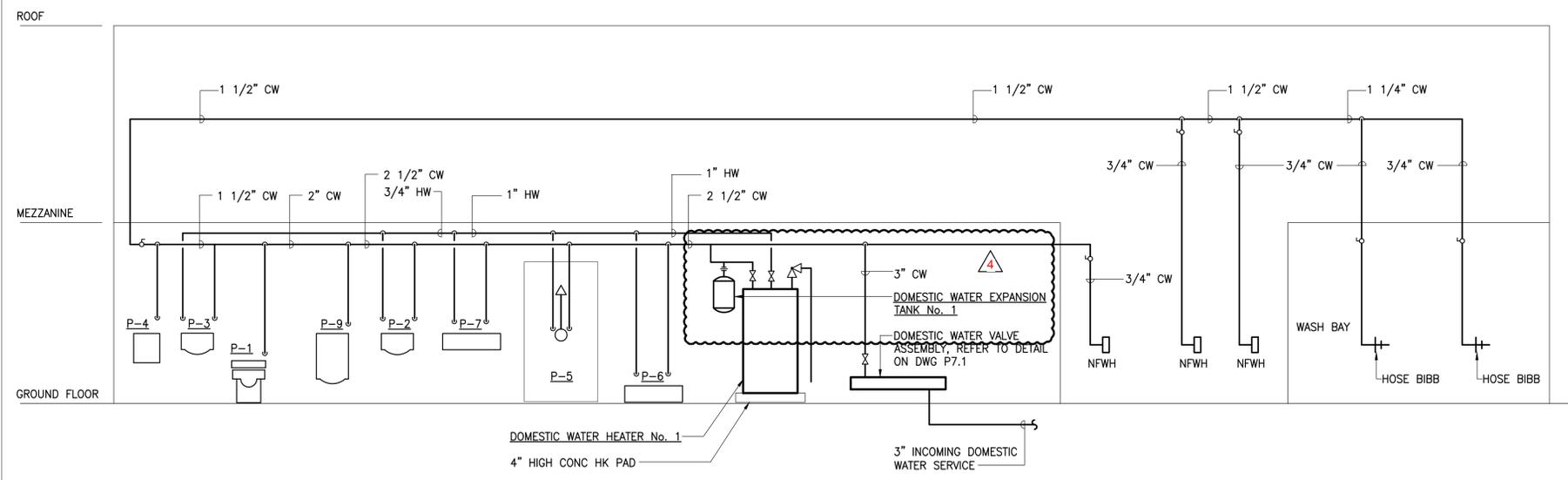
△ DELETE FLOOR DRAIN	10/8/12	
04/12/12 - REVISED PER KENT CO. COMMENTS		

**DINA M. DIXON**  
Professional Engineer  
No. 17123  
State of Delaware

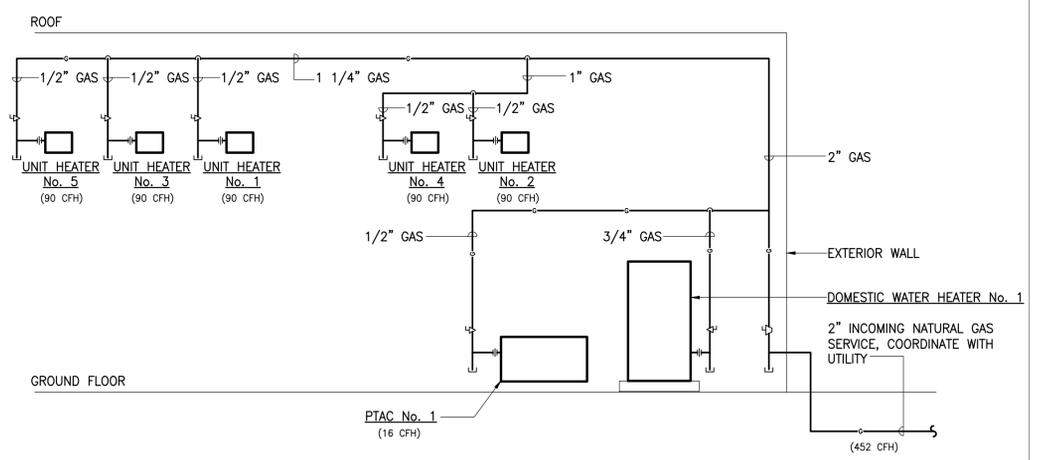
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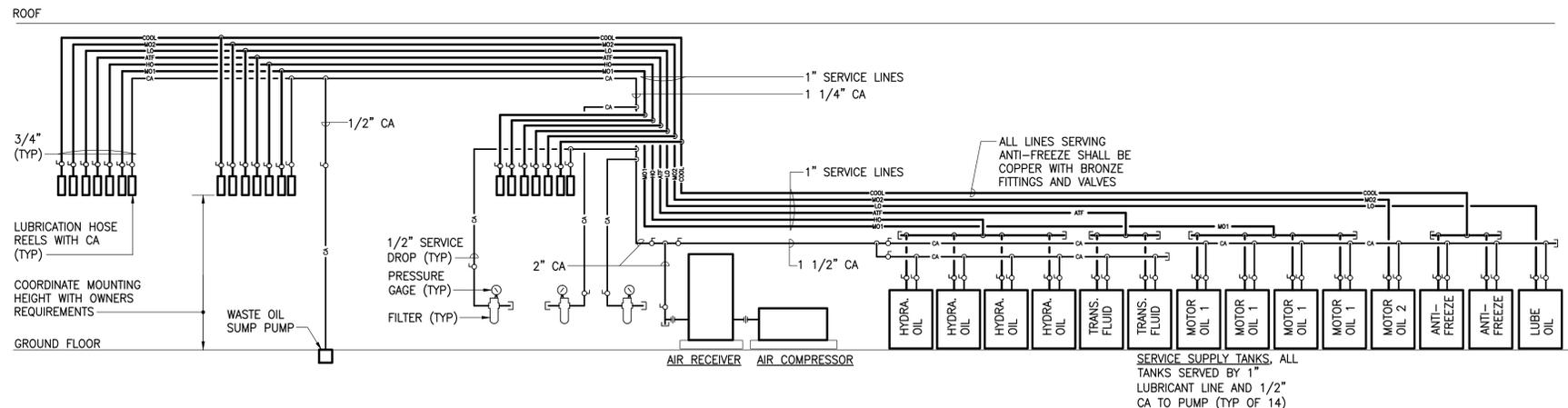
**(S-1) SANITARY RISER DIAGRAM**  
SCALE: NONE



**(W-1) DOMESTIC WATER RISER DIAGRAM**  
SCALE: NONE



**(G-1) NATURAL GAS RISER DIAGRAM**  
SCALE: NONE



**(L-1) HOSE REEL LUBRICANT W/ COMPRESSED AIR RISER DIAGRAM**  
SCALE: NONE

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 PREL. TRACING DESIGN CHKD.