Jones & Henry
ENGINEERS, LTD.

City Of Carmel
West Ground Storage Tank Booster Pump Station

ADDENDUM 1

October 30, 2024

Planholders on the City of Carmel Ground Storage Tank Booster Pump Station project are hereby notified of the following amendments to the Contract Documents. This Addendum is hereby made a part of the Contract Documents.

GENERAL NOTES

1. A non-mandatory pre-bid meeting will be held on Wednesday November 6 at 1:30 PM. It will be at the project site, congregating in the parking lot of the Carmel Water Distribution Office.

   3450 W 131st Street
   Carmel, IN 46033

   The "West Ground Storage Tank" and "Booster Pump Station" pre-bid meetings will occur at the same time as the projects are closely related to each other.

2. The attached "Report of Geotechnical Exploration Carmel Water Storage Tank" dated October 29, 2024, is made available.

   The technical data contained in the report upon which Contractor may rely are the boring method, plan and logs; level of subsurface water; laboratory test methods and results, if any; and similar factual data, all as of the dates made.

SPECIFICATIONS

The following attached specifications are added to the contract Documents:

15075 - HVAC & Plumbing Identification
15080 - Plumbing Insulation
15081 - HVAC Insulation
15140 - Domestic Water Piping
15150 - Sanitary Waste and Vent Piping
15195 - Facility Natural-Gas Piping
15211 - Small Piping and Valves
15214 - Compressed Air Systems
15440 - Plumbing Fixtures
15480 - Electric Domestic Water Heaters
15530 - Furnaces
15540 - Fuel-Fired Heaters
15550 - Breeching Chimneys and Stacks
15760 - Terminal Heating and Cooling Units
15810 - Ductwork
15820 - Duct Accessories

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(continued)
The following attached specifications are added to the contract Documents:
15830 - Fans
15850 - Air Outlets and Inlets
15855 - Louvers
15950 - Testing, Adjusting, and Balancing for HVAC
15980 - HVAC Controls

DRAWINGS

Replace the following drawings sheets with their attached counterparts. Changes are generally clouded for convenience.

A-1.1
A-1.2
S-1.2
PE-1.2
PE-1.3
P-1.1
P-1.2
P-1.3
M-0.2
M-0.4
M-0.5
M-1.1

Report of Geotechnical Exploration
Carmel Water Storage Tank
Carmel, Hamilton County, Indiana
S&ME Project No. 24180105

PREPARED FOR:

Jones & Henry Engineers, Ltd.
1980 E 116th St., Suite 260
Carmel, IN 46032

PREPARED BY:

S&ME, Inc.
7112 Zionsville Road
Indianapolis, IN 46268

October 29, 2024

October 29, 2024

Jones & Henry Engineers, Ltd.
1980 E 116th St., Suite 260
Carmel, Indiana 46032

Attention: Mr. Brian Roskowski, P.E.
E: BRoskowski@jheng.com

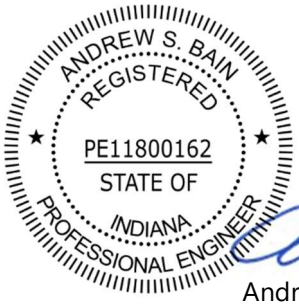
Reference: **Report of Geotechnical Exploration**
Carmel Water Storage Tank
Carmel, Hamilton County, Indiana
S&ME Project No. 24180105

Dear Mr. Roskowski:

S&ME, Inc. (S&ME) has completed our geotechnical exploration for the proposed 2-million gallon water storage tank and associated pump station building at the City of Carmel Water Operations facility located north of W 131st Street in Carmel, Hamilton County, Indiana. This report describes our understanding of the project, the subsurface conditions encountered, and presents our geotechnical recommendations for the planned construction. This work was performed in general accordance with S&ME Proposal No. 24180105 dated August 28, 2024, which was authorized by Jones & Henry Engineers, Ltd. on September 11, 2024. S&ME previously performed a geotechnical exploration for this project in 2022 (S&ME Report No. 21170023, dated May 27, 2022).

Sincerely,

S&ME, Inc.



Sadrish Panthi, P.E.
Geotechnical Operations Manager

Andrew S. Bain, P.E
Office Principal/Project Manager

Senior Review: Christopher L. Yohe, P.E., Vice President

Submitted: Email Copy broskowski@jheng.com

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Appendices

1.0 Introduction

S&ME, Inc. (S&ME) has completed our geotechnical exploration for the proposed 2-million gallon water storage tank and associated pump station building at the City of Carmel Water Operations facility located north of W 131st Street in Carmel, Hamilton County, Indiana. S&ME previously performed a geotechnical exploration for this project in 2022 (S&ME Report No. 21170023, dated May 27, 2022). Additional geotechnical services were requested due to the relocation of the center of the proposed tank approximately 100-feet northeast, and a pump station structure was added southeast of the proposed water tank. This report describes our understanding of the project, the subsurface conditions encountered, and presents our geotechnical recommendations for the planned construction. This work was performed in general accordance with S&ME Proposal No. 24180105 dated August 28, 2024, which was authorized by Jones & Henry Engineers, Ltd. on September 11, 2024.

The geotechnical exploration consisted of a total of four (4) soil borings (labeled B-08 through B-11) ranging from 25 to 60 feet below the existing site grades. Three (3) borings were completed for the shifted proposed water tank and one (1) boring was performed within the proposed footprint of the pump station building. Previous borings B-02 and B-05 were within the footprint of the relocated storage tank and were incorporated into our analysis.

The purpose of this exploration was to obtain subsurface data in order to evaluate the subsurface conditions and assess their characteristics relative to the support of the proposed water tank.

This report provides the following in general accordance with the information requested in ACI 372R-13.

- A summary of the project information;
- A summary of current site conditions, topography, and area geology;
- A summary of the field exploration methods;
- A summary of the subsurface conditions encountered in the soil borings;
- A summary of the laboratory test data;
- Results of our analysis and conclusions;
- Discussion of shallow foundations;
- Recommendations for Seismic Site Class based on the procedure discussed in AWWA D100-11; and
- An Appendix including Vicinity Map, Boring Location Plan, individual boring logs, and laboratory test reports.

A Site Location Map (Figure 1), Boring Location Plan (Figure 2), laboratory testing results, and typed boring logs are included in the Appendix of this report.

2.0 Project Information

Our understanding of the project is based on telephone and email conversations between Mr. Brian Roskowski, P.E. and Mr. Philip Teague, P.E. with Jones and Henry Engineers, Ltd. and Mr. Mike Sheek, Mr. Andrew Bain, P.E., and Mr. Sadrish Panthi, P.E. of S&ME. The following were provided to S&ME for review:

- Proposed Site Plan, marked up with new tank location and proposed borings, provided via email.
- Structural loading information for the proposed storage tank

- Dome Tank Drawings
- Three (3) Geotechnical Investigation Reports from 2002 near the immediate vicinity of the project.
- Geotechnical Information Checklists from DN Tanks and Preload Tanks.
- Pertinent Tank Foundation Geotechnical Information from ACI 372R-13.

Based on our review of the relevant project information, we understand the proposed construction is a 2-million-gallon potable water concrete storage tank with a diameter of 150 feet and a height of 15 feet, which will be located in a grassy area near the southwest corner of the Water Operations facility property. Please refer to Boring Location Plan (Figure 2) in Appendix I for site specific information. The center of the tank was relocated approximately 100 feet northeast from its initially planned location in 2022.

Based on our review of site elevations, site grades around the proposed tank are generally between El. 916 and El. 920. The maximum excavation depth for this project will be based on the final embedment depth of the foundation system and is not expected to exceed 10 feet.

Loading provided by Jones and Henry Engineers indicate that the foundation will consist of reinforced concrete slab with thickened edge along the perimeter of the tank. The thickened edge is proposed to be 3-foot wide and 1-foot thick whereas the inner slab is planned to be 4-inch thick. Maximum contact pressures of 2.46 kips per square foot (ksf) beneath the thickened perimeter edge and 0.97 ksf beneath the floor are expected.

Per the guidelines specified by ACI ACR372R-13, the maximum allowable settlement (uniform and tilting settlement) is 6 inches. For our analysis, we have considered a maximum allowable settlement of 3 inches. The project information and considerations detailed above should be reviewed and confirmed by the appropriate team members. Modification to our conclusions and recommendations may be required if the actual conditions vary from the project information and assumptions described herein.

Our exploration also included one (1) boring (labeled B-11) for the planned pump building. No specific information about this structure was provided to S&ME.

3.0 Regional Geology

The project site is located within the Tipton Till Plain unit of the Central Till Plain Region which is characterized by flat to gently rolling surfaces due to glaciation. The surficial geology in the area is characterized by Wisconsinan age glacial till with deposits exceeding 200 feet in depth characterized by alternating strata of clays, silts, and sands with variable amounts of gravel. Our review of the geologic mapping for the area (indianamap.org), indicates that bedrock at this site is part of the Muscatatuck Group and reportedly consists of dolomite and limestone. Bedrock is reported near El. 686, or at depths greater than 200 feet below the existing ground elevation at the site. Our borings extended to a maximum depth of about 60 feet or approximate El. 860 without encountering bedrock. The results of our exploration were generally consistent with the reported geologic mapping for the site.

4.0 Exploration Methods

The procedures used by S&ME for field and laboratory sampling and testing are in general accordance with ASTM procedures and established engineering practice. Appendix II and III contain brief descriptions of the procedures used in this exploration.

4.1 Field Exploration

A total of four (4) soil test borings (labeled B-08 through B-11) were performed for this geotechnical exploration and were extended to the depths shown in Table 4.1. The boring locations were staked in the field and cleared for utility conflicts by 811 prior to the field exploration by S&ME.

Boring B-09 was terminated above its planned depth of 60 feet due to auger refusal at 37.6 feet. Boring B-08 was extended to 60 feet, 20 feet more than its planned depth of 40 feet. Upon completion of soil augering and sampling at boring B-09, the borehole was left open for 24-hour groundwater reading.

The borings were performed using a Mobile B57 drill rig utilizing 3¼-inch hollow stem augers. Soil samples were obtained using a split-barrel sampler driven by an automatic hammer system in general accordance with ASTM D1586. Select cohesive samples were obtained using thin-walled undisturbed samples (Shelby) tubes in general accordance with ASTM D1587. Split-barrel samples were examined immediately after recovery and representative portions of each sample were placed in air-tight containers and retained for subsequent laboratory testing. Shelby Tube samples were measured for recovery and sealed at both ends with wax and plastic end caps for transportation to the laboratory.

A general description of our field procedures, a soil log legend, and boring logs are provided in Appendix II of this report. The stratification lines shown on the boring logs represent the approximate boundaries between soil types. The actual transitions may be more gradual than shown.

Approximate boring coordinates and estimated elevations are summarized in Table 4.1. The approximate locations of the borings are shown on the Boring Location Plan (Figure 2) in Appendix I.

Table 4.1 – Boring Coordinates Summary

Boring No.	Longitude (degrees)	Latitude (degrees)	Approx. Surface Elevation (ft)	Approximate Location	Termination Depth (ft)
B-08	39.97859295	-86.22045368	916	Outside perimeter of tank	60
B-09	39.97843106	-86.22050945	918	Center of tank	37.6
B-10	39.97852353	-86.22028797	917	Outside perimeter of tank	40
B-11	39.97802022	-86.22031672	916	Pump building	25

We measured the groundwater level in each boring during drilling, upon completion, and at the end of the workday, prior to backfilling with cement-bentonite grout. An extended groundwater level was recorded in boring B-09. The results of the groundwater level observations are presented on the appended boring logs and summarized in Section 5.3 of this report.

4.2 Laboratory Testing

The recovered soil samples were returned to our laboratory where applicable laboratory tests were performed. These tests are used to assess the engineering properties of the soil. The soil samples were visually classified by a geotechnical engineer in accordance with the Unified Classification System (ASTM D2487). The results of the soil classification and the field test results, are presented on the individual boring logs in Appendix II. Similar soils were grouped into strata on the logs and summarized in Section 5.1 below.

Selected split-barrel and undisturbed samples were subjected to the following laboratory tests:

- Natural Moisture Content (ASTM D2216)
- Atterberg Limit Tests (ASTM D4318)
- Grain Size Analyses (ASTM D422)
- One-Dimension Consolidation Testing (ASTM D2435)

5.0 Subsurface Findings

The following is a brief and general description of the subsurface conditions encountered in the borings. More detailed descriptions are provided in the individual boring logs included in Appendix II.

5.1 Soil Stratification

5.1.1 Surface Material

The borings were advanced through topsoil (in borings B-08, B-09 and B-11) and aggregate surface (in boring B-10) that cover the project site. The topsoil was generally described as dark to light brown, 3 to 7 inches in thickness, with variable amounts of root hairs and other organic materials. Aggregate surface material encountered in B-10 was about 3-inches thick. Previously placed fill material was also encountered beneath the surface materials in our borings, extending to a maximum depth of 3.5 feet below the ground surface (bgs).

5.1.2 Group A – Sandy Lean Clay (CL)

Sandy Lean Clay (CL) was the predominant soil type observed during the exploration and was encountered in each of the borings underlying the surface materials and extending to depths ranging from 8 feet bgs to 60 feet bgs. This stratum was observed to generally vary in color from brown to gray, with varying amounts of gravel. Recorded SPT N-values ranged from 7 blows per foot (bpf) to greater than 50 bpf, indicating a medium-stiff to hard consistency. Elevated blowcounts with depth and auger refusal encountered at 39.7-feet in boring B-09 are attributed to an increasing gravel/cobble content as is typical for glacial till soils. Laboratory testing performed on one sample of this clay had a liquid limit of 30 percent. Natural moisture contents ranged closer to the tested plastic limits, from 8.9 percent to 19.3 percent, indicating a stiffer, overconsolidated material.

5.1.3 Group B – Sandy Silty Clay (CL-ML)

Sandy Silty Clay (CL-ML) was encountered in borings B-09 through B-11 at depths typically ranging from 8 feet bgs to 13 feet bgs. This clay stratum was observed to be brown in color with varying amounts of sand and gravel.

Recorded SPT N-values ranged between 7 bpf and 12 bpf, indicating a medium-stiff to stiff consistency. Laboratory testing indicated this clay had a low plasticity with a liquid limit of 20 percent. Natural moisture content ranged from 11.1 percent to 12.4 percent.

5.1.4 Group C – Silty Sand with Gravel (SM) and Silt with Sand (ML)

Silty Sand with Gravel (SM) was encountered in boring B-08 from 22 feet bgs to 37 feet bgs. This sand was observed to be gray in color with varying amounts of gravel. Recorded SPT N-values ranged from 29 bpf to greater than 50 bpf, indicating a medium dense to very dense relative density.

Non-plastic Silt with Sand (ML) was encountered in boring B-10, between the depths of 13 feet bgs and 22 feet bgs. This silt was observed to be gray in color, with trace amounts of gravel. Recorded SPT N-values ranged from 9 bpf to 14 bpf, indicating a loose to medium dense relative density. Natural moisture content in this stratum varied between 12.2 percent and 15.8 percent.

5.2 Laboratory Testing Results

A summary of the classification testing is presented in Table 5.1. Individual laboratory testing reports are included in Appendix III.

Table 5.1 – Classification and Atterberg Limit Testing Summary

Boring No.	Depth (ft)	USCS Classification	% Fines	Natural Moisture (%)	Liquid Limit	Plastic Limit (%)
B-08	28.5 to 30.0	SM	32.1	9.6	NP[1]	NP[1]
B-09	8.5 to 10.0	CL-ML	61.1	12.4	20	13
B-10	15.5 to 17.5	ML	83.7	15.8	NP[1]	NP[1]
B-11	3.5 to 5.0	CL	56.7	19.3	30	15

[1] *NP = Non-Plastic*

5.3 Groundwater

Groundwater was encountered in all borings with the exception of boring B-11. Groundwater readings are summarized in Table 5.2.

Table 5.2 – Groundwater Summary

Boring No.	Depth at Time of Drilling (ft)	Depth after Completion (ft)	24-Hour Water Level Readings (ft)
B-08	Dry	8.8	---
B-09	23	28.4	9.4
B-10	17	15	---
B-11	Dry	Dry	---

Seasonal and periodic variations in precipitation can also affect the observed water level conditions. Long-term static groundwater readings can be obtained with the installation and periodic monitoring of piezometers.

6.0 Analyses and Recommendations

6.1 General Discussion

Our evaluation is based on the following criteria:

- 3.0 inches of total allowable settlement for shallow foundation supporting the tank, and 1-inch of total allowable settlement for the shallow spread foundation supporting the pump building;
- Maximum tilt of 1/300. This translates to a maximum allowable differential settlement of 3.0 inches between the center of the tank to the perimeter.

Structural loads for the 2M gallon tank are proposed to be supported on a ring wall foundation embedded up to 10 feet below existing grade. Soils encountered at this depth consisted of medium-stiff to stiff cohesive (CL, CL-ML) soils. These conditions are generally suitable to support the proposed foundation. However, some undercutting to remove soft and/or disturbed soils may be required in some locations. Shallow groundwater may have an impact on construction activities and the structural capacity of the soil, hence, dewatering may be necessary. These items are described in the sections below.

The following recommendations are based upon the project information provided as summarized in the foregoing text. We identified the following key geotechnical issues that may impact the development of this site:

- Location of groundwater table and need for dewatering
- Uplift resistance and Buoyancy
- Existing Utilities

6.1.1 Location of Groundwater Table and Dewatering

The groundwater table for completed investigations was encountered at or slightly above the foundation depth for the proposed structure. Therefore, groundwater should be anticipated to be encountered during excavation of the tank foundation and ancillary utility structures. If a system of sumps and pumps cannot sufficiently maintain the water level a minimum of 2-feet below invert/foundation elevations, a more extensive dewatering technique such as wells or a well-point system may be necessary for dewatering.

6.1.2 Uplift Resistance and Buoyancy

To resist potential uplift pressures created by groundwater, below-grade structures should be designed for uplift pressures resulting from the difference in elevation between the maximum anticipated hydrostatic head around the structures and the bottom of mat or floor of the structures. The structure dead weight and the frictional resistance developed between the backfill and structure walls must provide an adequate factor of safety against the anticipated hydrostatic uplift force. Uplift resistance may be increased by increasing the dead weight of the structure (mat and/or walls), cantilevering the mat foundation beyond the walls, or anchoring the mat/foundation

to the underlying soil using piles or post-tensioned anchors. Buoyancy may be reduced by shifting site grades vertically to decrease groundwater displacement.

6.1.3 Existing Utilities

An existing abandoned sanitary sewer utility line is shown on a provided layout plan within/near the southern edge of the proposed tank footprint. Plans showing the depth of this utility have not been provided, however it is expected this is a near surface line. The abandoned line should be removed and backfilled with compacted structural fill as detailed in Section 6.3, flowable fill, or concrete prior to construction of the proposed tank, to avoid potential settlement concerns.

6.2 Site Preparation

Prior to placing new fill or construction materials, all vegetation, topsoil, organic soils, abandoned utilities, or any unsuitable soils should be stripped from the proposed tank location. Following striping and necessary undercutting, the entire exposed subgrade should proofrolled using a heavily loaded, tandem axle truck to locate any soft, wet, or weak zones. Any observed unsuitable materials, or subgrade soils which exhibit significant pumping and/or rutting during proofrolling should be stabilized using one of the following methods:

- Scarifying, aerating, and recompacting;
- Over-excavating and replacing with suitable fill;
- Using a geogrid on top of the subgrade in connection with granular base; or,
- Using chemical stabilization techniques.

The determination of which of the four methods is appropriate for remediation of weak portions of the subgrade could be best determined by an S&ME representative witnessing a proofroll. If below-grade excavations are not accessible to proofrolling, then the exposed soils at the bearing elevations should be observed, and if accessible, hand probed by a qualified geotechnical engineer or their representative to determine if weak or wet zones are present.

6.3 Fill Placement

In areas where new fill is anticipated for support of structures, including any trench backfill placed within the zone of influence, we recommend the fill material meets the following minimum requirements:

1. Fill should be free of deleterious materials and rock fragments greater than 4 in. in diameter
2. Organic contents less than 4%
3. Uniformly spread in 6- to 8-in. thick loose lifts
4. Compacted at least 98 percent of the soil's maximum dry density, as determined by the laboratory Standard Proctor compaction test (ASTM D698)
5. The moisture content of any soil used as structural fill should be controlled at plus to minus 2 percent of the optimum moisture content during all compaction operations

Based on the conditions of the soil encountered in the borings, portions of the existing soils can be reused as structural fill provided the soils are properly moisture conditioned. All topsoil, organic materials, debris, cobbles, and boulders should be separated from structural fill for possible future reuse. New fill should not be in a frozen

condition when placed and should not be placed on a frozen subgrade. The final determination of whether an on-site soil is suitable for structural fill should be made in the field by a qualified technician, under the direction of a licensed Professional Engineer.

6.4 Open Trench Excavation

Sloughing and caving of excavations should be anticipated in weaker cohesive soils, and in granular soils. Provisions should be made to brace the walls of all excavations or slope the excavation walls back at a safe angle in accordance with the most recent Occupational Safety and Health Administration (OSHA) excavation rules and regulations. The contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should S&ME be assumed to be responsible for construction site safety.

Due to the potential presence of sand lenses in the encountered surficial sandy clays, soils will typically classify as OSHA Type C with maximum slopes of 1½H:1V (horizontal to vertical) to the existing ground surface in accordance with OSHA guidelines. The proposed soil type can be used provided the soil is not subjected to vibration and remains dry (no seepage or presence of perched groundwater). Flatter slopes are allowed, but the excavated slopes should not be steeper than the OSHA guidelines. As excavations are made, the competent person in charge of operations should evaluate the soils to determine the appropriate benching or shoring methods required per OSHA guidelines. Granular soils (e.g., sand and gravel) should be excavated/shored according to the OSHA guidelines.

In general, any existing underground utilities, pavement, or structures within the influence zone of an open-cut trench may be susceptible to lateral movements if the excavations are not fully braced as the excavations are performed. The influence zone of the trench may be determined by extending an imaginary line from the base of the excavation to the ground surface using an inclination of approximately 45 degrees with the horizontal. Therefore, provided the lateral distance to and the depth of the existing utility or structure are known, a determination may be made as to whether the utility or structure is in the zone which may be affected by the proposed excavation. The risk of lateral movement within the influence zone increases with both the length of the excavation and the time the trench remains open. Thus, requiring the contractor to limit open trench excavation length to that which can be backfilled the same day as the excavation is performed would reduce the risk of lateral movement of the trench side walls.

If there is no tolerance for lateral movement of an existing underground utility or above ground structure located within the influence zone of an excavation, S&ME recommends that the trench excavations be directly braced at the time of the excavation. To be effective, the bracing must be designed to minimize deflection along the entire height and be constructed “tight” against the retained soil. If lateral movement cannot be tolerated, a bracing system must be installed before the excavation is made.

6.5 Shallow Foundations

Based on conditions encountered in the borings, we anticipate the tank foundation will bear in natural medium-stiff to stiff cohesive soils (CL, CL-ML). We anticipate the tank will be supported on a reinforced concrete ringwall bearing approximately 10 feet below existing ground surface, and the pump building will be supported on conventional shallow (spread) foundation bearing approximately 3 feet below existing ground surface.

6.5.1 Ringwall (Shallow Foundation)

- A net allowable bearing pressure of 1,500 pounds per square foot (psf) may be used for the design of the continuous spread perimeter foundation bearing roughly 10 feet below the existing ground surface in natural medium-stiff to stiff soils.
- If weak natural soils or existing uncontrolled fill are encountered at the plan foundation bearing elevation, the footing excavations should be extended through these zones to stronger, more suitable natural bearing soils. The footing over-excavations below the plan bearing elevation can be backfilled with low-strength concrete having a minimum 28-day compressive strength of 1,500 psi or with additional footing concrete. This low strength concrete should be placed at least 24 hours prior to the placement of footing concrete;
- Footings should be placed at least 36 inches below the lowest adjacent grade for frost protection or in accordance with local codes;
- Footings designed and constructed in accordance with the foregoing recommendations and procedures will have a factor of safety of at least 3 with respect to shearing strength;
- Considering a slab/mat foundation bearing roughly 10 feet below grade, we have estimated that total settlement will be within tolerable ranges (i.e., less than 3 inches total and differential) for the tank.
- Considering groundwater levels observed in the borings, we anticipate that dewatering will likely be required to construct the tank foundation.
- The foundation recommendations presented above are applicable to the tank floor system as well.

The foundation excavations should be free of debris, as well as free of water at the time of the concrete placement. Surface water infiltration can be minimized by grading the ground surface adjacent to the foundation excavations to prevent surface runoff from entering the foundation excavations.

All foundation excavations should be observed by the engineer of record or their representative to determine that suitable bearing soils are present and capable of supporting the loads as designed and to minimize the amount of undercut required during excavation if weak or unsuitable soil conditions or existing fill are encountered.

6.5.1.1 Uplift and Lateral Resistance

To resist potential uplift pressures created by groundwater, below-grade structures should be designed for uplift pressures resulting from the difference in elevation between the maximum anticipated hydrostatic head around the structures and the bottom of mat or floor of the structures. The structure dead weight and the frictional resistance developed between the backfill and structure walls must provide an adequate factor of safety against the anticipated hydrostatic uplift force. Uplift resistance may be increased by increasing the dead weight of the structure (mat and/or walls), cantilevering the mat foundation beyond the walls, or anchoring the mat/foundation to the underlying soil using piles or post-tensioned anchors. We assume the effort to install piles or post-tensioned anchors would be greater than the effort of either increasing the structure dead weight or cantilevering the mat foundation beyond the walls. If recommendations for piles or anchors are desired, please contact us.

In addition to the weight of the structure, some resistance will come from friction of the sides of the tank that are buried. For uplift resistance calculations, the top 3-feet of soil shall be ignored due to frost depth, and due to the smooth nature of the proposed tank, a wall-soil interface friction coefficient is assumed to equal 0.5 * Effective Friction Angle (Φ) of the backfill material.

An additional option to reduce buoyancy forces would be to shift site grades up vertically, to decrease disturbance of the high groundwater table. If the tank bearing elevation is shifted without changing site grades, the structural engineer will need to confirm that the tank still meets sliding and overturning requirements.

6.5.2 Tank Floor Slab

A 4-inch thick reinforced concrete membrane floor is proposed underneath the tank. A maximum net allowable bearing pressure of 970 psf may be used for design of the tank floor, bearing roughly 10 feet below the existing ground surface in natural medium-stiff to stiff soils.

Slabs will be supported on existing natural soils. We recommend at least the upper three feet of pad subgrades consist of low plasticity fill with a plasticity index (PI) of less than 30 percent. Most on-site lean clays and clayey sands (CL/SC) meet this plasticity requirement. Soils beneath the tank foundations that are not within this range should be undercut and replaced, or chemically stabilized to prevent possible differential settlement due to expansion or contraction of the subgrade soils.

We suggest a layer of compacted dense-graded aggregate (DGA) or quarry screenings directly beneath the slab to enhance support and provide a working base for construction of the slab. The actual thickness should be based on the floor slab design, but our experience suggests a minimum depth of 4 inches. The DGA or quarry screenings should be moist, but not wet, as the concrete is placed to reduce curling of the slab as the concrete cures. The upper 1-foot of subgrade below floor slab aggregate base course should be compacted to at least 100 percent of maximum dry density within 3 percent of the optimum moisture.

Floor slabs prepared in the manner described are expected to provide a modulus of subgrade reaction (k-value) of 10 pci.

6.5.3 Spread Footings

For the pump station building, a maximum allowable bearing pressure of 2,500 psf may be used such that the magnitude of post-construction settlement is less than 1-inch and the shallow foundations (column or wall) bear on at least 12 inches of compacted dense graded aggregate (DGA) such as INDOT #53 crushed limestone, above the medium-stiff native cohesive (CL) soils as encountered in boring B-11. The above bearing pressure considers that the column footings are 3 feet x 3 feet maximum dimension and the wall footings are at least 24 inches wide, and also on the premise that foundation subgrade is prepared as recommended in this report.

6.6 Retaining Walls and Lateral Earth Pressure Recommendations

Below-grade portions of proposed structures, or walls acting as retaining walls, should be designed to withstand lateral earth pressures, as well as hydrostatic pressures, which may develop behind the walls. If it is anticipated that the walls of the proposed structures will be fixed at both the top and bottom preventing significant lateral deflections or rotations from occurring, then an "at-rest" earth pressure condition exists. If the walls can deflect a distance of at least 0.1 percent of their height, then an "active" earth pressure condition may be assumed for design purposes. The magnitude of lateral earth pressures varies based on soil type, permissible wall movement, and configuration of backfill.

Because cohesive soils and granular soils with significant clay content can cause high magnitudes of lateral loads due to creep and swelling pressures, these materials should not be used to backfill against below-grade walls. A free-draining granular material such as bank run sand and gravel containing a maximum of 20 percent passing the No. 200 sieve, or a coarse angular gravel such as No. 57 limestone, should be used as backfill against below-grade walls. This granular zone should be drained to reduce hydrostatic pressures, but for the anticipated embedded foundation configuration, hydrostatic pressure will be unavoidable and should be considered in wall design. It is unknown at this time what material type will be used behind the below-grade walls. However, design parameters for the conditions encountered in the upper 15 feet in our borings at the site are presented in Table 6.4.

Table 6.1 – Lateral Earth Pressure Design Parameters

Backfill Parameters:	Existing Cohesive Soil	Coarse Angular Gravel (No. 57 limestone)
Equivalent Fluid Pressure		
Active Case	53	34
Passive Case	296	390
At-Rest Case	62	52
Earth Pressure Coefficient		
Active Case (K_a)	0.42	0.29
Passive Case (K_p)	2.37	3.39
At-Rest Case (K_0)	0.49	0.46
Unit Weight (pcf)		
Moist	125	115
Saturated	130	120
Buoyant	63	58
Effective Friction Angle (Φ)	24°	33°

The soil backfill placed behind tank walls should be compacted to a similar requirement recommended in Section 6.3 of this report. We caution that operating compaction equipment directly behind the wall structures can create lateral earth pressures far in excess of those recommended for design. Therefore, bracing of the walls may be needed during backfilling.

6.7 Seismic Site Class and Design Spectral Accelerations

Based on the subsurface stratigraphy encountered within the borings, standard penetration resistance (blow counts), estimated shear strength values, and the estimated stratigraphy between the bottoms of the borings and 100 feet below existing grades, it is the opinion of S&ME that this site is best characterized by Seismic Site Class D in accordance with the 2014 Indiana Building Code, which references the 2012 International Building Code and ASCE 7-10. The resulting design spectral accelerations are presented in Table 6.3.

Table 6.3 – Design Spectral Acceleration

Site Class	PGA	S_s	S_1	F_{PGA}	F_a	F_v	PGA_M	S_{DS}	S_{D1}	Seismic Design Category
D	0.07g	0.149g	0.082g	1.6	1.6	2.4	0.109g	0.159g	0.132g	B (RC I-III) C (RC IV)

6.8 Groundwater Considerations

Based on the water levels recorded during and after drilling and included in Section 5.3 of this report and the depths of excavation required it should be anticipated that groundwater will be encountered during excavation for the tank foundations. If pumping from a system of sumps and pumps cannot sufficiently maintain the water level a minimum of 2 feet below the bottom of foundation subgrade or surface being compacted, then more extensive dewatering techniques, such as wells or a well-point system may be necessary for dewatering.

If perimeter drains are placed slightly below foundation bearing elevations surrounding the tank, slotted PVC pipe should be used wrapped in a geotextile to prevent fines migration. The pipe trench shall be backfilled with free-draining aggregate and either daylighted or pumped away from the tank foundations.

The presence of water in trenches, coupled with construction activity, will soften and weaken any cohesive soils present at the bottom of the excavations, and these affected materials may cause settlement beneath a pipe or structure following backfilling. Therefore, the bottom of all excavations should be kept free of standing water, and any softened, weakened, or disturbed materials should be removed and replaced with select granular backfill.

7.0 Limitations of Report

This geotechnical report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

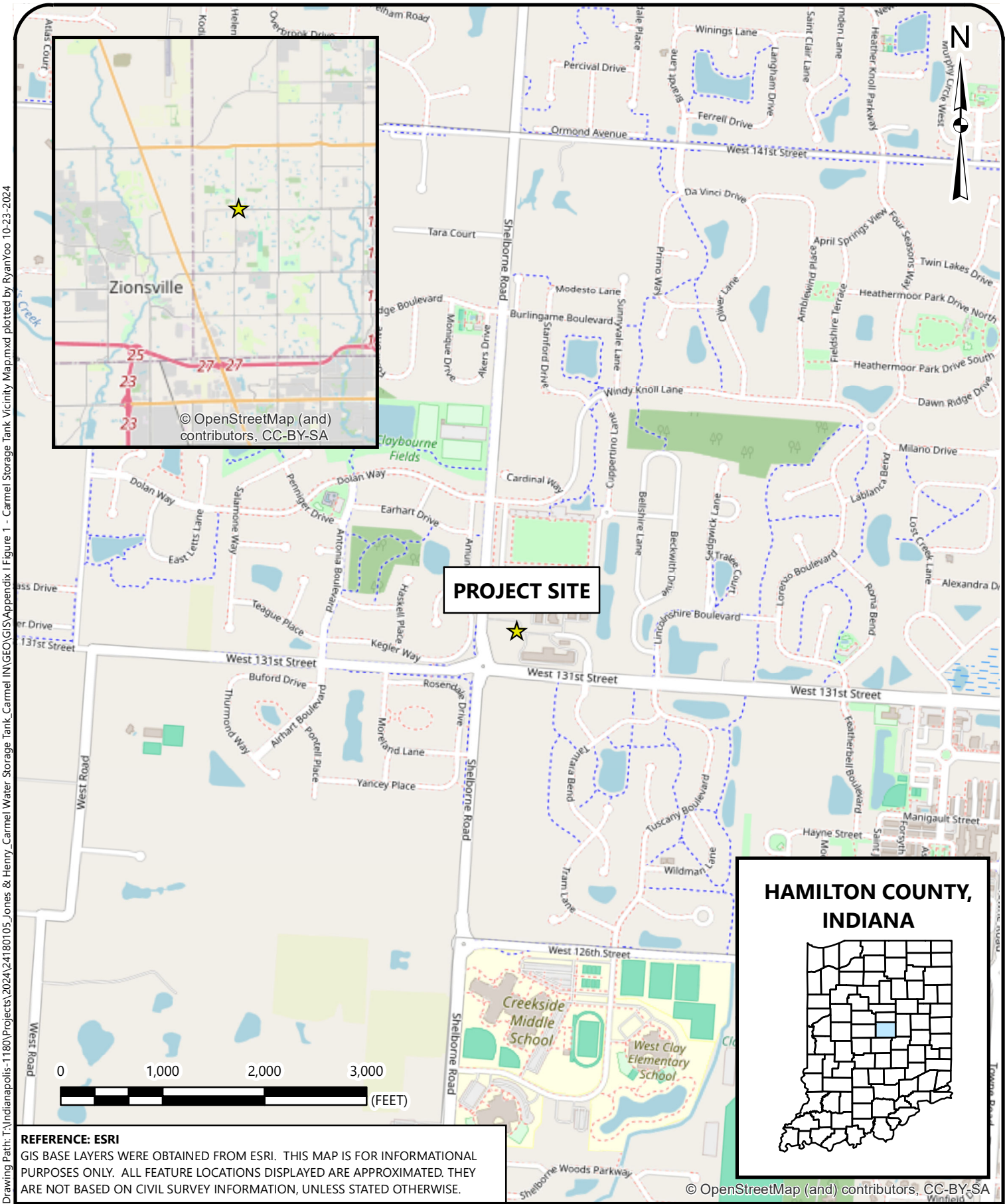
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria).

If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

Appendices

Appendix I – Additional Figures



REFERENCE: ESRI
GIS BASE LAYERS WERE OBTAINED FROM ESRI. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

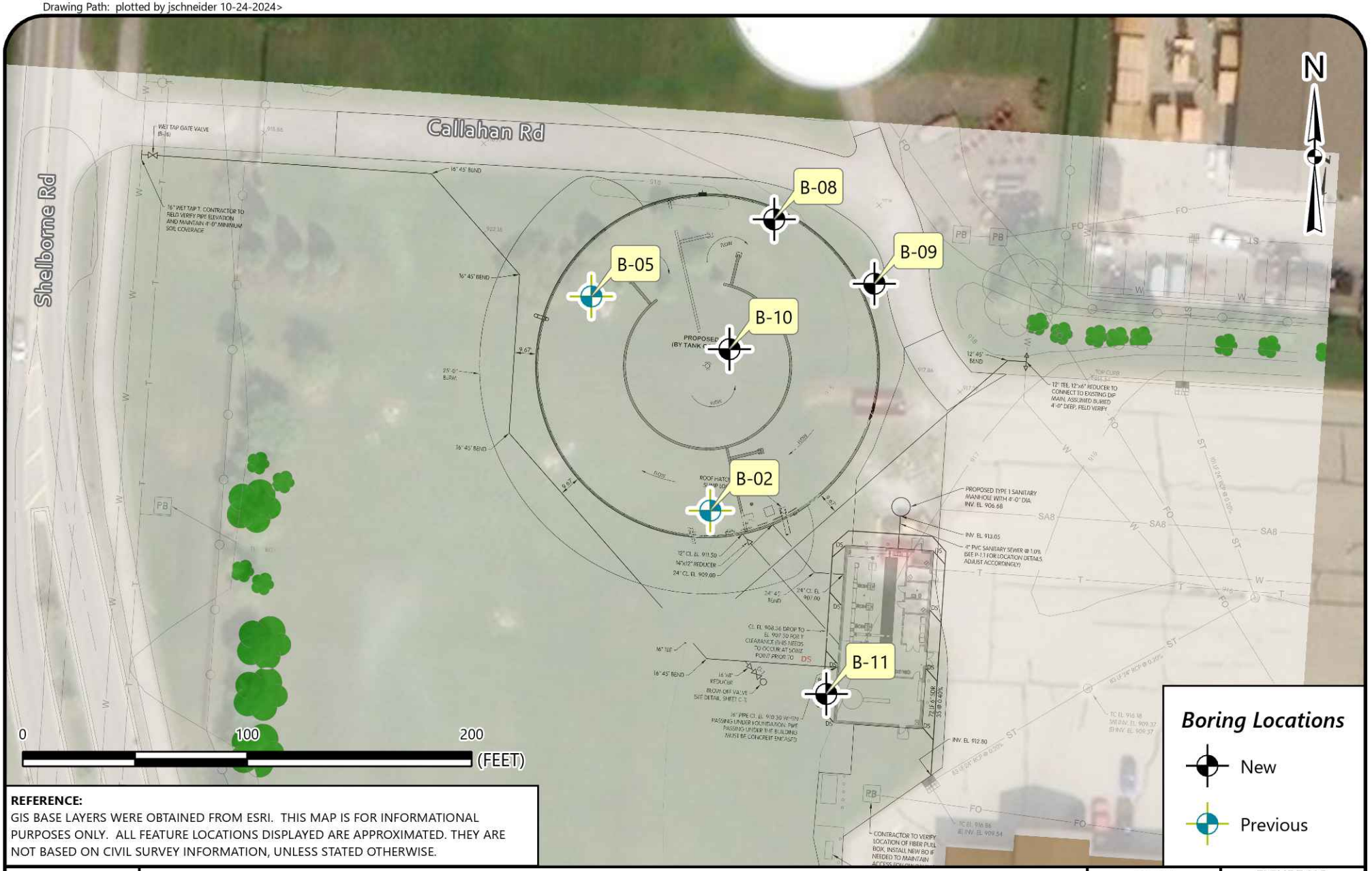
VICINITY MAP

CARMEL STORAGE TANK
CARMEL, HAMILTON COUNTY, INDIANA

SCALE:	FIGURE NO.
1:15,000	1
DATE:	
10-23-24	
PROJECT NUMBER	
24180102	

Drawing Path: T:\Indianapolis-1180\Projects\2024\24180105_Jones & Henry_Carmel Water Storage Tank_Carmel IN\GEO\GIS\Appendix I Figure 1 - Carmel Storage Tank Vicinity Map.mxd plotted by RyanYoo 10-23-2024

Drawing Path: plotted by jschneider 10-24-2024>



REFERENCE:
GIS BASE LAYERS WERE OBTAINED FROM ESRI. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

BORING LOCATION PLAN

CARMEL STORAGE TANK
CARMEL, INDIANA

SCALE:	1:700
DATE:	10/24/2024
PROJECT NUMBER	24180105
FIGURE NO.	2

Appendix II – Boring Logs

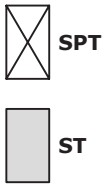
SOIL LOG LEGEND

SOIL PROPERTY SYMBOLS

N - Standard Penetration, bpf
LL - Liquid Limit, %
PPV - Pocket Penetrometer Value, tsf
NMC - Natural Moisture Content, %
PL - Plastic Limit, %
Qu - Unconfined Compressive Strength
F - Fines Content, %
PI - Plasticity Index, %
γd - Dry Unit Weight, pcf

The STANDARD PENETRATION TEST (SPT) as defined by ASTM D1586 (or AASHTO T206) is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D./2-inch O.D. split-barrel sampler is driven three 6-inch increments with a 140 lb. hammer freely falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The SPT N Value is determined by adding the number of blows from the 2nd and 3rd 6-inch increments. A normalized blowcount (N_{60}) may be determined by the following equation: N_{60} = [Rig Energy Ratio (%) / 60] * N.

SHELBY TUBE (ST) samples are obtained by hydraulically pushing a thin-walled tube (typically 3-inches in diameter) to obtain a relatively undisturbed sample for testing of fine-grained soils to determine engineering properties such as strength, compressibility, permeability, and density. Shelby tubes are sampled in general accordance with ASTM D1587 (AASHTO T207).



Descriptive Order of Soil Strata: Geologic Disposition (i.e., Fill, Colluvium, Alluvium, etc.), ASTM Group Name (ASTM Group Symbol), quantified/qualified soil constituents, misc. constituents, consistency/density, color, organic description, moisture. ASTM group classifications is determined per ASTM D2487 where lab testing has been performed and ASTM D2488 where lab testing has not been performed.

ASTM GROUP NAME (SYMBOL) AND GRAPHIC

- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- WELL GRADED GRAVEL WITH SILT (GW-GM)
- WELL GRADED GRAVEL WITH CLAY (GW-GC)
- POORLY GRADED GRAVEL WITH SILT (GP-GM)
- POORLY GRADED GRAVEL WITH CLAY (GP-GC)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- CLAYEY GRAVEL WITH SILT (GC-GM)
- WELL GRADED SAND (SW)
- POORLY GRADED SAND (SP)
- WELL GRADED SAND WITH SILT (SW-SM)
- WELL GRADED SAND WITH CLAY (SW-SC)
- POORLY GRADED SAND WITH SILT (SP-SM)
- POORLY GRADED SAND WITH CLAY (SP-SC)
- SILTY SAND (SM)
- CLAYEY SAND (SC)
- CLAYEY SAND WITH SILT (SC-SM)
- LEAN CLAY (CL)
- SILTY CLAY (CL-ML)
- SILT (ML)
- FAT CLAY (CH)
- ELASTIC SILT (MH)
- ORGANIC LOW PLASTICITY SILT OR CLAY (OL)
- ORGANIC HIGH PLASTICITY SILT OR CLAY (OH)
- PEAT (PT)
- TOPSOIL
- ASPHALT
- BASE - CEMENT MODIFIED
- BASE - CEMENT STABILIZED AGGREGATE
- BASE - GRAVEL
- CONCRETE
- VOID / NO RECOVERY
- IGM / PWR

FINE-GRAINED SOIL (Relative Consistency)

	N	PPV
Very Soft	< 2 bpf	< 0.25 tsf
Soft	2 - 4 bpf	> 0.25 - 0.5 tsf
Firm	5 - 8 bpf	> 0.5 - 1.0 tsf
Medium Stiff	9 - 15 bpf	> 1.0 - 2.0 tsf
Very Stiff	16 - 30 bpf	> 2.0 - 4.0 tsf
Hard	> 30 bpf	> 4.0 tsf

COARSE-GRAINED SOIL (Relative Density)

	N
Very Loose	< 5 bpf
Loose	5 - 10 bpf
Medium Dense	11 - 30 bpf
Dense	31 - 50 bpf
Very Dense	> 50 bpf

MINOR CONSTITUENTS (% By Weight)

	Percentage
Trace	0% - 10%
Little	11% - 20%
Some	21% - 35%
"And"	≥ 36%

ORGANIC CONTENT OF SOIL (Determined by ASTM D2974 or AASHTO T267)

Classification	Percentage
With Organic Matter	4% - 15%
Organic Soil	16% - 30%
Peat	> 30%

MOISTURE CONDITION

Dry	Absense of moisture, dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

At Time of Drilling (ATD) — Groundwater observation made anytime during the drilling process. Depending on time of reading and drilling methodologies, this value may be influenced by the drilling process.

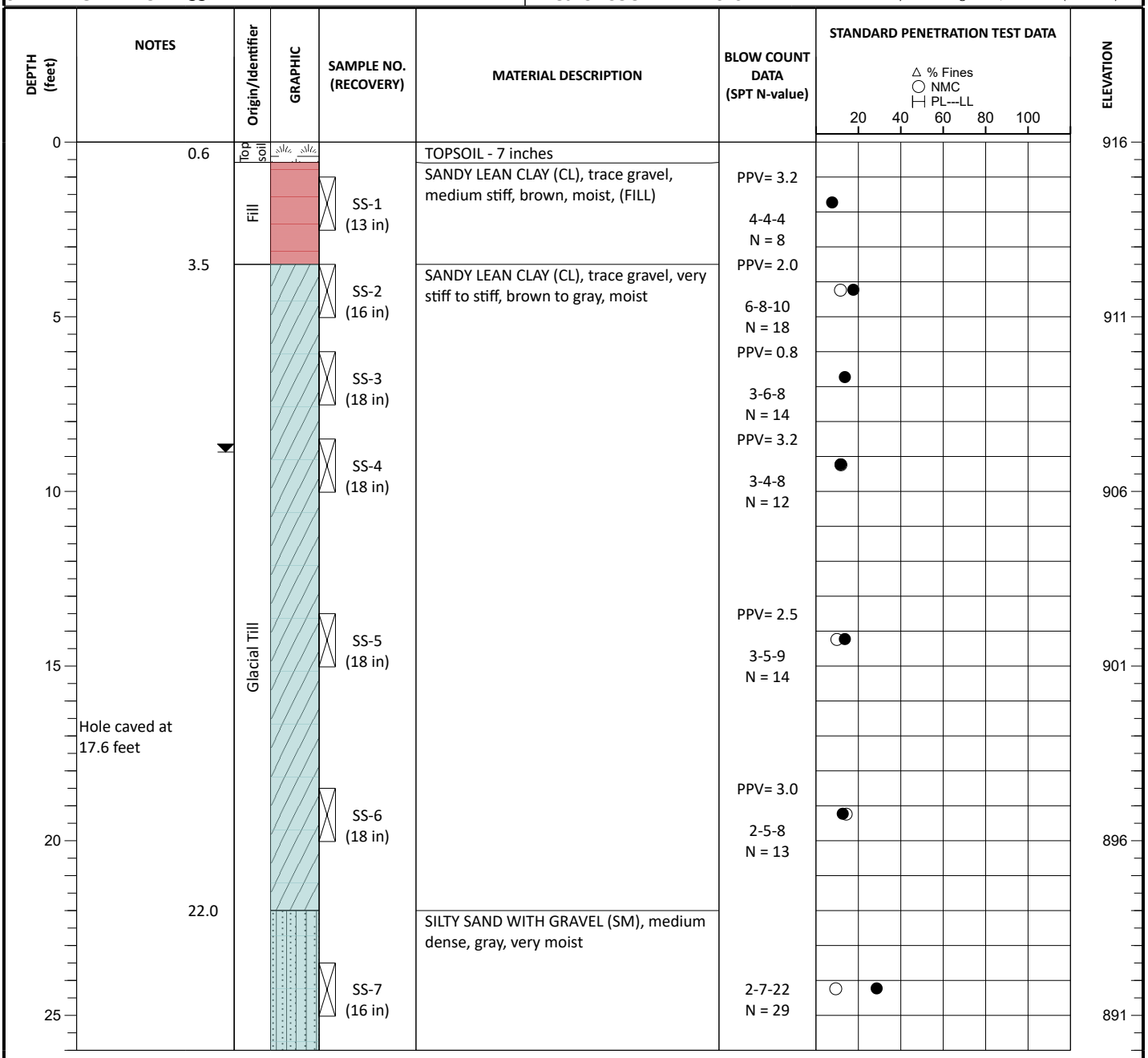
End of Drilling — Groundwater measurement soon after the drilling processes are complete, and the borehole is at final depth. Drilling fluids, if introduced during drilling, may influence this measurement.

After Drilling — Groundwater measurements made in a borehole hours to days after drilling is complete. Depending on subsurface conditions, elapsed time, drilling process, etc. this observation may reflect a stabilized level.

REFERENCES:

FHWA NHI-16-072, Geotechnical Engineering Circular No. 5 "Geotechnical Site Characterization"
ASTM Specifications D2487 and D2488
DOT Specifications & Design Manuals from NC, SC, OH, MI, IN, PA, VA.

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-08 *Sheet 1 of 3*
DATE DRILLED: 09/17/2024	**ELEVATION:** 916 ft	**NOTES:** Perimeter of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 60.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978593 **LONGITUDE:** -86.220454
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024		Not encountered during drilling, seepage encountered at 34 feet
END OF DRILLING	▼	09/17/2024		Not encountered at completion
AFTER DRILLING	▼	09/17/2024	8.8	Reading taken at the end of the workday
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-08 *Sheet 2 of 3*
DATE DRILLED: 09/17/2024	**ELEVATION:** 916 ft	**NOTES:** Perimeter of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 60.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978593 **LONGITUDE:** -86.220454
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
					SILTY SAND WITH GRAVEL (SM), medium dense, gray, very moist		
27.0					SILTY SAND WITH GRAVEL (SM), dense to very dense, gray, very moist to wet		
30				SS-8 (13 in)		9-50/5" N = 50/5"	886
35				SS-9 (18 in)		12-16-17 N = 33	881
37.0		Glacial Till			SANDY LEAN CLAY (CL), trace gravel, hard to very stiff, gray, moist		
40				SS-10 (16 in)		PPV= 4.5 8-15-24 N = 39	876
45				SS-11 (18 in)		PPV= 4.5 5-10-16 N = 26	871
50				SS-12 (16 in)		PPV= 4.5 3-7-11 N = 18	866

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
⊢ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024		Not encountered during drilling, seepage encountered at 34 feet
END OF DRILLING	▼	09/17/2024		Not encountered at completion
AFTER DRILLING	▼	09/17/2024	8.8	Reading taken at the end of the workday
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

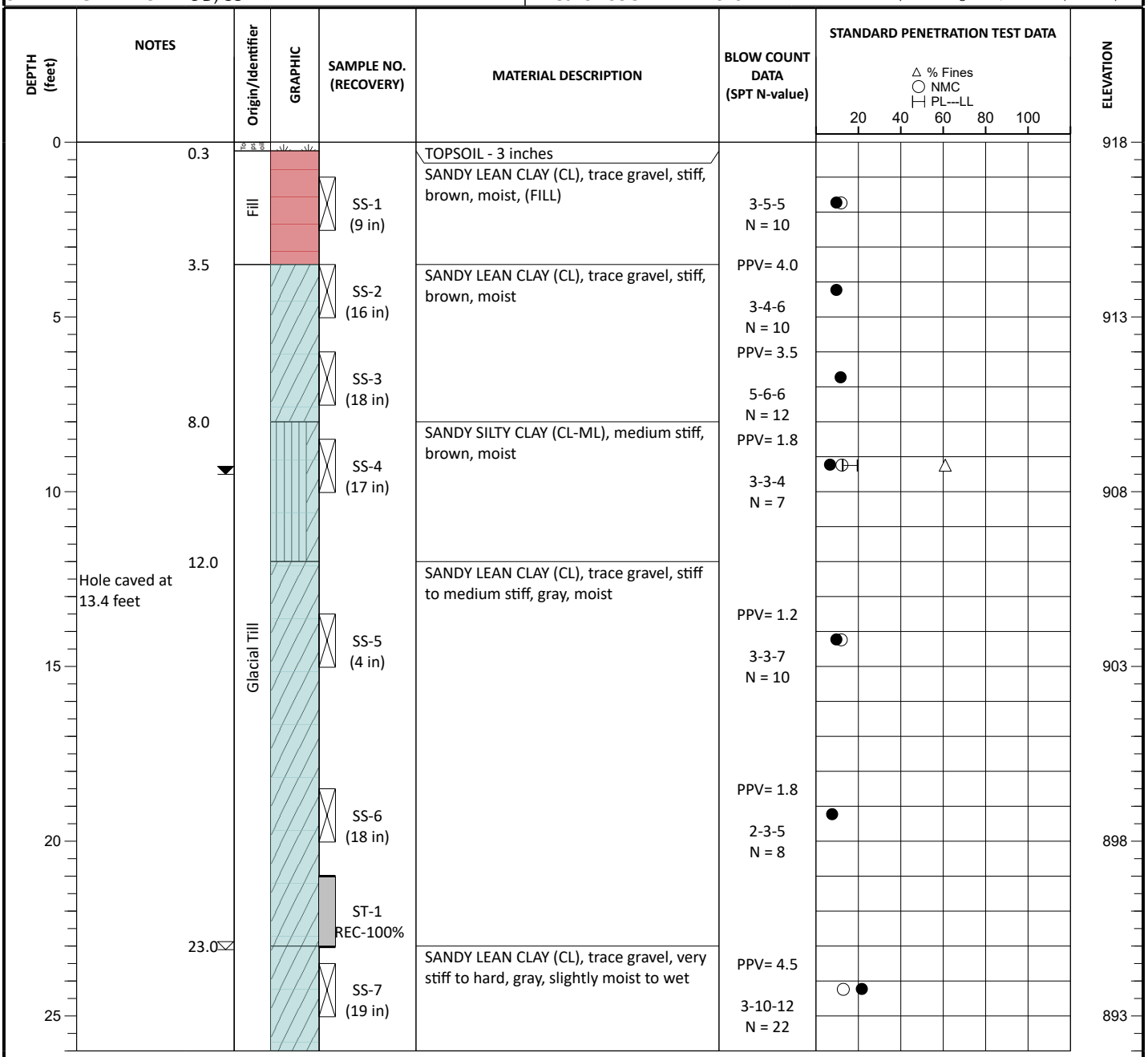
PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-08 *Sheet 3 of 3*
DATE DRILLED: 09/17/2024	**ELEVATION:** 916 ft	**NOTES:** Perimeter of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 60.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978593 **LONGITUDE:** -86.220454
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
55		Glacial Till		SS-13 (18 in)	SANDY LEAN CLAY (CL), trace gravel, hard to very stiff, gray, moist	PPV= 4.5 5-7-10 N = 17		861
60	60.0			SS-14 (14 in)	Borehole terminated at 60.0 feet	PPV= 2.5 3-7-13 N = 20		856
65								851
70								846
75								841

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024		Not encountered during drilling, seepage encountered at 34 feet
END OF DRILLING	▼	09/17/2024		Not encountered at completion
AFTER DRILLING	▼	09/17/2024	8.8	Reading taken at the end of the workday
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-09 *Sheet 1 of 2*
DATE DRILLED: 09/16/2024	**ELEVATION:** 918 ft	**NOTES:** Center of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 37.6 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978431 **LONGITUDE:** -86.220509
SAMPLING METHOD: UD, SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/16/2024	23.0	
END OF DRILLING	▼	09/16/2024	28.4	
AFTER DRILLING	▼	09/17/2024	9.4	24-hour reading
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

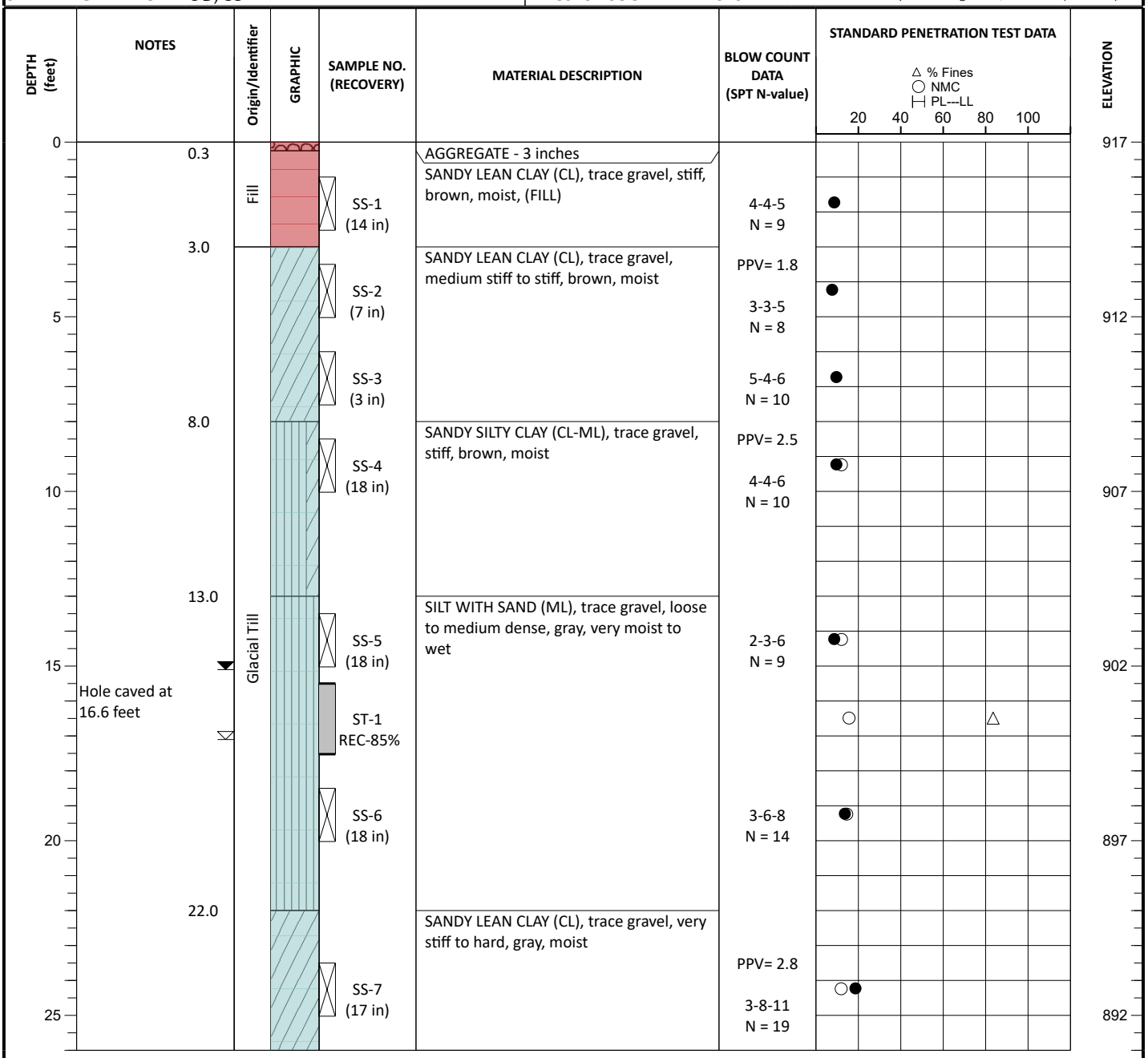
PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-09 *Sheet 2 of 2*
DATE DRILLED: 09/16/2024	**ELEVATION:** 918 ft	**NOTES:** Center of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 37.6 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978431 **LONGITUDE:** -86.220509
SAMPLING METHOD: UD, SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
					SANDY LEAN CLAY (CL), trace gravel, very stiff to hard, gray, slightly moist to wet			
						PPV= 2.2		
30		Glacial Till		SS-8 (18 in)		4-7-46 N = 53		888
				SS-9 (1 in)		50/1" N = 50/1"		
35								883
	Auger refusal at 37.6 feet				Borehole terminated at 37.6 feet			
	37.6							
40								878
45								873
50								868

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/16/2024	23.0	
END OF DRILLING	▼	09/16/2024	28.4	
AFTER DRILLING	▼	09/17/2024	9.4	24-hour reading
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-10 *Sheet 1 of 2*
DATE DRILLED: 09/17/2024	**ELEVATION:** 917 ft	**NOTES:** Perimeter of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 40.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978524 **LONGITUDE:** -86.220288
SAMPLING METHOD: UD, SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024	17.0	
END OF DRILLING	▼	09/17/2024	38.4	
AFTER DRILLING	▼	09/17/2024	15.0	Reading taken at the end of the workday
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-10 *Sheet 2 of 2*
DATE DRILLED: 09/17/2024	**ELEVATION:** 917 ft	**NOTES:** Perimeter of Tank
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 40.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978524 **LONGITUDE:** -86.220288
SAMPLING METHOD: UD, SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
					SANDY LEAN CLAY (CL), trace gravel, very stiff to hard, gray, moist			
				SS-8 (3 in)		50/4" N = 50/4"		
30								887
	32.0	Glacial Till			LEAN CLAY WITH SAND (CL), trace gravel, stiff to very stiff, gray, moist			
				SS-9 (18 in)		PPV= 2.0 3-3-6 N = 9		
35								882
				SS-10 (18 in)		PPV= 3.0 9-10-12 N = 22		
40	40.0				Borehole terminated at 40.0 feet			877
45								872
50								867

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024	17.0	
END OF DRILLING	▼	09/17/2024	38.4	
AFTER DRILLING	▼	09/17/2024	15.0	Reading taken at the end of the workday
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Carmel Water Storage Tank Carmel, Indiana S&ME Project No. 24180105	BORING LOG: B-11 *Sheet 1 of 1*
DATE DRILLED: 09/17/2024	**ELEVATION:** 916 ft	**NOTES:** Pump Building
DRILL RIG: Mobile B57	**DATUM:** NAVD88	
DRILLER: C Brummage	**BORING DEPTH:** 25.0 ft	
HAMMER TYPE: Auto	**CLOSURE:** Concrete Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** R Yoo	**LATITUDE:** 39.978020 **LONGITUDE:** -86.220317
SAMPLING METHOD: UD, SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0	0.3				TOPSOIL - 3 inches			916
		Fill		SS-1 (8 in)	SANDY LEAN CLAY (CL), trace gravel, stiff, brown, moist, (FILL)	6-7-8 N = 15	●	
	3.0				SANDY LEAN CLAY (CL), little gravel, medium stiff to stiff, brown, moist	PPV= 1.8		
				SS-2 (10 in)		3-3-4 N = 7	● ⊢ △	
5						PPV= 2.2		911
				SS-3 (18 in)		5-5-6 N = 11	●	
	8.5				SANDY SILTY CLAY (CL-ML), trace gravel, stiff, brown, moist	PPV= 1.2		
				SS-4 (14 in)		3-5-7 N = 12	●	
10								906
	12.0	Glacial Till			SANDY LEAN CLAY (CL), trace gravel, very stiff to stiff, gray, moist			
				SS-5 (18 in)		PPV= 1.8 3-4-16 N = 20	○ ●	
15								901
						PPV= 2.8		
				SS-6 (18 in)		3-5-6 N = 11	● ○	
20								896
				ST-1 REC-100%				
						PPV= 1.8		
				SS-7 (18 in)		4-8-9 N = 17	●	
25	25.0				Borehole terminated at 25.0 feet			891

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	09/17/2024		Not encountered during drilling
END OF DRILLING	▼	09/17/2024		Not encountered at completion
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

2022 S&ME Boring Logs (Previously Completed)

PROJECT:	Carmel Storage Tank Carmel, Indiana S&ME Project No. 21170023	BORING LOG: B-02 *Sheet 1 of 1*
DATE DRILLED: 03/28/2022	**ELEVATION:** 918 ft	**NOTES:**
DRILL RIG: Diedrich D-50 (track)	**DATUM:** NAVD88	
DRILLER: C. Brummage	**BORING DEPTH:** 39.5 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cement-Bentonite Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** C. Yohe	**LATITUDE:** 39.978230 **LONGITUDE:** -86.22052
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Indiana East FIPS 1301 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 50 100 150 200)	ELEVATION
0								
0.3		Fill		SS-1 (6 in)	TOPSOIL, (3.0 INCHES) SANDY LEAN CLAY (CL), trace gravel, trace roots, stiff, brown to dark brown, slightly moist, (FILL)	2-5-10 N = 15 PPV= 2.0		
3.5		Glacial Till		SS-2 (6 in)	SANDY LEAN CLAY (CL), trace gravel, medium stiff, light orange brown, moist, sand lens from 13.5 feet to 13.8 feet	3-3-5 N = 8 PPV= 1.0		913
5				SS-3 (6 in)				
				SS-4 (15 in)		1-3-3 N = 6 PPV= 0.8		
10								908
						2-3-3 N = 6 PPV= 0.5		
13.8				SS-5 (18 in)	SANDY LEAN CLAY (CL), trace gravel, hard, gray, slightly moist			
15						14-19-22 N = 41		903
18.5				SS-6 (15 in)	SANDY LEAN CLAY (CL), trace gravel, stiff, gray, slightly moist, sand lens from 23.5 feet to 23.8 feet	4-5-7 N = 12 PPV= 1.2		
20								898
				SS-7		5-8-10 N = 18		
25								893
25.0					SANDY LEAN CLAY (CL), trace gravel, hard, gray, slightly moist			
				SS-8		12-20-16 N = 36 PPV= 3.8		
30								888
				SS-9		16-34-41 N = 75		
34.5					SILTY, CLAYEY SAND (SC-SM), trace gravel, very dense, gray, slightly moist			
35								883
	Heaving sands encountered at 39.5'.			SS-10		7-23 N = 23		
39.0					SANDY LEAN CLAY (CL), trace gravel, very stiff, gray, slightly moist			
40								878
39.5					Borehole terminated at 39.5 feet			

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	03/28/2022	13.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT:	Carmel Storage Tank Carmel, Indiana S&ME Project No. 21170023	BORING LOG: B-05 *Sheet 1 of 1*
DATE DRILLED: 03/30/2022	**ELEVATION:** 920 ft	**NOTES:**
DRILL RIG: Diedrich D-50 (track)	**DATUM:** NAVD88	
DRILLER: C. Brummage	**BORING DEPTH:** 40.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cement-Bentonite Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** C. Yohe	**LATITUDE:** 39.978480 **LONGITUDE:** -86.22073
SAMPLING METHOD: SS, UD	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Indiana East FIPS 1301 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0				TOPSOIL, (3.0 INCHES)		
0.3		Fill	SS-1 (6 in)	SANDY LEAN CLAY (CL), trace gravel, trace roots, medium stiff, dark brown, moist, (FILL)	1-4-3 N = 7 PPV= 1.0	
3.5			SS-2 (12 in)	SANDY LEAN CLAY (CL), trace gravel, stiff, mottled orange brown and gray, moist to slightly moist	3-4-5 N = 9 PPV= 1.0	915
5			SS-3 (18 in)			
10			SS-4 (18 in)		4-5-9 N = 14 PPV= 2.0	910
14.0		Glacial Till	SS-5 (18 in)	SANDY SILTY CLAY (CL-ML), trace gravel, stiff, gray, slightly moist	2-4-6 N = 10 PPV= 1.5	905
15					3-4-6 N = 10 PPV= 1.0	
20			SS-6 (18 in)		2-5-8 N = 13 PPV= 1.8	900
25			SS-7 (18 in)		3-4-7 N = 11 PPV= 1.5	895
▽			ST-1 REC-69%			
27.0			SS-8 (18 in)	SILTY, CLAYEY SAND (SC-SM), trace gravel, medium dense, gray, moist	11-15-10 N = 25	
28.0				SANDY LEAN CLAY (CL), trace gravel, hard, dark gray, slightly moist		
30						890
35			SS-9 (18 in)		31-32-25 N = 57 PPV= 4.5	885
40			SS-10		13-14-33 N = 47 PPV= 4.5	880
40.0				Borehole terminated at 40.0 feet		

STANDARD PENETRATION TEST DATA: △ % Fines ○ NMC ⊢ PL---LL; 50 100 150 200

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	03/30/2022	26.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

Summary of Field Procedures

Boring and Sampling

Soil Test Boring with Hollow-Stem Auger

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. Borings were made by mechanically twisting a continuous steel hollow stem auger into the soil. At regular intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Undisturbed (UD) Sampling

Split spoon or split barrel sampling provide samples suitable for visual examination and classification tests but not sufficiently intact for quantitative laboratory testing. To provide samples for quantitative tests, relatively undisturbed samples were obtained by pushing sections of 3-inch O.D., 16-guage, steel tubing (Shelby tube) into the soil at the desired sampling intervals. The procedures used generally followed those described in ASTM D1587, *Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils*. Each tube, together with the encased soil, was carefully removed from the ground and the length of the recovered soil measured. Locations and depths of undisturbed samples were recorded on each field test boring record.

Refusal to Drilling

Refusal to the soil drilling methods used at this site may result from encountering hard cemented soil, soft weathered rock, coarse gravel, cobbles or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling would be required to determine the character and continuity of materials below refusal of the soil auger in natural soils. Where fills are present, refusal to drilling may also result from encountering buried debris, building materials, or objects. Backhoe test pits would be required to expose and identify buried materials below refusal levels in filled areas.

Preservation and Transporting of Soil Samples with Control of Field Moisture

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally followed those given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group B samples as defined in Section 4. Group B samples are those samples not suspected of being contaminated and for which only water content and classification, proctor, relative density, or profile logging will be performed. Group B samples also include bulk samples that are intended to be remolded in the laboratory for compaction, swell pressure, percent swell, consolidation, permeability, CBR, or shear testing. Representative samples of the cuttings or split spoon samples, or representative bulk samples, were placed in suitably identified, sealed glass jars or plastic containers and transported to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records

or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps.

Preservation and Transporting of Intact Soil Samples

Procedures for preserving certain selected soil samples obtained in the field and transportation of those samples to the laboratory generally followed procedures given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group C samples as defined in Section 4. Group C samples are intact, naturally formed or field fabricated, samples for density determination, swell pressure, percent swell, permeability testing or shear testing with or without stress-strain plots or volume change measurement, including dynamic and cyclic testing. Representative thin walled tube samples were protected against vibration or shock, or extreme heat or cold, during transport to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps. Samples were transported in the upright position in containers providing complete encasement in cushioning or insulation for individual samples.

Field Tests of Earth Materials

The subsurface conditions encountered during drilling were reported on a field test boring record by the staff professional. The record contains information about the drilling method, samples attempted and sample recovery, indications of materials in the borings such as coarse gravel, cobbles, etc., and indications of materials encountered between sample intervals. Representative soil samples were placed in glass jars and transported to the laboratory along with the field boring records. Recovered samples not expended in laboratory tests are commonly retained in our laboratory for 60 days following completion of drilling. Field boring records are retained at our office.

Measurement of Static Water Levels

Water level readings were made in the open boreholes immediately after completing drilling and withdrawal of the tools. Where feasible, measurements were repeated after an elapsed period of 24 hours to gauge the stabilized water level. Procedures for measurement of liquid levels in open boreholes are described in ASTM D4750, *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. A weighted measuring tape was slowly lowered into each borehole until the liquid surface was penetrated by the weighted end. The reading on the tape was recorded at a reference point on the surface and compared to the reading at the demarcation of the wetted and unwetted portions of the tape. The difference between the two readings was recorded as the depth of the liquid surface below the reference point. Measurements made by this method were then repeated until approximately consistent values were obtained.

Appendix III – Laboratory Testing Results

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 24180105 Report Date: 10/11/24

Project Name: Carmel Water Storage Tank

Client Name: Jones & Henry Engineers, Ltd.

Client Address: 1980 E 116th St. Suite 260 Carmel, Indiana

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE NO/TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	ATT. LIMITS P.L.	ATT. LIMITS P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
B-08	1-2.5	SS-1, SS													
B-08	3.5-5	SS-2, SS		11.7											
B-08	6-7.5	SS-3, SS													
B-08	8.5-10	SS-4, SS		12.0											
B-08	13.5-15	SS-5, SS		10.1											
B-08	18.5-20	SS-6, SS		14.4											
B-08	23.5-25	SS-7, SS		9.5											
B-08	28.5-30	SS-8, SS	SM	9.6	NP	NP	NP	46.4						32.1	
B-08	33.5-35	SS-9, SS													
B-08	38.5-40	SS-10, SS													
B-08	43.5-45	SS-11, SS		8.9											
B-08	48.5-50	SS-12, SS													
B-08	53.5-55	SS-13, SS													
B-08	58.5-60	SS-14, SS		10.1											

Notes:

Sadrish Panthi, P.E. — *Technical Responsibility*

Geotechnical Services Manager — *Position*

10/11/24 — *Date*

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 24180105 Report Date: 10/11/24

Project Name: Carmel Water Storage Tank

Client Name: Jones & Henry Engineers, Ltd.

Client Address: 1980 E 116th St. Suite 260 Carmel, Indiana

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE NO/TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	P.L.	P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
B-09	1-2.5	SS-1, SS		12.0											
B-09	3.5-5	SS-2, SS													
B-09	6-7.5	SS-3, SS													
B-09	8.5-10	SS-4, SS	CL-ML	12.4	20	13	7	10.1						61.1	
B-09	13.5-15	SS-5, SS		12.1											
B-09	18.5-20	SS-6, SS													
B-09	21.0-23.0	ST-1, ST													
B-09	23.5-25	SS-7, SS		13.1											
B-09	28.5-30	SS-8, SS													
B-09	33.5-35	SS-9, SS		12.9											
B-09	38.5-40	SS-10, SS													

Notes:

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 24180105 Report Date: 10/11/24

Project Name: Carmel Water Storage Tank

Client Name: Jones & Henry Engineers, Ltd.

Client Address: 1980 E 116th St. Suite 260 Carmel, Indiana

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE NO/TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	P.L.	P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
B-10	1-2.5	SS-1, SS													
B-10	3.5-5	SS-2, SS													
B-10	6-7.5	SS-3, SS													
B-10	8.5-10	SS-4, SS		12.2											
B-10	13.5-15	SS-5, SS		12.2											
B-10	15.5-17.5	ST-1, ST	ML	15.8	NP	NP	NP	2.9		143.3	123.8			83.7	
B-10	18.5-20	SS-6, SS		14.7											
B-10	23.5-25	SS-7, SS		12.1											
B-10	28.5-30	SS-8, SS													
B-10	33.5-35	SS-9, SS													
B-10	38.5-40	SS-10, SS													

Notes:

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 24180105 Report Date: 10/11/24

Project Name: Carmel Water Storage Tank

Client Name: Jones & Henry Engineers, Ltd.

Client Address: 1980 E 116th St. Suite 260 Carmel, Indiana

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE NO/TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	P.L.	P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
B-11	1-2.5	SS-1, SS													
B-11	3.5-5	SS-2, SS	CL	19.3	30	15	15	21.2						56.7	
B-11	6-7.5	SS-3, SS		11.1											
B-11	8.5-10	SS-4, SS		11.1											
B-11	13.5-15	SS-5, SS		11.7											
B-11	18.5-20	SS-6, SS		16.7											
B-11	20.5-22.5	ST-1, ST													
B-11	23.5-25	SS-7, SS													

Notes:

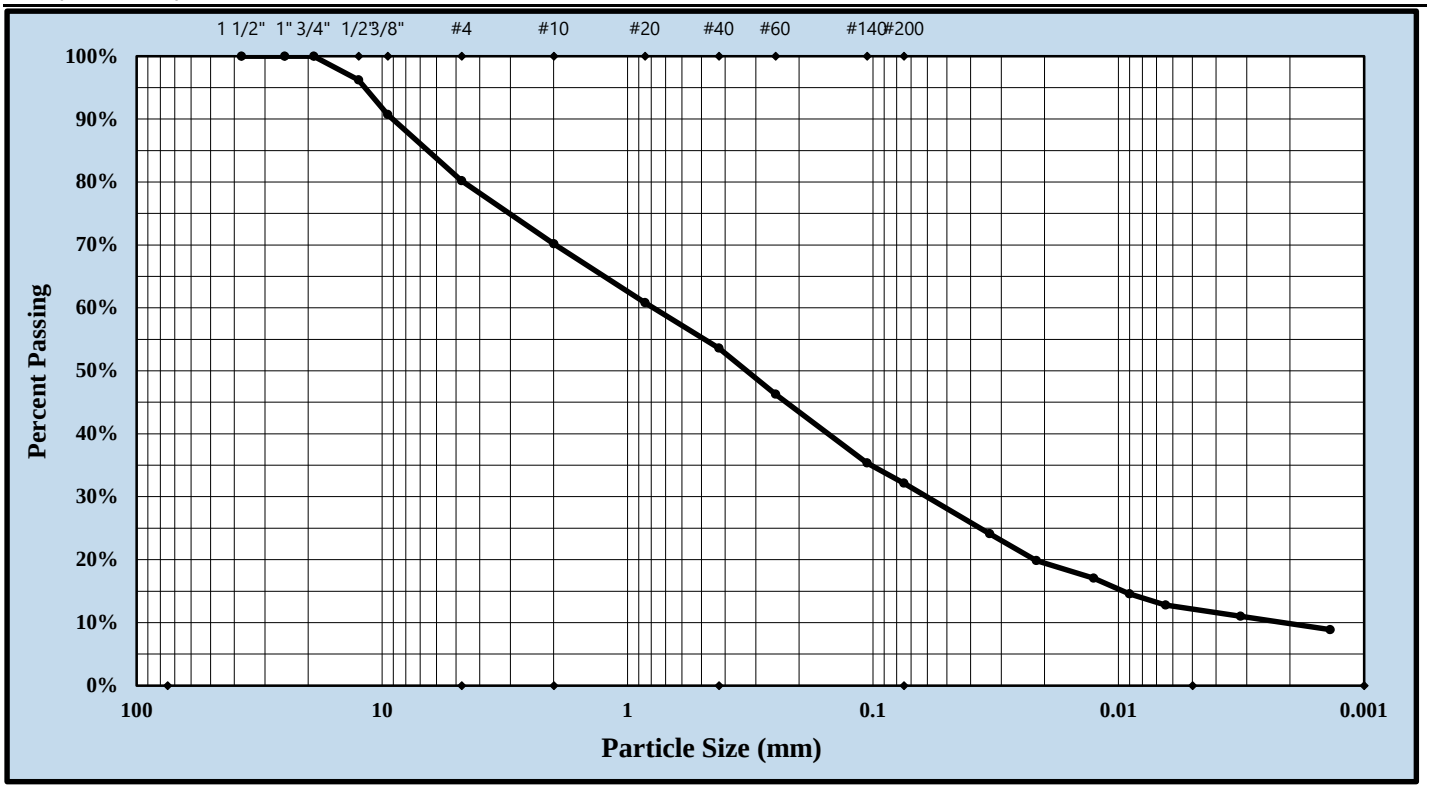
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - New Albany: 400 Industrial Boulevard, New Albany, IN 47150

Project #:	24180105	Report Date:	10/8/24
Project Name:	Carmel Water Storage Tank	Test Date(s):	10/1/24
Client Name:	Jones & Henry Engineers, Ltd.		
Client Address:	1980 E 116th St. Suite 260 Carmel, Indiana		
Type:	SS	Sample Date:	09/11/24
Location:	B-08	Depth (ft.):	28.5-30.0
Sample Description:	SILTY SAND WITH GRAVEL (SM)		SM



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	3/4"	Gravel:	20%	Silt Size:	20%
Silt & Clay (% Passing #200):	32%	Total Sand:	48%	Clay Size:	12%
Assumed Relative Density:	2.650	Moisture Content:	10%		
Liquid Limit:	NP	Plastic Limit:	NP	Plastic Index:	NP
Coarse Sand:	10%	Medium Sand:	17%	Fine Sand:	21%

Description of Sand and Gravel: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: Specific Gravity was assumed.

Specimen did not meet sample size requirement. All available material used.

Sadrish Panthi, P.E. — *Technical Responsibility*
Signature
Geotechnical Services Manager — *Position*
10/11/2024 — *Date*

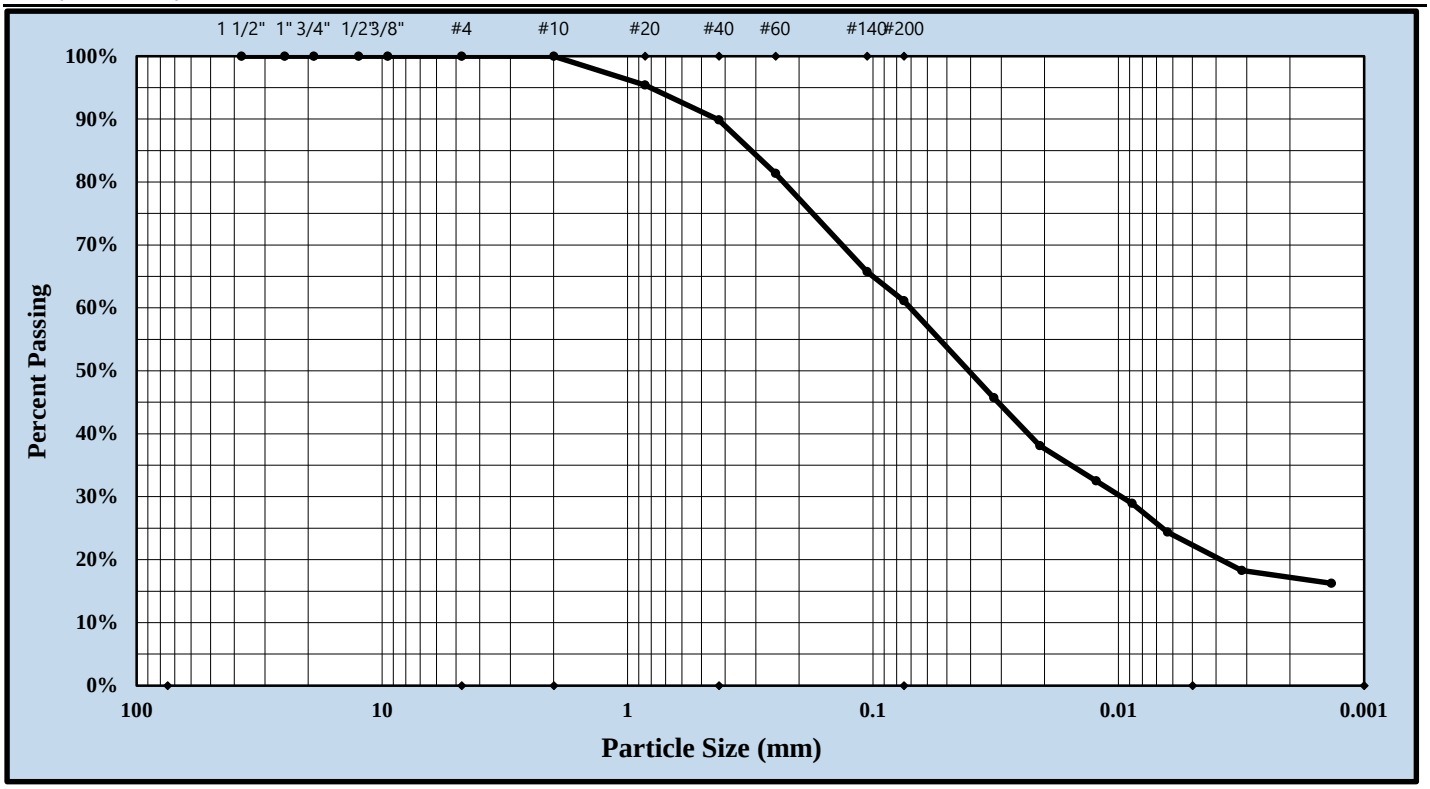
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - New Albany: 400 Industrial Boulevard, New Albany, IN 47150

Project #:	24180105	Report Date:	10/8/24
Project Name:	Carmel Water Storage Tank	Test Date(s):	10/1/24
Client Name:	Jones & Henry Engineers, Ltd.		
Client Address:	1980 E 116th St. Suite 260 Carmel, Indiana		
Type:	SS	Sample Date:	09/11/24
Location:	B-09	Depth (ft.):	8.5-10.0
Sample Description:	SANDY SILT CLAY (CL-ML)		CL-ML



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#10	Gravel:	0%	Silt Size:	39%
Silt & Clay (% Passing #200):	61%	Total Sand:	39%	Clay Size:	22%
Assumed Relative Density:	2.650	Moisture Content:	12%		
Liquid Limit:	20	Plastic Limit:	13	Plastic Index:	7
Coarse Sand:	0%	Medium Sand:	10%	Fine Sand:	29%

Description of Sand and Gravel: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: Specific Gravity was assumed.

Sadrish Panthi, P.E.		Geotechnical Services Manager	10/11/2024
Technical Responsibility	*Signature*	*Position*	*Date*

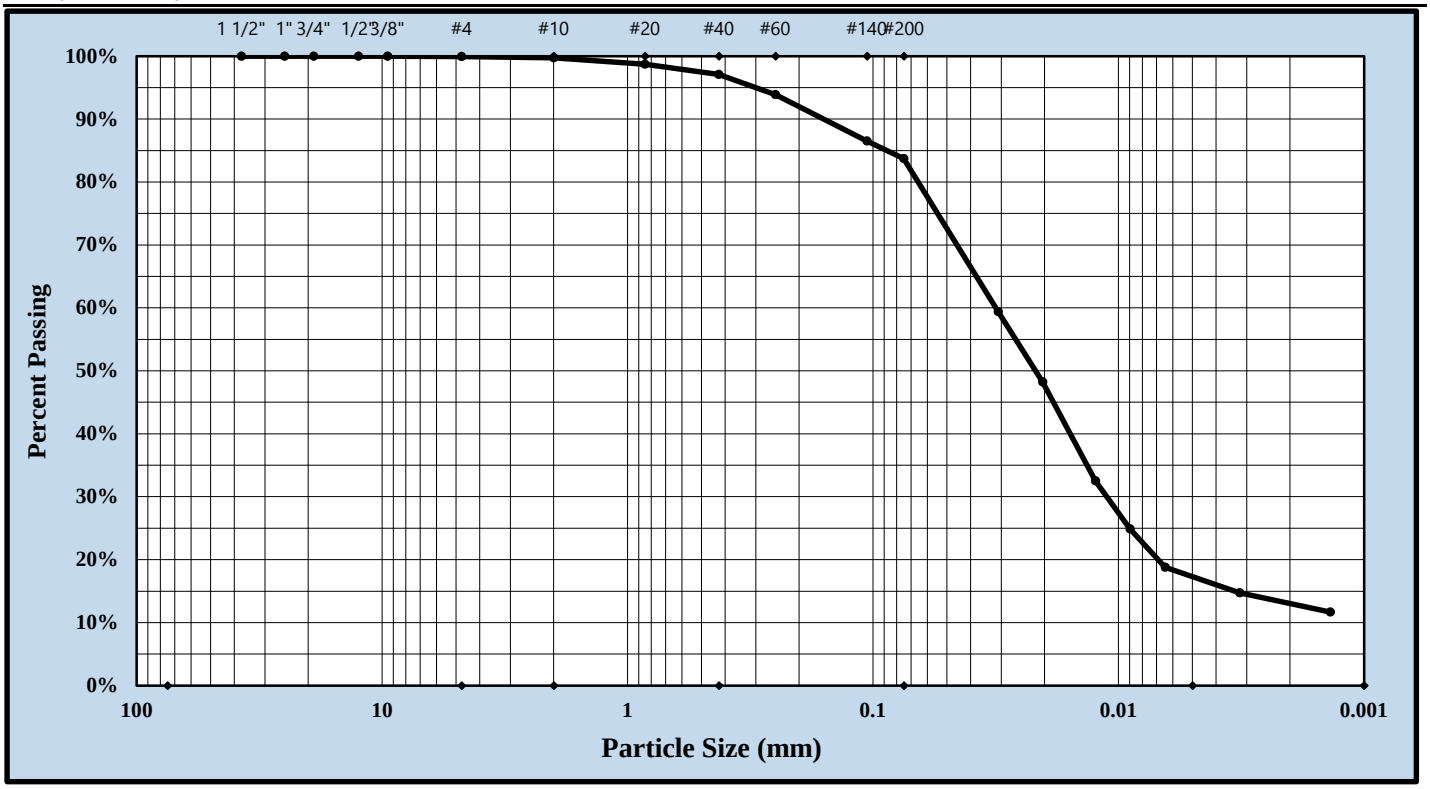
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - New Albany: 400 Industrial Boulevard, New Albany, IN 47150

Project #:	24180105	Report Date:	10/8/24
Project Name:	Carmel Water Storage Tank	Test Date(s):	10/1/24
Client Name:	Jones & Henry Engineers, Ltd.		
Client Address:	1980 E 116th St. Suite 260 Carmel, Indiana		
Type:	SS	Sample Date:	09/11/24
Location:	B-10	Depth (ft.):	15.5-17.5
Sample Description:	SILT WITH SAND (ML)		ML



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#10	Gravel:	0%	Silt Size:	66%
Silt & Clay (% Passing #200):	84%	Total Sand:	16%	Clay Size:	17%
Assumed Relative Density:	2.650	Moisture Content:	16%		
Liquid Limit:	NP	Plastic Limit:	NP	Plastic Index:	NP
Coarse Sand:	0%	Medium Sand:	3%	Fine Sand:	13%

Description of Sand and Gravel: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: Specific Gravity was assumed.

Sadrish Panthi, P.E.		Geotechnical Services Manager	10/11/2024
Technical Responsibility	*Signature*	*Position*	*Date*

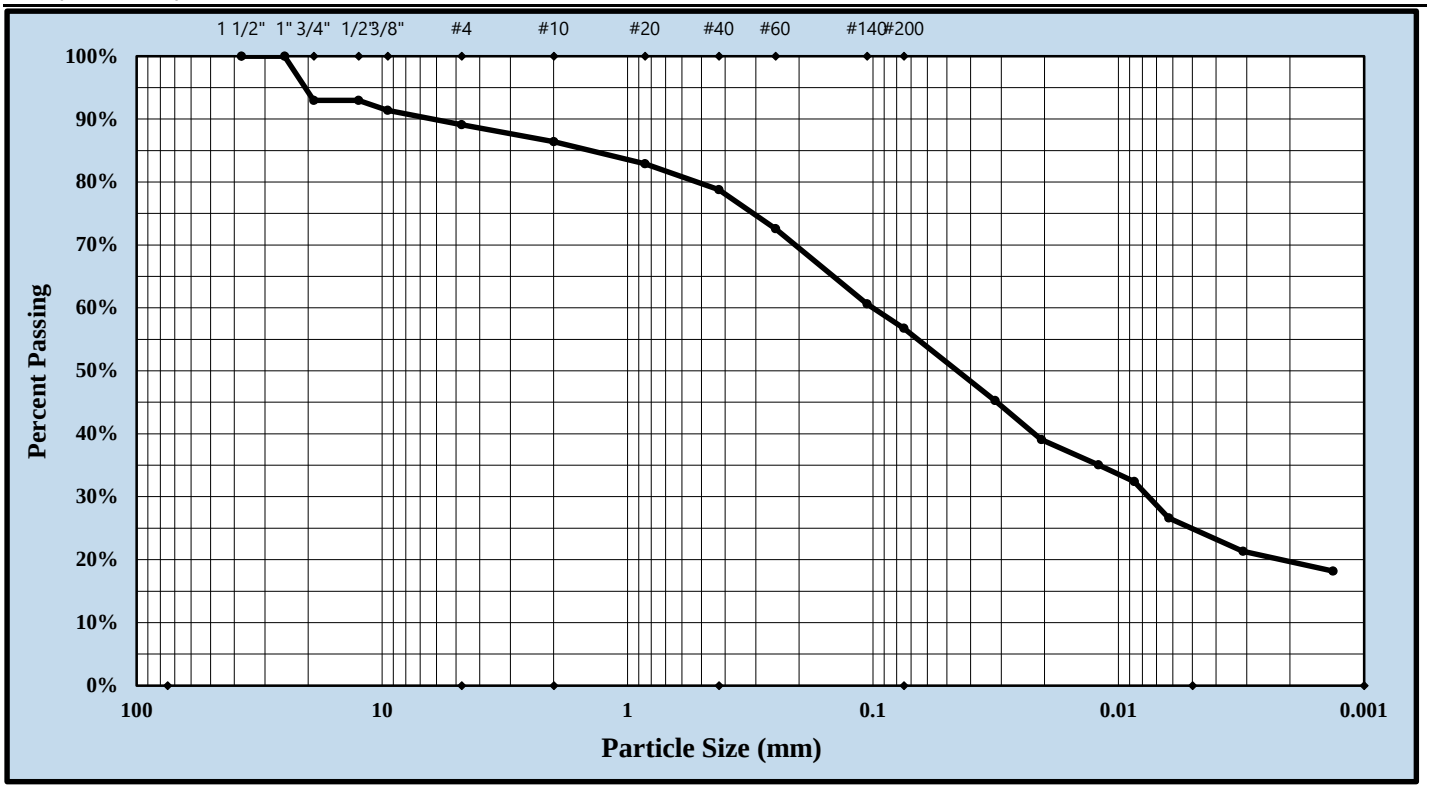
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - New Albany: 400 Industrial Boulevard, New Albany, IN 47150

Project #:	24180105	Report Date:	10/8/24
Project Name:	Carmel Water Storage Tank	Test Date(s):	10/1/24
Client Name:	Jones & Henry Engineers, Ltd.		
Client Address:	1980 E 116th St. Suite 260 Carmel, Indiana		
Type:	SS	Sample Date:	09/11/24
Location:	B-11	Depth (ft.):	3.5-5.0
Sample Description:	SANDY LEAN CLAY (CL)		CL



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	1"	Gravel:	11%	Silt Size:	32%
Silt & Clay (% Passing #200):	57%	Total Sand:	32%	Clay Size:	25%
Assumed Relative Density:	2.650	Moisture Content:	19%		
Liquid Limit:	30	Plastic Limit:	15	Plastic Index:	15
Coarse Sand:	3%	Medium Sand:	8%	Fine Sand:	22%

Description of Sand and Gravel: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

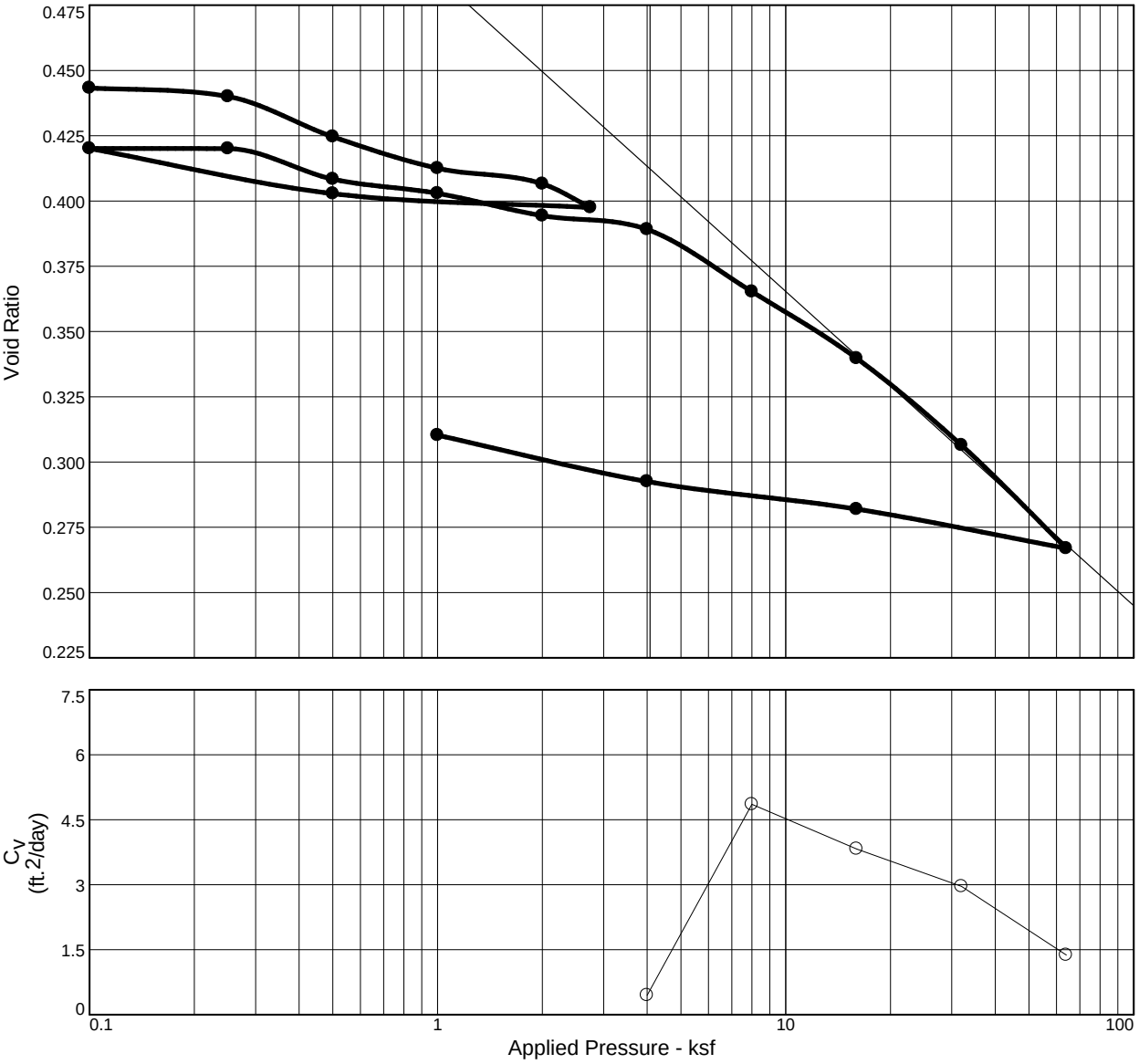
Mechanical Stirring Apparatus A — Dispersion Period: 1 min. — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: Specific Gravity was assumed.

Specimen did not meet sample size requirement. All available material used.

Sadrish Panthi, P.E. — *Technical Responsibility*
Signature
Geotechnical Services Manager — *Position*
10/11/2024 — *Date*

ASTM D2435 CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
80.6 %	13.1 %	118.2	21	9	2.734	7.4	0.12	0.444

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY LEAN CLAY (CL), gray brown	CL	A-4, 3

Project No. 24180105 **Client:** Jones & Henry Engineers, Ltd.

Project: Carmel Water Storage Tank

Source of Sample: B-09 **Depth:** 22.8 **Sample Number:** B-09

S&ME, Inc.

Lexington, Kentucky

Remarks:
Inundated in the seating load.

Figure 1

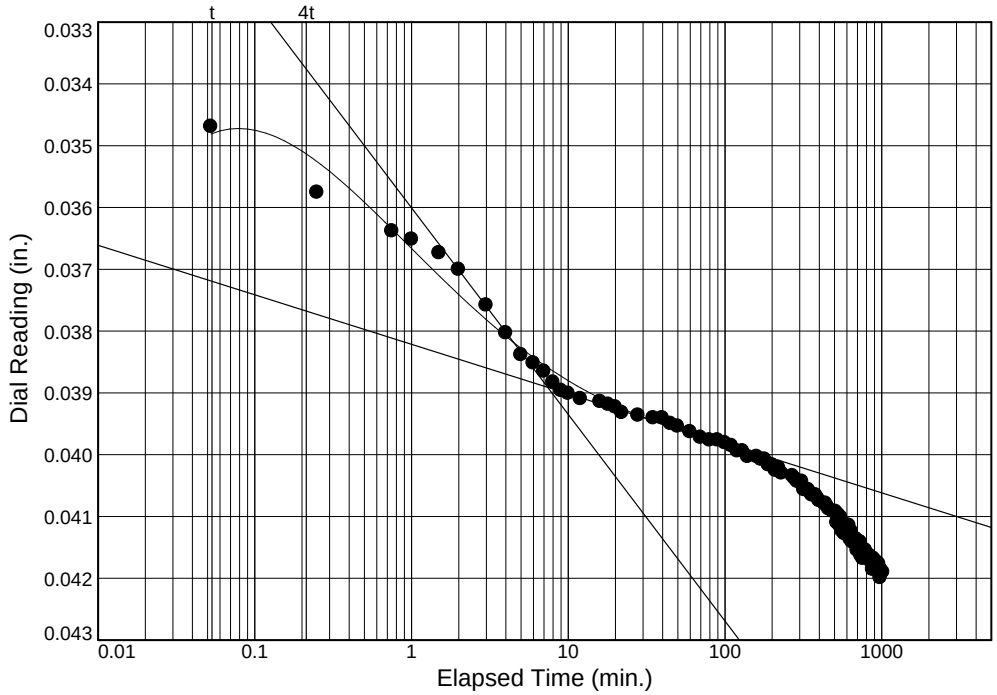
Tested By: J. LaMothe **Checked By:** J. Folsom 10/14/2024

Cc, Pc, etc are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME, Inc.

Dial Reading vs. Time

Project No.: 24180105
Project: Carmel Water Storage Tank

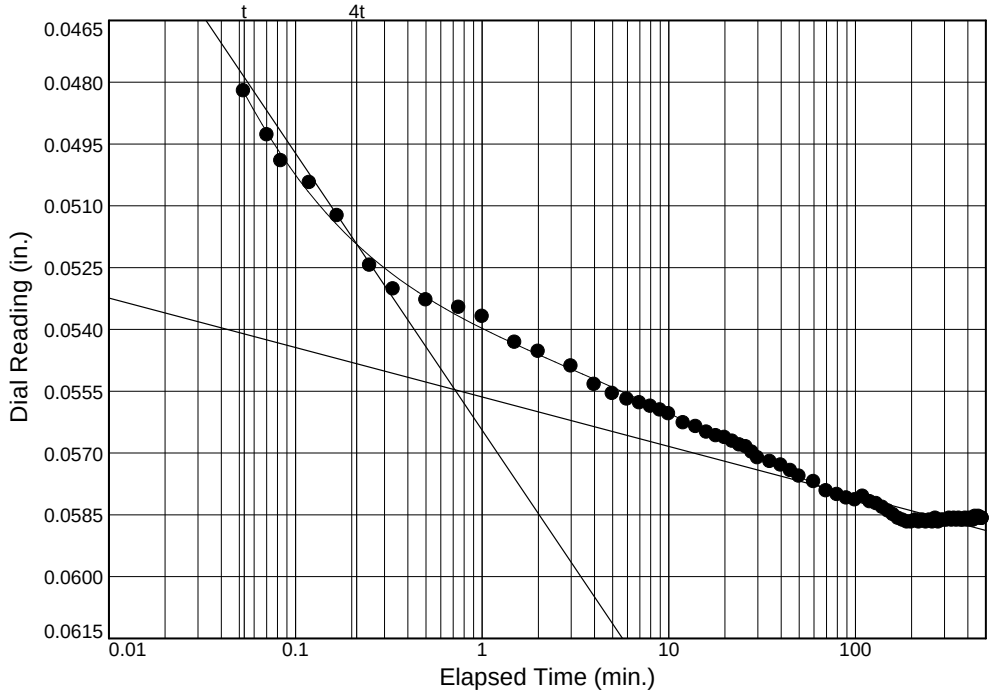
Source of Sample: B-09 Depth: 22.8 Sample Number: B-09



Load No.= 13
Load= 4.00 ksf
D_0 = 0.0345
D_{50} = 0.0367
D_{100} = 0.0389
T_{50} = 1.03 min.

C_v @ T_{50}
0.447 ft.^{2}/day

C_α = 0.001



Load No.= 14
Load= 8.00 ksf
D_0 = 0.0446
D_{50} = 0.0500
D_{100} = 0.0555
T_{50} = 0.09 min.

C_v @ T_{50}
4.856 ft.^{2}/day

C_α = 0.002

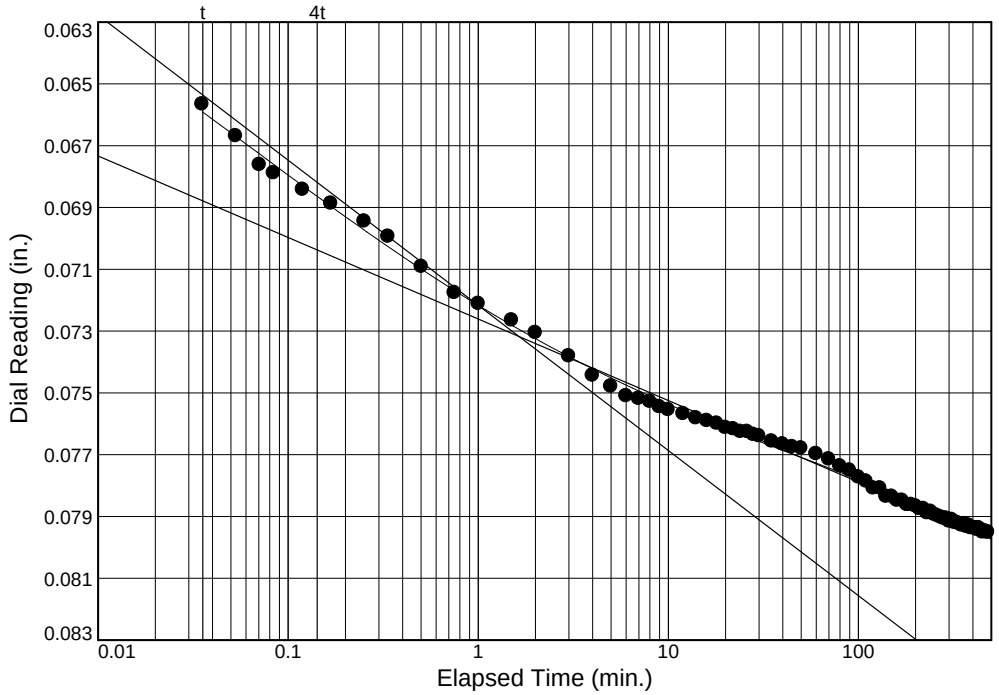
Figure 2

S&ME, Inc.

Dial Reading vs. Time

Project No.: 24180105
Project: Carmel Water Storage Tank

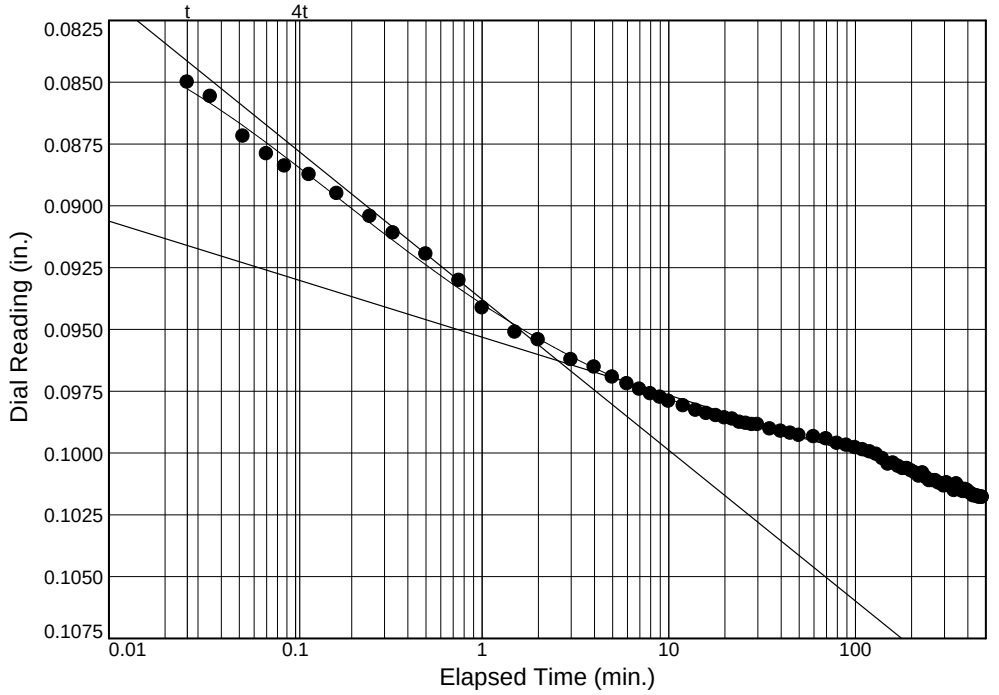
Source of Sample: B-09 Depth: 22.8 Sample Number: B-09



Load No.= 15
Load= 16.00 ksf
D_0 = 0.0632
D_{50} = 0.0682
D_{100} = 0.0732
T_{50} = 0.11 min.

C_v @ T_{50}
3.823 ft.^{2}/day

C_α = 0.004



Load No.= 16
Load= 32.00 ksf
D_0 = 0.0821
D_{50} = 0.0892
D_{100} = 0.0963
T_{50} = 0.14 min.

C_v @ T_{50}
2.960 ft.^{2}/day

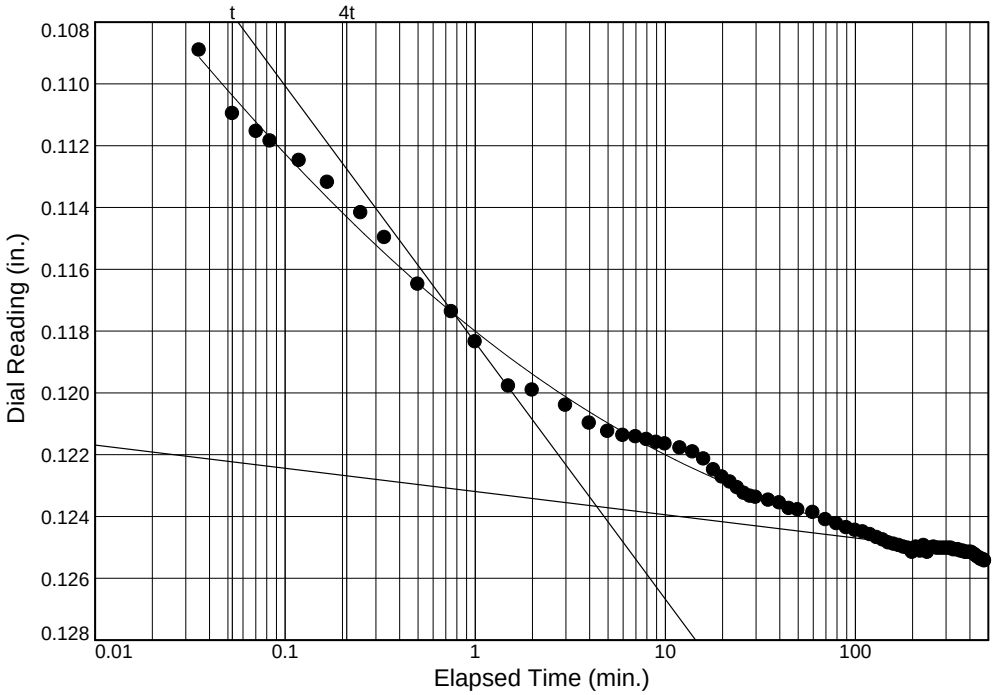
C_α = 0.003

Figure 3

Dial Reading vs. Time

Project No.: 24180105
Project: Carmel Water Storage Tank

Source of Sample: B-09 Depth: 22.8 Sample Number: B-09



Load No.= 17
Load= 64.00 ksf
D_0 = 0.1064
D_{50} = 0.1151
D_{100} = 0.1237
T_{50} = 0.28 min.

C_v @ T_{50}
1.376 ft.^{2}/day

C_α = 0.001

Figure 4

Summary of Laboratory Procedures

Recovered disturbed and undisturbed samples and the field staff field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means. Other samples were tested in the laboratory to determine their strength or consolidation properties.

Laboratory Tests of Soil

Examination of Split Spoon Soil Samples

Soil and rock samples and field boring records were reviewed in the laboratory by the geotechnical engineer. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Method)*. The geotechnical engineer also prepared the final boring records enclosed with this report.

Extrusion and Examination of Group C Undisturbed Samples

Undisturbed samples were stored in the vertical position in the laboratory. Samples were extruded from the thin-walled sampler, using a specially constructed extruder, in the same direction of travel as the sample entered the tube during sampling. In certain cases it was necessary to cut the tube into short sections to facilitate removal of the soil without compressing or disturbing the sample. Specimens were trimmed using a wire saw or steel straightedge. Where removal of pebbles or crumbling resulting from trimming caused voids on the surface of the specimens selected for quantitative laboratory testing, they were filled with remolded soil obtained from the trimmed portion of the sample.

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*. Albert Atterberg originally

defined "limits of consistency" of fine grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the liquid limit of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The plastic limit defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The plasticity index (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine grained Group A, B, C, or D samples were prepared using the wet method described in Section 10.1 of ASTM D4318. The liquid limit of each sample was determined using the multipoint method (Method A) described in Section 11. The liquid limit is by definition the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced combinations of N versus moisture content. When plotted on semilog paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D2216.

Grain Size Analysis of Samples with Hydrometer

The distribution of particle sizes was determined in general accordance with the procedures described by ASTM D421, *Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants*, and D422, *Standard Test Method for Particle Size Analysis of Soils*. During preparation samples were divided into two portions. The material coarser than the No. 10 U.S. sieve size fraction was dry sieved through a nest of standard sieves as described in Article 6. Material passing the No. 10 sieve was soaked in demineralized water and a dispersing agent, then the soil-water slurry placed in a glass sedimentation chamber and the specific gravity of the slurry recorded at various time intervals. The grain size distribution was calculated from the time rate of sedimentation of the various size particles. After the final hydrometer reading was obtained, the suspension was washed through the No. 200 sieve. The remaining material retained on the No. 200 sieve was oven dried, and then passed through a standard nest of sieves.

Consolidation Tests of Undisturbed Samples

The data from the consolidation test are used to estimate the magnitude and rate of both total and differential settlement of a structure or earthfill. In this test method a saturated soil specimen is restrained laterally by a steel mold and loaded axially with total stress increments. As the specimen consolidates, measurements are made of the change in specimen height and plotted vs. time to determine the relationship between the effective stress and void ratio or strain, and the time rate at which consolidation occurs.

Procedures for determining the magnitude and rate of consolidation of laterally restrained soil generally followed those described in ASTM D2435, *Standard Test Method for One-Dimensional Consolidation of Soils*. Undisturbed samples intended for use in consolidation testing were handled as Group C or D samples as described in ASTM D4220. Extruded samples were each trimmed to a disc 2.5 inches in diameter and 1.0

inches thick as described in Section 9. Each disc was confined in a stainless steel ring and sandwiched between two porous stone plates. After application of a seating load of 100 lb/ft2 to confine the specimen, the ring was placed in an oedometer and the sample immersed in water to full saturation.

Prepared specimens were loaded to the desired stress in accordance with one of the standard loading schedules ("A" or "B") described in Section 11.5 and indicated on the attached test reports, then unloaded in four equal decrements. Resulting deformation of the sample was measured using a micrometer dial gage.

Time deformation properties were plotted for each load increment using either the log time or square root of time methods described in Section 12.3 and the coefficient of consolidation Cv computed. Load deformation properties were plotted in terms of either void ratio at 100 percent consolidation for each loading increment vs. applied load or in terms of percentage strain (of initial sample height) vs. applied load plotted on log scale. The preconsolidation stress pc of the specimen was estimated from this plot using the Casagrande construction described in Section 12.4.6. The compression index Cc was estimated from the straight line portion of the semilog consolidation curve, above the preconsolidation stress.

SECTION 15075
IDENTIFICATION FOR HVAC/PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. Nameplates.
2. Tags.

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 – Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop drawings for review:
   a. Product Data: Submit manufacturers catalog literature for each product required.
   b. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
   c. Samples: Submit two samples of each type of identification device.
2. Information for the record:
   a. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.04 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.05 PROJECT REQUIREMENTS

A. Use plastic nameplates where in-service surface temperature will not exceed 150 degrees F.

B. Use metal nameplates where in-service surface temperature will exceed 150 degrees F.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:

1. W.H. Brady Co., Signmark Division.
2. Seton Name Plate Co.
3. Or equal.

B. Plastic Nameplates:

1. Material: Laminated, three-layer plastic with engraved black letters on white background; satin finish with beveled edges.
2. Minimum Size: 4 inches by 1-1/2 inches.
3. Provide each plate with two mounting holes and 3/8-inch No. 3 round head stainless steel screws. Provide adhesive for mounting nameplates where screws are not practical.

C. Metal Nameplates:

1. Material: Aluminum, 0.020 inches thick, with black enamel background with natural aluminum border and text.
2. Minimum Size: 4 inches by 1-1/2 inches.
3. Provide each plate with two mounting holes and 3/8-inch No. 3 round head stainless steel screws. Provide adhesive for mounting nameplates where screws are not practical.

2.02 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

B. Plastic Tags: Laminated, three-layer plastic with engraved black letters on white background. Tag size minimum of 1-1/2 diameter.

C. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09900 for stencil painting.

3.02 INSTALLATION

A. Apply stencil painting in accordance with Section 09900.

B. Install identifying devices after completion of coverings and paintings.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. For plumbing items, identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. For HVAC items, identify all equipment with plastic nameplates. Identify in-line pumps and other small devices with tags.

I. Identify control panels, major control components, and thermostats on the outside of panels with plastic panels. Tag automatic controls, instruments, and relays. Key to control schematic.

J. Identify valves in main branch piping with tags.

K. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers, or stenciled painting. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. Identify ductwork with plastic nameplates or stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 15080
PLUMBING INSULATION

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. Plumbing piping insulation, jackets, and accessories.

2. Plumbing equipment insulation, jackets, and accessories.

B. This Section includes furnishing all materials, equipment, labor, and supervision to install insulation work including insulation, cements, mastics, adhesives, attachment pins, studs, or clips, covering, lagging, jackets, hardware, flashing, and finishes.

C. Work shall be complete, in full conformance with the material manufacturer's requirements and recommendations, applicable national standards, the National Insulation Contractors Association, National Commercial, and the Industrial Insulation Standards.

D. All insulation as applied shall meet or exceed the requirements of this Section or the applicable version of ASHRAE/IES Standard 90.1.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop drawings for review:

a. Product Data: Submit manufacturers published literature indicating product description, thermal characteristics, list of materials and thickness for each service, and location. Include the method of fastening.

2. Information for the record:

a. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

b. Substantiation of vendor compliance with codes, standards, or test methods noted herein.

1.03 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum three years documented experience.

E. Applicator: Company specializing in performing Work in this section with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. In accordance with the requirements of Section 01350 concerning transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation form weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.05 ENVIRONMENTAL REQUIREMENTS

A. In accordance with the requirements of Section 01350 concerning environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials furnished under this specification shall be standard, catalogued products, new and commercially available, suitable for service requiring high performance and reliability with low maintenance, and free of all defects.

B. Materials include insulation materials, accessories (staples, bands, mesh, wire, clips, pins, tape, anchors, corner angles, and similar recommended accessories) and compounds (cements, adhesives, coatings, sealers, protective finishes, and similar items recommended for the applications indicated).

C. The Contractor, unless clearly otherwise stated, shall supply materials which meet the owner's requirements with respect to the design criteria, thermal conductivity, and standards.

D. The Contractor shall warrant that materials furnished and installed be free of defects for a period of one year from the time the system is completed.

E. If a defect occurs in materials, workmanship, or application within the stated time, the Contractor shall promptly repair or replace the defect. Damages caused by others shall be repaired at the expense of the damaging party.

F. Specified components of the insulation system, including facings, mastics, and adhesives should have a fire hazard rating not to exceed 25 for flame spread, and 50 smoke developed, as tested under ASTM E84.

G. All accessories and materials (i.e. coatings, adhesives, sealers, etc.) are to be shipped to the job site in marked, unopened containers as received from the manufacturer.

H. Provide and install insulation, cements, mastics, adhesives, covering, lagging, flashing, and finishes in full conformance with the material manufacturer's requirements and the recommendations, applicable national standards, the National Insulation Contractors Association, and the Industrial Insulations Standards.

2.02 PIPE INSULATION

A. Glass Fiber Insulation:

1. Manufacturers:
    a. Owens Corning Fiberglass, SSL II.
    b. Johns Manville Micro-Lok.
    c. Knauf Fiber Glass Pipe Insulation.
    d. Or equal.
2. Insulation: ASTM C547; rigid molded glass fiber, non-combustible.
    a. Thermal Conductivity (k-Value): ASTM C335, 0.24 at 75 degrees F.
    b. Operating Temperature Range: 0 to 850 degrees F.
    c. Maximum Moisture Absorption: 0.2 percent by volume.
3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive with longitudinal laps and butt strips.
    a. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
4. Jacket Temperature Limit: Minus 20 to 150 degrees F.

B. Flexible Cellular Foam Insulation:

1. Manufacturers:
    a. Armacel, LLC; Armaflex.
    b. Rubatex.
    c. Or equal.
2. Insulation: ASTM C534 Grade 1; flexible, cellular elastomeric, Type I Molded or Type II Sheet.

a. Thermal Conductivity (k-Value): ASTM C177 or C518; maximum 0.28 at 75 degrees F.

b. Operating Temperature Range: Minus 297 to 220 degrees F.

c. Water Absorption: ASTM C209; 0.2 percent for molded or sheet by volume.

d. Moisture Vapor Transmission: ASTM E96; maximum 0.08 perm inches.

e. Connection: Water-proof vapor barrier adhesive.

f. Density: ASTM D1622 or D1667; 3.0 to 6.0 pounds per square foot.

PART 3 EXECUTION

3.01 GENERAL

A. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.

B. The Contractor shall be responsible for coordination and cooperation with the Owner and other trades so that the installation is performed with minimum interference and conflict.

C. The final appearance of the insulation work shall be a neat, workmanlike and attractive insulation system.

D. Progressive testing of systems to be insulated shall have been completed, inspected, and approved by Owner's representative before insulation is applied.

E. Insulation shall not be applied until all surfaces are clean, dry, free of dirt, dust, grease, frost, moisture, and other imperfections.

F. Suitable application temperature and conditions shall be provided by others.

G. Insulation shall be protected from moisture and weather during storage and installation. Applied insulation which has become wet shall be thoroughly dried before it is sealed or jacketed.

H. The Contractor shall not arc-weld brackets, clips, or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with acceptable standards.

I. Insulation, fabric, and jacketing shall be protected from mechanical damage during construction. Damage by the insulator shall be repaired without cost to the Owner.

J. Contractor is responsible for proper material storage at the Work site.

K. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the Contractor without cost to the purchaser.

L. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.

M. All insulation at handholes, access doors, or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

N. Where insulated pipes or ducts pass through sleeves or openings, the full specified thickness of the insulation shall pass through the sleeve or opening.

O. Vapor barriers shall be continuous through sleeves, hangers, etc. If pierced, vapor barriers shall be covered and suitably resealed.

3.02 INSTALLATION

A. Pipe insulation shall include all fittings, valves, (including bonnets) piping specialties, pumps, tanks, and heat exchangers.

B. Prior to insulating, all required inspections, examinations, and tests (such as hydrostatic tests, air pressure tests, and heat tracing tests) shall be successfully completed.

C. All insulation shall be well secured to the item being insulated, by means of wire, clips, studs or other proven fasteners.

D. All fittings, flanges and valves shall be insulated with block, preformed or sectional insulation of the same material as adjacent pipe material, except on sizes up to 3-inch, two or more layers cemented in place may be used to obtain the required thickness of insulation.

E. The insulation and its covering shall be applied free of gaps or voids. All joints, cracks and depressions shall be pointed with cement. When irregular or compound shapes require insulation be cut and fit, all gaps shall be filled. Cut and fit jacketing shall be free of jagged edges and shall provide complete coverage.

F. Insulation of any pipe line or any other item shall include insulation of all take-off connections (including those for instruments, controls, vents, drains or sampling) and all branch connections, up to and including the first valve in the take-off connection or branch connection.

G. Double layer insulation shall have staggered joints. Each layer shall be wired in place.

H. Insulation on vertical pipes shall have provisions which preclude eventual gaps in the insulation as a result of pipe expansion, settling, or shrinking of the insulation, or other causes. The provision may be intermediate supports, insulation “expansion joints” or other means approved by the Engineer.

I. All welding (including stud welding and other attachment on boiler, pressure vessels, piping systems and equipment) shall conform to applicable codes and standards.

J. At each pipe hanger or support, the insulation shall accommodate the hanger or supports and its anticipated movement.

K. Insulation work on all items (including boilers, pumps, vessels, etc.) shall conform to the requirements and recommendations of the respective manufacturers.

L. Insulation work of all of the following items shall be blankets which are designed to allow removal, reuse and replacement of the insulation work:

1. Flanges, 6-inch NPS or larger.
2. Manholes, handholes, and other access devices.

M. Insulation on heat traced pipe lines shall be such that the specified nominal thickness of insulation is uniformly maintained around the pipe.

N. The Contractor shall identify and insulate all Personnel Protection Areas and insulate as necessary in accordance with the following:

1. All points where personnel can easily come in contact with hot surfaces.
2. Areas are to include all hot surfaces within an elevation of 7-feet and with 2-feet of the sides of all access zones, walkways, platforms, working areas, or stairways and ladders.

O. Insulation Class DW shall be installed as noted in National Commercial & Industrial Insulation Standards - 1988, as published by Midwest Insulation Contractors Association. The method shown on plate 19 shall be used for interior ducts, and that shown on plate 20 shall be used for exterior ducts. Staple - stitching shall not be used.

P. Roof drain systems shall be insulated when located within any building.

Q. All external lines insulated above ground shall be enclosed with Class CG insulation and aluminum lagging. All external insulated lines belowground shall be enclosed with Class CG insulation and coated with Pittcote 300 and Pitwrap SSII.

R. The insulation and its covering shall be applied free of gaps or voids. All joints, cracks, ends, and depressions shall be pointed with cement or mastic as recommended.

3.03 OWNER'S ACCEPTANCE

A. All materials, accessories, and methods of installation and fabrication are subject to the Owner's inspection and approval during any phase of the Work.

3.04 PAINTING

A. All plumbing pipe, equipment, tank insulation shall be painted as required by Section 09900.

B. Pittcote 404 shall be installed by this Contractor with color selection by Owner.

3.05 PIPING INSULATION SCHEDULE

PIPE SYSTEMS	PIPE SIZE (INCH)	TYPE OF INSULATION	THICKNESS (INCH)	JACKET
Interior Domestic Hot Water Supply and Recirculation	1-1/4 and Smaller	Cellular Elastomeric Foam or Fiberglass	1.0	None
	1-1/2 and Larger	Cellular Elastomeric Foam	1.5	None

Interior Domestic Cold Water and NPW Supply	1-1/4 and Smaller	Cellular Elastomeric Foam	0.5	None
	1-1/2 and Larger	Cellular Elastomeric Foam	1.0	None
Exterior Domestic Hot and Cold Water Supply, Heat Traced	All Sizes	Cellular Elastomeric Foam or Fiberglass	2.0	Aluminum
Interior Roof Drain Sumps and Storm Drainage Piping	All Sizes	Cellular Elastomeric Foam	0.5	None
Interior Hot and Cold Water Supply and P-Trap Under ADA Lavatory	1-1/2 and Smaller	Molded Closed Cell Vinyl	0.1875	Integral with Insulation

END OF SECTION

SECTION 15081
HVAC INSULATION

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. HVAC piping insulation, jackets, and accessories.

2. HVAC ductwork insulation, jackets, and accessories.

B. This Section includes furnishing all materials, equipment, labor, and supervision to install insulation work including insulation, cements, mastics, adhesives, attachment pins, studs, or clips, covering, lagging, jackets, hardware, flashing, and finishes.

C. Work shall be complete, in full conformance with the material manufacturer's requirements and recommendations, applicable national standards, the National Insulation Contractors Association, National Commercial, and the Industrial Insulation Standards.

D. All insulation as applied shall meet or exceed the requirements of this Section or the applicable version of ASHRAE/IES Standard 90.1.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop drawings for review:

a. Product Data: Submit manufacturers published literature indicating product description, thermal characteristics, list of materials and thickness for each service, and location. Include the method of fastening.

2. Information for the record:

a. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

b. Substantiation of vendor compliance with codes, standards, or test methods noted herein.

1.03 QUALITY ASSURANCE

A. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

B. Duct Insulation, Coverings, and Linings: Maximum25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E2231.

C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum three years documented experience.

D. Applicator: Company specializing in performing Work in this section with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. In accordance with the requirements of Section 01350 concerning transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation form weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.05 ENVIRONMENTAL REQUIREMENTS

A. In accordance with the requirements of Section 01350 concerning environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials furnished under this specification shall be standard, catalogued products, new and commercially available, suitable for service requiring high performance and reliability with low maintenance, and free of all defects.

B. Materials include insulation materials, accessories (staples, bands, mesh, wire, clips, pins, tape, anchors, corner angles, and similar recommended accessories) and compounds (cements, adhesives, coatings, sealers, protective finishes, and similar items recommended for the applications indicated).

C. The Contractor, unless clearly otherwise stated, shall supply materials which meet the owner's requirements with respect to the design criteria, thermal conductivity, and standards.

D. The Contractor shall warrant that materials furnished and installed be free of defects for a period of one year from the time the system is completed.

E. If a defect occurs in materials, workmanship, or application within the stated time, the Contractor shall promptly repair or replace the defect. Damages caused by others shall be repaired at the expense of the damaging party.

F. Specified components of the insulation system, including facings, mastics, and adhesives should have a fire hazard rating not to exceed 25 for flame spread, and 50 smoke developed, as tested under ASTM E84.

G. All accessories and materials (i.e. coatings, adhesives, sealers, etc.) are to be shipped to the job site in marked, unopened containers as received from the manufacturer.

H. Provide and install insulation, cements, mastics, adhesives, covering, lagging, flashing, and finishes in full conformance with the material manufacturer's requirements and the recommendations, applicable national standards, the National Insulation Contractors Association, and the Industrial Insulations Standards.

2.02 DUCTWORK INSULATION

A. Manufacturers:

1. Owens Corning.
2. Johns Manville.
3. Knauf Insulation, Inc.
4. Or equal.

B. Duct Liner:

1. Rigid:
    a. Thermal Conductivity (k-Value): 0.23 at 75 degrees F.
    b. ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
    c. Density: 3.0 pound per cubic foot.
    d. Maximum Operating Temperature: 250 degrees F.
    e. Maximum Air Velocity: 4,000 feet per minute.

2.03 DUCTWORK INSULATION JACKETS

A. Outdoor Duct Jacket: Asphalt impregnated and coated sheet 50 lb/square foot.

2.04 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Adhesive: Waterproof, ASTM E162 fire-retardant type.

C. Linear Fasteners: Galvanized steel, aluminum, or stainless steel, self-adhesive, impact applied, or welded, with integral or press-on head.

D. Tie Wire: 0.048 stainless steel with twisted ends on maximum 12-inch centers.

E. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Impale Anchors: Galvanized steel, 12-gauge self-adhesive pad.

G. Adhesives: Compatible with insulation.

H. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.

B. The Contractor shall be responsible for coordination and cooperation with the Owner and other trades so that the installation is performed with minimum interference and conflict.

C. The final appearance of the insulation work shall be a neat, workmanlike and attractive insulation system.

D. Progressive testing of systems to be insulated shall have been completed, inspected, and approved by Owner's representative before insulation is applied.

E. Insulation shall not be applied until verification that piping and ductwork has been tested.

F. Insulation shall not be applied until all surfaces are clean, dry, free of dirt, dust, grease, frost, moisture, and other imperfections.

G. Suitable application temperature and conditions shall be provided by others.

H. Insulation shall be protected from moisture and weather during storage and installation. Applied insulation which has become wet shall be thoroughly dried before it is sealed or jacketed.

I. The Contractor shall not arc-weld brackets, clips, or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with acceptable standards.

J. Insulation, fabric, and jacketing shall be protected from mechanical damage during construction. Damage by the insulator shall be repaired without cost to the Owner.

K. Contractor is responsible for proper material storage at the Work site.

L. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the Contractor without cost to the purchaser.

M. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.

N. All insulation at handholes, access doors, or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

O. Where insulated ducts pass through sleeves or openings, the full specified thickness of the insulation shall pass through the sleeve or opening.

P. Vapor barriers shall be continuous through sleeves, hangers, etc. If pierced, vapor barriers shall be covered and suitably resealed.

3.02 INSTALLATION-DUCTWORK

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through the walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Ductwork exposed in Mechanical Rooms or finished spaces below ten feet above finished floor, finish with an aluminum jacket to protect insulation.

E. External Duct Insulation:

1. Adhere to clean oil-free surfaces with full coverage of adhesive.
2. Seal seams and butt joints with manufacturer’s recommended adhesive.
3. When application requires multiple layers, apply with joints staggered.
4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
5. Lift ductwork off trapeze hangers and insert spacers.

F. Duct Liner:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

G. Ducts Exterior to Building:

1. Install insulation according to external duct insulation paragraph above.
2. Provide external insulation with vapor retarder jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Finish with aluminum duct jacket.
4. Caulk seams at flanges and joints. Locate major longitudinal seams on bottom side of horizontal duct sections.

3.03 OWNER'S ACCEPTANCE

A. All materials, accessories, and methods of installation and fabrication are subject to the Owner's inspection and approval during any phase of the Work.

3.04 PAINTING

A. Pittcote 404 shall be installed by this Contractor with color selection by Owner.

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15140
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Domestic water piping, above grade.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Pressure gages.
6. Pressure gage taps.
7. Thermometers.
8. Flow control valves.
9. Backflow preventers.
10. Water hammer arrestors.
11. Thermostatic mixing valves.
12. Diaphragm-type compression tanks
13. System lubricated circulators.

B. This Section includes domestic water piping systems with pipe, valves, piping specialties, pumps, and other components.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.22 – Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 – Building Services Piping.
5. ASME B40.1 – Gauges – Pressure Indicating Dial Type – Elastic Element.
6. ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels.
7. ASME Section IX – Boiler and Pressure Code – Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 – Performance Requirements for Water Hammer Arresters.
2. ASSE 110 – Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 – Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 – Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).

D. ASTM International:

1. ASTM A53– Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395 – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM B32 – Standard Specification for Solder Material.
5. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.
6. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
7. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications.
8. ASTM E1 – Standard Specification for ASTM Thermometers.

9. ASTM E77 – Standard Test Method for Inspection and Verification of Thermometers.
10. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
11. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:

1. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C651 – Disinfecting Water Mains.
2. AWWA C706 – Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
3. AWWA M6 – Water Meters – Selection, Installation, Testing, and Maintenance.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 67 – Butterfly Valves.
3. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
4. MSS SP 80 – Bronze Gate, Globe, Angle and Check Valves.
5. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
6. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

I. Plumbing and Drainage Institute:

1. PDI WH201 – Water Hammer Arrester Standard.

J. Underwriters Laboratories Inc.:

1. UL 393 – Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 – Gauges, Indicating Pressure, for Compressed Gas Service.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Product Data:

a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.

b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

c. Hangers and Supports: Submit manufacturers catalog information including load capacity.

d. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

e. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

2. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

3. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

B. Information for the Record:

1. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.04 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

1.05 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.06 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

A. Furnish two packing kits for each size valve and two pump seals for each pump model.

PART 2 PRODUCTS

2.01 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

2.02 FLUE AND COMBUSTION AIR PIPING

A. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2466, Schedule 40, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.

B. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.

C. CPVC Pipe: ASTM F441, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM F438, CPVC, Schedule 40, socket type.
2. Joints: ASTM D2846, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.

D. CPVC Pipe: ASTM F441, Schedule 80, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM F439, CPVC, Schedule 80, socket type.
2. Joints: ASTM D2846, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.

2.03 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].

2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 BALL VALVES

A. Manufacturers: Nibco, Crane, Conbraco, or equal.

B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, chrome plated bronze or type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends, and lever handle.

C. 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F ASTM D1785 PVC body and ball, double lever handle, EPDM seals, teflon seats, full port, double union type with socket or threaded ends.

2.05 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers: Crane, Powell, Jenkins, or equal.

2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.

3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast-iron disc, renewable disc seal and seat, flanged ends.

2.06 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping: Conform to ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.

C. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

D. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

E. Vertical Support: Steel riser clamp.

F. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

G. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

2.07 PRESSURE GAGES

A. Manufacturers: H.O. Trerice Co., Model 450; Ametek U.S. Division; Ashcroft, Division of Dresser Industries, or equal.

B. Description: ASME B40.1 Grade 2A, liquid filled, with bourdon tube, rotary stainless steel geared movement, brass socket, front calibration adjustment, black scale on white background.

1. Fiberglass reinforced polypropylene case and threaded ring.
2. Window constructed of acrylic.
3. Bourdon tube constructed of phosphorous bronze.
4. 4-1/2” diameter aluminum dial face size with white background and black graduations and figures.
5. Mid-Scale Accuracy: - ± 1/2 percent accuracy full scale.
6. Scale in PSI, 0 to 100 psi specific range, 10 psi figure intervals, 1 psi minor divisions.

2.08 PRESSURE GAGE TAPS

A. Connect pressure gauges with a pulsation dampeners upstream of a gauge cocks or needle valves.

B. Pulsation Dampener: Pressure snubbers, brass construction with 1/4-inch NPT connections, manufactured by Trerice, Series 872, or equal.

C. Gauge Cocks: Ball valve type with tee or lever handle, brass construction, for maximum 250 psig pressure, as manufactured by Trerice Series 865, or equal.

D. Needle Valves: Rising stem type with knurled dial or lever type handle, brass construction, as manufactured by Trerice Series 735, or equal.

2.09 THERMOMETERS

A. Dial Type Thermometers: 5-inch dial, bimetal type, with adjustable face, Trerice Model B856, Weiss Model 5VBM, Ashcroft 50AI60E, or equal, 20 to 240 degrees F range with thermometer supports.

B. Stem Type Thermometers: 9-inch Trerice Model BX9, US Gauge, Weiss, Ashcroft, or equal, adjustable angle units, filled with blue colored organic spirit, 30 to 240 degrees F range with separable sockets.

C. Thermometer Supports:

1. Socket: Brass separable socket type for thermometer stems with or without extensions.

2. Flange: 3-inch outside diameter reversible flange, designed to fasten to sheet meatal air ducts, with brass perforated stem.

2.10 FLOW CONTROL VALVES

A. Manufacturers: Bell & Gossett, Taco, Armstrong, or equal.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.11 BACKFLOW PREVENTERS

A. Manufacturers: Watts, Zurn/Wilkins, Cla-Val, or equal.

B. Reduced Pressure Backflow Preventers:

1. Comply with ASSE 1013.

2. Bronze body, with bronze internal parts and stainless-steel springs.

3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer upstream of inlet, and four test cocks.

4. Provide an air gap fitting between relief valve outlet and connection to drain piping.

2.12 WATER HAMMER ARRESTORS

A. Manufacturers: Precision Plumbing Products, Inc., Sioux Chief Manufacturing Co., Inc., or equal.

B. ASSE 1010; stainless steel or copper construction, piston type sized in accordance with PDI WH-201.

C. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 250 psi static pressure.

2.13 THERMOSTATIC MIXING VALVES

A. Manufacturers: Powers Series LFMMV, Leonard Model LF, or equal.

B. Valve: Point of use, chrome plated cast brass lead free body, stainless steel or copper alloy bellows, integral temperature adjustment with range of 80 to 120 degrees F. Conform to ASSE 1070 to temper water to maximum 110 degrees F.

C. Accessories:

1. Check valve on inlets.

2. Volume control shut-off valve on outlet.

2.14 DIAPHRAGM-TYPE THERMAL EXPANSION TANKS

A. Manufacturers: Bell & Gossett Series PT, Amtrol Therm-X-Trol, Model ST, State Industries, Inc. Model Therm-O-Flex, or equal.

B. Construction: Pre-charged vertical carbon steel expansion tank with integral, flexible heavy duty butyl blend diaphragm sealed into tank and polypropylene lined dome, FDA approved for domestic potable water, with NPTF system connection. 150 psig maximum design pressure and 200 degrees F maximum operating temperature.

C. Accessories: Pressure gage, tank drain, and pre-charged to 38 psig. 0.305 inch-32 air-charging fitting (standard tire valve) facilitates on-site charging of the tank to meet system pressure requirements.

D. Size: 5-gallon capacity.

2.15 SYSTEM LUBRICATED CIRCULATORS

A. Manufacturers: Bell & Gossett Model PL-36, Taco, Armstrong, or equal.

B. Use: domestic hot water recirculation.

C. Type: horizontal shaft, single stage, close coupled, dry motor, circulator pumps for in-line mounting, permanently lubricated type, specifically designed and guaranteed for quiet operation. Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting. 150 psig maximum working pressure, 225 degrees f maximum water temperature.

D. Casing: lead-free bronze with stainless steel face plate with flanged pump connections.

E. Impeller: 30 percent glass filled Noryl.

F. Shaft: carbon steel with stainless steel sleeve.

G. Elastomers: EPDM.

H. Bearings: sealed precision ball bearing.

I. Seals: mechanical, carbon on silicon carbide.

J. Motor: permanent split capacitor motor, non-overloading, open drip-proof, sealed precision ball bearing, quiet-operating construction, with thermal overload protection. The permanent split capacitor motor impedance protected, single speed.

K. Performance:

1. Flow capacity: 2 GPM.

2. Head: 10 feet.

L. Electrical characteristics: in accordance with division 16 and the following:

1. Power (hp): 1/6.
2. Electrical (V/PH/HZ): 120/1/60.

M. Control:

1. Manufacturers: Bell & Gossett model AQS, Taco, Armstrong, or equal.
2. Type: aquastat with epoxy thermoset covering, bimetal sensing element, stainless steel pipe clip, and insulated 18-inch in length number 18 AWG wire leads. Bimetal thermostatic element senses surface temperature of outside diameter of pipe.
3. Thermostatic switch modes: off (open) at 120 degrees F and on (closed) at 100 degrees F.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

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

3.02 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install gage taps in piping.

C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage.

D. Install thermometers at water heaters and as shown on the Drawings.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

I. Install Work in accordance with applicable standards.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:

1. Provide inserts for placement in concrete forms.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, and MSS SP 89.
2. Support horizontal piping as schedule.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping, sheet lead packing between hanger or support and piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation.

3.04 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not accessible.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors.

N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

O. Install unions downstream of valves and at equipment or apparatus connections.

P. Install valves with stems upright or horizontal, not inverted.

Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

R. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

S. Install ball or butterfly valves for throttling, bypass, or manual flow control services.

T. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

U. Provide spring loaded check valves on discharge of water pumps.

V. Provide flow controls in water circulating systems as indicated on Drawings.

W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

Y. Test backflow preventers in accordance with ASSE 5013.

Z. Install water hammer arrestors complete with accessible isolation valve on hot and cold-water supply piping to lavatories, sinks, water closets, quick closing valves, and at every solenoid valve location.

AA. Install Work in accordance with applicable standards.

3.05 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with applicable code.

3.06 CLEANING

A. Prior to starting work, verify system is complete, flushed and clean.

B. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15150
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Sanitary drain, waste, and vent (DWV) piping located in all buildings and buried up to a point within 5 feet of building.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Floor drains.
6. Cleanouts.
7. Interceptors.
8. Sump pumps.
9. Bedding and cover materials.

B. This Section includes furnishing all materials, equipment, labor, and supervision related to air sanitary waste and vent piping necessary for the completion of the Work in accordance with the Contract Documents. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American Standard of Mechanical Engineers:

1. ASME A112.21.1 – Floor Drains.
2. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
3. ASME B31.9 – Building Services Piping.

B. ASTM International:

1. ASTM A74 – Standard Specification for Cast iron Soil Pipe and Fittings.
2. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
3. ASTM C1053 – Standard Specification for Borosilicate Glass Pipe and Fittingd for Drain, Waste, and Vent (DWV) Applications.
4. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
5. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
8. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
9. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
10. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
11. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
12. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
14. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waster, and Vent Piping Applications.
2. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.

3. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.

E. Plumbing and Drainage Institute:

1. PDI G101 – Standard – Testing and Rating Procedure for Grease Interceptors.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

1. Product Data:

a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

c. Hangers and Supports: Submit manufacturers catalog information including load capacity.

d. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

e. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

2. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

3. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

C. Information for the Record:

1. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include spare parts list, exploded assembly views for pumps and equipment.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.07 FIELD MEASUREMANTS

A. Verify field measurements prior to fabrication.

1.08 EXTRA MATERIALS

A. Furnish two sets of pumps seals for each pump.

PART 2 PRODUCTS

2.01 SANITARY DRAIN, WASTE, AND VENT (DWV) PIPING

A. Cast Iron Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2729, PVC.

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

D. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.

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

E. PVC Pipe: ASTM D1785 Schedule40 80 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.

a. Fittings: ASTM D2466, Schedule 40, PVC, ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.

b. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.02 JOINTS: ELECTRICAL RESISTANCE FUSION. BALL VALVES

A. Plastic Ball Valves for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward TBH Series, Spears Manufacturing, or equal.

2. True Union Ball Valves: All thermoplastic ball valves shall be true union standard type, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.03 CHECK VALVES

A. Plastic Check Valves for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward TC Series, Spears Manufacturing, or equal.

2. True Union Ball Check Valves: All thermoplastic check valves shall be true union ball type suitable for horizontal or vertical installation, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. Valve stem shall have an O-ring stem seal. All handles shall be of polypropylene construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.04 UNIONS

A. Plastic Unions for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward, Spears Manufacturing Union 2000, or equal.

2. Unions: All thermoplastic unions shall be schedule 80, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.05 PIPE HANGERS AND SUPPORTS

A. Drain, Waste, and Vent: Conform to ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

F. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.06 FLOOR DRAINS

A. Medium Duty:

1. Manufacturers: Zurn Industries, Inc., Model ZN550, J.R. Smith Mfg. Co., Model 2120-NB, Josam Manufacturing Co., or equal.

2. Construction: ASME A112.21.1; 9-inch diameter top drain, medium duty, latex coated, cast-iron two-piece body with double drainage flange and bottom outlet, seepage pan, weep holes, combination membrane flashing clamp and frame with integrated trap primer and plug, and round, adjustable slotted nickel-bronze medium-duty grate.

3. Deep Seal Trap with Floor Cleanout:

a. Manufacturer: Zurn Industries, Inc., Model Z1012/ZN1406, J.R. Smith Mfg. Co., Josam Manufacturing Co., or equal.

b. Construction: Deep seal trap, latex coated, cast-iron body for use with bottom outlet drain, with adjustable cast iron floor cleanout with spigot for caulking into Hub. Latex coated cast iron body with gas and watertight ABS plug and cast iron housing with round, scoriated, secured cast iron heavy-duty cover adjustable to finished floor.

2.07 CLEANOUTS

A. Interior Finished Floor Areas:

1. Manufacturers: Zurn Model ZN1400, J.R. Smith Mfg. Co., Josam, or equal.

2. Construction: Adjustable floor cleanout, latex coated cast iron body, anchor flange, threaded top assembly, and round scored polished nickel bronze cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

B. Interior Finished Wall Areas:

1. Manufacturers: Zurn Model Z1446, J.R. Smith Mfg. Co., Josam, or equal.

2. Construction: Cleanout tee, latex coated cast iron body, gas and watertight ABS tapered thread plug, smooth stainless steel wall access cover with securing screw.

2.08 BARRIER-TYPE TRAP SEAL

A. Manufacturers: Everflow Supplies Green Drain, Sure Seal, or equal.

B. Construction: ASSE 1072 tested and certified, inline floor drain, barrier type trap seal with UV ABS plastic frame, silicone rubber sealing flapper, and four flexible sealing ribs. Trap seal shall open to allow drainage and close when there is no flow. Trap seals shall be in compliance with the Indiana Plumbing Code.

2.09 SLEEVES

A. Type B Sleeve:

1. Type B sleeves are for use in exterior walls.

2. Type B sleeves consist of casting in place a black wrought iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.

3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.

B. Type C Sleeve:

1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.

2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.

3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of 40-degree F to 250-degree F. The pressure plates shall be of Delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

C. Type D Floor Sleeve - Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

D. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.

2. Type E sleeves consist of casting in place mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.

3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting all requirements of AWWA C111 on both ends.

E. Type F Sleeve:

1. Type F sleeves shall be used for passing through masonry walls.

2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

2.10 SUBMERSIBLE SUMP PUMPS

A. Manufacturers: Zoeller Pump Company, Model 137, or equal.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body with 100 percent baked-on powder coated epoxy finish for corrosion resistance and longer casting durability and oil filled motor chamber. All fasteners and external metal parts shall be of stainless steel.

D. Impeller: Cast iron; open non-clog vortex, corrosion resistant alloy steel shaft.

E. Pump Discharge: 1-1/2-inch NPT.

F. Bearings: Sleeve bearings.

G. Accessories: UL listed, oil resistant 10-foot cord and plug with three-prong connector for connection to electric wiring system.

H. Controls: Integral float operated mechanical switch type level controls.

I. Performance:

1. Flow: 30 GPM, at 20 feet lift.

J. Electrical Characteristics and Components:

1. Power: 1/2 HP.

2. Electrical (V/PH/HZ): 120/1/60

K. Motors: In accordance with Division 16.

2.11 BEDDING AND COVER MATERIALS

A. Bedding, Cover, and Backfill: In accordance and as specified in Section 02200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

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

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:

1. Provide inserts for placement in concrete forms.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, and MSS SP 89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
8. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
9. Install hangers adjacent to motor driven equipment with vibration isolation.

3.04 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than one ft of cover.

C. Establish minimum separation of from other services piping in accordance with applicable code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 02200.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

J. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 02200.

2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.

4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

5. Do not use wheeled or tracked vehicles for tamping.

K. Install Work in accordance with applicable standards.

3.05 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations and maintain gradients.

B. Slopes for Horizontal Drainage Pipe:

1. 2-1/2 Inches or Less: 1/4 inch per foot.

2. 3 to 6 Inches: 1/8 per foot.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

G. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

H. Install piping to maintain headroom. Do not spread piping, conserve space.

I. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation.

L. Provide access where valves and fittings are not accessible.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

P. Install bell and spigot pipe with bell end upstream.

Q. Sleeve pipes passing through partitions, walls, and floors.

R. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07270.

S. Support cast iron drainage piping at every joint.

T. Install Work in accordance with applicable standards.

3.06 INSTALLATION – SUMP PUMPS

A. The submersible sump pump is located in the pump room.

B. Provide check valve, union, and ball valves on sump pump discharge piping.

C. Provide shaft length allowing ejector pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

D. Check, align, and certify alignment of pumps prior to start-up.

E. Install Work in accordance with applicable standards.

3.07 FIELD QUALITY CONTROL

A. Test sanitary waste and vent piping system in accordance with applicable code or local authority having jurisdiction.

END OF SECTION

SECTION 15195

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Strainers.
7. Natural gas pressure regulators.
8. Natural gas pressure relief valves.
9. Underground pipe markers.
10. Bedding and cover materials.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.15 – Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:

1. ASME B16.3 – Malleable Iron Threaded Fittings.
2. ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 – Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes ½ – 2).
4. ASME B31.9 – Building Services Piping.
5. ASME Section IX – Boiler and Pressure Vessel Code – Welding and Brazing Qualifications.

C. ASTM International:

1. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
4. ASTM B280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM B749 – Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
6. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:

1. AWS D1.1 – Structural Welding Code – Steel.

E. American Water Works Association:

1. AWWA C105 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 67 – Butterfly Valves.
3. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
4. MSS SP 78 – Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
6. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Fire Protection Association:

1. NFPA 54 – National Fuel Gas Code.

H. Underwriters Laboratories Inc.:

1. UL 842 – Valves for Flammable Fluids.

1.03 SYSTEM DESCRIPTION

A. Natural gas service to the pump station is to be supplied by Center Point Gas. A 2-inch diameter natural gas main located along Shelborne road near the intersection with 131st st. This main shall be tapped and a 1-1/4-inch diameter service line shall be installed back to the meter and pressure regulator set located near the road. Tap in, service line, and meter and pressure regulator set shall be furnished and installed by Center Point Gas. Delivery pressure at the outlet of the pressure regulator at the meter shall be 7-14 inches w.c. All piping downstream of the meter and pressure regulator set (house lines) within the plant site shall be furnished and installed by the contractor.

B. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

C. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

D. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

E. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.04 SUBMITTALS

A. Submittals shall be accordance with the requirements of Section 01300 and include the following.

1. Product Data:

a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

c. Hangers and Supports: Submit manufacturers catalog information including load capacity.

d. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:

1) Strainers.

2) Natural gas pressure regulators.

3) Natural gas pressure relief valves.

e. Test Reports: Indicate results of piping system pressure test.

f. Manufacturer’s Certificate: Certify Products meet or exceed specified requirements.

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

2. Information for the record:

a. Manufacturer’s Installation Instructions: Submit manufacturer’s published literature indicating proper installation procedures.

b. Substantiation of vendor compliance with codes, standards, or test methods noted herein.

c. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.05 QUALITY ASSURANCE

A. Perform natural gas Work in accordance with NFPA 54.

B. Perform work in accordance with applicable code and local gas company requirements.

C. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

D. Perform Work in accordance with applicable code and authority having jurisdiction, AWS D1.1 for welding hanger and support attachments to building structure.

E. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

F. Perform Work in accordance with applicable standard.

1.06 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

C. Design piping system, hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location in State of Indiana.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01350 – Common Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.09 COORDINATION

A. Coordinate trenching, excavating, bedding, and backfilling of buried piping systems with the requirements of Section 02200 – Excavation and Backfill.

1.10 EXTRA MATERIALS

A. Furnish two packing kits for each type and size valve.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING BURIED BEYOND 5 FEET OF BUILDING

A. Pipe: ASTM D2513, ANSI B31.8, and AGA standards polyethylene pipe. Pipe shall be SDR 11 with a working pressure of 100 psi and shall be Phillips Driscopipe 8000, or equal.

1. Fittings: Approved plastic for making heat fusion joints complying with ASTM D2513 or D2683. When applicable, compression fittings shall be Dresser 401 plastic.

2. Joints: Fusion-welded.

B. Trace Wire: All underground piping shall be traced with No. 12 insulated magnetic detectable wire taped and installed as required by the governing authority.

2.02 NATURAL GAS PIPING BURIED WITHN 5 FEET OF BUILDING

A. Pipe: ASTM D2513, ANSI B31.8, and AGA standards polyethylene pipe. Pipe shall be SDR 11 with a working pressure of 100 psi and shall be Phillips Driscopipe 8000, or equal.

1. Fittings: Approved plastic for making heat fusion joints complying with ASTM D2513 or D2683. When applicable, compression fittings shall be Dresser 401 plastic.

2. Joints: Fusion-welded.

B. Anodeless Riser: Flexible steel casing or rigid non-corrosive steel encased plastic and shall be coated and cathodically protected.

C. Trace Wire: All underground piping shall be traced with No. 12 insulated magnetic detectable wire taped and installed as required by the governing authority.

2.03 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53 Schedule 40 black.

1. Fittings: ASTM A234 forged steel welding type.

2. Joints: ASME B31.9, welded.

3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.04 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53 Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234 forged steel welding type.

2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.05 REGULATOR VENT PIPING, ABOVE GRADE

A. Indoors: Same as natural gas piping, above grade.

B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.06 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Gaskets: 1/16-inch-thick preformed neoprene gaskets.

2.07 BALL VALVES

A. Manufacturers: Nibco, Inc., Apollo Valves, or equal.

B. ¼ inch to 1 inch: MSS SP 110, Class 125, two-piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.08 PLUG VALVES

A. Manufacturers: Nordstrom/Flowserve Corporation.

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, rectangular port, regular opening, pressure lubricated, teflon packing, threaded ends. UL listed for use with natural gas. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, rectangular port, regular opening, pressure lubricated, teflon packing, flanged ends. UL listed for use with natural gas. Furnish wrench operated.

2.09 PIPE HANGERS AND SUPPORTS

A. Furnish materials in accordance with applicable standards.

B. Conform to NFPA 54, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.

D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

G. Vertical Support: Steel riser clamp or angle ring.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

J. Sheet Lead: ASTM B749, 2.5 lb./sq ft, 0.039 inch thick.

2.10 STRAINERS

A. Manufacturers: Keckley Company, or equal.

B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64-inch stainless steel perforated screen.

D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8-inch stainless steel perforated screen.

2.11 NATURAL GAS PRESSURE REGULATORS

A. Manufacturers: Sensus/A Xylem Brand, Fisher/Emerson Electric Company, or equal.

B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

1. Comply with ANSI Z21.80.

2. Temperatures: minus 20 degrees F to 150 degrees F.

3. Body: Cast iron or steel.

4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.

5. Disk, diaphragm, and O-ring: Nitrile.

6. Maximum inlet pressure: 150 psig.

7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

2.12 UNDERGROUND PIPE MARKERS

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

2.13 BEDDING AND COVER MATERIALS

A. Bedding, Cover, and Backfill: In accordance and as specified in Section 02200.

PART 3 EXECUTION

3.01 EXAMINATION

A. 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

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

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION – INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.04 INSTALLATION – PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.9, ASTM F708 and MSS SP 89.

B. Support horizontal piping hangers as scheduled.

C. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Install hangers to allow 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Prime coat exposed steel hangers and supports in accordance with Section 09900. Finish paint exposed steel hangers and supports in accordance with Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.05 INSTALLATION – BURIED PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Verify connection size, location, and invert are as indicated on Drawings.

C. Establish elevations of buried piping with not less than 12 inches of cover.

D. Establish minimum separation from other services piping in accordance with the applicable code.

E. Remove scale and dirt on inside of piping before assembly.

F. Excavate pipe trench in accordance with Section 02200.

G. Install pipe to elevation as indicated on Drawings.

H. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

I. Install pipe on prepared bedding.

J. Route pipe in straight line.

K. Install pipe to allow for expansion and contraction without stressing pipe or joints.

L. Install trace wire continuous over top of pipe.

M. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 02200.

2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.

4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

N. Install Work in accordance with applicable standards.

3.06 INSTALLATION – ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.

E. Install piping to conserve building space and not interfere with use of space.

F. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Sleeve pipe passing through partitions, walls and floors.

J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07270.

K. Provide clearance for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

N. Provide support for utility meters in accordance with requirements of utility company.

O. Breather vents may be manifolded together with piping sized for combined appliance vent requirements.

P. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09900.

Q. Install identification on piping systems including underground piping.

R. Install valves with stems upright or horizontal, not inverted.

S. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

T. Install medium pressure gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.

U. Install medium pressure gas pressure regulator with tee fitting not less than 10 pipe diameters down stream of regulator. Cap or plug one opening of tee fitting.

V. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

W. Provide and install new gas service complete with tap in to main, service piping to gas meter location, and installation of gas meter and regulators. Gas service distribution piping upstream of meter to have a pressure of 20-60 psi. Gas delivery pressure downstream of the pressure regulators at the meter shall be 7-14 inches w.c.

X. Install Work in accordance with applicable standards.

3.07 FIELD QUALITY CONTROL

A. Field inspecting, testing, adjusting, and balancing.

B. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.

C. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.

D. Pressure test natural gas piping in accordance with NFPA 54.

E. Where new branch piping is extended from existing system, pressure test new branch piping only. Leak test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.

F. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

G. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.

H. Where leakage is detected, shut off gas supply until necessary repairs are complete.

I. Do not place appliances in service until leak testing and repairs are complete.

3.08 SCHEDULES

A. Natural Gas Service:

Unit	Gas Flow (CFH)	Regulator Inlet Pressure	Regulator Outlet Pressure Range (Inches W.C.)	Regulator Outlet Pressure (Inches W.C.)
Natural Gas Generator	6454	5 PSI	10-20	14
GUH-1-1	45	10”-20” W.C.	6-8	7
GUH-1-2	45	10”-20” W.C.	6-8	7

GUH-1-3	45	10”-20” W.C.	6-8	7
Total	6589			

3.09 OWNER’S ACCEPTANCE

A. All materials, accessories, and methods of installation and fabrication are subject to the Owner’s inspection and approval during any phase of the Work.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15211
SMALL PIPING AND VALVES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing all pipelines and valves less than 4-inch in diameter as shown on the Drawings or as required for a complete piping system for each service or combination of services except the piping and valves included in Section 15400 and Section 15500.

B. Each piping system shall be adequate to conduct and control the flow of process water, plant water, non-potable water, instrument air, compressed air, vacuum, natural gas, sewage gas, propane, fuel oil, chemicals, sewage, sludge, sampling or other uses as specified or shown on the Drawings.

C. This Section includes, but is not limited to:

1. Securing and bearing the cost of all permits, certificates, and inspection as required by local regulations and state codes.
2. All pipe, fittings, and connections for water supply to equipment and waste to drains.
3. Valves less than 4-inch in diameter, control devices, pipe hangers, anchors, supports, and sleeves for the piping systems covered under this Section.
4. Hose bibbs, sill cocks, and hydrants.
5. Non-potable water supply, drain lines, and connections to boilers, pump priming systems, pump gland seals, valve operating cylinders, or other equipment requiring these services.
6. Compressed air piping, valves, connections to valve operators, and other equipment requiring compressed air.
7. Compressed air, non-potable water, natural gas, propane, vacuum, deionized water, and other services as required for laboratory service.

D. The Contractor shall remove all existing pipelines and valves less than 4-inch in diameter that are indicated on the Drawings to be removed except piping and valves included in Section 15400 and Section 15500. Removals shall be done in accordance with the requirements of Section 02110.

E. The Contractor shall relocate existing piping and valves less than 4-inch in diameter, except piping and valves included in Section 15400 and Section 15500, which interfere with Work under this Section or any Section of the Specifications.

F. The Contractor shall furnish, install, and remove all temporary piping and valves that are required to maintain processes in operation during construction.

G. All wall, floor, and roof penetration and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

H. Instruments which are to be located in pipelines to be furnished under Division 16 shall be installed under this Section.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Drawings shall include plan dimensions to and elevations of sleeves, inserts, and anchors, the size and location of each run of pipe, and the location of valves and unions.

b. Manufacturer's literature, catalog data, specifications, and illustrations shall be bound in a brochure which includes a complete bill of materials.

2. Information for the Record:

a. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Copper Pipe and Tubing shall be manufactured in accordance with ASTM B88. Type L hard temper shall be used above ground and inside of structures for compressed air, hot and cold potable water, plant water, vacuum, and other services unless another type of pipe is specifically called for. Type K soft temper shall be used where underground piping is installed. Fittings and unions shall be solder joint fittings of cast bronze manufactured in accordance with ASTM B62 and with ends complying to ANSI B16.18 or wrought copper manufactured in accordance with ASTM B75 and with ends complying to ANSI B16.22. Unions shall be cast bronze and shall be installed adjacent to valves and equipment and as required to assemble the piping but not less than one union shall be included in each run. Threaded adapters shall be installed on each side of valves in copper lines. Where joints are made between pipes of different materials, dielectric couplings shall be installed. Pipe nipples shall be standard weight seamless red brass pipe ASTM B43. Solder joints shall be made in conformance with ASTM B828 Flux conforming to ASTM B813 shall be applied. Materials used for solder joints in all potable water services shall contain less than 0.2% lead and comply with ASTM B32.

B. Cast Iron Soil Pipe for exterior and buried conduits shall conform to ASTM A74 service grade. Rubber gaskets for compression joints and hubless joints shall conform to ASTM C564. Cast iron soil pipe 2-inch diameter and larger shall be used for buried conductors from toilet fixtures; floor, roof, equipment, and area drains; and similar services unless otherwise shown on the Drawings or specified. Buried pipe shall be coated inside and

out and interior piping shall be coated inside with nonbrittle coal tar pitch paint. Threaded openings shall not be coated. Double bell fittings shall not be used.

C. Steel Pipe, unless otherwise noted, shall be used for all aboveground natural gas, digester gas aboveground only, aboveground fuel oil, and scum. Pipe shall be ASTM A53 Schedule 40, unless otherwise noted or where code requirements differ, with standard weld or malleable iron fittings. Unions shall comply with ANSI B16.3.

1. Steel piping installed above ground, unless otherwise noted, shall be Schedule 40 pipe with standard malleable iron screwed fittings. Unions shall be 250 pound screwed malleable iron with iron to iron seats. On pipes 2-inch and larger, ASTM A105 companion flanges shall be used in lieu of unions. For natural gas through 2-inch, fittings shall be 3,000-pound forged steel socket weld. For natural gas, digester gas, and fuel oil, pipe 2-1/2-inch and larger, ASTM A234 weld fittings and ASTM A105 flanges shall be used.

2. Steel piping installed underground, unless otherwise noted, shall be Schedule 40 plastic coated at the factory with Scotchkote 212 by 3M or equal. Pipe fittings through 1-1/2-inch shall be 3000-pound forged steel socket weld, and 2-inch and larger shall be ASTM A234 weld fittings. Joints shall be welded, primed, and wrapped double the manufacturer's recommended thickness with Tapecoat TC Primer and Tapecoat CT, or equal.

3. Where couplings are called for on gas piping, they shall be Dresser Style 38, or equal. The couplings shall be specifically designed for digester or natural gas, middle ring width shall be 5-inch long.

D. Stainless Steel Pipe:

1. Stainless steel pipe less than 4-inch in diameter shall be designed and fabricated in accordance with ASTM A312. The interior surface of the pipe shall be smooth with no protrusions, stiffeners, or bracing. The pipe and fittings shall be constructed of 304L stainless steel, or as specified on the Drawings.

2. Stainless steel pipe shall be minimum Schedule 40S, unless otherwise noted on the Drawings.

3. Fittings shall conform to ASTM A403 and shall have the same wall thickness and structural properties as the pipe. All bends shall be long radius smooth type. Mitered bends will not be acceptable.

4. Flanges where required shall be ASTM A182-F304L flanges with full facing gaskets and centering rings. Flange bolts shall be stainless steel.

5. Wherever possible, butt weld fittings shall be used for field welding. All welds shall be made by a certified welder and shall conform to procedures for which the welder has been certified. The Contractor shall submit certification statements for the welders and the methods employed. Belled end fittings may be used in lieu of butt weld fittings on air lines.

6. All welds shall have full penetration and be smooth and without protrusions on the interior of the pipe. Weld metal shall be equal to or greater than the parent metal. Any cracks or blow holes appearing on the surface of a welding bead shall be ground away before depositing the next bead.

7. All stainless-steel surfaces shall be passivated by the following procedures:

   a. All outside weld areas shall be wire brushed to remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.

   b. All stainless-steel assemblies and parts shall be completely immersed in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material after this procedure.

   c. Previously pickled parts shall be neutralized by immersion in a trisodium phosphate rinse.

E. PVC Pipe and fittings shall be composed of Class 12454-B rigid PVC compound in conformance with ASTM D1784 (formerly classified Type I, Grade 1). Pipe shall be Schedule 80 with a design stress of 2000 psi in conformance with ASTM D1785. All joints, unless otherwise shown on the Drawings, shall be solvent welded in conformance with ASTM D2855. Joint solvent shall be as recommended by the pipe manufacturer and shall comply with ASTM D2564. In pressure or vacuum lines and in gravity drains 1-inch diameter and less, the fittings shall be Schedule 80 and shall conform to ASTM D2467. For gravity drains greater than 1-inch diameter, the fittings shall conform to the requirements of ASTM D2665. PVC pipe shall be used for acid-resistant services and all lines carrying chlorine solution, sodium hypochlorite, De-ionized (DI) water and other chemicals unless otherwise shown on the Drawings or specified.

F. CPVC Pipe shall be composed of Class CPVC 23447-B plastic as defined in ASTM D1784 (formerly classified Type IV, Grade 1). Pipe shall be Schedule 80 chlorinated polyvinyl chloride pipe in accordance with ASTM F441. Fittings shall be schedule 80 and shall conform to ASTM F439. All joints, unless otherwise shown on the Drawings, shall be solvent welded in conformance with ASTM D2896. Joint solvent shall be as recommended by pipe manufacturer and shall comply with ASTM F493. CPVC pipe shall be used where designated in Part 4 or on the Drawings.

2.02 VALVES

A. Unless otherwise specified or shown on drawings, valves installed in pipelines 3-1/2-inch diameter and smaller for process water lines shall be gate valves; for compressed air and vacuum, globe valves; for natural and sewage gas lines, lubricated plug or eccentric nonlubricated plug valves; and for gas lines less than 2-inch diameter tapered nonlubricated plug cocks; for fuel oil, ball valves; for sludge, eccentric nonlubricated plug valves. Valves for other types of services when required will be specified under that Section.

B. Gate Valves shall be 150-pound, all bronze, rising stem, solid wedge disc furnished with screwed or flanged ends as required. Gate valves shall be Crane No. 431, Jenkins No. 47-U, Powell No. 514/515, or equal.

C. Quick Opening Gate Valves shall be used at locations as shown on the Drawings. Quick opening gate valve shall be Crane 432 or equal.

D. Globe Valves shall be 150-pound, all bronze body with renewable plug-type disc of 500 Brinell Hardness Stainless Steel. The seat ring shall be screwed-in and of the same material as the disc. Globe valves shall be Powell No. 2600, Crane No. 14-1/2P, Jenkins No. 2032, or equal.

E. Ball Valves through 2-inch shall be screwed end bronze, two-piece, 125 psi, Teflon seats, bronze trim, and blowout-proof stem, Nibco No. T-580-BR-Y-20, or equal.

F. Butterfly Valves shall be AWWA, Class 150 B, wafer body equipped for ANSI 125-pound flanges. Butterfly valves shall provide bubble-tight shutoff to 150 psig cold water pressure. The valve body shall be made from ASTM A126, Grade B cast iron or equal. The valve disc shall be made with nickel-coated cast iron, bronze, or equal. Valve shall have bronze shaft bearings, O-ring shaft seals, and EPDM valve body seat Keystone Figure 239, or equal. Valves shall be hand lever actuated.

G. Check Valves shall be 200-pound, all bronze body with bronze disc, Y-pattern, with flanged or screwed ends as required. The check valves shall be Crane No. 36, Powell 560-Y/561-Y, Jenkins 762-A, or equal. Non-slam check valves shall be used on all pipelines operating at 25 psig or higher pressure and shall be Valve and Primer Corporation, Series 300 or equal.

H. Nonlubricated Plug Valves shall be 150-pound, all bronze body and plug, with synthetic rubber faced plugs and have screwed or flanged ends as required. They shall be DeZurik Figure 120, or equal. Valves shall operate with nonremovable lever type handles.

I. Lubricated Plug valves 3-1/2-inch and smaller shall be 150-pound solid bronze body and plug, lever operated, furnished with screwed or flanged ends as required, and with nonremovable lever operating handles. Lubricated plug valves shall be Rockwell Permaturn Figure 114, or equal. Each valve shall be equipped with a giant button head coupler for use with a hydraulic hand lubrication gun. One gun shall be furnished.

J. Plug Cocks shall be nonlubricated tapered plug type cocks, furnished with a square operating nut and wrench. Plug cocks 1-inch diameter and smaller shall be all bronze; larger sizes shall be furnished with bronze plug and washer and iron body. Plug cocks shall be designed for 125 pound working pressure, Walworth 554, Hays 1275, or equal.

K. Sampling Cocks shall be Ernest Gage Co. Fig. 29, Conbeaco, or equal.

L. Pressure Regulator shall be Watts U5HP, or equal.

M. Corporation Stops shall be brass and comply with AWWA C800 as manufactured by Ford Meter Box Co., Inc. or equal. Corporation stops shall be provided with inserts, saddles, and curb boxes as required. Saddles shall be brass with double straps and be placed over a molded rubber gasket.

2.03 PVC VALVES

A. PVC Ball Valves shall be used in all PVC lines under this Section. Ball valves shall be PVC body, Hayward TBH Series True Union; or equal.

B. PVC Butterfly Valves:

1. Butterfly Valves shall be made of Class 23447-B rigid PVC compound in conformance with ASTM D1/84 (formerly classified Type IV, Grade 1).
2. Shaft shall be 316 stainless steel. Seats and secondary seals shall be Viton.
3. Bearings shall be glass filled Teflon. Butterfly valves shall have a pressure rating of 150 psi at 70 degrees F.
4. Valve bodies shall be the wafer type compatible with 150-pound ANSI flanges.
5. Valves which are scheduled to be motor operated shall be furnished with mounting saddle. Manually operated valves shall be furnished with lever operators.

C. Check Valves:

1. Check Valves shall be made of Class 12454-B rigid PVC compound in conformance with ASTM D1784 (formerly classified Type I, Grade 1).
2. All check valves shall have Viton seals.
3. Check valves 4-inch size and smaller shall be true union ball checks.

D. PVC Pressure Relief Valves shall be Wallace & Tiernan No. U-23655, Fischer & Porter, or equal, with 1-inch female NPT BPV connections. These shall not be used on chlorination systems.

E. Chlorine solution valves shall be Hayward Flow Control thermoplastic, true-union ball valves. Seals and gaskets shall be suitable for chlorine solution.

2.04 AIR RELEASE VALVES

A. Air release valves shall be used at various high points in the piping systems under constant pressure to exhaust entrapped air while the pipe is under pressure. Valves shall be designed for a working pressure of 150 psi.

B. Each air release valve shall be of the compound lever type and have a body and cover made of cast iron and a float of stainless steel. The float seat shall be made of Buna-N material while all other internal parts such as lever pins, cotter pins, screws, and linkage shall be made of highest quality stainless steel or bronze.

C. Each unit shall have female NPT connections in the sizes indicated on the Drawings. A valve shall be furnished and installed to isolate the process from the air release valve.

D. Discharge shall be piped to 6-inch above nearest drain out of traffic pattern.

E. Type “A” air release valves shall be Valve and Primer Corp. 200A; Golden Anderson AR Series, or equal.

2.05 AIR AND VACUUM VALVES

A. Air and vacuum valves shall be used at high points in pressurized piping systems subject to cycling to exhaust entrapped air whenever placed under pressure and to allow air to re-enter the line to prevent a vacuum from developing. Normal service pressures will be less than 150 psi.

B. Each air and vacuum valve shall have a body, cover, and baffle constructed of cast iron and a float made of stainless steel. The float seat shall be made of Buna-N material while all other internal parts such as float guides, bushings, and baffle retaining screws shall be made of high quality stainless steel or bronze.

C. Each unit shall have female NPT connections in the sizes indicated on the Drawings. A nonlubricated plug valve of same size as the air and vacuum valve shall be furnished and installed to isolate the process from the air and vacuum valve.

D. Discharge shall be piped to 6-inch above nearest drain out of traffic pattern.

E. Equipment shall be Type “AV” or Type “CAV” as manufactured by Valve and Primer Corp., GA Industries, or equal.

F. Air and vacuum valves located on the discharge of each vertical turbine pump shall be well service by Golden Anderson or equal.

2.06 HOSE BIBBS

A. Hose bibbs inside buildings shall be all bronze angle hose valves with 3/4 by 11-1/2 threads per inch American (National) or Chicago Standard Hose Threads, Mueller Brass Co. No. V-1016, or equal. Hose bibbs shall have nonremovable type vacuum breaker, Watts No. 8A, or equal. Hose bibbs shall be located 3-feet above the floor.

2.07 SILL COCKS

A. Sill cocks shall be cast bronze non-freeze wall hydrants, Wade W-8620, Zurn Z-1310, or equal, with 3/4 by 11-1/2 threads per inch hose connection, polished face, galvanized wall sleeve, renewable seat, brass or bronze operating parts, ground joint union elbow adapter with 3/4-inch IPS (or 3/4-inch solder) and removable T-handle.

2.08 ELECTRIC VALVE OPERATORS (OPEN-CLOSE)

A. Electric operators shall be sized and geared to meet the torques required at a valve opening and closing speed of 2 to 8 seconds per 90-degree rotation. The operator shall be rated for 25% duty cycle at maximum rate output.

B. Operators shall be powered by 115 v, single phase, 60 Hz current and shall operate in any mounting attitude.

C. Operators shall have thermal overload protection, reversing magnetic starter, and a NEMA 4 enclosure for all electrical components. The starter shall be capable of receiving contact closures from remote sources to actuate the operator in either direction. The

operating motor shall be provided with surge suppression to limit voltage transients. The surge suppression device shall be equal to Electrocube Part No. RC1782, sized as required to suit the motor characteristics.

D. Adjustable limit switches shall be provided. Two limit switches shall be used for de-energizing operator once the fully open position or fully closed position of the valve is reached. Two limit switches shall be used for remote indication of end positions. Limit switches shall be single pole double throw snap acting totally enclosed and rated at 250 VAC.

E. Each operator shall be equipped with a manual override feature with manual lockout switch to prevent electrical operation when in the manual mode. Upon completion of manual operation, the operator will automatically return to the electrical mode.

F. Each operator shall be supplied with local indicator for visual valve position and an electro-mechanical brake to minimize overrun.

G. Electric motor valve operators that are to be supplied with butterfly valves shall be sized for 1-1/2 times the valves rated torque or a minimum of 400-inch-pound, whichever is greater.

H. The operators shall be a product of Raymond Control Systems, Worcester Control, or equal. Operators shall have easily identifiable terminal blocks for all external power and control connections.

2.09 STRAINERS

A. Strainers shall be provided where shown on the Drawings and as required to meet local and State codes. Strainers shall also be provided in all water lines ahead of all solenoid valves, pressure regulators, and pilot valves.

B. Unless otherwise specified or required by code, strainers shall be Leslie Model 7000, Mueller Muessco Model 11, or equal. Strainer shall have a Y-pattern cast iron body and a 40-mesh stainless steel screen.

C. The Contractor shall provide a plug cock for blow-off purposes.

2.10 BACKFLOW PREVENTERS

A. Reduced pressure type backflow preventers shall conform to ASSE Standard 1013, AWWA C511, and be approved by the State Department of Public Health, the State Plumbing Board, and the State Department of Labor-Construction Code. Preventers shall be Watts No. 909 with strainer, or equal. Relief valve shall be provided with an air gap, Watts Series AG or equal, piped to drain. Preventers 2-inch and smaller shall be Watts No. 009 with strainer.

B. All backflow preventers are to include an in-line strainer between the stop valves.

2.11 SLEEVES

A. Type B Sleeve:

1. Type B sleeves are for use in exterior walls.

2. Type B sleeves consist of casting in place a black wrought iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.

3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.

B. Type C Sleeve:

1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.

2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links by Link-Seal, or equal.

3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of Delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

C. Type D Floor Sleeve - Type D sleeves consist of casting in place a steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

D. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.

2. Type E sleeves consist of casting in place mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.

3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting all requirements of AWWA C111 on both ends.

E. Type F Sleeve:

1. Type F sleeves shall be used for passing through masonry walls, except as otherwise noted on the Drawings.

2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound. felt paper and sealant.

F. Type G Sleeve - Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrinking grout as shown on the Drawings.

2.12 PIPE ESCUTCHEONS

A. Split-type escutcheons shall be used for piping through finished walls, floors, or ceilings. Escutcheons shall be of brass or chromium plated Model 3A by Ritter or equal.

2.13 RESERVED

2.14 TAPPED SADDLES

A. Where specifically called for on the Drawings, service saddles shall be installed to provide a simple, positive, bubble tight tapping connection.

B. Saddles shall be rated for 150 psi working pressure and be constructed of corrosion resistant materials for long life, and of heavy proportions to withstand the strains of the tapping operations, and to support the service pipe after tapping.

C. Saddle gasket shall be made of neoprene rubber and assure a positive leak proof service connection.

D. Tapped saddles shall be Clow Corporation, Style 3408; Dresser Style 91 (double strap); or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cutting of all pipe shall be done with sharp tools. The ends of each pipe shall be reamed until all burrs or fins are removed. Full tapered threads shall be used throughout and threaded joints shall turn up perfectly tight without the use of filling substances. A standard pipe joint paste or tape suitable to use of pipe shall be used on the male threads only, and none shall be allowed to accumulate on the inside of the pipes. All connections between pipe, pipe hangers, and equipment shall be made with an approved dielectric insulating material. Dielectric unions or insulated couplings shall be installed between any dissimilar metallic piping materials or at connections between dissimilar metallic pipes and equipment, tanks, etc.

B. Pipe joints shall conform to respective industry standards.

C. Expansion and contraction of the piping system shall be provided for by the use of swing joints, right angle loops, or approved expansion joints. Branch connections shall have three elbow spring pieces to allow for movement. Unless specified in Part 4, the piping system shall provide for the expansion as required in Section 15010. An expansion joint is also required at all building isolation or expansion joints.

D. Interior and exterior pipelines shall be installed and graded in accordance with State and/or Local Codes. Interior pipes shall run at right angles or parallel to building walls, placed as close as practicable to the ceiling and/or walls, and supported according to Section 15010. Drain valves shall be installed at all low points.

E. Pipe groups shall be run parallel with pipes of other trades, and wherever practicable, all piping shall be supported on common group hangers unless pitch of pipe as hereinbefore mentioned is required.

F. The piping shall be installed in a workmanlike manner and shall avoid interference with columns, beams, equipment, and other piping or fixed construction. A minimum of 7-feet of headroom shall be maintained at any point including stairs.

G. Type C wall sleeves shall be provided for all pipes passing through exterior walls unless other sleeve types are noted on the Drawings. Type C sleeves shall also be provided in interior walls where indicated on the Drawings, Type D floor sleeves shall be used where piping passes through floor. Other sleeve types shall be used where shown on the Drawings.

H. Buried pipe shall be firmly bedded the full length with the exception where bell holes are required. Buried piping located less than 3-feet below a building slab or footing shall be encased in concrete. Where unstable soil conditions occur under buildings, support shall be made from the underside of the structural slab by an approved type hanging device embedded in the concrete.

I. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 42-inch. Pressure piping which carries gases shall be installed with a minimum cover of 3-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade shall be approved by the Engineer.

J. Where PVC piping is laid in a trench, the bottom of the trench shall be well graded and compacted to insure even bearing for the full length of the pipe and the pipe shall be snaked at approximate 50-foot intervals to provide for expansion or contraction. Prior to testing the pipe, the pipe shall be center loaded with backfill between joints before testing to prevent the pipe from arching or whipping under pressure. During backfill the line shall be pressurized to 25 psi to minimize impact damage.

K. All valves shall be installed with their stems horizontal or above. As far as possible, all valves of the same type shall be of the same manufacturer.

L. Solenoid operated valves shall be installed in horizontal lines with the solenoid mounted vertically and upright.

M. The T-drill method manufacturing tees in continuous copper tubing is not acceptable.

3.02 EQUIPMENT CONNECTIONS

A. The Contractor shall make all connections where required between the various piping systems and all pieces of equipment. This shall include adapters, traps, backwater valves, or other fittings required when not furnished with the equipment.

B. Unions - Provide a union or flange in piping connections to each valve, device, or item of equipment, and elsewhere as required to makeup or disconnect piping. Each union shall be so installed as to permit the removal of parts and equipment for inspection and cleaning, and shall be installed in a position which will permit the valve device or part to be removed without disconnection of any piping except unions. Union and flange shall be installed in such a position as will be accessible for disconnection items which are to be screwed. All ground joint unions on copper lines shall be cast brass or bronze. Wrought copper unions are not to be used. All unions, where possible, shall be brass to MPT type.

3.03 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.

D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

3.04 PRESSURE AND LEAKAGE TESTS FOR (LIQUID) PROCESS AND PRESSURE PIPE

A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all liquid conducting lines unless otherwise directed by the Engineer.

B. Tests shall be conducted on all liquid conducting pipelines or valved sections thereof as directed by the Resident Engineer. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilled prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The

test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 50 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.

E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.

F. Testing of chlorination system piping shall also comply with the provisions of Section 11235.

3.05 PRESSURE TESTING FOR (GAS) PROCESS AND PRESSURE PIPE

A. All new and reused pipelines conducting gases shall be tested for tightness by the Contractor before final approval. All testing shall be witnessed by the Resident Engineer. Testing of natural gas lines shall meet the requirements of this Section or the governing authority.

B. All gas conducting pipelines shall be tested at 100 psig or 150% of the normal operating pressure, whichever is greater.

C. The test medium shall be air or an inert gas such as nitrogen or carbon dioxide. Oxygen, water, and/or natural gas are not to be used. Testing for leaks shall be done with an approved leak detector, or by brushing a soap solution or equivalent on each joint while the system is under pressure.

D. The Contractor shall provide for proper purging of all natural gas piping. All such purging shall be scheduled to minimize interruptions to the continued use of existing natural gas pipelines. After the piping has been pressure tested, leak tested, and approved, it shall be fully purged or cleared of air at the most distant point from the point of entry of the gas. This involves replacement of the atmosphere within the natural gas conduit by an inert substance in such a manner as to prevent the formation of explosive mixtures. Each major branch line shall be similarly purged at its far end. Purging shall be done only by personnel experienced in this particular operation.

E. Testing of chlorination system piping shall also comply with the provisions of Section 11235.

3.06 DISINFECTION OF WATER MAINS

A. After the pressure test and prior to disinfecting, the lines shall be thoroughly flushed through hydrant fixtures or by other means as approved by the Engineer.

B. The Contractor shall furnish required materials and apparatus and perform the Work of disinfection. Temporary and permanent materials, apparatus and appurtenances shall have the same NSF 61 approval and the installed work.

C. All water lines shall be cleaned and disinfected in accordance with federal, state and local codes; and AWWA C651, generally outline as follows.

1. Liquid sodium hypochlorite applied means of a suitable solution feed machine or pump. Sodium hypochlorite storage conditions and durations shall be controlled to minimize deterioration.

2. Calcium hypochlorite applied tablets, powder. Tablets or powder shall be placed in the water line during construction. The water line shall be filled, carefully, with potable water to produce a uniform solution.

3. Calcium hypochlorite applied as a water mixture. The calcium hypochlorite powder shall be mixed with water to form a paste and then thinned to a slurry, to be introduced into the pipe by pumping.

D. The dosage of chlorinating agent shall be of the amount to produce a minimum chlorine residual of 50 parts of chlorine per million. Tests with the DPD drop dilution method shall be made at selected points to determine the residual.

E. Treated water shall be retained in the lines for sufficient time to accomplish the desired disinfection but not less than 24 hours. Valves in the line shall be operated during the retention period.

F. Following disinfection, all treated water shall be flushed from the lines at their extremities until the replacement water throughout the lines shall, upon testing, be chemically and bacteriologically acceptable.

1. Two or more successive sets of samples taken at 24-hour intervals shall indicate microbiologically satisfactory water before the lines are placed into service.

2. Should the initial treatment prove ineffective, the disinfection shall be repeated until the test shows acceptable results.

G. All testing shall be done by a laboratory acceptable to the public authority having jurisdiction, and all costs shall be paid for by the Contractor.

3.07 EQUIPMENT DRAINS

A. Seal chamber, base plate drains, and equipment drains shall be piped to the nearest floor or equipment drain with copper lines as directed by the Engineer. All discharges shall provide a 2-inch minimum air gap above the drain.

PART 4 SPECIAL PROVISIONS

4.01 WATER HOSES AND ACCESSORIES

A. Water hoses shall be general purpose industrial grade with radial belted reinforcement of synthetic yarns. Tube and cover material shall be black EPDM. The hose shall have a minimum water pressure rating of 150 psi. End fittings shall be heavy duty 3/4 by 11-1/2 threads per inch American (National) or Chicago Standard Hose Threads.

B. 3/4-inch diameter and 50-feet long hoses shall be furnished. A threaded brass hand operated control nozzle shall be provided for each hose.

C. Hose racks shall be provided and mounted at the locations as designated by the Engineer. Each rack shall have a minimum capacity of 100-feet of 3/4-inch hose. Racks shall be heavy duty steel construction. Provide one rack per hose. Racks shall be a Dura-Loop Utility Caddy by TFC, Inc. or equal. Provide one hose and hose rack.

4.02 PRESSURE REDUCING VALVES FOR AIR LINE

A. Pressure reducing valves shall be installed in the air lines at the locations shown on the Drawings. The reducing valves shall be spring-loaded, self-operated, automatic, adjustable by means of an adjusting bolt, and be capable of bubble tight shutoff. The valve shall have a body and spring case of cast iron, NPT end connections, internal parts of brass, stainless steel, and neoprene diaphragm. The reducing valves shall be line size. At 100 psig inlet pressure, the valve shall deliver the flow rate shown on the Drawings at the set outlet pressure. The outlet pressure shall be adjustable over the range called for on the Drawings. The pressure reducing valves shall be Fischer Control Type 95L, 95H, or equal.

4.03 POST HYDRANTS

A. Post hydrants shall be sized 1-1/2-inch inlet, 1-1/2-inch hose connection and be of general non-freeze construction with red brass or bronze valve stem, valve body, bottom connection, tail and tail nut, and hand wheel designed for bury as shown on the Drawings.

B. Post hydrants shall be 1-1/2 by 9 threads per inch American (National) or Chicago standard hose threads.

C. Hydrants shall be Murdock 150 or equal compression hydrants.

4.04 POLYETHYLENE PRESSURE TUBING

A. Tubing shall meet the requirements of ASTM D2737 and AWWA C901, latest revisions.

B. Specifications of and marking on the tubing shall be the following with markings spaced at intervals of not more than 5-feet:

1. Nominal tubing size = 2-inch.
2. Plastic tubing type = PE2305.
3. Pressure rating for water at 73-degree F = 160 psig.
4. Designation ASTM D2737 or AWWA C901, with which the tubing complies.
5. The Manufacturer's name (or trademark).
6. Testing agency seal.

4.05 PIPING SERVICE MATERIAL REQUIREMENTS

A. The following are the material classifications to be used for the piping service identified.

Service	Piping	Gaskets
Plant Water in Buildings	Type L Copper	N/A
Plant Water Buried	Type K Copper	N/A
Compressed Air	Type L Copper	N/A
Chlorine Solution	Schedule 80 PVC	

4.06 AIR COMPRESSOR

A. Two tank mounted two stage air compressors, one to be installed in the Tertiary Pump Station and one to be installed in the Industrial Waste Pump Station.

B. Each shall be a tank-mounted, factory assembled and tested, compressed air system, and be equal to Model B311BL as manufactured by Kellogg-American; or Model F306-30 as manufactured by colt Industries, Quincy Compressor Division; or equal. Motors shall be one horsepower and operate on 460 volts, 3 phase, 60 Hz service.

C. Each shall include:

1. Pressure switch for automatic start/stop at pressures of 80 to 100 psi.
2. Thirty-gallon tank with automatic drain.
3. Check valves, service valves, and safety valve.
4. Pressure gauge.
5. Centrifugal or other device for loadless starting.
6. Enclosed belt guards.
7. A valved connection with a safety type quick disconnect coupling and a safety type blow gun, including a 25-feet length of hose with couplings.

4.07 MISCELLANEOUS PRODUCTS

A. Solenoid Operated Valves - Packless type, 150 pound, screwed brass body, with soft discs, encapsulated Class B insulation, continuous duty, NEMA 4 or 7 enclosure as indicated on the Drawings, 115-volt coil, ASCO, JD Gould, or equal. Solenoid operated valves shall operate properly in both vertical and horizontal installations.

B. Shock Absorbers - Zurn “Shoktrol” Josam, or equal. Unit shall conform with ASSE 1010.

C. Relief Valves - All brass, Crane No. 2606, Kennedy, or equal, unless noted; pipe to floor.

4.08 PRESSURE GAUGES AND THERMOMETER

A. Pressure gauges and thermometers shall be 4-1/2-inch in size with fiberglass reinforced polypropylene case, phosphor bronze bourdon tube, 6-inch or 4-1/2-inch dial faces with black lettering, micrometer type pointers and an accuracy of 1% of scale range. Pressure gauge shall be H.O. Trerice No. 450 series, Ashcroft 2462 series, or equal.

B. Pressure gauges shall read in pressure or compound as required by use.

C. All pressure gauges unless otherwise directed shall include a brass pressure snubber and a needle type shut-off valve.

D. Where directed, pressure gauges shall have diaphragm seals. The gauges, seals, and snubber shall be factory assembled and filled with a stainless-steel housing. Diaphragm seal shall be an Ashcroft 101 series, H.O. Trerice 877-2 series, or equal.

E. Thermometers shall be of the mercury in glass type with 9-inch C scale of proper range for the service shown and an adjustable angel mount. The thermometer shall be an H.O. Trerice BX9, US Gauge, or equal.

F. Thermometers shall be placed in piping at the following locations and elsewhere as noted:

1. In AH and AMU units coil inlet and outlet.
2. In domestic hot water heater and/or storage tank.
3. In designated pump inlet and discharge piping.

G. Pressure gauges shall be installed at each chorine ejector installation and elsewhere as shown on the Drawings and specified under other Sections.

4.09 EXPANSION JOINTS

A. For pipe sizes 1/2-inch to 3/4-inch use an Arch Type, Holz Rubber Co., Model 300 or equal.

B. Joints shall be single arch type with control rods and plates. Joints shall have a one-piece elastomer leak free tube compatible with the process fluid. The manufacturer shall select the tube material.

C. For pipe sizes 2-inch up to 4-inch use a Mercer style 500 or equal. Joints shall be a single arch type with control rods and plates. Joints shall have a one-piece elastomer leak free tube compatible with the process fluid. The manufacturer shall select the tube material.

4.10 INSULATION FOR PIPES

A. Pipe insulation shall be as specified in Section 15504.

END OF SECTION

SECTION 15214
COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Compressed air piping.
2. Unions and flanges.
3. Valves.
4. Strainers.
5. Pipe hangers and supports.
6. Flexible connectors.
7. Relief valves.
8. Compressed air outlets.
9. Air compressor.
10. Refrigerated compressed air dryer.
11. Air receiver.
12. Air pressure reducing valve.
13. Pressure regulators.
14. Compressed air filters.
15. Hose connectors.

B. Related Sections:

1. Section 03300 - Cast-in-Place Concrete: Execution requirements for equipment bases specified by this section.
2. Section 09900 - Paints and Coatings: Execution requirements for painting material specified by this section.
3. Section 15075 - Identification for Plumbing Piping and Equipment: Product requirements for pipe and valve identification for placement by this section.
4. Section 16150 - Wiring Connections: Execution requirements for electric connections specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B31.1 - Power Piping.
3. ASME B31.9 - Building Services Piping.
4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Pipes.
5. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
9. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
10. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
5. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

E. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.

1.03 SUBMITTALS

A. Shop Drawings: Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. System Components: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes. When applicable, include electrical characteristics and connection requirements.
5. Compressors: Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.

C. Product Data: Submit manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit hoisting and setting requirements, starting procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 MAINTENANCE MATERIALS

A. Furnish two-quart containers of compressor oil.

PART 2 PRODUCTS

2.01 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.

2. Joints: Threaded for pipe 2 inch and smaller.

B. Steel Pipe: ASTM A53 Schedule 40, black, cut grooved ends.

1. Fittings: ASTM A395 and ASTM A536 ductile iron, or ASTM A234 carbon steel, grooved ends.

2. Joints: Grooved mechanical couplings meeting ASTM F1476.

a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron, compatible with steel piping sizes, rigid type.

b. Gasket: Elastomer composition for operating temperature range from 0 degrees F to 180 degrees F.

c. Accessories: Steel bolts, nuts, and washers.

2.02 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.03 GATE VALVES

A. Manufacturers:

1. Apollo, or equivalent.

B. Gate valves 2 inches and smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, rising stem, hand-wheel, inside screw with back-seating stem, solid wedge disc, threaded ends.

2.04 BALL VALVES

A. Manufacturers:

1. Nibco, Watts, or equivalent.

B. Ball valves, 2 inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, threaded ends, lever handle.

2.05 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:

a. Nibco, or equivalent.

2. Check valves, 2 inches and smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, threaded ends.

2.06 STRAINERS

A. Manufacturers:

1. Titus Air Systems, Compressed Air Systems, or equivalent.

B. Strainers, 2 inch and smaller: Y pattern, ASTM A126 cast iron body, threaded ends, Class 250, 20 mesh stainless steel perforated screen.

2.07 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9 MSS SP 58 and MSS SP 69.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Vertical Support: Steel riser clamp.

E. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.08 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Compressed Air Systems, or equivalent.

B. 2 inches and Smaller: Corrugated stainless-steel hose with single layer of stainless-steel exterior braiding, Schedule 40 black steel ends; maximum working pressure 170 psig, threaded or soldered connections.

2.09 RELIEF VALVES

A. Manufacturers:

1. Watts, or equivalent.

B. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.10 COMPRESSED AIR OUTLETS

A. Compressed Air Outlets: Quick Connector: 1/4-inch brass, snap on connector with self-closing valve.

2.11 AIR COMPRESSOR

A. Manufacturers:

1. Quincy Model QGS 10, Sullair, or equal.

B. Air Compressor: tank mounted compressor unit consisting of air-cooled compressor, air receiver, after cooler, and operating controls.

C. Rotary Compressors:

1. Unit: Rotary screw compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves, on cast iron or welded steel base for motor and compressor with provision for V-belt adjustment.

2. Automatic Capacity Reduction Equipment: Suction valve unloading device with lifting mechanism. Furnish unloaded compressor start.

3. Motor: Constant speed 1800 rpm with electronic overheating protection in each phase with full voltage starting.

D. Capacity:

1. Continuous Delivery: 34 cfm of compressed air.

2. Intake Conditions: 325 cfm of free air, 75 degrees F.

3. Discharge Conditions: 125 psi at 920 ft altitude.

E. Electrical Characteristics:

1. 10 hp.

2. 480 volts, three phase, 60 Hz.

F. Controls:

1. Pressure Switch: Line voltage contactor to break at 100 psi with minimum differential of 20 psi.

G. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

H. Disconnect Switch: Factory mount on equipment.

2.12 REFRIGERATED COMPRESSED AIR DRYER

A. Manufacturers:

1. Quincy, or equal.

B. Refrigerated Air Dryer: Self-contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Air to air and refrigerant to air coils. Furnish heat exchangers with automatic control system to bypass refrigeration system on low or no-load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 39 degrees F dew point. House unit in steel cabinet with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage.

H. Capacity:

1. Discharge Air: 39 degrees F atmospheric dew point.

2. Rated Air Flow: 64 cfm.

3. Inlet Air Pressure: 125 psig.

I. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2. Full load: 0.4 kW.

J. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

K. Disconnect Switch: Factory mount on equipment.

2.13 AIR RECEIVER

A. Manufacturers:

1. Quincy, or equal.

B. Air Receiver: Horizontal, built to ASME Section VIII regulations for working pressure of 125 psi. Flange or screw inlet and outlet connections.

C. Fittings: Adjustable pressure regulator, safety valve, pressure gage, drain valve, and automatic float actuated condensate trap.

D. Size:

1. Capacity: 120 gallons.

2.14 AIR PRESSURE REDUCING VALVE

A. Air Pressure Reducing Valve: Consisting of automatic reducing valve and bypass, and low-pressure side relief valve and gage. Furnish oil separator.

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upward from reduced pressure.

2.15 PRESSURE REGULATORS

A. Pressure Regulators: Pilot operated, bronze body, direct acting, spring loaded, manual pressure setting adjustment, rated for 250 psig inlet pressure.

2.16 COMPRESSED AIR FILTERS

A. Mechanical Separation Filter: 2 stage. Furnish with deflector plates, resin impregnated ribbon type filters with 40-micron thick edge filtration and drain valve.

B. Coalescing Filters: Furnish with activated carbon capable of removing water and oil aerosols, with color-change dye indicating when carbon is saturated and warning light indicating when maximum pressure drop has been exceeded.

2.17 HOSE CONNECTORS

A. Manufacturers:

1. Compressed Air Systems, or equivalent.

B. Hose Connectors: Corrugated stainless-steel tubing with stainless steel wire braid covering and ends welded to inner tubing.

C. Working Pressure: 250 psig minimum.

D. End Connections:

1. 2 inches and Smaller: Threaded steel pipe nipple.

PART 3 EXECUTION

3.01 EXAMINATION

A. 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify connection size, location, and invert are as indicated on Drawings.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

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

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.04 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.1, ASME B31.9, and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support riser piping independently of connected horizontal piping.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Provide sheet lead packing between hanger or support and piping.

I. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.05 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

A. Install drip connections with valves at low points of piping system.

B. Install take-off to outlets from top of main, with shut off valve after take-off. Slope take-off piping to outlets.

C. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated as indicated on Drawings.

D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

E. Cut pipe and tubing accurately and install without springing or forcing.

F. Slope piping in direction of flow.

G. Stainless Steel Pipe with press-type Joints: Square cut ends to plus or minus 0.030 inches tolerance. Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting during assembly. Press joint using manufacturer's tool with proper sized jaw.

H. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions.

I. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

J. Install pipe identification in accordance with Section 15075.

K. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.

L. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

M. Install strainers on inlet side of pressure regulators.

3.06 INSTALLATION - EQUIPMENT

A. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side. Refer to Section 03300.

B. Install air compressor unit on vibration isolators. Level and bolt in place.

C. Install air valve and drain connection on horizontal casing.

D. Install line size shut-off valve and check valve on compressor discharge.

E. Install replaceable cartridge type filter silencer for each compressor.

F. Install shut-off valve on water inlet to after cooler. Pipe drain to floor drain.

G. Install condensate drain piping to nearest floor drain.

H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.

I. Provide bypass with valves, around receivers.

3.07 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1, ASME B31.9.

B. Verify for atmospheric pressure in piping systems, other than system under test.

C. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 50 psi.

3.08 CLEANING

A. Blow systems clear of free moisture and foreign matter.

3.09 SCHEDULES

PIPE HANGER SPACING		
PIPE SIZE Inches	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
1/2	7	3/8
3/4	7	3/8
1	7	3/8
1-1/4	7	3/8
1-1/2	9	3/8
2	10	3/8
2-1/2	11	1/2
3	12	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	3/4
10	22	7/8
12	23	7/8
14	25	1
16	27	1
18	28	1
20	30	1-1/4
24	32	1-1/4
PVC (All Sizes)	6	3/8

END OF SECTION

SECTION 15410
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Water closets.
2. Lavatories.
3. Service sinks.
4. Emergency Combination Shower with Eye and Face Wash.

B. This Section includes representative examples of plumbing fixtures and trim. Select, repeat, and edit for Project conditions.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer’s recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
   a. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.
   b. Product Data: Submit catalog illustrations of fixtures, sizes, [rough-in dimensions, utility sizes, trim, and finishes.
   c. Submit manufacturer’s installation instructions including mounting and support requirements.
2. Information for the Record:
   a. Material certificates.
   b. Operation and maintenance manual.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with State or Municipality standard.

B. Provide products requiring electrical connections listed and classified by [testing firm acceptable to authority having jurisdiction] as suitable for purpose specified and indicated.

C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

D. Maintain one copy of each document on site.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

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.

1.06 EXTRA MATERIALS

A. Furnish two sets of faucet washers, flush valve service kits, lavatory supply fittings, shower heads, and toilet seats.

1.07 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 FLUSH VALVE WATER CLOSETS

A. Wall Hung:

1. Manufacturers: American Standard Model Afwall 2257.101, Kohler, Crane, or equal.

2. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2-inch top spud, china bolt caps.

B. Floor Mounted:

1. Manufacturers: American Standard Model Afwall 2257.101, Kohler, Crane, or equal.

2. Bowl: ASME A112.19.2M; floor mounted, siphon jet 17-inch bowl height, ADA accessible vitreous china closet bowl, with elongated rim, 1-1/2-inch top spud, china bolt caps.

C. Exposed Flush Valve:

1. Manufacturers: Sloan Model Royal 110, American Standard, or equal.

2. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.6 gallon flush volume.

D. Seat:

1. Manufacturers: Bemis Model 1955CT 000, Church, or equal.

2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Wall Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.02 LAVATORIES (WALL HUNG):

A. Construction: ASME A112.19.2, American Standard Model Decorum 9134004EC, ADA compliant, 21 inches x 20-1/4 inches, white vitreous china, wall hung lavatory, drillings on 4-inch centers, rear overflow, recessed self-draining deck with minimal splash, with concealed arm or wall support.

B. Faucet: ANSI A117.1, American Standard Model Monterrey 7500.175, 4-inch centerset faucet, rigid/swivel gooseneck spout, vandal-resistant wrist blade handles, cast brass construction with shank nuts and brass coupling nuts. Water conserving vandal resistant 0.5 gpm, pressure compensating, multi-laminar spray.

C. Accessories: Chrome plated 17-gauge brass P-trap with cleanout plug and arm with escutcheon, offset waste with perforated open strainer, wheel handle stops, flexible supplies, with water supplies, trap, and waste insulated to meet ADA compliance.

2.03 UTILITY SINK:

A. ASME A112.19.1, E.L. Mustee & Sons, Inc., Model UTILATUB 19F molded thermoplastic resin with heavy gauge steel legs.

B. Faucet: ANSI A117.1, American Standard Model Monterrey 7500.175, 4-inch centerset faucet, rigid/swivel gooseneck spout, vandal-resistant wrist blade handles, cast brass construction with shank nuts and brass coupling nuts. Water conserving vandal resistant 0.5 gpm, pressure compensating, multi-laminar spray.

2.04 EMERGENCY COMBINATION SHOWER WITH EYE AND FACE WASH

A. Manufacturers: Speakman SE-697, or equal

B. Shower: ANSI Z358.1; free standing, self- cleaning, non-clogging 8-inch diameter shower head, instant action stay open valve actuated by rigid stainless steel pull rod.

C. Eyewash: ANSI Z358.1; Polypropylene bowl with elbow, 1-1/4-inch stainless steel pipe pedestal with floor flange, instant action stay open valve actuated by push flag or foot pedal, twin spray heads, dust cover assembly, and tailpiece and chrome plated brass P-trap. Eyewash to provide 2.4 gpm water continuously.

D. Supply and Waste Piping: 1-1/4-inch galvanized steel pipe pedestal with floor flange.

E. Furnish universal emergency sign.

F. Furnish corrosion resistant powder-coated coating on stanchion.

G. Flow Switch: Manufacturer to provide a 115/1/60 flow switch for activation of an alarm condition to the PLC whenever the shower or eye/face wash is activated. Switch must be able to activate at low flows when only the eye/face wash is in use.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify electric power is available and of correct characteristics.

C. Confirm millwork is constructed with adequate provision for installation of countertop lavatories and sinks.

3.02 PREPARATION

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

3.03 INSTALLATION

A. Install Work in accordance with State or Municipality standards.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports, wall carriers, and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.04 INTERFACE WITH OTHER PRODUCTS

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

3.05 ADJUSTING

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

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit use of fixtures before final acceptance.

3.08 SCHEDULES

A. Fixture Mounting Heights:
   1. Water Closet:
      a. Standard: 15 inches to top of bowl rim.
      b. Accessible: 18 inches to top of seat.
   2. Water Closet Flush Valves:
      a. Standard: 11 inches min. above bowl rim.
      b. Recessed: 10 inches min. above bowl rim.
   3. Lavatory:
      a. Standard: 31 inches to top of basin rim.
      b. Accessible: 34 inches to top of basin rim.
   4. Emergency Eye And Face Wash: Standard: 38 inches to receptor rim.
   5. Emergency Shower: Standard: 84 inches to bottom of head.

B. Fixture Rough-In:

Fixture	Hot inches	Cold inches	Waste inches	Vent Inches
Water Closet (Flush Valve):		1	4	2
Water Closet (Tank Type):		1/2	4	2
Lavatory:	1/2	1/2	1-1/2	1-1/4
Service Sink:	1/2	1/2	2	1-1/2
Service Sink:	1/2	1/2	3	1-1/2

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15480
ELECTRIC DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing light duty and commercial electric water heaters and accessories to complete the water heating system for each service or combination of services.

B. Each water heater shall be adequate to provide the quantity of hot potable water as shown on the Drawings.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Submit dimensioned drawings and manufacturer's catalog literature of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics, wiring diagrams, and connection locations.

b. Submit manufacturer's installation instructions including mounting and support requirements.

2. Information for the Record:

a. Material certificates.

b. Licenses and permits.

c. Operation and maintenance manual.

B. All units to be certified, listed, and stamped as necessary by UL. In addition, as the usage demands, the unit shall meet the recommendations of NSF, meet construction requirements of ASME and be so stamped if required, be certified by the National Board of Boiler and Pressure Vessel Inspectors.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with applicable codes and standards.

B. Regulatory requirements:

1. Conform to ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

2. Conform to NFPA 70 and UL for water heaters.

C. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

1.04 CONTRACT DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of waters heaters and piping.

B. The exact location of water heaters and piping shall be ascertained by the Contractor in the field, and the Work shall be laid out accordingly. Should the Contractor fail to ascertain such locations, the Work shall be changed at his own expense when so ordered by the Engineer. The Engineer reserves the right to make minor changes in the location of piping and water heaters up to the time of installation without additional cost to Owner.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

2. Accept water heaters on site in original labeled cartons and inspect for damage.

3. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

B. After Installation:

1. Suitable covers and guardrails shall be placed to protect against chipping enamel or denting the surfaces of any water heaters after it is installed and during final days of construction.

2. Before acceptance, all covers and protective material shall be removed and the water heaters cleaned and ready to use.

PART 2 PRODUCTS

2.01 LIGHT DUTY ELECTRIC WATER HEATERS

A. Manufacturers: Lochinvar Model LTD-120 XR, A.O. Smith, Bradford White, or equal.

B. Type: Automatic, electric, vertical storage.

C. Tank: Glass lined, welded steel, thermally insulated with Non-CFC foam insulation and encased in corrosion-resistant steel jacket with baked-on enamel finish.

D. Heating Elements: Zinc coated, immersion type, copper sheathed or nichrome elements, threaded or flanged in for easy service and replacement, wired for simultaneous operation.

E. Controls: Automatic water thermostat with externally adjustable controller, temperature range from 120 to 170 degrees F, enclosed controls and electrical junction. Automatic overheat safety control with manual reset high limit.

F. Accessories: Brass water connections and dip tube, brass drain valve, high density magnesium anode, and ASME temperature and pressure relief valve.

G. Performance:

1. Storage Capacity: 120 gallons.
2. Immersion Heating Elements: 6000 W upper; 6000 lower.
3. Minimum Recovery Rate: 49 gph with 100-degree F temperature rise.
4. Maximum Working Pressure: 150 psig.
5. Electrical (V/PH/HZ): 480/3/60.
6. Ratings: Thermal efficiency not less than requirements of ASHRAE 90.1.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions

B. Install to UL requirements.

C. Maintain manufacturer's recommended clearances around and over water heaters.

D. Install water heaters on concrete housekeeping pad, minimum 4-inches high and 6-inches larger than water heater base on each side; follow Section 3300.

E. Connect domestic hot water piping to the outlet water heater connection and cold-water piping to the inlet water heater connection.

F. Provide and install dielectric unions between water heater inlet and outlet connections and water piping.

G. Install discharge piping from temperature and pressure relief valves and drain valves to nearest floor drain.

H. Install water heater trim and accessories furnished loose for field mounting.

I. Install electrical devices furnished loose for field mounting.

J. Install control wiring between water heater control panel and field mounted control devices.

K. Coordinate with plumbing piping and related electrical work to achieve operating system.

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15530
FURNACES

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Gas Fired Furnaces.
2. Evaporator Coil Units.
3. Condensing Units.
4. Thermostats.

B. This Section shall include but not limited to all appurtenances required for complete installation.

C. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

D. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

E. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.47 – Gas-Fired Central Furnaces.

B. Air-Conditioning and Refrigeration Institute:

1. AHRI 210/240 – Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. AHRI 270 – Sound Rating of Outdoor Unitary Equipment.
3. AHRI 520 – Positive Displacement Condensing Units.

C. American Society of Heating, Refrigerating and Air Conditioning Engineers:

1. ASHRAE 15 – Safety Code for Mechanical Refrigeration.
2. ASHRAE 52.1 – Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
3. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. International Code Council:

1. ICC IFGC – International Fuel Gas Code.

E. National Electric Manufacturers Association:

1. NNEMA MG 1 – Motors and Generators.

F. National Fire Protection Association:

1. NFPA 54 – National Fuel Gas Code.
2. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
3. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
4. NFPA 211 – Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Buring Appliances.

G. Underwriters Laboratories Inc.:

1. UL 207 – Refrigerant-Containing Components and Accessories, Nonelectrical.

H. United States Department of Energy:

1. DOE 10 CFR – Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
    a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    b. Product Data: Submit rated capacities, fan curves, materials of construction, efficiencies, weights, dimensional drawings, required clearances, and location and size of field connections, accessories, electrical nameplate data, and wiring diagrams.
    c. Design Data: Indicate refrigerant pipe sizing.
    d. Manufacturer's Installation Instructions: Submit rigging, assembly, and installation instructions.
    e. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
2. Information for the Record:
    a. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, service instructions, installation instructions, maintenance and repair data, and parts listing.

1.04 QUALITY ASSURANCE

A. Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR and ANSI Z21.47.

B. Perform Work in accordance with applicable standard.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept furnaces, humidifiers, electronic air cleaners, condensing units and thermostats on site in factory packaging. Inspect for damage.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install condensing unit foundation pad when ground is frozen or muddy.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

2.01 EXTRA MATERIALS

A. Furnish two pilot thermocouples and four sets of filters for each furnace.

PART 2 PRODUCTS

2.01 GAS FIRED FURNACES

A. Gas Furnace:

1. Manufacturers: Trane Model 4TXC + S9X2B, Carrier, Lennox, or equal.
2. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter and accessories; wired for single power connection with control transformer.
    a. Air Flow Configuration: Horizontal.
    b. Fuel: Natural gas fired.
    c. Electric Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.
    d. Accessories: Concentric wall termination kit.
3. Provide equipment that is UL listed as suitable for clearance space available in installed location.
4. Cabinet: Steel with baked enamel finish, easily removed and secured access panels with safety interlock switches for furnaces installed indoors, insulation.
5. Supply Fan: Centrifugal type rubber mounted with direct drive, adjustable variable pitch motor pulley.

6. Motor: Direct drive Refer to Division 16 and NEMA MG 1; 1075 rpm variable speed, permanently lubricated.
7. Heat Exchanger: Stainless steel tubular type.
8. Gas Burner:
    a. Atmospheric type with adjustable combustion air supply.
    b. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety ignition system, manual On-Off valve, pilot filtration, automatic electric valves.
    c. Electronic or pilot ignition, with hot surface igniter.
    d. Combustion air damper with synchronous spring return damper motor.
    e. Corrosion resistant combustion air blower with permanently lubricated motor.
9. Gas Burner Safety Controls:
    a. Flame rollout switch: Installed on burner box and prevents unsafe operation.
    b. Blocked Vent shutoff system: Temperature sensor installed on draft hood and prevents operation, manual reset.
    c. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive outlet air temperature, automatic resets.
10. Operating Controls:
    a. Room Thermostat: Cycles furnace system on and off to maintain room temperature setting.
    b. Supply Fan Control: Energize from outlet air temperature or timer device independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.
11. Air Filters: 1-inch-thick glass fiber, disposable type arranged for easy replacement.
12. Performance:
    a. Ratings: Seasonal Efficiency Rating not less than requirements of ASHRAE 103.
    b. Refer to Furnace Schedule. Gas heating capacities are sea level ratings.

B. Evaporator Coil Units:
1. Construction and Ratings: In accordance with AHRI 210/240.
2. Evaporator Coil: Copper tube aluminum fin assembly, galvanized or polymeric drain pan, drain connection, refrigerant piping connections, restricted

distributor or thermostatic expansion valve, steel cabinet with baked enamel finish and insulation.

C. Condensing Units:

1. Manufacturers - Trane Company Model 4TT, Carrier, or approved equal.
2. General - Condensing unit shall be factory fully charged for matched indoor section and up to the length of the refrigerant piping.
3. Casing - Unit casing shall be constructed of heavy gauge, galvanized steel and painted with weather resistant powder paint. Corrosion and weatherproof CMBP-G30 base.
4. Refrigerant Controls - Refrigeration system controls shall include condenser fan and compressor contactor, high- and low-pressure controls, and standard liquid line drier. Provide for low ambient cooling down to 0 degrees F.
5. Compressor - Scroll type compressor with total dipped hermetic motor, with centrifugal oil pump. Compressor shall be resiliently mounted integral with condenser, with positive lubrication, compressor motor starter, crankcase heater, high pressure control, motor overload protection, anti-cycle timer to prevent restart for at least 5 minutes after start-up, and service valves. Provide time delay control to prevent short cycling.
6. Condenser Coil - Outdoor coil shall be constructed of copper tube and aluminum fins with direct drive axial propeller fan and galvanized fan guard. Coil shall provide low airflow resistance and efficient heat transfer. The coil shall be protected on all four sides by louvered panels.
7. Refrigerant - Furnish with a charge of refrigerant R-410a.
8. Refrigerant Accessories - Provide liquid line filter and sight glass, suction filter dryer, high pressure switch (manual reset), low pressure switch (automatic reset), service valves, and gage ports, thermometer well (in liquid line). Provide thermostatic expansion valves. Provide refrigerant lines, factory-cleaned, dried, pressurized and sealed, with insulated suction line.

2.02 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Division 16.

B. Motors: In accordance with Division 16.

C. Disconnect Switch: Mount switch on or near equipment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify building is ready for installation of units and openings are as indicated on Drawings.

3.02 INSTALLATION

A. Install Work in accordance with applicable codes and standards.

B. Install gas fired furnaces in accordance with NFPA 54.

C. Install vent connections in accordance with NFPA 211 and NFPA 54.

D. Install refrigeration systems in accordance with ASHRAE 15.

E. Mount condensing units on concrete pads or footers or accessory pads.

F. Installation – Natural Gas Piping:

1. Connect natural gas piping in accordance with NFPA 54.

2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

3. Install the following piping accessories on natural gas piping connections. Refer to Section 15195.

a. Strainer.

b. Pressure gage.

c. Shutoff valve.

d. Pressure reducing valve.

G. Pipe drain from cooling coils to exterior.

H. Connect units to electric supply and connect controls remote from units.

I. Install control components supplied with equipment and provide control wiring.

J. Install control wiring between thermostat, indoor unit, and outdoor unit.

K. Install evaporator unit in section of lined ductwork fastened to furnace. Connect return air and evaporator unit duct to system ductwork with flexible duct connection. Refer to Section 15820.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15540
FUEL-FIRED HEATERS

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Gas fired unit heaters.

B. This Section includes indirect fired, gas unit heaters.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI Z83.8 - Gas Unit Heaters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

3. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

4. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Provide manufacturer's product data including rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams

2. Information for the Record:

a. Operation and maintenance manual. Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Section 01600 - Product Requirements: Product storage and handling requirements.

2. Accept heaters and controls on site in factory packaging. Inspect for damage.

1.06 QUALITY ASSURANCE

A. Gas-Fired Unit Heater Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with ANSI Z83.8.

B. Perform Work in accordance with applicable codes and standards.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 GAS FIRED UNIT HEATERS

A. Manufacturers: Reznor model UDZ, or equal.

B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:

1. Heating fuel: Natural gas fired.

2. Discharge Louvers: Individually adjustable vertical louvers to match cabinet finish.

3. Gas Control: Single stage, two stage for larger units.

4. Ignition System: Electric direct ignition.
5. Control Voltage: 24-volt, 60 hertz.
6. Location: Suspended overhead.

C. Cabinet: Galvanized steel, easily removed and secured access panels, insulated or double panel construction.

D. Supply Fan: Propeller.

E. Heat Exchanger: Aluminized steel welded construction.

F. Gas Burner: Power-vented with non-corrosive air blower with permanently lubricated motor.

G. Gas Burner Safety Controls:

1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
2. Flame rollout switch: Installed on burner box and prevents operation.
3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic reset.

H. Controls:

1. Room Thermostat: Adjustable, low voltage, to control burner operation, heater stages in sequence with delay between stages on larger units, and supply fan to maintain temperature setting.
2. Supply Fan Control: Energize either from discharge temperature independent of burner controls or with timed off delay and timed on delay. Furnish manual switch for continuous fan operation.

I. Performance:

1. Air flow: 629 cfm.
2. Motor: 0.06 hp two speed.
3. Heating Capacity:
    a. Heating output: 37350 Btuh.
    b. Heating input: 45000 Btuh.
    c. Annual fuel utilization efficiency (AFUE): 83 percent.
    d. Gas heating capacities are sea level ratings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify space is ready for installation of units and openings are as indicated on shop drawings.

3.02 INSTALLATION

A. Install units in accordance with gas fired units to NFPA 54.

B. Installation - Natural Gas Piping:

1. Connect natural gas piping in accordance with NFPA 54.
2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
3. Install the following piping accessories on natural gas piping connections. Refer to Section 15195.
    a. Strainer.
    b. Pressure gage.
    c. Shutoff valve.
    d. Pressure reducing valve.

C. Install vent connections in accordance with NFPA 211. Install vents and stacks. Refer to Section 15550.

D. Install unit heaters with vibration isolation.

E. Provide hangers and supports for suspended units. Support infrared radiant heaters in fixed position.

F. Provide hangers and supports for suspended units.

G. Provide operating controls.

H. Provide connection to electrical power systems. Refer to Section 16150.

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15550
BREECHING CHIMNEYS AND STACKS

PART 1 GENERAL

1.01 SCOPE

A. This section includes furnishing all materials, equipment, labor, and supervision related to the following:

1. Type B double wall gas vents.
2. Double wall metal stacks.
3. Single wall metal stacks.

B. The completion of the Work in accordance with the Contract Documents.

C. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

D. All wall, roof, and floor penetrations for any building modifications which are required for the installation of the Work under this Section shall be provided by this Section. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

E. in Division 15 as included shall be provided by this Contract.

F. Provide and install all equipment specified within this Section.

G. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.66 - Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

B. ASTM International:

1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

5. ASTM C401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories.

C. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

2. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - Guide for Steel Stack Construction.

2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:

1. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances.

2. UL 378 - Draft Equipment.

3. UL 441 - Gas Vents.

1.03 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: Portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: Part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.04 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop drawings for review:

a. Indicate general construction, dimensions, weights, support and layout of breeching. Submit layout drawings indicating plan view and elevations. Where factory-built unit is used; signed and sealed by professional engineer.

b. Product Data: Submit manufacturers published literature indicating factory-built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and

connection requirements, product description, thermal characteristics, list of materials and thickness for each service, and location. Include the method of fastening.

2. Information for the record:

a. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

b. Substantiation of vendor compliance with codes, standards, or test methods noted herein.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State and local code standards.

B. Provide factory-built vents and chimneys used for venting natural draft appliances complying with NFPA 211 and UL listed and labeled.

C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum three years documented experience.

D. Applicator: Company specializing in performing Work in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. In accordance with the requirements of Section 01350 concerning transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation form weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.07 ENVIRONMENTAL REQUIREMENTS

A. In accordance with the requirements of Section 01350 concerning environmental conditions affecting products on site.

B. Maintain water integrity of roof during and after installation of chimney or vent.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 TYPE B DOUBLE WALL GAS VENTS

A. Manufacturers:

1. Selkirk Corporation.

2. American Metal Products.
3. Metal-Fab, Inc.
4. Or equal.

B. Construction:

1. Outer Wall: Constructed of G-90 galvanized steel
   a. Diameters 3 Inch to 14 Inch: 0.018 inch thick.
   b. Diameters: 16 Inch to 30 Inch: 0.024 inch thick.
2. Inner Wall: Constructed of aluminum alloy.
   a. Diameters 3 Inch to 8 Inch: 0.012 inch thick.
   b. Diameters: 10 Inch to 30 Inch: 0.018 inch thick.
   c. Inner pipe constructed of sheet aluminum alloy, 0.12 inch thick for sizes 3 inch to 8 inch diameter, 0.18 inch thick for sizes 16 inch to 30 inch diameter. Outer wall and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

PART 3 EXECUTION

3.01 PREPARATION

A. Install concrete inserts for support of breeching, chimneys, and stacks in coordination with formwork.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 54 (ANSI Z223.1), NFPA 31, or SMACNA Guide for Steel Stack Construction.

C. Install breeching with minimum of joints. Align accurately at connections, with internal surfaces smooth.

D. Support breeching from building structure, rigidly with suitable ties, braces, hangers, and anchors to hold to shape and prevent buckling. Support vertical breeching, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

E. Install stacks on concrete foundations. Refer to Section 03300.

F. Pitch breeching with positive slope up from fuel-fired equipment to chimney or stack.

G. Coordinate installation of dampers, and induced draft fans.

H. Insulate breeching in accordance with Section 15081.

I. For Type B double wall gas vents, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories for complete installation.

J. Install vent dampers, locating close to draft hood collar, and secured to breeching.

K. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

L. Level and plumb chimney and stacks.

M. Clean breeching, chimneys, and stacks during installation, removing dust and debris.

N. Install slip joints allowing removal of appliances without removal or dismantling of breeching, breeching insulation, chimneys, or stacks.

O. Provide minimum length, maximum 2 feet of breeching to connect appliance to chimney. Provide Type B chimney continuously from appliances.

P. Extend vent above roof in accordance with applicable code.

Q. Maximum Vent Horizontal Distance: 75 percent of vent vertical distance.

R. Where appliance requires draft hood or barometric control device, install manufacturer furnished listed devices in accordance with manufacturer's instructions and applicable code.

END OF SECTION

SECTION 15760
TERMINAL HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Fan coil units.
2. Electric unit heaters.
3. Electric wall heaters.

2.01 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. AHRI 410 – Forced-Circulation Air-Conditioning and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:

1. SMACNA – HVAC Duct Construction Standard – Metal and Flexible.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Descriptive information of all mechanical and electrical items used in providing a complete job.

c. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

d. Provide and submit manufacturer's product data including coil and frame configurations, materials of construction, dimensions, materials, rows, connections, and rough-in dimensions, mechanical and electrical service locations, capacities, and accessories or optional items.

e. Schematic wiring diagrams and electrical load requirements.

f. Shop Drawings shall include data for all equipment, piping, and valves, controls, accessories, and electrical apparatus to be supplied with equipment.

2. Information for the Record:

a. Operation and maintenance manual. Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.03 ELECTRICAL AND CONTROL COORDINATION

A. All equipment shall be powered electrically and wired as required in Division 16.

1.04 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

2. All equipment and appurtenances shall be accepted on site in factory packaging. Inspect for damage.

B. After Installation:

1. Protect installed equipment from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

2. Suitable covers shall be placed to protect against any equipment damage after it is installed and during the final days of construction.

3. Before acceptance, all covers and protective material shall be removed and the equipment cleaned and ready for use.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Section 01600 - Product Requirements: Product storage and handling requirements.

2. Accept heaters and controls on site in factory packaging. Inspect for damage.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept units on site in factory packing. Inspect for damage. Store under roof.

B. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by strong indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Conform to applicable code for internal wiring of factory-wired equipment.

B. Heating units shall be UL listed and comply with the requirements of the National Electrical Code.

C. Fans shall be AMCA certified.

D. Contractor shall check electrical, architectural, and piping drawings for possible interferences and shall coordinate installation with other contractors.

E. Equipment shall be as indicated in the Specifications and on the Drawings.

F. Where noted, all coils shall be coated externally with a thermal setting, two coat, corrosive resistance to sulfides coating such as Liberty Plastics & Metals, Libcote-7, Heresite P-403 or equal. Coil to be completely degreased and free of paint and soft solder. Unit to be coated by a dip and baking operation and repeated for a 2-mil minimum thickness. Coating to reduce heat transfer rate by less than 5% with a thermal conductivity of 7000 Btuh/mil-SF. Application when finished must meet requirements of the USDA and FDA.

PART 2 PRODUCTS

2.01 FAN COIL UNITS (FC)/CONDENSING UNITS (CU)

A. Fan Coil Units:

1. Manufacturers - Trane Company, Model BCHD, or approved equal.

2. General - Units shall be completely factory assembled as a package; including all unit mounted controls, wiring, and accessories. Factory fabricate and test fan coil units of sizes, capacities, and configuration as indicated and specified. Units shall be fully assembled and packaged. Cabinet shall be of the draw-thru design type, horizontal flow arrangement, for interior use only. Components shall consist of a supply fan section, DX coil section, filter section, and electric resistive coil heating section.

3. Casing - Constructed of 18-gauge galvanized, insulated with 1-inch thick, 1-1/2-pound density fire resistant and odorless glass fiber material to provide thermal and acoustical insulation. Fan housing sides are directly attached to the unit top and bottom panels, strengthening the entire unit assembly. Internal coils are attached directly to the rear mounting lugs. Coil access panels are located on both sides of the unit and allow easy removal of the internal coil and drain pan. Main access panels with generous access to the fan, motor, and drive from both sides.

4. Evaporator Coils - Aluminum fins mechanically bonded to 1/2-inch seamless copper tubes designed and circuited for water use. Sweat connections. Factory tested with 450 psig air under water.

5. Fan Section - Forward curved fan, centrifugal type. Dynamically and statically balanced. Heavy-duty adjustable speed V-belt drive. Fan shaft supported by heavy-duty permanently sealed ball bearings.

6. Electric Heating Coil - Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings easily accessible with automatic reset thermal cut-out, built-in contactors, galvanized steel frame, control circuit transformer and fuse. And load fuses.

7. Drain Pan - White plastic construction sloped in two directions and fully drainable. The coils mount above the drain pan. Drain pan connections are unthreaded 3/4-inch Schedule 40 PVC for solvent bonding. Provide adaptor for connection to copper condensate piping.

8. Filters - Filter efficiency and weight Arrestance shall be determined in accordance with ASHRAE STD 52; air cleaning devices used in general ventilation for removing particulate matter. Throwaway filters shall be two-inch thick pleated media, 50 percent efficiency.

9. Motors - Totally enclosed, fan cooled (TEFC) with permanently sealed ball bearings, internal overload protection, 1.15 service factor, and resilient base frame. Factory installed and wired to the unit's junction box.

10. Controls - Fan contactor, low voltage terminal strip, low voltage transformer, disconnect switch, and all necessary controls shall be factory installed and wired.

B. Condensing Units:

1. Manufacturers - Trane Company, Model TTA, or approved equal.

2. General - Condensing unit shall be factory fully charged for matched indoor section and up to the length of the refrigerant piping.

3. Casing - Unit casing shall be constructed of heavy gauge, galvanized steel, and painted with weather resistant powder paint. Corrosion and weatherproof CMBP-G30 base.

4. Refrigerant Controls - Refrigeration system controls shall include condenser fan and compressor contactor, high- and low-pressure controls, and standard liquid line drier. Provide for low ambient cooling down to 0 degrees F.

5. Compressor - Scroll type compressor with total dipped hermetic motor, with centrifugal oil pump. Compressor shall be resiliently mounted integral with condenser, with positive lubrication, compressor motor starter, crankcase heater, high pressure control, motor overload protection, anti-cycle timer to prevent restart for at least 5 minutes after start-up, and service valves. Provide time delay control to prevent short cycling.

6. Condenser Coil - Outdoor coil shall be constructed of copper tube and aluminum fins with direct drive axial propeller fan and galvanized fan guard. Coil shall

provide low airflow resistance and efficient heat transfer. The coil shall be protected on all four sides by louvered panels.

7. Refrigerant - Furnish with a charge of refrigerant R-410a.

8. Refrigerant Accessories - Provide liquid line filter and sight glass, suction filter dryer, high pressure switch (manual reset), low pressure switch (automatic reset), service valves, and gage ports, thermometer well (in liquid line). Provide thermostatic expansion valves. Provide refrigerant lines, factory-cleaned, dried, pressurized and sealed, with insulated suction line.

C. Controls:

1. Wall-mounted remote thermostat with single stage heating and single stage cooling with manual changeover. Furnish system selector switch off-heat auto-cool.

D. Spare Parts:

1. Furnish one spare set of replacement filters and one spare set of belts for each V-belt drive motor.

2.02 ELECTRIC UNIT HEATERS

A. Manufacturers: Chromalox, Type LUH; Q-Mark, Type MUH, or approved equal.

B. General: Electric unit heater, horizontal projection, suspended above the floor from the wall.

C. Assembly: UL listed and labeled assembly with terminal box and cover, with controls.

D. Heating Elements: Corrosion resistant steel fins furnace brazed to the tubular element.

E. Heating Contactors: Heavy duty magnetic type with thermal cutouts that open the control circuit and disconnect power to the heating elements when overheating occurs. Automatic reset shall allow the control circuit to reclose and restore power when temperature returns to normal.

F. Cabinet: Heavy 18-gauge steel, phosphate undercoated for corrosion resistance and finished in polyester powder coat, with easily removed front panel.

G. Discharge Louvers: Individually adjustable louvers allowing directional airflow up or down.

H. Fan: Direct-drive propeller type, statically and dynamically balanced, attached with rubber vibration insulators, with fan guard on inlet.

I. Fan Motor: Totally enclosed fan motor is rated for continuous duty with built-in thermal overload protection. Permanently lubricated, sleeve bearings.

J. Wall Mounting Bracket: Swivel-mount hanger provided by the manufacturer with swivel bolt permitting heater 180 degrees of rotational direction.

K. Controls:

1. Heating Control Contactor: Built-in and rated at 120 volts, single- phase, 60 Hz.
2. Thermostat:
    a. Manufacturer: Chromalox Type WR-80, or approved equal.
    b. General: UL listed, wall-mounted thermostat with metal enclosure, positive snap-action switch, 3 degrees F control differential, with minimum adjustable temperature range of 40 to 80 degrees F, 120/1/60.

2.03 CORROSION-RESISTANT ELECTRIC UNIT HEATERS

A. Manufacturers: Chromalox Type HD3D, Q-Mark Type JUW, Indeeco Series TRIAD, or approved equal.

B. General: UL listed, NEMA 4X rated for hose down requirements, horizontal projection, with all metal parts including fan; fabricated with stainless steel or coated with a corrosion-resistant paint.

C. Casing: Roll Formed, material not less than 20-gauge corrosion resistant Type 304 stainless steel. Finish shall be epoxy coated stainless steel.

D. Heating Elements: Fin tube type heating elements constructed of Type 316 stainless steel tubing and fins. Elements constructed of high-quality resistance wire imbedded in a compacted magnesium oxide refractory for dielectric strength and optimum thermal conductivity. fin tubular element with automatic reset thermal overheat protection.

E. Heating Contactors: Heavy duty magnetic type with thermal cutouts that open the control circuit and disconnect power to the heating elements when overheating occurs. Automatic reset shall allow the control circuit to reclose and restore power when temperature returns to normal.

F. Fan: Epoxy coated aluminum fan blades, dynamically balanced, resilient mounting, for vibration free operation, with a heavy wire rear protection grille

G. Fan Motor: Totally enclosed, epoxy coated motor, with permanently lubricated bearings designed to resist moisture and corrosion, and built-in thermal overload protection. Epoxy coated Type 304 stainless steel fan guard on inlet.

H. Discharge Louvers: Adjustable for directional airflow up or down painted with zinc chromate primer and two coats of corrosion resistant epoxy paint.

I. Wall Mounting Bracket: Type 304 stainless steel swivel-mount hanger provided by the manufacturer with swivel bolt permitting heater 180 degrees of rotational direction.

J. Accessories: Units shall be provided, stainless steel hardware and Type 304 stainless steel universal swivel wall mounting brackets with epoxy coating. Lockable non fused disconnect switch where specified.

K. Controls: NEMA 4X control enclosure housing pre-wired built-in controls: automatic reset over-temperature cutout, fan delay relay to dissipate residual heat build-up after

shutdown, heater contactor, motor contactor, terminal block and 120-volt control voltage transformer.

L. Thermostat:

1. Manufacturer: Chromalox Type WCRT-100, Honeywell T631F1084, or approved equal.

2. Case: UL listed, wall-mounted thermostat, corrosion resistant, NEMA 4X weatherproof enclosure construction, sealed Noryl case with neoprene gasket, positive snap-action switch, 2.5 degrees F control differential, with a minimum adjustable temperature range of 40 to 100 degrees F with knob opening closed with lubricated “O” ring, 120/1/60.

3. Sensing Bulb: Nickel plated shielded sensing bulb attached directly to bottom of enclosure case, shielded from damage and accumulation of insulating particles.

2.04 ELECTRIC WALL HEATERS

A. Manufacturers: Q-Mark, Type CWH, or equal.

B. General: Electric wall heater consisting of a heating element assembly, fan and motor assembly, and controls, all housed in a steel cabinet suitable for exposed mounting on a masonry wall.

C. Wall Box: Provide a steel wall box manufactured by the heater company specifically for mounting in conditions indicated on drawing.

D. Electrical Power (V/PH/HZ): 120/1/60. Provide with built-in power disconnect switch.

E. Controls: Built-in thermostat as provided by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. For recessed units, verify recess dimensions are correct size.

B. Verify wall construction is ready for installation.

C. Verify ductwork is ready for installation.

D. Verify concealed blocking and supports are in place and connections are correctly located.

E. Verify that space is ready to receive Work and opening dimensions are as instructed by the unit manufacturer.

F. Verify required utilities are available, in proper location, and ready for use.

3.02 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install air coils in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible. Refer to Section 15810.

C. Support air coil sections independent of piping on steel channel or double angle frames and secure to casings. Furnish frames for maximum three coil sections. Arrange supports to avoid piercing drain pans. Install with airtight seal between coil and duct or casing.

D. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

E. Install coils level.

F. Make connections to coils with unions and flanges.

G. For cooling coils where air velocity exceeds 500 ft/min, install three break moisture eliminators of 24-gauge galvanized steel.

H. Install insulation air coil casings. Refer to Section 15081.

I. Install drain and drain piping connection for cooling coils. Fabricate drain pan from 20-gauge galvanized steel. Extend 3 inches from face of coil entering air side, 6 inches from face of coil leaving airside. Pipe drain pans individually to floor drain. Refer to Section 15180.

J. On refrigerant coils, install sight glass in liquid piping within 12 inches of coil.

K. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 15081.

L. Wire electric duct coils. Refer to Division 16 specifications.

M. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

N. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

O. Fan-Coil Units: install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

P. Units with Cooling Coils: Install drain piping to condensate drain.

Q. Install electric heating equipment including devices furnished by manufacturer but not factory mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electric wiring in accordance with manufacturer's submittals and Division 16 specifications.

3.03 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

D. Details of material and equipment installation shall conform to manufacturer's latest printed instructions, where not covered by the Drawings and Specifications.

E. Terminal heating and cooling units shall be installed complete as shown on the Drawings and as specified.

F. Hang unit heaters from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

G. Install electric heating equipment including devices furnished by manufacturer but not factory mounted. Furnish copy of manufacturer's wiring diagram submittal. Verify that electrical wiring installation is in accordance with manufacturer's submittals and installation requirements of Division 16 Sections.

3.04 TESTING AND ADJUSTING

A. When the terminal and heating cooling unit systems are complete and ready to be turned over and before final acceptance, Contractor shall run systems for the purpose of testing and adjusting. Air shall circulate freely and there shall be no evidence of leaks or air binding.

B. All equipment shall run at full capacity without undesirable singing, undue vibration, or objectionable noise. All equipment shall deliver specified capacities and Contractor shall deliver to Engineer complete data sheets covering results of tests.

3.05 PROTECTION

A. Protect units with protective covers during balance of construction.

3.06 MOUNTING AND ATTACHMENT

A. The Contractor shall provide all devices and materials such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means required to fasten all equipment and materials to be installed on or in concrete bases or structures which are existing or provided under other sections of the Contract. Foundation bolts shall be set by using manufacturer's templates.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15810
DUCTWORK

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing all materials, equipment, labor, and supervision related to HVAC ductwork systems necessary for the completion of the Work in accordance with the Contract Drawings.

B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

C. Additional product requirements are specified in Section 01350.

1.02 DESCRIPTION OF SYSTEMS AND MATERIAL

A. Systems shall be as shown on the Drawings.

B. Pump Building:

1. Chlorinator Rooms: Aluminum.

2. Electrical Room: Galvanized.

1.03 DESIGN OF SYSTEM

A. The Contractor shall design the duct to meet the required operating pressure by means of duct material thickness, spacing of joints, and reinforcing and joint construction.

1.04 PERFORMANCE REQUIRMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Submit duct fabrication drawings showing general arrangement, dimensions, and sectional assembly, drawn to scale not smaller than 1/4

inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:

1) Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.

2) Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.

3) Materials of construction.

4) Fittings.

5) Reinforcing details.

6) Seam and joint construction details.

7) Penetrations through fire rated and other walls.

8) Terminal unit, coil, and humidifier installations.

9) Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

c. Product Data:

1) Descriptive literature, bulletins, or other data describing each item of equipment.

2) Complete list of accessories and appurtenances included with each item complete with manufacturer's name and model number.

d. Certified leak test as required by SMACNA HVAC Duct Leakage Test Manual.

2. Information for the Record:

a. Certified design capacity data for each section of duct.

b. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

3. Operation and maintenance manual.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with the latest edition as published by SMACNA – HVAC Duct Construction Standards – Metal and Flexible and SMACNA – Thermoplastic Duct (PVC) Construction Manual.

B. Construct ductwork to NFPA 90A standards.

PART 2 PRODUCTS

2.01 DUCTWORK GENERAL

A. Sheet Metal – Rectangular:

1. Ductwork, unless otherwise noted, shall be galvanized sheet metal, stainless steel, or aluminum and shall be built as required by HVAC Duct Construction Standards, Metal and Flexible, latest edition as published by SMACNA and diagrammatically shown on the Drawings.
2. Ductwork 18-inch width and over shall be cross-broken, or ribbed and stiffened, so that it will not “breathe,” rattle, vibrate, or sag.
3. Curved elbows shall have a throat radius equal to the duct width. Provide splitter or turning vane(s) in all elbows.
4. Square elbows shall have double-thickness turning vanes, unless single-thickness vanes are clearly identified on the Drawings.
5. Transitions in ductwork shall be made with a slope not exceeding 1 to 5, preferably 1 to 7.
6. Supply duct splits shall be provided with splitter damper and adjustable locking quadrant. Splitter blade shall be 1.5 times the smaller split width.
7. Supply duct takeoffs shall include an adjustable air-turning device equal to Carnes No. 1250 Variturn Model 2, 3, or 4 or equal.

2.02 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A924 and ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating in conformance with ASTM A90.

B. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum connectors and bar stock; alloy 6061-T6; or of equivalent strength.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36; steel, galvanized or compatible with duct material; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible (Round Duct Construction Standards), and as indicated on the Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's. bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round or oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat weld joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

G. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.

1. Sealants, Mastics, and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.

2. Do not provide sealing products not bearing UL approval markings.

2.04 AUXILIARY EQUIPMENT

A. Duct reinforcing and hangers shall be of the same material as the duct system.

B. Duct splitter dampers - Young Regulator Co., Barber Coleman, Carnes, Hart and Cooley, or equal.

C. Spiral duct - Young Regulator Co., United Sheet Metal Division, or equal.

D. Turning devices - Carnes, Barber Coleman, Hart and Cooley, or equal.

E. Turning devices and splitter damper hardware for fibrous glass duct - Duro Dyne Midwest, or equal.

F. Mastics and Sealers - Foster Products, HB Fuller Co., United McGill, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION OF DUCT SYSTEMS

A. Manufacture, install, seal, and insulate all ductwork as shown on the Drawings and as required in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible.

B. Install glass fiber ducts in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.

C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

E. Use double nuts and lock washers on threaded rod supports.

F. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

G. Exhaust Outlet Locations:

1. Minimum Distance from Property Lines: 3 feet.

2. Minimum Distance from Building Openings: 3 feet.

3. Minimum Distance from Outside Air Intakes: 10 feet.

H. Low pressure ductwork and fittings shall be made tight for minimum air leakage. Large or noisy leaks will not be accepted. Duct tape shall not be used to seal joints, to make transitions, or for any other reason except on the outside of wrapped insulation. Duct tape shall not be used on sheet metal.

I. All ductwork shall have all joints, seams, and laps sealed to Class "C" duct sealing requirements with mastic equal to Hardcast DT-5300 to ensure a completely airtight duct system.

J. All duct systems shall be at least 95% efficient in volumetric transfer. The Contractor shall demonstrate efficiency by testing.

K. Hangers for ductwork shall be in accordance with the SMACNA Standards, Plate Nos. 18 and 19, hanger for ducts and upper attachments. Hanger strap material and angles shall be galvanized. With bar joist and roof construction, use welded studs or C-clamp with retaining clip attached to the bar joist. In all cases, the maximum hanger spacing shall not be exceeded and the hangers shall be readily removable as required by SMACNA.

L. Ducts may be hung from the building construction by strap hangers fastened to the duct in not less than two places and rigidly braced against swaying. Do not fasten any hanger to metal roof decking. Strap material shall be aluminum, stainless steel, or galvanized in order to be compatible with the service requirements.

M. Where ducts pass through walls or floors, sheet metal closures shall be provided to close openings around ducts except where noted by specific detail. All passages shall be airtight to restrict air, moisture, and dust migration.

N. All ductwork exposed to weather shall have all joints, laps, edges, etc., sealed and coated with duct sealer equal to Hardcast DT-5300 and applied with FTO-20 adhesive or approved equivalent.

O. All ductwork exposed to weather and not insulated shall have all joints, laps, edges, etc., sealed and coated with duct sealer equal to Hardcast DT-5300 and applied with FTO-20 adhesive or approved equivalent.

3.03 INSTALLATION OF INSULATED FLEXIBLE DUCT

A. Connect air terminal units and air outlets and inlets to supply ducts with five foot maximum length of flexible duct. Do not use flexible duct to change direction. Flexible duct shall be limited in length to that necessary to make connections between trunk ducts and terminal units. This shall not exceed 5-feet.

B. All duct shall be fully stretched out to reduce resistance.

C. Connections to fittings or terminals shall be made with stainless steel bands, designed for that service. The inner liner shall be clamped tight with the band, then the insulation and jacket pulled up tight against the duct or terminal. Install a second band around the outside of the jacket. Installation shall be as recommended by the duct manufacturer.

D. Support the flexible duct by the hanger strip with support wires on 30-inch intervals to relieve strain on any fitting. Unnecessary bends, sags, twists, etc., will not be allowed.

3.04 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.05 TESTING

A. Subject completed duct system to pressure and leakage test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Test shall be completed after duct cleaning, but before duct insulation is applied or ductwork is concealed.

3.06 DUCTWORK PRESSURE CLASS

A. Design pressure required is 2-inch WC for all ductwork systems.

PART 4 SPECIAL PROVISION

END OF SECTION

SECTION 15820
DUCT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing all materials, equipment, labor, and supervision related to duct accessories necessary for the completion of the Work in accordance with the Contract Documents. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

B. This Section shall include but not limited to all appurtenances required for complete installation.

C. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

D. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

E. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Product Data: Provide manufacturer's data on duct accessories to include catalog information. Submit information that illustrates pressure drops for all sizes of dampers required at all anticipated air flow rates in accordance with AMCA Standard 500.

2. Information for the Record:

a. Operation and maintenance manual. Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.03 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.04 DELIVERY, STORAGE. AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect material and finishes during handling and installation to prevent damage.

1.05 ELECTRICAL AND CONTROL COORDINATION

A. Products Requiring Electrical Connection: Listed and classified by Underwriter's Laboratories, Inc., as suitable for the purpose specified and indicated.

1.06 SPARE PARTS

A. Provide two of each size and type of fusible link.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS

1. Aluminum: Manufacturers: Ruskin Model BD2A2, Arrow, or equal.
2. Construction:
    a. Frame: 2-inch depth, minimum 0.090 inch 6063-T6 extruded aluminum channel with mitered corners, no flanges.
    b. Blades: Single piece, overlap frame, parallel action, minimum 0.050 inch 6063-T6 extruded aluminum, maximum 6-inch width.
    c. Bearings: Corrosion resistant, long life, synthetic, formed as single piece with axles.
    d. Blade Seals: Neoprene, mechanically attached to blade edge.
    e. Linkage: Concealed in frame.
    f. Axles: Corrosion-resistant, long life, synthetic, locked to blade and formed as single piece with bearings.
    g. Finish: Mill aluminum.

2.02 VOLUME CONTROL DAMPERS

A. Galvanized Steel:

1. Manufacturers: Ruskin Model CD-35, Arrow Type 1770, or equal.
2. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated.

3. Construction: Fabricate from galvanized steel, minimum 16 gauge frames and blades. Blades shall overlap when closed. Linkage shall be concealed in frame and out of airstream. Molded synthetic blade bearings. Steel parts factory-coated with enamel.

4. Locking Quadrants: Dampers shall include extended shafts and be capable of being locked in position for air balancing from the exterior and not require further adjustment. File-mark shafts to permanently indicate damper blade position.

5. Dampers 12 inches and over in height shall be opposed blade type.

2.03 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers: Ductmate Industries, Inc., Proflex, Duro Dyne, Metal Fab, or equal.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated.

C. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed, fire-retardant, neoprene-coated, woven glass fiber fabric to NFPA 90A, minimum density 30 ounces per square yard.

2. Net Fabric Width: Approximately 3 inches wide.

3. Metal: 3 inches wide.

a. 0.032-inch-thick aluminum.

2.04 DUCT TEST HOLES

A. Plastic Plugs: Plastic, removable type, duct plugs, for duct test holes used for HVAC duct system air balancing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify ducts and equipment installation are ready for accessories.

B. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION

A. Install in accordance with NFPA 9-A, and follow SMACNA HVAC Duct Construction Standards – Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.

B. Details of ductwork accessories installation shall conform to manufacturer’s latest printed instructions, where not covered by the Drawings and Specifications.

C. Check location of ductwork accessories and make necessary adjustments in position to conform with architectural features and symmetry.

D. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on the Drawings.

E. Provide duct test holes where indicated and required for testing and balancing procedures.

F. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized HVAC equipment, and supported by vibration isolators. For fans developing static pressures of 5.0 inches w.c. and over, cover connections with leaded vinyl sheet, held in place with metal strips.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for balancing. Install minimum two duct widths from duct take-off.

H. Use splitter dampers only where indicated.

I. Provide balancing dampers on high velocity systems where indicated.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

K. The Drawings show approximate location for ductwork accessories. Carefully check electrical and architectural drawings for proper placement of air outlets and inlets and be responsible for exact location and size of openings required.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15830
FANS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing fans as shown and scheduled on the Drawings, and as specified herein.

B. The fans shall be furnished with all drives, belts, guards, support brackets, curbs, anchor bolts, vibration isolators, dampers, motor and temperature controls, and all other equipment as required and scheduled on the Drawings.

C. All Work performed under this Section shall comply with and be in accordance with all approved trade practices and manufacturer's recommendations.

D. Additional product requirements are specified in Section 01350. Protect motors, shafts, and bearings from weather and construction dust.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

   b. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

   c. Product Data: Submit data on each type of fan and include accessories, certified fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet rated capacity, electrical characteristics and connection requirements.

   d. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions literature.

2. Information for the Record:

   a. Certification that units are licensed to carry the AMCA "A" Seal.

3. Operation and Maintenance Data: Submit operation and maintenance manual that includes instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.03 MOTOR AND EQUIPMENT REQUIREMENTS - WIRING, CONDUIT, AND STARTER

A. All wiring, including factory prewired units, shall conform to NEC Standards.

B. Motors, controls, and disconnects shall be furnished as required and scheduled on the Drawings.

C. All fans and motors required for explosion hazard areas shall be shipped prewired from the factory or shall be able to be connected in the field as required by the National Electrical Code for the NEMA class specified.

1.04 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.05 EXTRA MATERIALS

A. Furnish two spare sets of belts for each type fan.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Fan motor starters and wiring to fan motor and damper operators, including interlocks shall be installed as required under the Division 16.

B. Vibration isolators shall be provided for all supports.

C. Provide duct companion flanges for round duct connections to the unit. Provide back-draft dampers of the gravity type for units discharging to the outside or against any pressure from other sources.

D. Units in exposed locations shall be provided with weather protection.

E. Motors required for explosion hazard areas shall meet Class 1, Division 1, Group D classification as required per the NEC.

F. All fans required for explosion hazard areas shall meet AMCA 99-0401-66, Type A construction.

2.02 CENTRIFUGAL WALL EXHAUST FANS

A. Manufacturers: Loren Cook Models ACW, Greenheck, Penn, or approved equal.

B. Fan Unit: V-belt or direct-driven with spun aluminum housing of bolted and welded construction; wall mounted, horizontal centrifugal exhaust ventilator; resilient-mounted motor; 1/2-inch mesh, 16 gage aluminum bird screen. Spun aluminum structural components constructed of minimum 16-gauge marine alloy aluminum bolted to a rigid

aluminum support structure. Spun aluminum wall flange shall have pre-punched key slot holes and mounting template with wall opening location for ease of installation. Windband shall have rolled bead for added strength. Two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment to facilitate wiring connections.

C. Fan Wheel: Centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub.

D. Electrical Characteristics and Components:

1. Motor: Follow NEMA MG1. Provide built-in overload protection for single-phase fractional horsepower motors.

2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

3. Disconnect Switch: Provide integral mounted and pre-wired NEMA 7 and NEMA 3R disconnect switches.

4. Fan Speed Controller: Integrated circuitry, solid state, variable speed, pre-wired, integrally mounted, fan speed controller, for use in balancing proper airflow.

5. Variable Flow Motors:

a. Two speed fan direct drive motors shall have electrically commutated (EC) variable flow motors with EC speed control for 100% and 50% airflow settings.

b. Two Speed Controller: Loren Cook Model VF2SC, or approved equal, variable flow two speed controller shall allow the setting of two separate motor speeds and switching between these speeds by an external control device. Two speed control dials individually set 0-10VDC signals which are then selected via an external switch, relay, or control system input. The device shall have an A-B-Stop-Auto switch to set the two fan speeds, accept an external selection signal or stop the control signal to the motor. Controller shall contain an integral 24VAC control transformer and terminals for connecting motors and controls as well as auxiliary control of motor operated dampers.

E. Bearings: Heavy duty regreasable ball type construction, cast iron pillow block housing selected for minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

F. Wall Fan Accessories:

1. Backdraft Damper: Gravity-actuated, aluminum frame and multiple-blade construction, felt edged with nylon bearings.

2. Square Wall Grille: Aluminum construction, face bars permanently fixed into an extruded aluminum frame at a 40-degree angle, white enamel finish.

G. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning, pre-lubricated ball bearings.

H. Finish: Electrostatically applied, phenolic epoxy powder coating. Provide UV resistant topcoat to prevent coating deterioration for outdoor applications. Coating must be resistant to hydrogen sulfide.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fans shall be installed as recommended by the manufacturer using the proper supports and isolators for quiet operation.

B. Proper rotation of the fan shall be verified.

C. Belts or speed control shall be adjusted to provide the design system air quantity at the system static pressure.

D. The current draw shall be measured and compared to the nameplate current shown.

E. The installation is not complete until the system has been balanced to provide the correct air quantity and has been tested to demonstrate the correct system performance. See Testing, Adjusting and Balancing, Section 15990.

F. Secure wall exhausters with stainless steel lag screws to structure.

G. Install flexible connections between inlet and outlet of fans to ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

H. Provide sheaves required for final air balance.

I. Install backdraft dampers on inlet to wall exhausters.

J. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on the Drawings.

K. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test-run under observation.

L. At rough openings in walls for fans, provide sheet metal escutcheon to close opening around fan plenums.

M. Extend ducts to wall exhausters through wall structure. Counterflash duct to wall opening.

N. Install safety screen where inlet or outlet is exposed.

O. Install backdraft dampers on discharge of exhaust fans.

P. Pipe scroll drains to nearest floor drain.

3.02 MANUFACTURER'S FIELD SERVICES

A. Furnish services of factory trained representative for a minimum of one day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15850
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Registers.

2. Grilles.

B. This Section includes furnishing all materials, equipment, labor, and supervision related to air outlets and inlets necessary for the completion of the Work in accordance with the Contract Documents. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Provide manufacturer's product data including materials of construction, type of mounting, finish, and airflow capacity tables showing size, airflow, static pressure drop, and sound rating information at rated capacity.

2. Information for the Record:

a. Operation and maintenance manual. Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.03 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.

2. All air outlets and inlets shall be accepted on site in factory packaging. Inspect for damage.

B. After Installation:

1. Protect installed air outlets and inlets from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

2. Suitable covers shall be placed to protect against any air outlets and inlets damaged after it is installed and during the final days of construction.

3. Before acceptance, all covers and protective material shall be removed and the air outlets and inlets cleaned and ready for use.

1.06 QUALITY ASSURANCE

A. Test and rate register and grille performance in accordance with ASHRAE Standard 70.

B. Perform Work in accordance with applicable codes and standards.

1.07 QUALIFICATIONS

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

PART 2 PRODUCTS

2.01 SUPPLY REGISTERS

A. Non-Corrosive Areas:

1. Manufacturers: Titus Model 272RS, Anemostat, Price, or equal.

2. Type: Streamlined and individually adjustable blades, ¾-inch minimum depth, ¾ inch maximum spacing with spring or other device to set blades, with front blades parallel to short dimension.
3. Frame: 1-1/4-inch margin with countersunk screw mounting and gasket.
4. Fabrication: Steel 20 gauge minimum frames/borders with minimum 22 gauge aluminum extruded airfoil blades construction with baked enamel off-white clear anodized finish.
5. Damper: Integral, gang-operated, steel opposed blade damper type with removable key operator, operable from face.

2.02 EXHAUST/RETURN GRILLES

A. Non-Corrosive Areas:

1. Manufacturers: Titus Model 50R, Anemostat, Price, or equal.
2. Type: Fixed grilles of 1/2 by 1/2 by 1/2-inch eggcrate type grid.
3. Frame: 1-1/4-inch margin with countersunk screw mounting and gasket.
4. Fabrication: Steel 20-gauge minimum frames/borders with aluminum eggcrate grid construction with baked enamel off-white clear anodized finish.
5. Damper: Integral, gang-operated, steel opposed blade type damper with removable key operator, operable from face.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify inlet and outlet locations.

B. Verify that ceiling, walls, and ductwork systems are ready for installation.

3.02 INSTALLATION

A. Details of air outlets and inlets installation shall conform to manufacturer’s latest printed instructions, where not covered by the Drawings and Specifications.

B. Check location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

C. Provide and install balancing dampers on duct take-off to registers and grilles, despite whether dampers are part of the register or grille assembly.

D. Paint ductwork visible behind air outlets and inlets matte black.

E. The Drawings show approximate location for air outlets and inlets. Carefully check electrical and architectural drawings for proper placement of air outlets and inlets and be responsible for exact location and size of openings required.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 15855
LOUVERS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing all materials, equipment, labor, and supervision related to intake and exhaust louvers necessary for the completion of the Work in accordance with the Contract Documents. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

B. This Section shall include but not limited to all appurtenances required for complete installation.

C. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

D. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

E. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

   b. Provide manufacturer's data on louvers to include the following information: free area chart/table, static pressure loss, air leakage, and water penetration data.

   c. Provide and submit catalog information on louver motor operators.

   d. Provide and submit a color and finish chart.

2. Information for the Record:

   a. Operation and maintenance manual. Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.03 QUALITY ASSURANCE

A. Test and rate louver performance in accordance with AMCA 500.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.
2. All louvers shall be accepted on site in factory packaging. Inspect for damage.

B. After Installation:

1. Protect installed louvers from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.
2. Suitable covers shall be placed to protect against any louver damaged after it is installed and during the final days of construction.
3. Before acceptance, all covers and protective material shall be removed and the louvers cleaned and ready for use.

PART 2 PRODUCTS

2.01 LOUVERS – GENERAL

A. Free areas of louvers shall be sufficient for intended airflows without water penetration.

B. Construct louvers which exceed manufacturer’s instructed width or height in multiple sections, connected by hidden mullions. Fabricate mullions of same material as louver with same finish.

C. Provide extended sills and stools for ease in mounting where indicated on Drawings.

D. Bird Screens: Minimum 0.040-inch aluminum wire, 1/2-5/8-inch square mesh mounted in removable aluminum frames.

E. Insect Screens: 18-16 mesh, 0.011-inch aluminum wire mounted in aluminum frames. Louver design shall allow screens to be removable and mounted on the face of louvers without interfering with louver, damper, and drive function.

F. Extended Sills: Extruded 6063-T6 aluminum alloy, minimum nominal wall thickness of 0.060 inch.

G. Finish: Kynar fluoropolymer, minimum 1.2 mils dry film thickness conforming to AA-C12C4421x and AAMA 605.2 or other corrosion-resistant finish appropriate for installation conditions.

H. Provide finish on entire louver and birdscreen.

I. Color: Selected by Owner from manufacturer's standard colors.

2.02 COMBINATION LOUVERS

A. Manufacturers: Ruskin Model ELC6375DAX, Arrow, Airolite, or equal.

B. Description: Unit consists of drainable stationary blade and an integral adjustable low leak backdraft damper.

C. Construction: 6-inch frame depth, extruded 6063-T6 aluminum alloy frame and blades, 0.125-inch frame wall thickness, 0.081-inch-thick front blade wall thickness, 0.070 inch thickness double wall adjustable rear blades not visible when open and drain to the exterior. Linkage concealed in frame with stainless steel or nylon bearings. Extruded vinyl blade edge seals and flexible, compressible aluminum jamb seals.

D. Rating: AMCA rated at zero water penetration with the specified airflows and for air leakage of less than 4.0 cfm per square foot of face area at a wind velocity of 30 mph (0.44-inch w.c. pressure) with damper blades closed.

E. Actuator:

1. Two-position, spring return.
2. Operator opening time shall not exceed 60 seconds.
3. Provide additional or larger motors where required to meet louver torque requirements.
4. Electrical Requirements (V/PH/HZ): 120/1/60.

PART 3 EXECUTION

3.01 INSTALLATION

A. Details louvers installation shall conform to manufacturer's latest printed instructions, where not covered by the Drawings and Specifications.

B. Check location of louvers and make necessary adjustments in position to conform with architectural features.

C. At rough openings in walls for louvers, provide sheet metal escutcheon to close opening around open louver plenums.

D. Install louvers plumb, level, in plane of wall, and alignment with adjacent work. Provide supporting structure and joint sealant as required.

E. The Drawings show approximate location for louvers. Carefully check all other discipline drawings for proper placement of louvers and be responsible for exact location and size of openings required.

PART 4 SPECIAL PROVISIONS

END OF SECTION

SECTION 15950
TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing all materials, equipment, labor, and supervision to test, adjust, and balance all heating, ventilating, air conditioning, and foul air conveyance systems necessary for the completion of the Work in accordance with the Contract Documents.

B. Work Included:

1. Testing, adjusting, and balancing of air systems.
2. Measurement of final operating condition of HVAC systems.

1.02 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 – National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers:

1. ASHRAE 111 – Practices for Measurement Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

D. Testing, Adjusting and Balancing Bureau:

1. TABB – International Standards for Environmental Systems Balance.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300.

B. Test reports shall indicate data on forms prepared by one of the following:

1. AABC MN-1.
2. ASHRAE 111.
3. NEBB.
4. TABB.

C. Field reports shall indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment tom achieve specified performance.

D. Submit draft copies of report for review prior to final acceptance of Project.

E. Furnish final reports in soft cover, letter size, binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.

1. Include diagrams of systems and equipment including balancing devices and dampers with pressure drops at each location.

2. Include both initial and final pressure drops and flows.

3. Indicate data on standard forms as listed above.

4. Completeness and accuracy of reports shall be certified by a principle of the balancing agency, who is not affiliated with any firm involved in the construction Project.

5. Submit data sheets on each item of testing equipment utilized. Include name of device, manufacturer's name, model number, latest date of calibration, and correction factors.

6. Record actual locations of flow measuring stations, balancing valves and their rough settings.

1.04 QUALITY ASSURNACE

A. All Work performed under this Section shall comply and be in accordance with the following:

1. All approved trade practices and manufacturer's recommendations.

2. AABC, ASHRAE 111, and NEBB.

1.05 QUALIFICATIONS

A. General:

1. Engage the services of an independent agency specializing in the testing, adjusting, and balancing of systems specified in this Section, hereinafter called the Balancing Subcontractor. The agency shall be acceptable to Owner and Engineer.

2. The agency selected shall be a fully certified member of the Associated Air Balance Council (AABC) and perform work under supervision of the following:

a. AABC Certified Test and Balance Engineer.

b. NEBB Certified Testing, Balancing, and Adjusting Supervisor or TABB Certified Supervisor.

c. Registered Professional Engineer experienced in performance of this Work and licensed at the place where the Project is located.

3. All testing, adjusting, and balancing of HVAC systems shall be performed in complete accordance with the AABC "Standards and Instrumentations Form No. 81226, Volume I" as published by the AABC, including all current revisions thereto and/or ANSI/ASHRAE 110.

B. Workmanship:

1. All Work shall be done by technicians skilled in the particular field involved under the direct supervision of a Registered Professional Engineer and with the best modern practices and equipment.

2. All instruments used for measurement shall be accurate and calibration for each instrument shall be available for examination. The Engineer may request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.

3. The Balancing Subcontractor shall consult all drawings, construction details, job site, and confer and cooperate with others to avoid interference.

4. The Balancing Subcontractor shall check all control interlocks and cooperate with the control Subcontractor in adjusting and calibration of control equipment.

5. Any ceiling tile that is damaged by the Balancing Subcontractor shall be replaced with new tile identical to that damaged.

1.06 RESPONSIBILITY FOR PROPER BALANCING AND TESTING

A. The final testing, adjusting, and balancing and the test and balance data shall be witnessed by the Engineer's Project Representative if required by the Owner.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 EVALUATION OF SYSTEM AND EXAMINATION

A. The Balancing Subcontractor shall furnish all materials and equipment necessary to properly measure the air capacity of the system, the electrical voltage and current, fan speeds, static pressures, air velocity, water pressure drops, refrigeration pressures, and all other readings normally necessary to evaluate the performance of a system, adjust the quantities to those called for, and test the system.

B. Verify that all systems are complete and operable before commencing Work. Verify the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for the electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Volume control dampers are in place and operating.
8. Air coil fins are cleaned and combed.
9. Air outlets and inlets are installed and connected.
10. Duct system leakage is minimized.
11. Proper strainer baskets are clean and in place or in normal position.
12. Service and balancing valves are open.

3.02 BALANCE REQUIREMENTS

A. Balance equipment and systems per the information provided in the HVAC schedules, plan views, air flow schematics, or sequence of operations as shown on the Drawings.

3.03 CONTROL SEQUENCE

A. All control sequencing electrical interlocking shall be tested and verified. This Work shall be accomplished with a representative of the heating, ventilating, and air conditioning Contractor and temperature control Contractor present and assisting.

3.04 COMPONENT IDENTIFICATION

A. The Contractor is responsible for the identification of the equipment.

3.05 TESTING ACCESSES

A. The Contractor shall provide and/or arrange for all labor and material such as valves, tap holes, and plugs in the location required to perform the Work.

3.06 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets:

1. Adjust total to within plus 10 percent and minus 5 percent of design of space.
2. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.07 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.08 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, outside, and exhaust air quantities.

B. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from minimal objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers to check leakage.

J. Measure temperature conditions across outside air, return air, and exhaust dampers for design conditions.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust systems to obtain required relationship between each to maintain approximately 0.05 inches differential static pressure between spaces.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing box dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

O. On fan powered VAV boxes, adjust airflow switches for proper operation.

3.09 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Packaged Rooftop Units.
2. Terminal Heat Transfer Unis.
3. Fans.
4. Air Filters.
5. Air Inlets and Outlets.
6. Balancing Dampers.

B. Report Forms:

1. Title Page:
    a. Name of Testing, adjusting, and Balancing.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Architect.
    g. Project Engineer.
    h. Project Contractor.
    i. Project altitude.
    j. Report date.
2. Summary Comments:
    a. Design versus final performance.
    b. Notable characteristics of system.

c. Description of systems operation sequence.

d. Summary of outdoor and exhaust flows to indicate building pressurization.

e. Nomenclature used throughout report.

f. Test conditions.

3. Instrument List:

a. Instrument.

b. Manufacturer.

c. Model number.

d. Serial number.

e. Range.

f. Calibration.

4. Cooling Coil Data:

a. Identification/number.

b. Location.

c. Service.

d. Manufacturer.

e. Air flow, design and actual.

f. Entering air DB temperature, design and actual.

g. Entering air WB temperature, design and actual.

h. Leaving air DB temperature, design and actual.

i. Leaving air WB temperature, design and actual.

j. Water flow, design and actual.

k. Water pressure drop, design and actual.

l. Entering water temperature, design and actual.

m. Leaving water temperature, design and actual.

n. Saturated suction temperature, design and actual.

o. Air pressure drop, design and actual.

5. Heating Coil Data:

a. Identification/number.

b. Location.

c. Service.

d. Manufacturer.

e. Air flow, design and actual.

f. Water flow, design and actual.

g. Water pressure drop, design and actual.

h. Entering water temperature, design and actual.

i. Leaving water temperature, design and actual.

j. Entering air temperature, design and actual.

k. Leaving air temperature, design and actual.

l. Air pressure drop, design and actual.

6. Refrigerant Compressors:

a. Suction pressure of each compressor.

b. Discharge pressure of each compressor.

7. Packaged Rooftop Unit Data:

a. Identification/number.

b. Location.

c. Manufacturer.

d. Model number.

e. Size.

f. Air flow, design and actual.

g. Water flow, design and actual.

h. Water pressure drop, design and actual.

i. Entering water temperature, design and actual.

j. Leaving water temperature, design and actual.

k. Entering air temperature, design and actual.

l. Leaving air temperature, design and actual.

8. Return Air/Outside Air Data:

a. Identification/location.

b. Design air flow.

c. Actual air flow.

d. Design return air flow.

e. Actual return air flow.

f. Design outside air flow.

g. Actual outside air flow.

h. Return air temperature.

i. Outside air temperature.

j. Required mixed air temperature.

k. Actual mixed air temperature.

l. Design outside/return air ratio.

m. Actual outside/return air ratio.

9. Fan Data:

a. Identification/number.

b. Location.

c. Manufacturer.

d. Model number.

e. Serial number.

f. Air flow, specified and actual.

g. Total static pressure (total external), specified and actual.

h. Inlet pressure.

i. Discharge pressure.

j. Sheave Make/Size/Bore.

k. Number of Belts/Make/Size.

l. Fan RPM.

10. Duct Traverse:

a. System zone/branch.

b. Duct size.

c. Area.

d. Design velocity.

e. Design air flow.

f. Test velocity.

g. Test air flow.

h. Duct static pressure.

i. Air temperature.

j. Air correction factor.

11. Duct Leak Test:

a. Description of ductwork under test.

b. Duct design operating pressure.

c. Duct design test static pressure.

d. Duct capacity, air flow.

e. Maximum allowable leakage duct capacity times leak factor.

f. Test apparatus:

1) Blower.

2) Orifice, tube size.

3) Orifice size.

4) Calibrated.

g. Test static pressure.

h. Test orifice differential pressure.

i. Leakage.

PART 4 SPECIAL PROVISIONS

4.01 MISCELLANEOUS TESTS

A. The Balancing Subcontractor shall perform building pressure tests with outside temperature and wind velocity noted at points of typical location inside building on both lee and windward side of building. Tests to be made with all supply and exhaust systems in normal operation and with supply systems at minimum outside air at approximately nominal wind velocity outside.

B. The Balancing Subcontractor shall perform air curtain tests for all fume hoods as noted below. Tests are to be conducted per ANSI/ASHRAE 110.

END OF SECTION

SECTION 15980
HVAC CONTROLS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing all materials, equipment, labor, and supervision to HVAC controls necessary for the completion of the Work in accordance with the Contract Documents.

B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

1.02 SECTION INCLUDES

A. Thermostats.

B. Smoke detectors.

C. Control panels.

1.03 SUBMITTALS

A. Provide description and engineering data for each control system component. Include sizing as requested. Provide data and wiring diagram for each system component and software module.

B. Indicate complete operating data, system drawings, wiring diagrams, control panel layout, ladder diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities and static pressure drops for each system.

1.04 QUALITY ASSURANCE

A. Install HVAC controls under the direct supervision of a licensed Temperature Controls Contractor.

1.05 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 FAN THERMOSTATS

A. Thermostats:

1. Exhaust Fan Thermostat:

a. Manufacturers: Honeywell T631C, Johnson A19JNC-2, or approved equal.

b. Metal enclosure with a minimum range of 70 to 90 degrees F. Line voltage type rated for 10 amperes at 115 VAC and pilot duty at 115 volts, single-phase.

2. Corrosion Resistant Exhaust Fan Thermostat:

a. Manufacturers Honeywell T631F, Chromalox WCRT-100, or approved equal.

b. Corrosion resistant, NEMA 4X, with a minimum temperature range of 40 to 100 degrees F. Line voltage type rated for 16 amperes at 120 VAC with externally set point adjustment.

c. Shielded sensing bulb attached to the exterior of the thermostat.

2.02 DUCT MOUNTED SMOKE DETECTORS:

A. Smoke Detector:

1. Manufacturers: Provide products of the following; Invensys Model L-302-2, System Sensor Model Innovair, Air Products and Controls Model SL-2000, Honeywell, or approved equal.

a. Smoke detectors shall be NFPA 72, ionization type with the following features.

b. 4-Wire type detector with common power supply and signal circuits.

c. Auxiliary relay contacts for both fan control and annunciation of remote alarm.

d. Key-operated normal-reset-test switch.

e. Duct sampling tubes extending width of duct.

f. Visual indication of detector actuation.

g. Duct-mounted housing.

h. Removable filters.

i. Electrical 120 VAC.

2.03 CONTROL PANELS

A. Enclose controls in their respective equipment control panel, or in a remote, wall-mounted control panel.

B. Panel: NEMA 12 rated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are ready to receive Work.

3.02 PREPARATION

A. Sequence Work to ensure installation of components is complimentary to installation of similar components in other systems.

B. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.03 INSTALLTION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate 60 inches above finished floor.

C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

D. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same Equipment Room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

E. Install "Hand-Off-Auto" selector switches to override automatic interlock controls when switch is in "Hand" position.

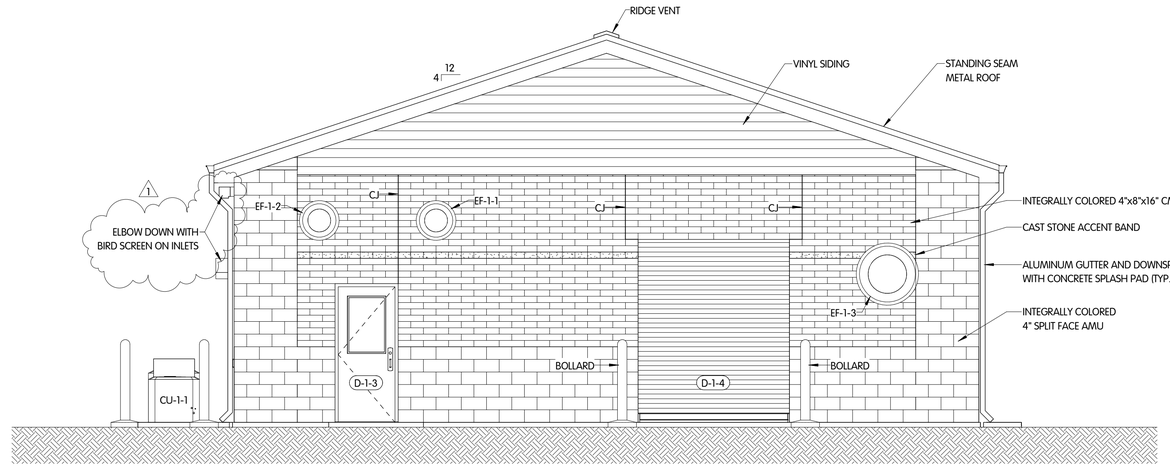
F. After installation, verify the complete operation of each system using the operation description submitted in the Shop Drawings and as described herein to the satisfaction of the Owner.

3.04 MANUFACTURER'S START-UP SERVICES

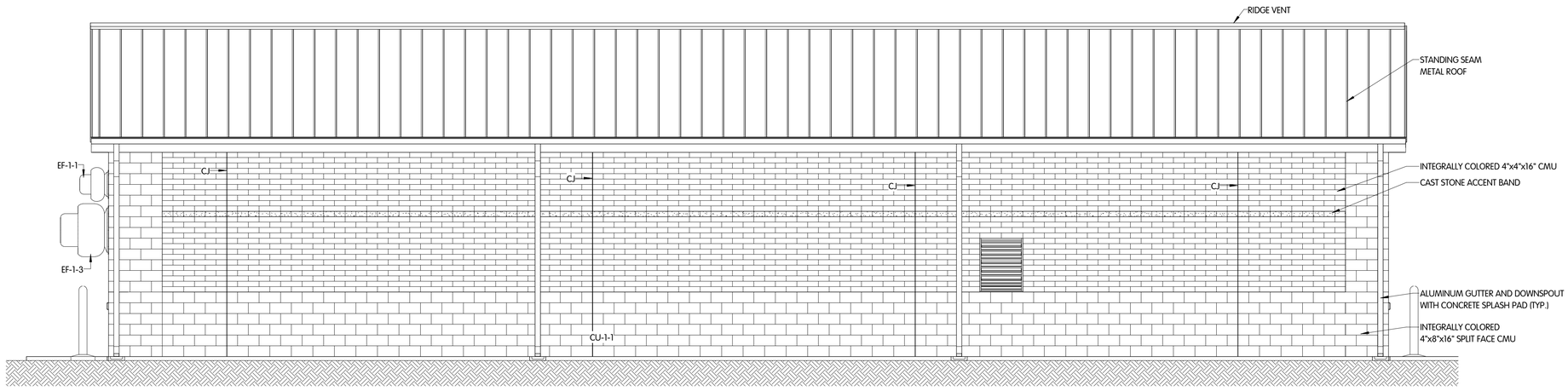
A. Provide for a minimum of one 4-hour day.

END OF SECTION

NOTE:
COLORS AND STYLE TO MATCH ADJACENT WATER UTILITY BUILDING. OWNER TO APPROVE COLORS.



NORTH ELEVATION
1/4" = 1'-0"



WEST ELEVATION
1/4" = 1'-0"

CITY OF CARMEL A PARTNERSHIP INDIANA

PUMP BUILDING ARCHITECTURAL ELEVATIONS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	10-29-24	ADDENDUM 1	JDM

Jones & Henry Engineers, Ltd.
Fluid thinking®...
www.JHeng.com

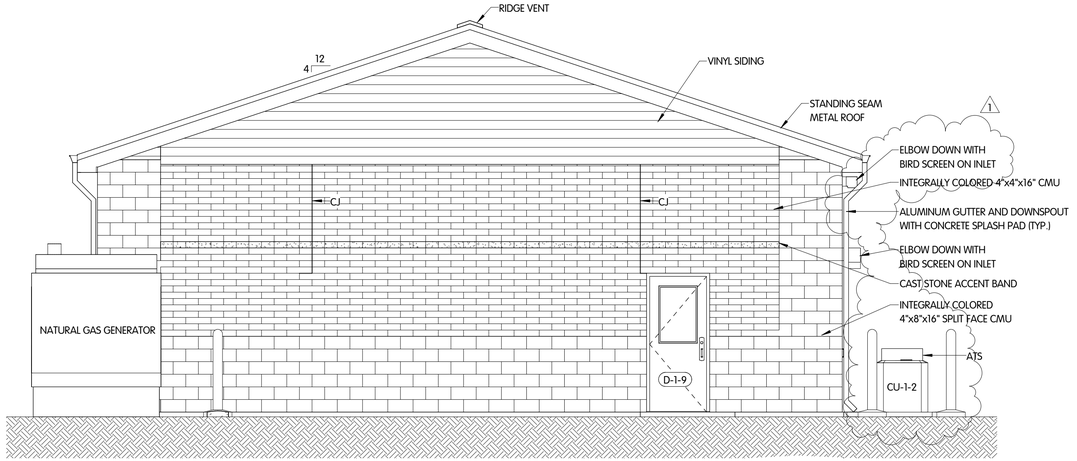
JOB NO.:	451-7893.001
SCALE:	1/4" = 1'-0"

THIS LINE SCALES 1" WHEN PLOTTED TO NOTED SCALE

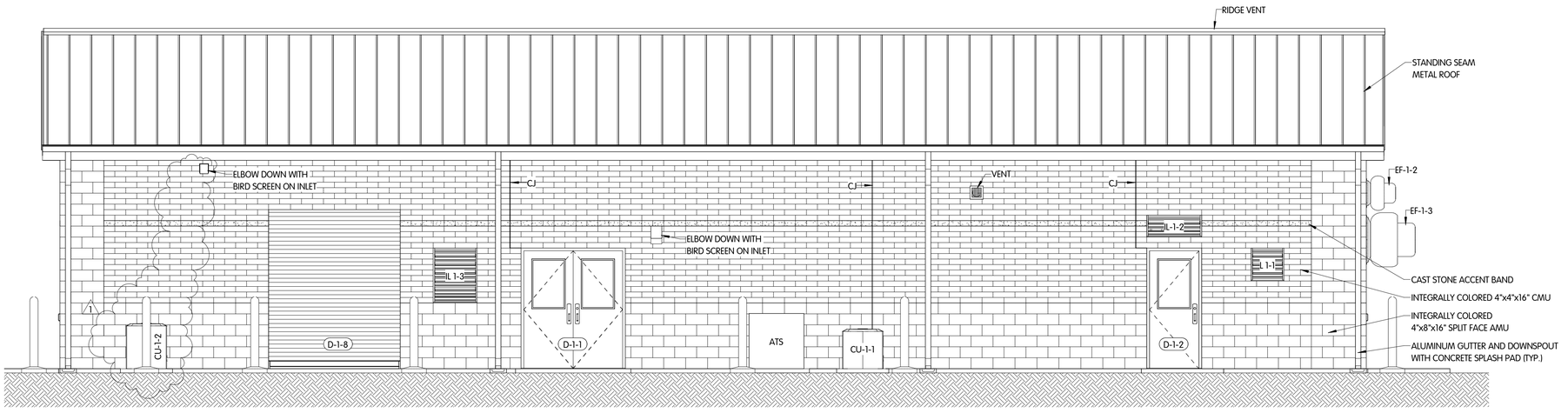
DESIGNED	DRAWN	CHECKED
JDM	RGW	JDM

STATUS: ISSUED FOR BID
DATE: SEPTEMBER 2024
SHEET NO.
A-1.1
13 OF 50

NOTE:
COLORS AND STYLE TO MATCH ADJACENT WATER UTILITY BUILDING. OWNER TO APPROVE COLORS.



SOUTH ELEVATION
1/4" = 1'-0"



EAST ELEVATION
1/4" = 1'-0"

CITY OF CARMEL
A PARTNERSHIP
INDIANA

PUMP BUILDING ARCHITECTURAL ELEVATIONS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	10-29-24	ADDENDUM 1	JDM

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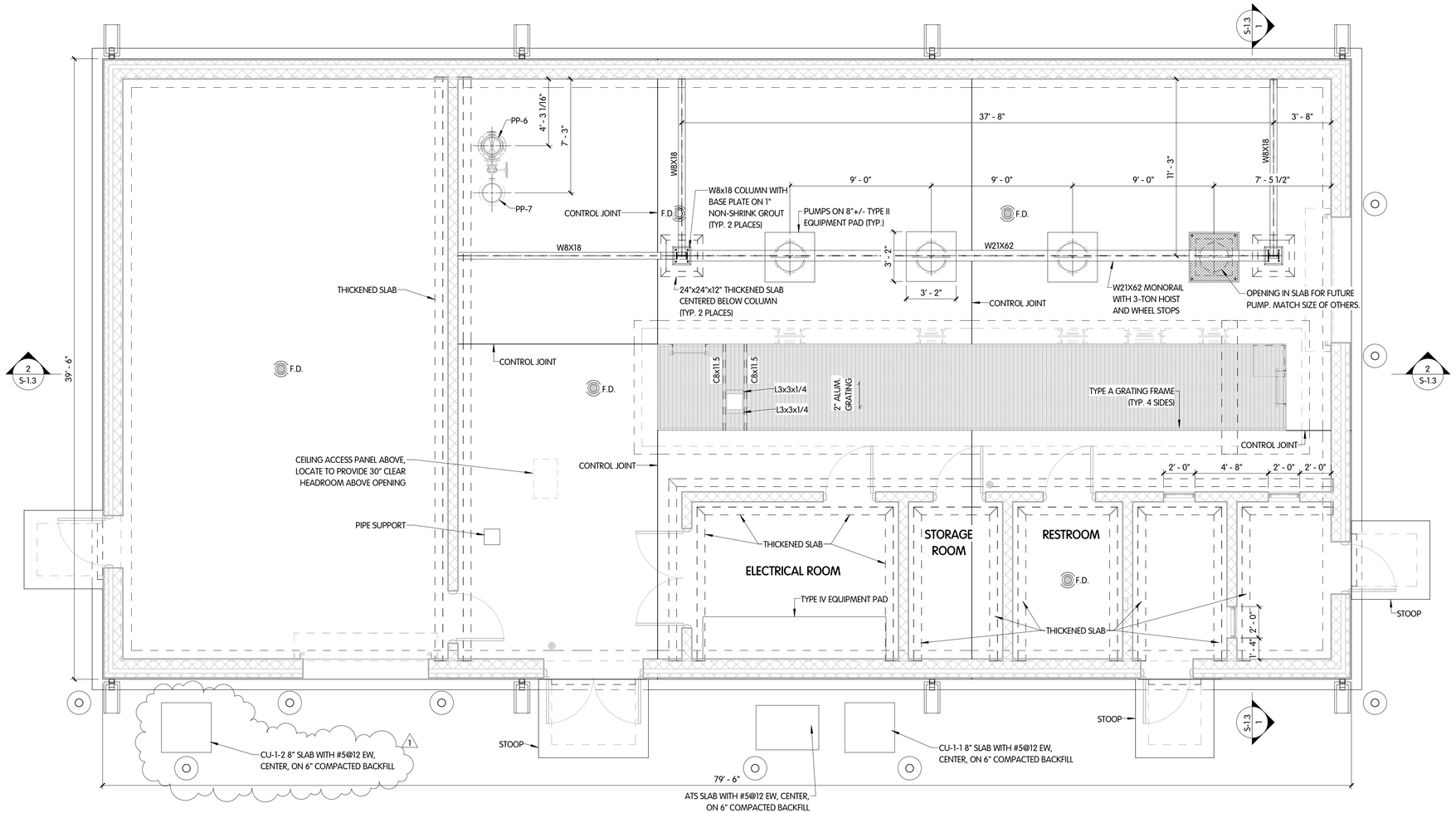
SCALE:	1/4" = 1'-0"

THIS LINE SCALES 1" WHEN PLOTTED TO NOTED SCALE

DESIGNED	DRAWN	CHECKED
JDM	RGW	JDM

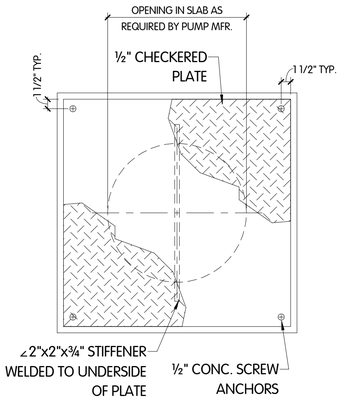
STATUS:	ISSUED FOR BID
DATE:	SEPTEMBER 2024

SHEET NO.
A-1.2
14 OF 50



PLAN @ EL. 925.50

1/4" = 1'-0"



COVER PLATE DETAIL

1" = 1'-0"

C:\USERS\VALUED CUSTOMER\ONEDRIVE - JONES & HENRY ENGINEERS, LTD\DOCUMENTS\7893001-RM_RWORLEY@JHENG.COM.RVT
10/30/2024 8:08:33 AM

CITY OF CARMEL
A PARTNERSHIP
INDIANA

PUMP BUILDING
STRUCTURAL
PLAN @ EL. 925.50 AND DETAIL

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	10-29-24	ADDENDUM 1	JDM

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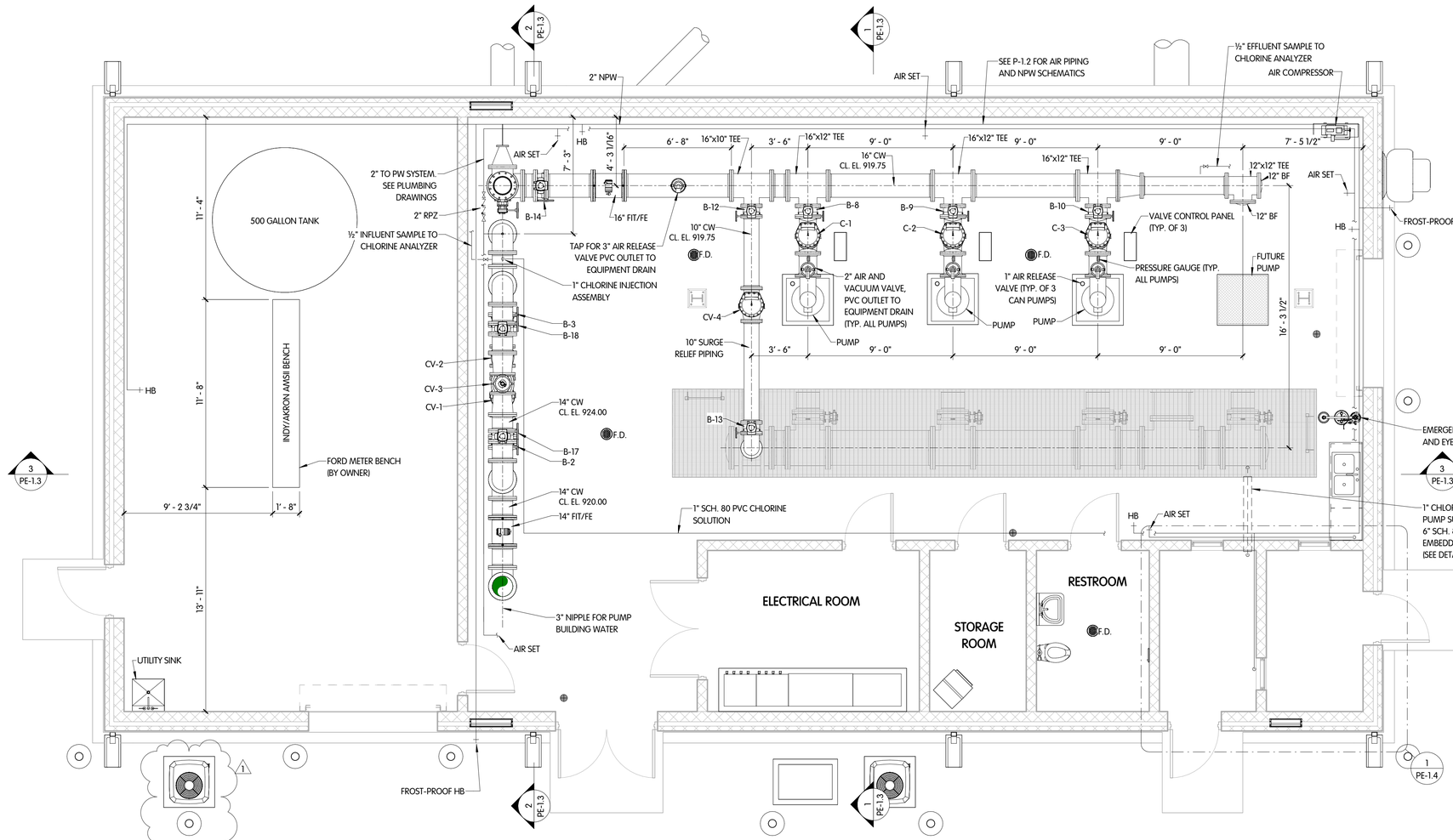
JOB NO.:	451-7893.001
SCALE:	AS INDICATED

THIS LINE SCALES 1" WHEN PLOTTED TO NOTED SCALE

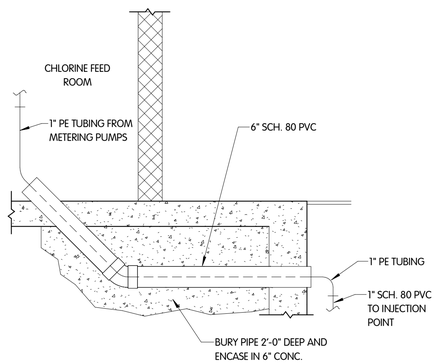
DESIGNED	DRAWN	CHECKED
JDM	RGW	JDM

STATUS: ISSUED FOR BID
DATE: SEPTEMBER 2024
SHEET NO.
S-1.2
22 OF 50



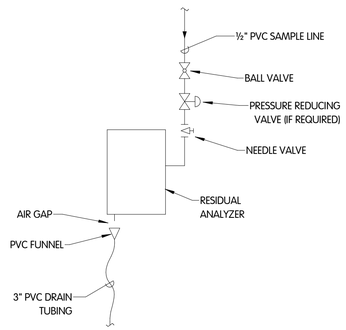
PLAN @ EL. 925.50

1/4" = 1'-0"



PUMP SUCTION CHLORINE PIPE DETAIL

1/2" = 1'-0"



TYP. RESIDUAL ANALYZER DIAGRAM

NTS

NOTE:
ALL ABOVE GRADE PIPING, FITTINGS, AND VALVES SHALL RECEIVE INSULATION IN ACCORDANCE WITH SPEC SECTION 15080

PUMP BUILDING PIPING & EQUIPMENT PLAN @ EL. 925.50 AND DETAILS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	10-29-24	ADDENDUM 1	JDM

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DATE:	SEPTEMBER 2024

SHEET NO.
PE-1.2
27 OF 50

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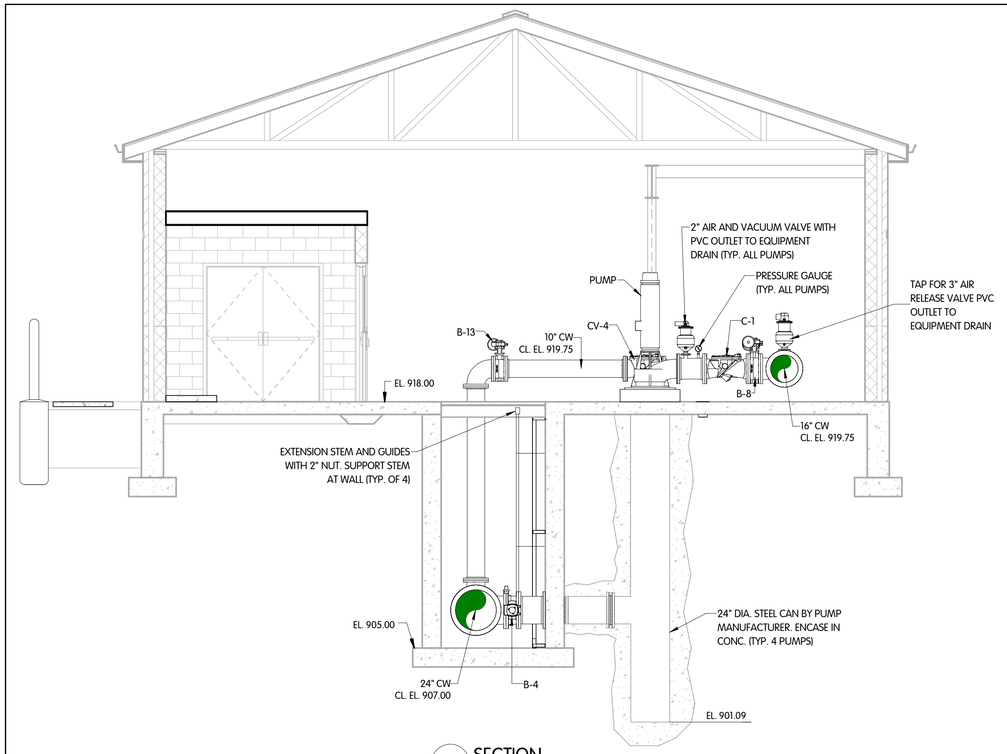

1 SECTION
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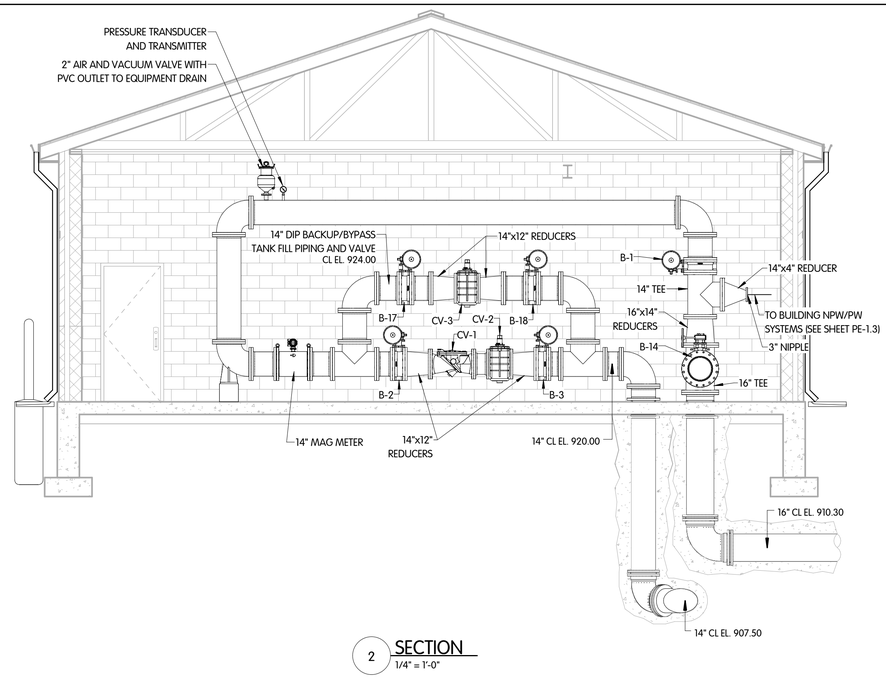

2 SECTION
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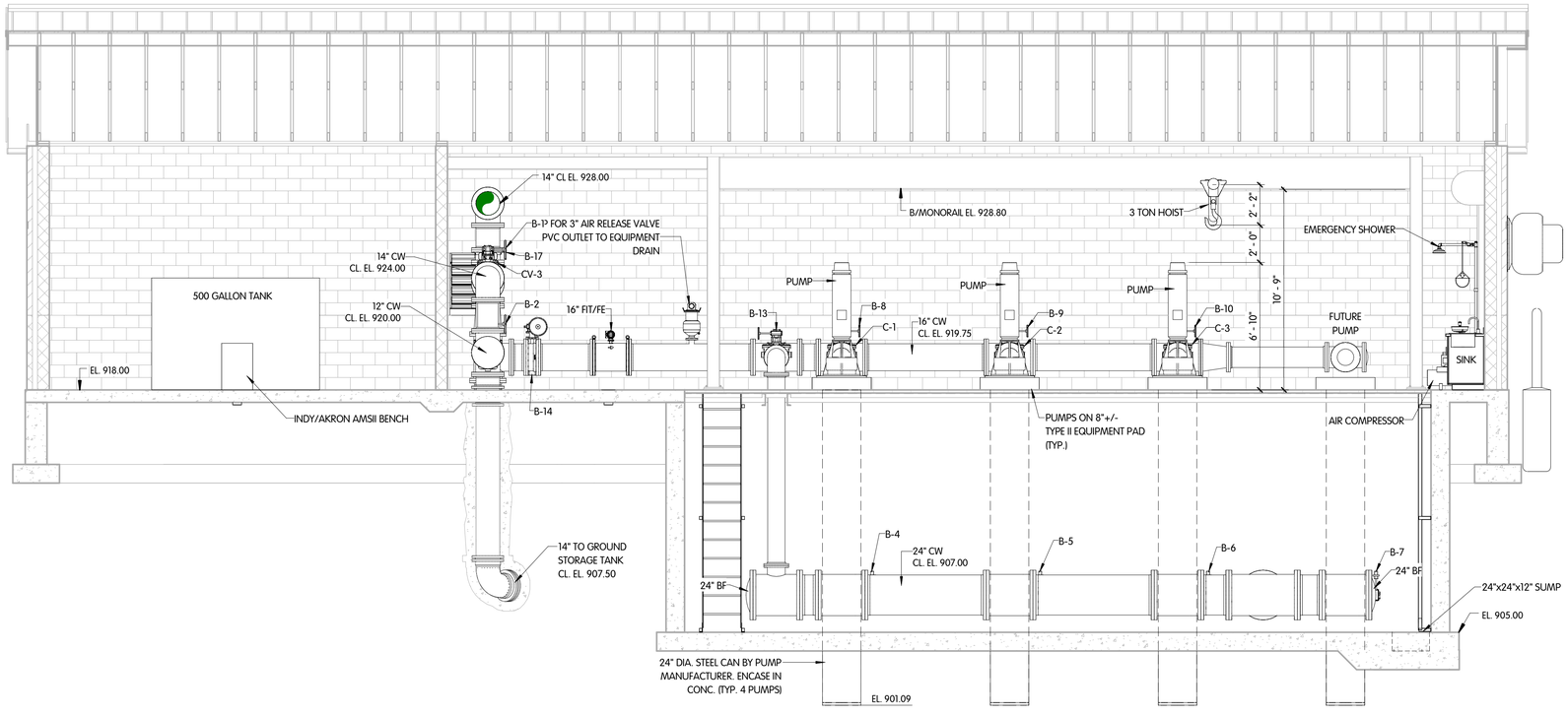

3 SECTION
1/4" = 1'-0"

NOTE:
ALL ABOVE GRADE PIPING, FITTINGS, AND VALVES SHALL RECEIVE INSULATION IN ACCORDANCE WITH SPEC SECTION 15080

CITY OF CARMEL
A PARTNERSHIP
INDIANA

PUMP BUILDING PIPING & EQUIPMENT SECTIONS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	BY
	REVISIONS AFTER ISSUED FOR BID	

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SCALE:	1/4" = 1'-0"

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JDM	LKB	JDM

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DATE: SEPTEMBER 2024
SHEET NO.
PE-1.3
28 OF 50

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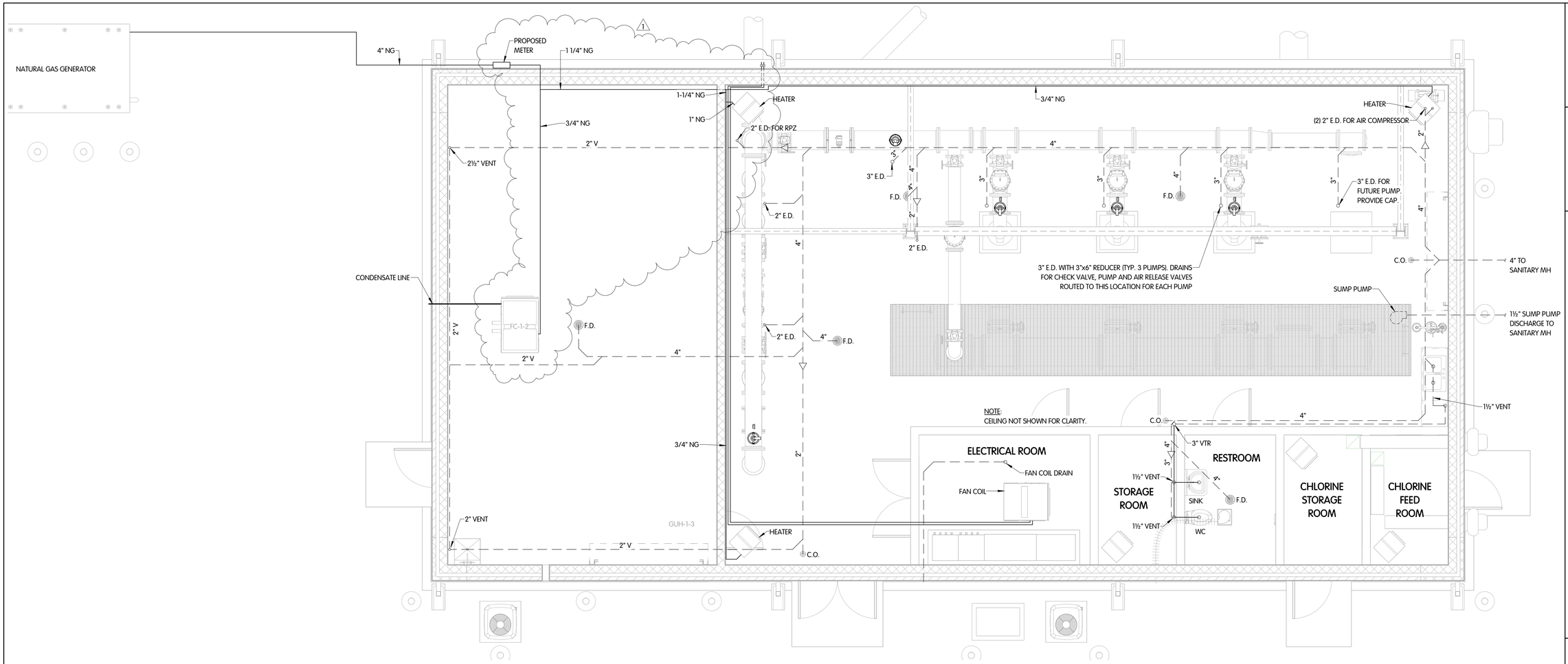

PLAN @ EL. 930.00

1/4" = 1'-0"

NORTH

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10/30/2024 10:01:56 AM

CITY OF CARMEL
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FOR THE COMMON GOOD
INDIANA

PUMP BUILDING PLUMBING PLAN @ EL. 930.00

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
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STATUS: ISSUED FOR BID
DATE: SEPTEMBER 2024
SHEET NO.
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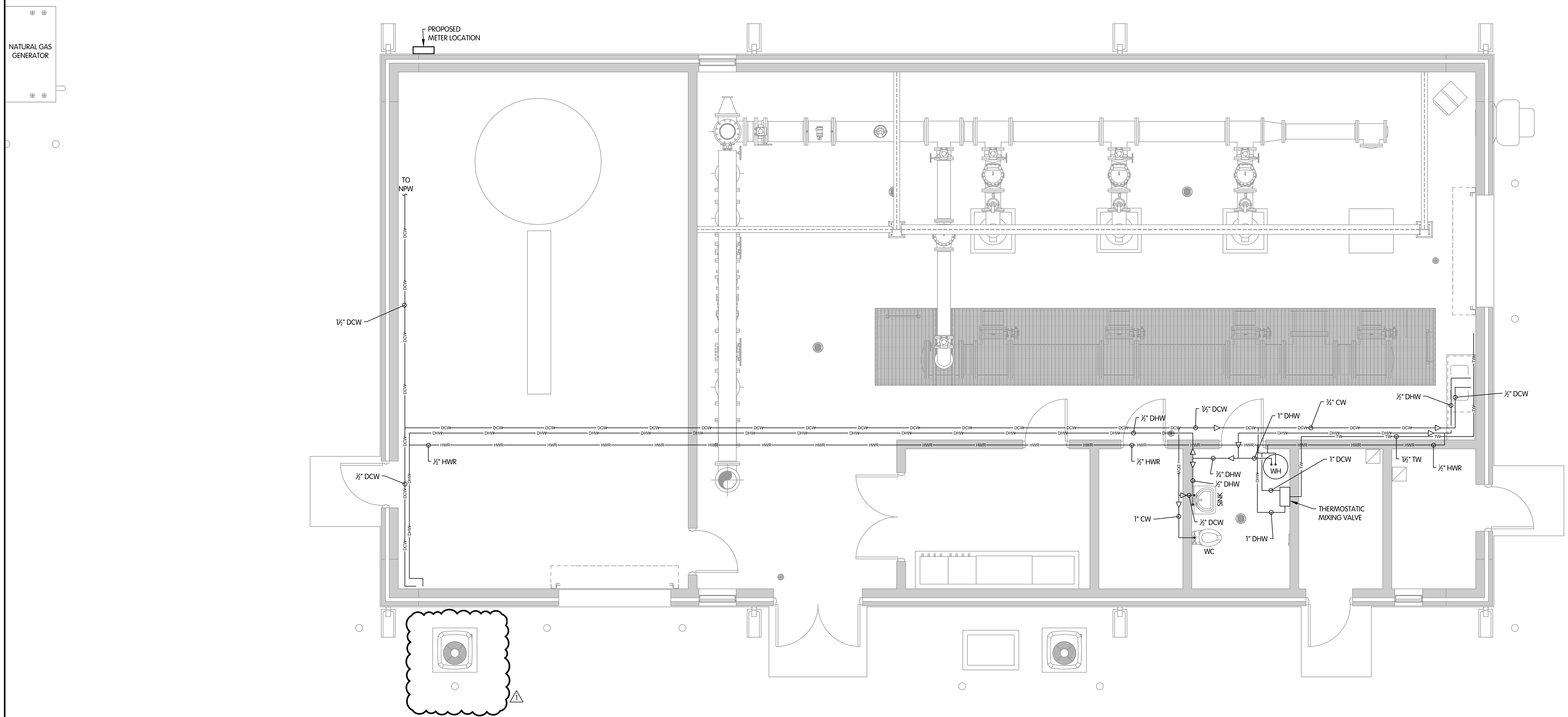
33 OF 50



POTABLE WATER PLAN

¼"=1'-0"

PUMP STATION
PLUMBING
POTABLE WATER PLAN

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

CITY OF CARMEL — A PARTNERSHIP FOR TOMORROW — INDIANA

NO.	DATE		BY
5			
4			
3			
2			
1	10-28-24	ADDENDUM 1 REVISIONS AFTER ISSUED FOR BID	JDM

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JOB NO.	451-7893.001
SCALE	1/4"=1'-0"

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DESIGNED	DRAWN	CHECKED
JDM	LKB	JDM

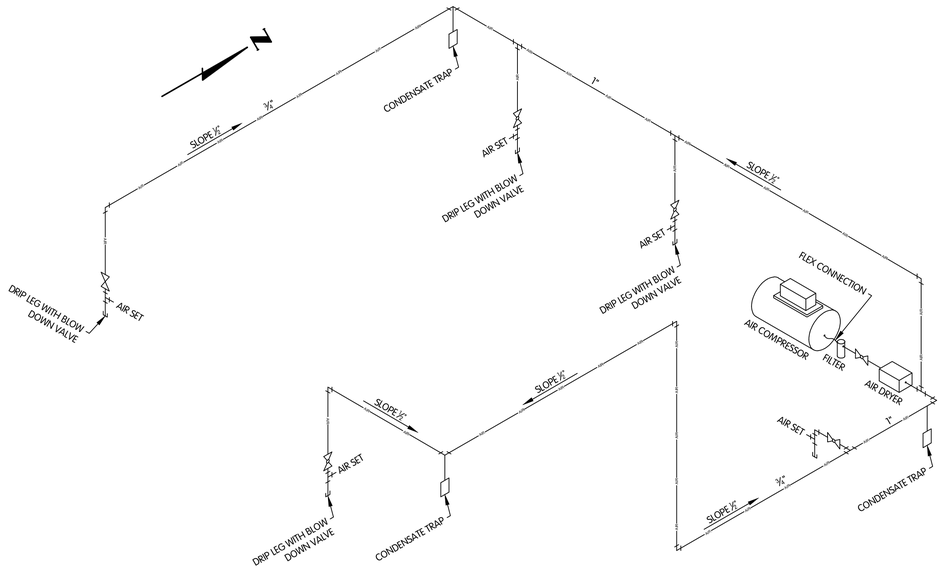
STATUS	ISSUED FOR BID
DATE	SEPTEMBER 2024

SHEET NO.

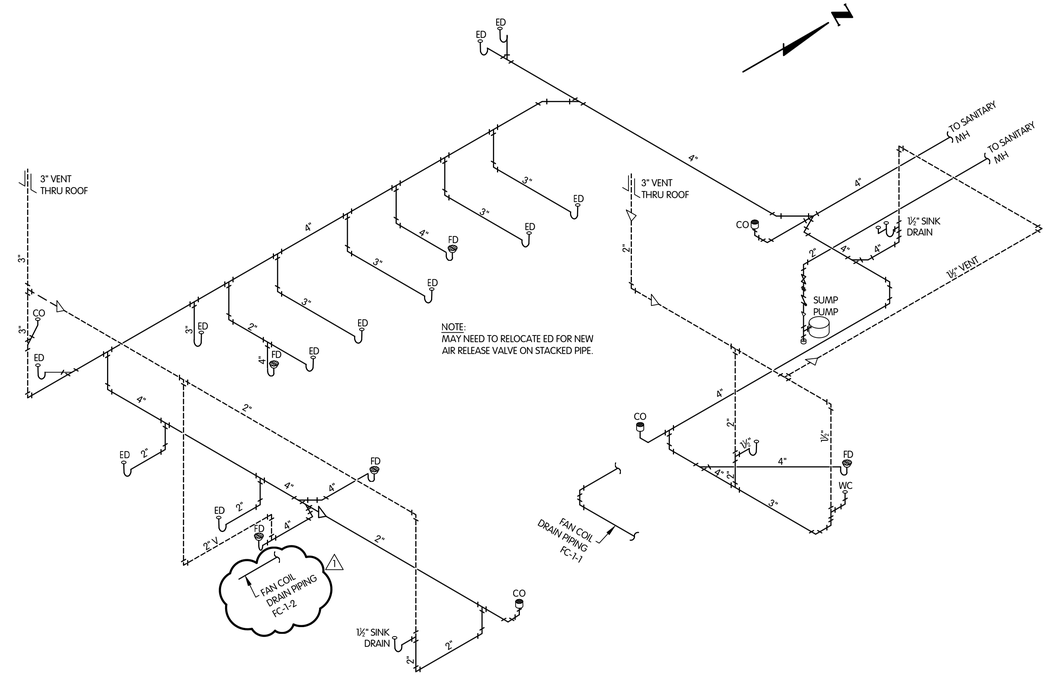
P-1.2

34 of 50

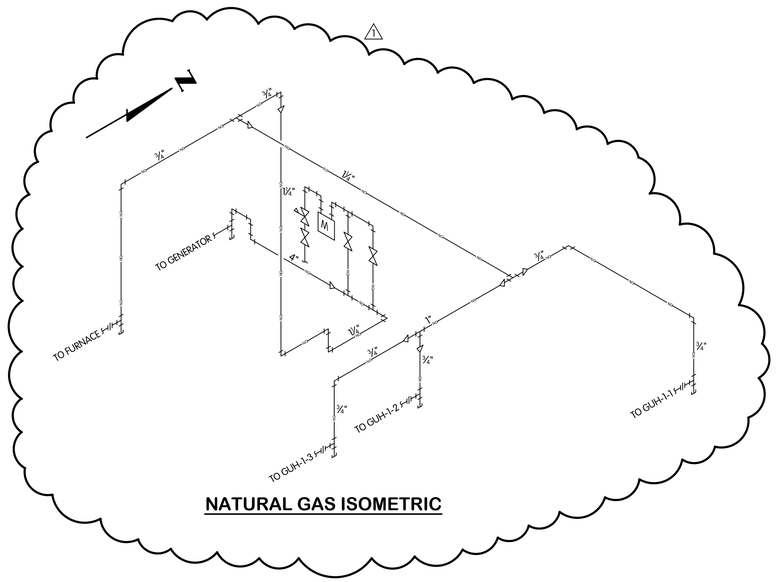
TOL-789300IP12-POTABLE WATER PLAN
10/29/2024 12:58 PM - RWORLEY
10/30/2024 8:15 AM



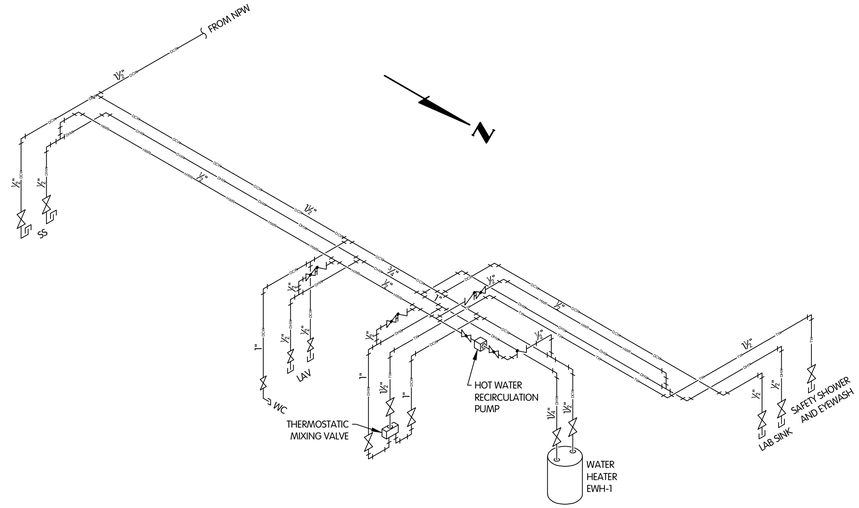
COMPRESSED AIR ISOMETRIC



PUMP BUILDING SANITARY AND VENT PIPING ISOMETRIC



NATURAL GAS ISOMETRIC



POTABLE WATER PIPING ISOMETRIC

PUMP STATION
PLUMBING
ISOMETRICS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
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DATE: SEPTEMBER 2024

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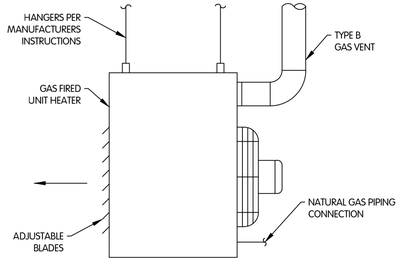
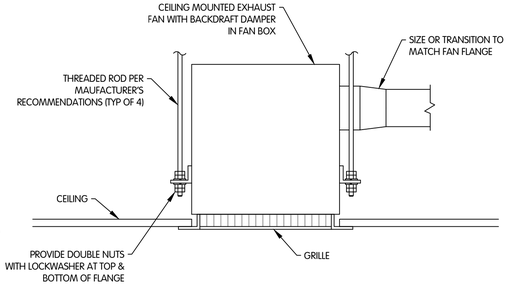
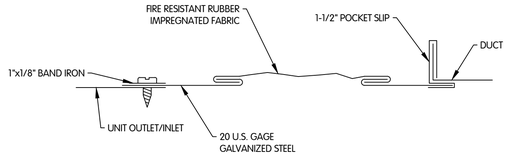
P-1.3
35 OF 50



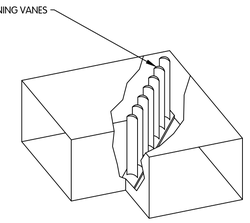
GAS FIRED UNIT HEATER DETAIL
NTS



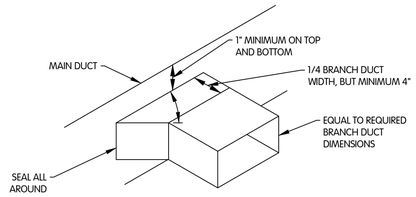
CEILING MOUNTED EXHAUST FAN DETAIL
NTS



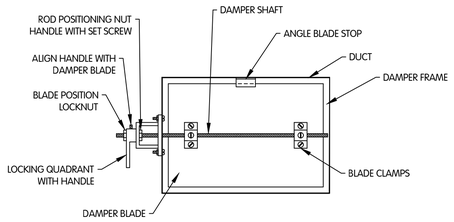
TYPICAL FLEXIBLE CONNECTION DETAIL
NTS



TYPICAL DUCT ELBOW DETAIL
NTS



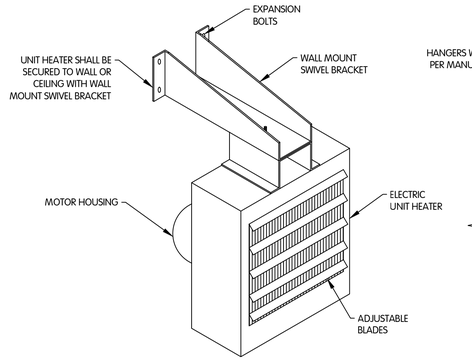
TYPICAL BRANCH TAKE-OFF FITTING DETAIL
NTS



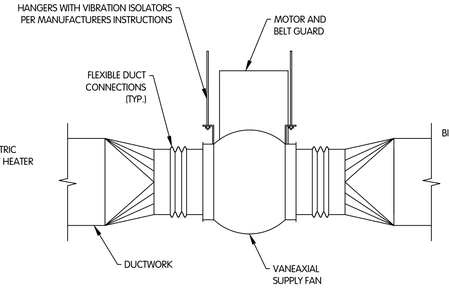
NOTES:

1. DAMPERS FOR ROUND DUCTS SHALL BE SIMILAR TO THE DAMPER SHOWN ABOVE.
2. ENSURE THAT FULL 90 DEGREE DAMPER BLADE MOVEMENT IS UNOBSTRUCTED.
3. FOR DUCT HEIGHTS MORE THAN 12 INCHES, PROVIDE OPPOSED BLADE DAMPERS.

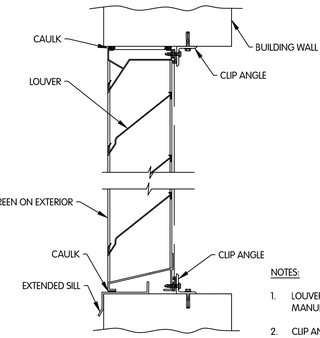
MANUAL BALANCING DAMPER DETAIL
NTS



ELECTRIC UNIT HEATER DETAIL
NTS



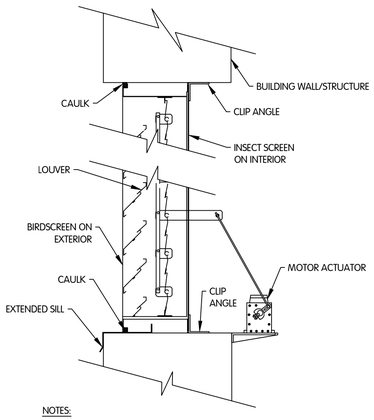
VANEAXIAL SUPPLY FAN DETAIL
NTS



NOTES:

1. LOUVER TO BE ASSEMBLED AT LOUVER MANUFACTURER FACTORY.
2. CLIP ANGLES AND EXTENDED SILL TO BE PROVIDED BY LOUVER MANUFACTURER.
3. INSTALLATION OF LOUVER TO BE IN ACCORDANCE WITH LOUVER MANUFACTURER'S RECOMMENDATIONS.

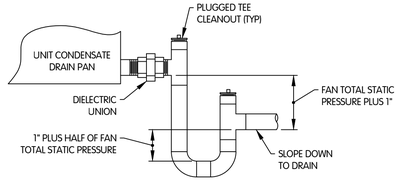
TYPICAL STATIONARY LOUVER DETAIL
NTS



NOTES:

1. LOUVER TO BE ASSEMBLED AT LOUVER MANUFACTURER FACTORY.
2. CLIP ANGLES AND EXTENDED SILL TO BE PROVIDED BY LOUVER MANUFACTURER.
3. INSTALLATION OF LOUVER TO BE IN ACCORDANCE WITH LOUVER MANUFACTURER'S RECOMMENDATIONS.

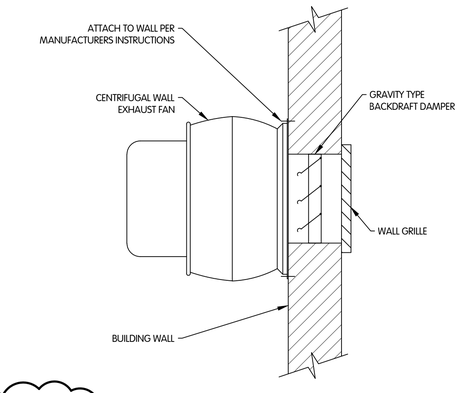
TYPICAL COMBINATION LOUVER DETAIL
NTS



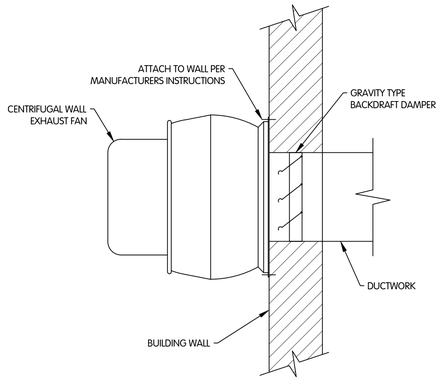
NOTES:

1. LOCATE TRAP AS CLOSE AS POSSIB;E TO CONDENSATE DRAIN PAN OUTLET WITH BOTTOM BELOW SUPPORT STRUCTURE.
2. DRAIN PIPING SHALL BE INSULATED.
3. SIZE OF TRAP PIPING TO BE LARGER OF EQUIPMENT OUTLET SIZE OR DIMENSION OF PLANS.
4. DRAIN PIPING SHALL PENETRATE THE ROOF LINE WITHIN THE CONFINEMENT OF THE HVAC EQUIPMENT CURB.

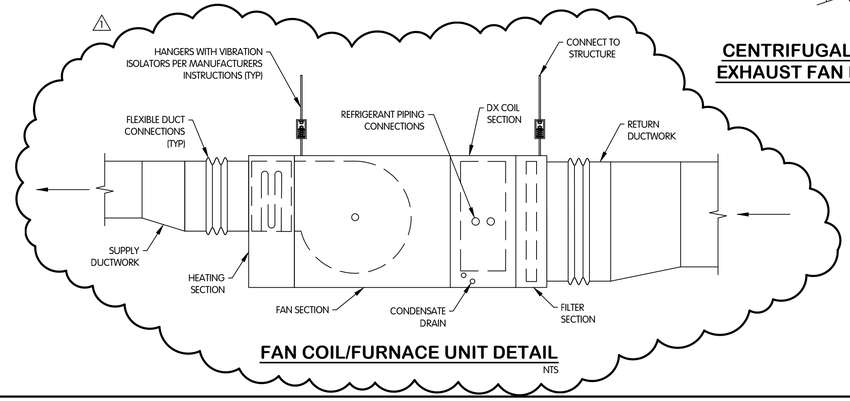
CONDENSATE DRAIN TRAP DETAIL
NTS



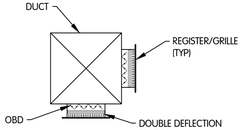
CENTRIFUGAL WALL EXHAUST FAN DETAIL
NTS



CENTRIFUGAL WALL EXHAUST FAN W/DUCTWORK DETAIL
NTS



FAN COIL/FURNACE UNIT DETAIL
NTS



DUCT MOUNTED REGISTER/GRILLE DETAIL
NTS

CITY OF CARMEL A PARTNERSHIP FOR COMMUNITY INDIANA

MECHANICAL DETAILS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	10-24-24	ADDENDUM 1	JDM

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SCALE AS NOTED

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JDM	LKB	JDM

STATUS: ISSUED FOR BID

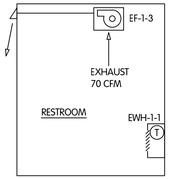
DATE: SEPTEMBER 2024

SHEET NO.

M-0.2

37 OF 50

TOL-7893001M02-MECHANICAL DETAILS
10/30/2024 8:15 AM - RWORLEY
10/30/2024 8:15 AM

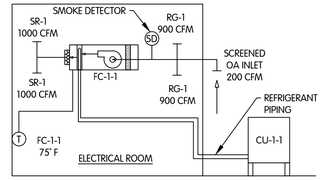


RESTROOM AIRFLOW SCHEMATIC

RESTROOM HEATING AND VENTILATION SEQUENCE OF OPERATION:

EXHAUST FAN EF-1-3 SHALL BE CONTROLLED AND INTERLOCKED WITH THE ROOM LIGHT SWITCH. WHEN THE LIGHT SWITCH IS ACTIVATED, EXHAUST FAN EF-1-2 SHALL BE ACTIVATED. WHEN THE LIGHT SWITCH IS DE-ACTIVATED, EXHAUST FAN EF-1-2 SHALL BE DE-ACTIVATED.

ELECTRIC WALL HEATER EWH-1-1 SHALL BE CONTROLLED BY AN INTEGRAL SINGLE TEMPERATURE THERMOSTAT THAT MAINTAINS SPACE TEMPERATURE BY CONTROLLING UNIT HEATING ELEMENTS AND FAN SIMULTANEOUSLY.



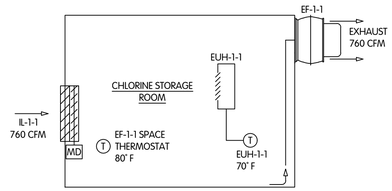
ELECTRICAL ROOM AIRFLOW SCHEMATIC

ELECTRICAL ROOM (FC-1-1/CU-1-1) SEQUENCE OF OPERATION:

HEAT AND COOL THE ELECTRICAL ROOM BY A SPLIT SYSTEM CONSISTING OF AN INDOOR FAN COIL UNIT FC-1-1 AND OUTDOOR CONDENSING UNIT CU-1-1. CONTROL THE SYSTEM BY A SINGLE STAGE HEAT/SINGLE STAGE COOL, WALL MOUNTED THERMOSTAT WITH MANUAL/AUTOMATIC HEAT-COOL CHANGEOVER. ENERGIZE FAN COIL UNIT FAN AND STAGE CONDENSING UNIT COMPRESSORS WHENEVER THE THERMOSTAT CALLS FOR COOLING TO MAINTAIN SET-POINT.

COMPRESSORS SHALL RUN SUBJECT TO THEIR OWN INTERNAL SAFETIES AND CONTROLS. DE-ENERGIZE THE COOLING AND FAN WHEN THERMOSTAT HAS REACHED SET-POINT. ENERGIZE FC-1-1 FAN AND STAGE ELECTRIC RESISTANCE HEATING COIL WHENEVER THE THERMOSTAT CALLS FOR HEATING TO MAINTAIN SET-POINT. THE HEATING COIL SHALL BE ACTIVATED IN STAGES. DE-ENERGIZE THE HEATING COIL, AND FAN WHEN THE THERMOSTAT HAS REACHED SET-POINT.

MOTORIZED BACKDRAFT DAMPER MD IN THE OUTSIDE AIR DUCT SHALL BE ENERGIZED OPEN WHENEVER FC-1-1/CU-1-1 ARE ACTIVATED TO ALLOW 200 CFM OF OUTSIDE AIR TO ENTER THE UNIT. MD SHALL BE DE-ENERGIZED CLOSED WHENEVER FC-1-1/CU-1-1 IS DE-ENERGIZED.

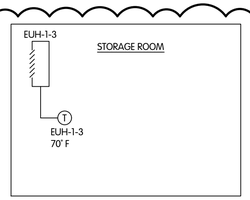


CHLORINE STORAGE ROOM AIRFLOW SCHEMATIC

CHLORINE STORAGE ROOM HEATING AND VENTILATION SEQUENCE OF OPERATION:

VENTILATION SHALL BE PROVIDED BY EXHAUST FAN EF-1-1 AND INTAKE LOUVER WITH MOTORIZED BACKDRAFT DAMPER IL-1-1. EF-1-1 SHALL BE CONTROLLED BY AN H-O-A SWITCH. IN THE HAND POSITION, THE EXHAUST FAN MOTOR IS ACTIVATED. IN THE AUTO POSITION, A SINGLE TEMPERATURE WALL MOUNTED THERMOSTAT SHALL CYCLE THE FAN MOTOR. IL-1-1 MOTORIZED BACKDRAFT DAMPER SHALL PROVIDE MAKE-UP AIR FOR EF-1-1. THE MOTORIZED BACKDRAFT DAMPER SHALL BE ACTIVATED OPEN WHENEVER THE EXHAUST FAN MOTOR IS ACTIVATED. WHENEVER THE EXHAUST FAN MOTOR IS DEACTIVATED, THE MOTORIZED BACKDRAFT DAMPER SHALL BE DEACTIVATED AND GO THE THE CLOSED POSITION.

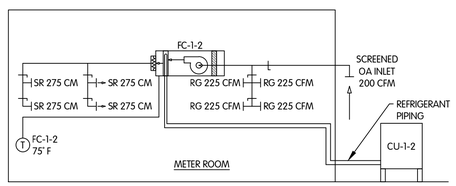
ELECTRIC UNIT HEATER EUH-1-1 SHALL BE CONTROLLED BY A SINGLE TEMPERATURE, WALL-MOUNTED THERMOSTAT THAT MAINTAINS SPACE TEMPERATURE BY CONTROLLING UNIT HEATING ELEMENTS AND FAN SIMULTANEOUSLY.



STORAGE ROOM AIRFLOW SCHEMATIC

STORAGE ROOM HEATING SEQUENCE OF OPERATION:

ELECTRIC UNIT HEATER EUH-1-3 SHALL BE CONTROLLED BY A SINGLE TEMPERATURE, WALL-MOUNTED THERMOSTAT THAT MAINTAINS SPACE TEMPERATURE BY CONTROLLING UNIT HEATING ELEMENTS AND FAN SIMULTANEOUSLY.



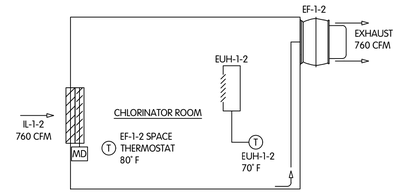
METER ROOM AIRFLOW SCHEMATIC

METER ROOM (FC-1-2/CU-1-2) SEQUENCE OF OPERATION:

HEAT AND COOL THE ELECTRICAL ROOM BY A SPLIT SYSTEM CONSISTING OF AN INDOOR GAS FIRED FURNACE FC-1-2 AND OUTDOOR CONDENSING UNIT CU-1-2. CONTROL THE SYSTEM BY A TWO STAGE HEAT/SINGLE STAGE COOL, WALL MOUNTED THERMOSTAT WITH MANUAL/AUTOMATIC HEAT-COOL CHANGEOVER. ENERGIZE FURNACE FAN AND STAGE CONDENSING UNIT COMPRESSORS WHENEVER THE THERMOSTAT CALLS FOR COOLING TO MAINTAIN SET-POINT.

COMPRESSORS SHALL RUN SUBJECT TO THEIR OWN INTERNAL SAFETIES AND CONTROLS. DE-ENERGIZE THE COOLING AND FAN WHEN THERMOSTAT HAS REACHED SET-POINT. ENERGIZE FC-1-2 FAN AND HEATING WHENEVER THE THERMOSTAT CALLS FOR HEATING TO MAINTAIN SET-POINT. THE HEATING SHALL BE ACTIVATED IN STAGES. DE-ENERGIZE THE UNIT HEATING, AND FAN WHEN THE THERMOSTAT HAS REACHED SET-POINT.

MOTORIZED BACKDRAFT DAMPER MD IN THE OUTSIDE AIR DUCT SHALL BE ENERGIZED OPEN WHENEVER FC-1-2/CU-1-2 ARE ACTIVATED TO ALLOW 200 CFM OF OUTSIDE AIR TO ENTER THE UNIT. MD SHALL BE DE-ENERGIZED CLOSED WHENEVER FC-1-2/CU-1-2 IS DE-ENERGIZED.

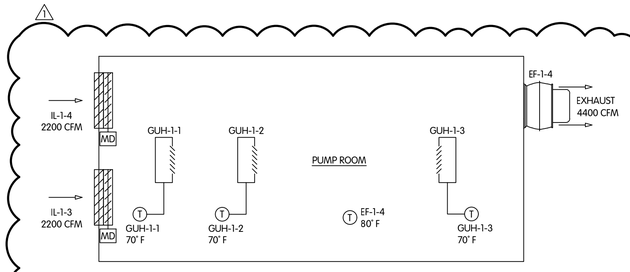


CHLORINATOR ROOM AIRFLOW SCHEMATIC

CHLORINATOR ROOM HEATING AND VENTILATION SEQUENCE OF OPERATION:

VENTILATION SHALL BE PROVIDED BY EXHAUST FAN EF-1-2 AND INTAKE LOUVER WITH MOTORIZED BACKDRAFT DAMPER IL-1-2. EF-1-2 SHALL BE CONTROLLED BY AN H-O-A SWITCH. IN THE HAND POSITION, THE EXHAUST FAN MOTOR IS ACTIVATED. IN THE AUTO POSITION, A SINGLE TEMPERATURE WALL MOUNTED THERMOSTAT SHALL CYCLE THE FAN MOTOR. IL-1-2 MOTORIZED BACKDRAFT DAMPER SHALL PROVIDE MAKE-UP AIR FOR EF-1-2. THE MOTORIZED BACKDRAFT DAMPER SHALL BE ACTIVATED OPEN WHENEVER THE EXHAUST FAN MOTOR IS ACTIVATED. WHENEVER THE EXHAUST FAN MOTOR IS DEACTIVATED, THE MOTORIZED BACKDRAFT DAMPER SHALL BE DEACTIVATED AND GO THE THE CLOSED POSITION.

ELECTRIC UNIT HEATER EUH-1-2 SHALL BE CONTROLLED BY A SINGLE TEMPERATURE, WALL-MOUNTED THERMOSTAT THAT MAINTAINS SPACE TEMPERATURE BY CONTROLLING UNIT HEATING ELEMENTS AND FAN SIMULTANEOUSLY.



PUMP ROOM AIRFLOW AND CONTROL SCHEMATIC

VENTILATION (EF-1-4/IL-1-3 &IL-1-4) SEQUENCE OF OPERATION:

VENTILATION FOR THE PUMP ROOM SHALL BE PROVIDED BY EXHAUST FAN EF-1-3 AND INTAKE LOUVERS WITH MOTORIZED BACKDRAFT DAMPERS IL-1-3 AND IL-1-4. EF-1-3 SHALL BE CONTROLLED BY A HAND-OFF-AUTO SWITCH. IN THE HAND POSITION, THE EXHAUST FAN MOTOR IS ACTIVATED. IN THE AUTO POSITION, A SINGLE TEMPERATURE WALL MOUNTED THERMOSTAT SHALL CYCLE THE FAN MOTOR. IL-1-3 AND IL-1-4 MOTORIZED BACKDRAFT DAMPERS SHALL PROVIDE MAKE-UP AIR FOR EF-1-3. THE MOTORIZED BACKDRAFT DAMPERS SHALL BE ACTIVATED OPEN WHENEVER THE EXHAUST FAN MOTOR IS ACTIVATED. WHENEVER THE EXHAUST FAN MOTOR IS DEACTIVATED, THE MOTORIZED BACKDRAFT DAMPERS SHALL BE DEACTIVATED AND GO TO THE CLOSED POSITION.

HEATING (GUH-1-1, GUH-1-2, & GUH-1-3) SEQUENCE OF OPERATION:

GAS FIRED UNIT HEATERS GUH-1, GUH-2 & GUH-3 SHALL BE CONTROLLED BY SINGLE TEMPERATURE, WALL MOUNTED THERMOSTATS THAT MAINTAINS SPACE TEMPERATURE OF 70°F BY CYCLING UNIT GAS AND FAN CONTROLS. UNITS SHALL BE EQUIPPED WITH A HIGH LIMIT AND FAN TIME DELAY RELAY. THE FAN TIME DELAY RELAY SHALL DELAY THE FAN START UNTIL THE HEAT EXCHANGER REACHES A PREDETERMINED TEMPERATURE AND ALLOW THE FAN TO OPERATE AFTER BURNER SHUTDOWN TO REMOVE RESIDUAL HEAT FROM THE HEAT EXCHANGER. PROVIDE FACTORY ASSEMBLED FLUE VENT FAN SHALL BE ACTIVATED IN RESPONSE TO THE SPACE THERMOSTAT. A FACTORY PROVIDED COMBUSTION AIR PRESSURE PROVING SWITCH SHALL VERIFY PROPER POWERED VENT FLOW PRIOR TO ALLOWING GAS VALVE TO OPERATE.

MECHANICAL SCHEMATICS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

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1	10-24-24	ADDENDUM I	JDM

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DATE: SEPTEMBER 2024

SHEET NO.

M-0.4

39 OF 50

SPLIT SYSTEM FAN COIL UNIT/CONDENSING UNIT SCHEDULE

TAG	LOCATION	TYPE	SUPPLY AIRFLOW (CFM)	OUTSIDE AIRFLOW (CFM)	SUPPLY FAN			HEATING OUTPUT CAPACITY	COOLING CAPACITY		AHU					FILTER		CU					NOTES
					E.S.P. (IN. W.C.)	HP	BLOWER TYPE		TOTAL (MBH)	SENSIBLE (MBH)	MAKE	MODEL	V/PH/HZ	MCA	MFS	TYPE	MERV	MAKE	MODEL	V/PH/HZ	MCA	MFS	
FC-1-1/CU-1-1	ELECTRICAL ROOM	SPLIT SYSTEM/DX COIL	2,000	200	0.60	1-1/2	CENTRIFUGAL	5 KW	84	54	TRANE	BCHE072	480/3/60	11.65	15.0	2" PLEATED	8	TRANE	TTA09044AAA	480/3/60	17.0	30.0	1,2,3,4,5,6,7,8,9
FC-1-2/CU-1-2	METER ROOM	FURNACE/DX COIL	1,100	200	0.60	0.5	CENTRIFUGAL	38.8 MBH	34	25	TRANE	4TXCB004DS3 + S9X2B040U3PSB	120/1/60	9.40	15.0	2" PLEATED	8	TRANE	4TTR4036	480/3/60	18.0	30.0	1,2,3,4,5,6,7,8,9

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. PROVIDE AIR HANDLING UNIT WITH SPRING VIBRATION ISOLATORS FOR HORIZONTAL INSTALLATION.
3. PROVIDE EVAPORATOR COIL WITH REMOVABLE COMPOSITE DRAIN PAN.
4. EVAPORATOR COIL ENTERING AIR DRY BULB/WET BULB TEMPERATURES: 80/67 DEGREES F.
5. CONDENSING UNIT ENTERING AIR DRY BULB TEMPERATURE: 95 DEGREES F.
6. PROVIDE PRE-CHARGED LINE SETS FOR INSTALLTION OF REFRIGERANT PIPING, REFRIGERNT R-410A.
7. PROVIDE 24 VOLT TWO STAGE HEATING, TWO STAGE COOLING THERMOSTAT WITH AUTOMATIC CHANGEOVER.
8. PROVIDE CONDENSING UNIT WITH LOW AMBIENT CONTROL FOR COOLING OPERATION TO OUTDOOR AMBIENT OF 0 DEGREES F.
9. HARD WIRED REMOTE CONTROLLER WITH MODE, FAN SPEED, AND TEMPERATURE SELECTION.

AIR OUTLETS AND INLETS SCHEDULE

TAG	SERVICE	TYPE	STATIC P.D. (IN. W.C.)	PATTERN	MATERIAL	FINISH	MAKE	MODEL	NOTES
SR	SUPPLY	REGISTER	0.08	DOUBLE DEFLECTION	ALUMINUM	CLEAR ANODIZED	TITUS	272FS	1,2,3,4
EG	EXHAUST	GRILLE	0.08	EGGCRATE	ALUMINUM	CLEAR ANODIZED	TITUS	50F	1,2,3,4

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. SEE DRAWING FOR SIZES, AIRFLOW, AND QUANTITY.
3. INTEGRAL BALANCING DAMPER.
4. DUCT MOUNTING.
5. LAY-IN T-BAR CEILING GRID MOUNTING.

GAS FIRED UNIT HEATER SCHEDULE

TAG	LOCATION	TYPE	AIRFLOW DISCHARGE	HEATING SECTION		AIRFLOW (CFM)	TEMPERATURE RISE (°F)	THROW (FT.)	ELECTRICAL		MAKE	MODEL	NOTES
				INPUT (BTUH)	OUTPUT (BTUH)				HP	V/PH/HZ			
GUH-1-1	PUMP ROOM	PROPELLER	HORIZONTAL	45,000	37,350	629	55	37	0.03	120/1/60	REZNOR	UDZ45	1,2,3,4
GUH-1-2	PUMP ROOM	PROPELLER	HORIZONTAL	45000	37350	629	55	37	0.03	120/1/60	REZNOR	UDZ45	1,2,3,4
GUH-1-3	PUMP ROOM	PROPELLER	HORIZONTAL	45000	37350	629	55	37	0.03	120/1/60	REZNOR	UDZ45	1,2,3,4

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. UNITS SHALL BE UL LISTED.
3. UL LISTED, NEMA 1 RATED, DISCONNECT SWITCH.
4. 24 VOLT, SINGLE STAGE, WALL MOUNTED THERMOSTAT.

ELECTRIC UNIT HEATER SCHEDULE

TAG	LOCATION	AIRFLOW DISCHARGE	OUTPUT CAPACITY (KW)	AIRFLOW (CFM)	THROW (FT)	AIR VELOCITY (FPM)	ELECTRICAL		MAKE	MODEL	NOTES
							FAN (HP)	(V/PH/HZ)			
EUH-1-1	CHLORINATOR ROOM	HORIZONTAL	5	405	12	430	1/15 HP	480/3/60	CHROMALOX	HD3D-500	1,2,6,7,9
EUH-1-2	CHLORINATOR ROOM	HORIZONTAL	5	405	12	430	1/15 HP	480/3/60	CHROMALOX	HD3D-500	1,2,6,7,9
EUH-1-3	STORAGE ROOM	HORIZONTAL	2	410	12	880	1/40 HP	208/1/60	CHROMALOX	LUH-02-21-34	1,2,3,4,5
EWH-1-1	REST ROOM	HORIZONTAL	2	-	-	-	-	208/1/60	QMARK	CWH1208DSAF	1,2,10,11

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. UNITS SHALL BE UL LISTED.
3. PROVIDE WITH WALL MOUNT SWIVEL BRACKET FOR UNIT MOUNTING.
4. PROVIDE WITH A UL LISTED DISCONNECT SWITCH.
5. PROVIDE 120 VOLT, SINGLE STAGE, WALL MOUNTED THERMOSTAT, CHROMALOX TYPE WR-80, OR EQUAL.
6. PROVIDE NEMA 4X, HORIZONTAL BLOWER HOSEDOWN TYPE, EPOXY COATED, STAINLESS STEEL CONSTRUCTION UNIT WITH UL LISTED DISCONNECT SWITCH NEMA 4X RATED.
7. PROVIDE WITH A STAINLESS STEEL, EPOXY COATED, WALL MOUNT SWIVEL BRACKET FOR UNIT MOUNTING.
8. PROVIDE WITH A STAINLESS STEEL, WALL MOUNT SWIVEL BRACKET FOR UNIT MOUNTING.
9. PROVIDE 120 VOLT, SINGLE STAGE, WALL MOUNTED THERMOSTAT, NEMA 4X, INDEECO #1004328, CHROMALOX WCRT-100, OR EQUAL.
10. PROVIDE WITH A SURFACE MOUNTING FRAME.
11. INTEGRAL ADJUSTABLE THERMOSTAT WITH 40-90 DEGREES F TEMPERATURE RANGE.

FAN SCHEDULE

TAG	LOCATION	TYPE	AIRFLOW (CFM)	STATIC PRESSURE (INCH W.C.)	DRIVE	POWER (HP)	ELECTRICAL (V/PH/HZ)	MAKE	MODEL	NOTES
EF-1-1	CHLORINATOR ROOM	CENTIRFUGAL BLOWER	760	0.50	BELT	1/4	480/3/60	LOREN COOK	ACWB 100W3B	1,3,4,5,7,8,9,11,12,19
EF-1-2	CHLORINATOR ROOM	CENTIRFUGAL BLOWER	760	0.50	BELT	1/4	480/3/60	LOREN COOK	ACWB 100W3B	1,3,4,5,7,8,9,11,12,19
EF-1-3	REST ROOM	CENTRIFUGAL ROOF UPBLAST	84	0.25	BELT	30.3 W	120/1/60	LOREN COOK	GC-146	1,2,7,17,26
EF-1-4	PUMP ROOM	CENTRIFUGAL WALL UPBLAST	4,400	0.25	BELT	1 1/2	120/1/60	LOREN COOK	ACWB 180W8B	1,2,12,13,14,15,19

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. INTEGRAL PRE-WIRED, NEMA 3R RATED DISCONNECT SWITCH.
3. INTEGRAL PRE-WIRED, EXPLOSION PROOF, NEMA 7 RATED DISCONNECT SWITCH.
4. EXPLOSION PROOF, NEMA 7 RATED MOTOR.
5. SPARKPROOF ALUMINUM CONSTRUCTION.
6. 12 INCH HIGH ROOF CURB OF ALUMINUM CONSTRUCTION.
7. GRAVITY TYPE BACKDRAFT DAMPER.
8. INLET AND OUTLET FLEXIBLE DUCT CONNECTIONS.
9. VIBRATION ISOLATORS.
10. BELT GUARD.
11. WEATHERPROOF MOTOR AND BELT GUARD COVER.
12. SPARE BELT SET.
13. SQUARE WALL MOUNT GRAVITY TYPE BACKDRAFT DAMPER.
14. SQUARE WALL GRILLE OF ALUMINUM CONSTRUCTION WITH WHITE ENAMEL FINISH.
15. ALUMINUM BIRDSCREEN.
16. STANDARD FINISH.
17. UNIT MOUNTED, INTEGRAL, PRE-WIRED, SOLID STATE SPEED CONTROLLER.
18. PACKAGED WALL SLEEVE, INLET GUARD, AND MOTORIZED BACKDRAFT DAMPER.
19. FINISH PROVEN CORROSION RESISTANT WITH HYDROGEN SULFIDE FUMES.
20. FRP CONSTRUCTION WITH STAINLESS STEEL BIRDSCREEN.
21. GRAVITY TYPE BACKDRAFT DAMPER OF FRP CONSTRUCTION.
23. INTEGRAL PRE-WIRED, NEMA 4X RATED DISCONNECT SWITCH.
24. PHENOLIC EPOXY WITH UV FINISH.
25. WEATHERHOOD WITH BIRDSCREEN.
26. WALL CAP WITH DAMPER.
27. TWO SPEED CONTROL.

CONTROL DAMPER SCHEDULE

TAG	TYPE	BLADES	MATERIAL	DUCT TYPE	MAKE	MODEL	NOTES
BD	BALANCING	OPPOSED	ALUMINUM	RECTANGULAR	RUSKIN	CD51	1,2,3,4
MD	MOTORIZED	PARALLEL	ALUMINUM	RECTANGULAR	RUSKIN	CD51	1,2,3,4
BDD	BACKDRAFT	PARALLEL	ALUMINUM	RECTANGULAR	RUSKIN	BD2A2	1,2,3,4

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. SEE DRAWINGS FOR SIZES, AIRFLOW, AND QUANTITY.
4. PROVIDE WITH LOCKING QUADRANT.
5. PROVIDE 120/1/60 DAMPER MOTOR OPERATOR.

LOUVER SCHEDULE

TAG	LOCATION	SERVICE	TYPE	MODULAR OPENING SIZE		DEPTH (IN.)	AIRFLOW (CFM)	FREE AREA (SQ. FT.)	MAKE	MODEL	NOTES
				WIDTH (INCHES)	HEIGHT (INCHES)						
IL-1-1	CHLORINATOR ROOM	INTAKE	COMBINATION	24	24	6	760	1.09	RUSKIN	ELC6375DAX	1,2,4,5,6,7,8,9
IL-1-2	CHLORINATOR ROOM	INTAKE	COMBINATION	40	16	6	760	1.09	RUSKIN	ELC6375DAX	1,2,4,5,6,7,8,9
IL-1-3	PUMP ROOM	INTAKE	COMBINATION	32	40	6	2200	3.15	RUSKIN	ELC6375DAX	1,2,4,5,6,7,8,9
IL-1-4	PUMP ROOM	INTAKE	COMBINATION	32	40	6	2200	3.15	RUSKIN	ELC6375DAX	1,2,4,5,6,7,8,9

NOTES:
1. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. FRONT STATIONARY DRAINABLE BLADE WITH INTEGRAL BACKDRAFT DAMPER.
3. STATIONARY DRAINABLE BLADE.
4. COMBINATION DRAINABLE BLADE.
5. 6063T6 EXTRUDED ALUMINUM CONSTRUCTION.
6. BIRDSCREEN MOUNTED ON EXTERIOR.
7. INSECT SCREEN MOUNTED ON INTERIOR.
8. KYNAR OR FLUOROPOLYMER FINISH ON ENTIRE LOUVER AND BIRDSCREEN. COLOR TO BE SELECTED BY OWNER.
9. TWO POSITION, SPRING RETURN, 120/1/60 BACKDRAFT DAMPER MOTOR ACTUATOR.
10. TWO POSITION, SPRING RETURN, EXPLOSION PROOF NEMA 12 RATED, DAMPER MOTOR ACTUATOR FOR CLASS I, DIVISION 1, GROUP D AREAS.
11. TWO POSITION, SPRING RETURN, 120/1/60, NEMA 4X, BACKDRAFT DAMPER MOTOR ACTUATOR.

CITY OF CARMEL A PARTNERSHIP FOR TOMORROW INDIANA

MECHANICAL SCHEDULES

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
5			
4			
3			
2	10-24-24	ADDENDUM I	JDM
1			

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STATUS: ISSUED FOR BID

DATE: SEPTEMBER 2024

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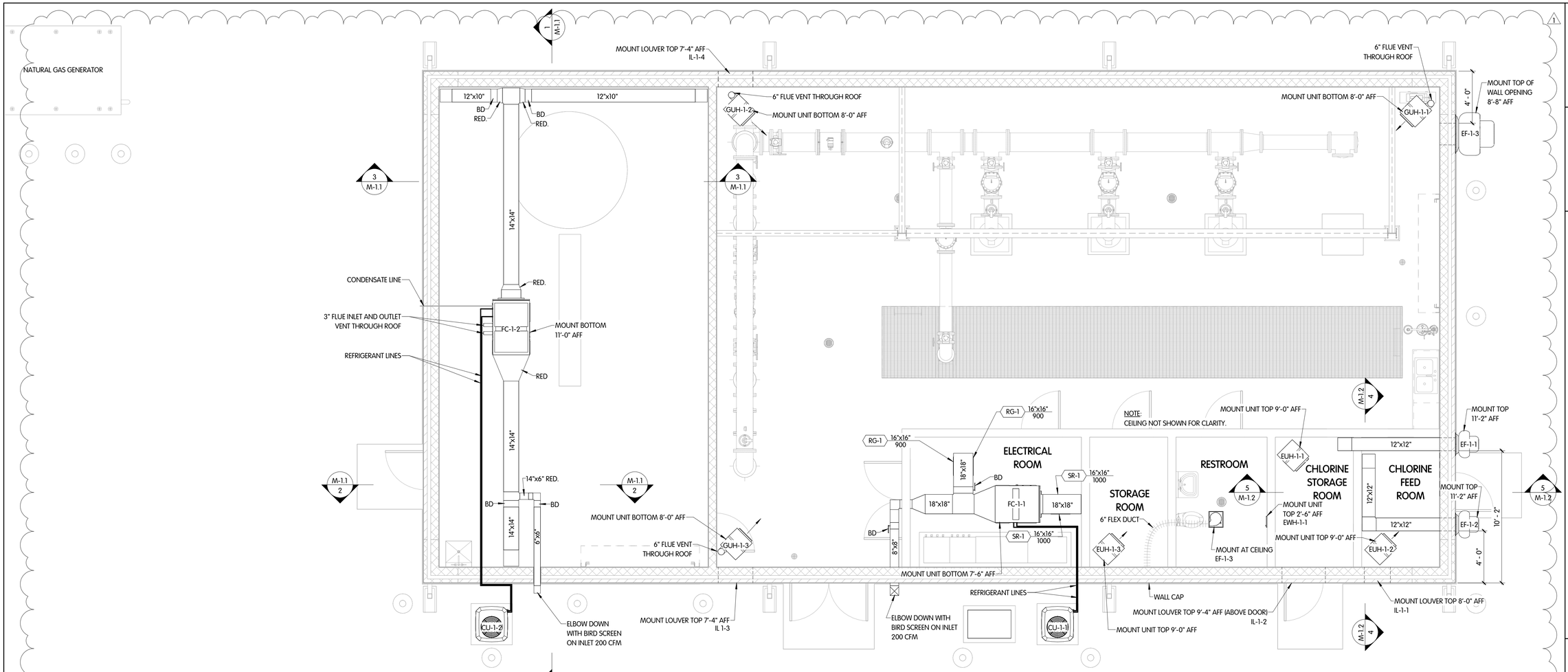
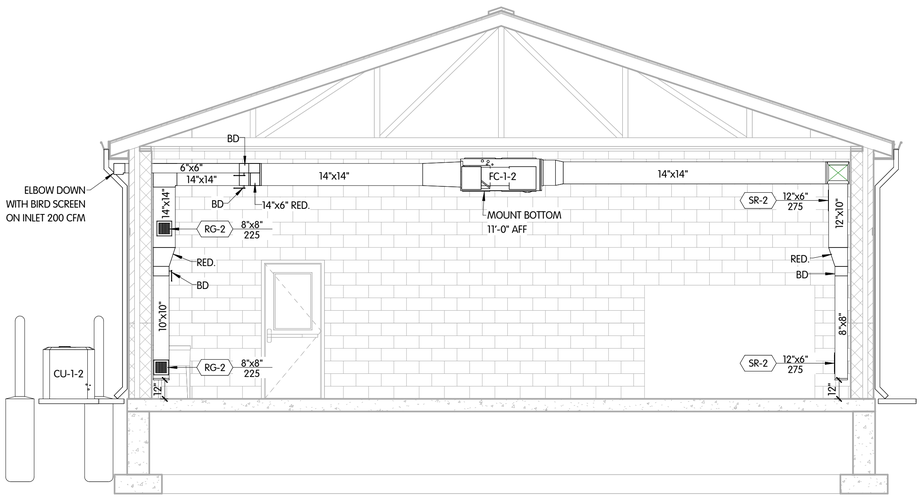
40 OF 50

TOL-7893001M05-MECHANICAL SCHEDULES
10/30/2024 8:15 AM - RWORLEY
10/30/2024 8:15 AM



PLAN @ EL. 930.00
1/4" = 1'-0"



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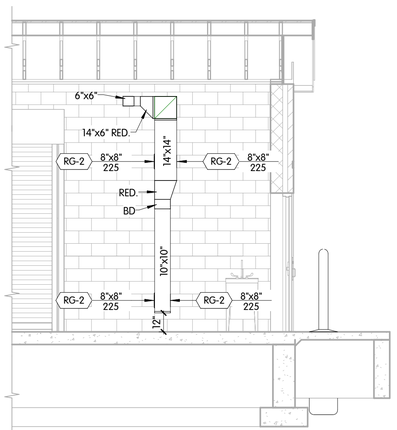

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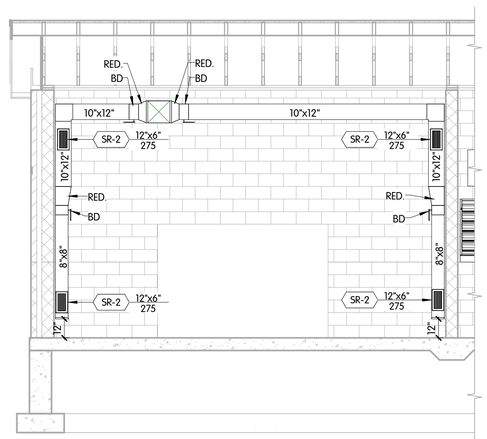

3 SECTION
M-1.1 1/4" = 1'-0"

CITY OF CARMEL
A PARTNERSHIP FROM GROWTH
INDIANA

PUMP BUILDING MECHANICAL
PLAN @ EL. 930.00 AND SECTIONS

WEST GROUND STORAGE TANK BOOSTER PUMP STATION
CITY OF CARMEL, INDIANA

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1	10-29-24	ADDENDUM 1	JDM

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M-1.1
41 OF 50