

**MOORE PUBLIC SCHOOLS
HIGHLAND EAST JUNIOR HIGH SCHOOL
CLASSROOM ADDITION**

**INDEPENDENT DISTRICT NO. 2
CLEVELAND COUNTY, MOORE, OKLAHOMA**

**1200 SOUTHEAST 4TH STREET
MOORE, OKLAHOMA 73160**

PROJECT MANUAL
SEPTEMBER 2021

AGP | the Abla Griffin
Partnership



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**1200 SOUTHEAST 4TH STREET
OKLAHOMA CITY, OKLAHOMA 73160**

ARCHITECT:

AGP | the Abla Griffin
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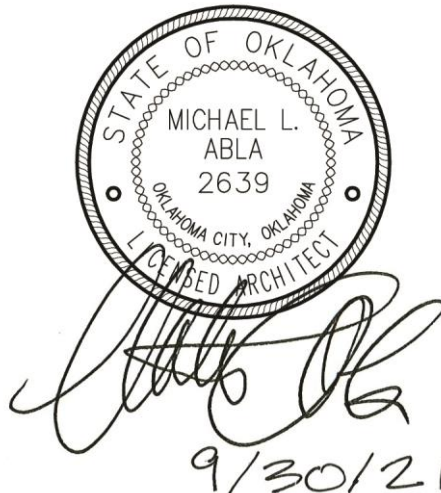


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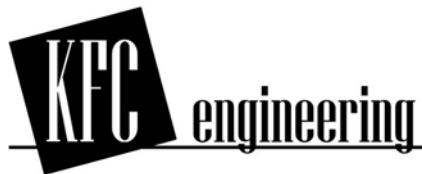
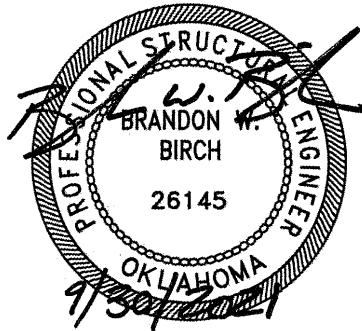
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Engineer of Record
Divisions 21, 22, 23
Dwayne McDonald Gordon
Mechanical Engineer
Salas O'Brien, LLC
OK 30822 / EXP 02.28.2022
CA 7058/ EXP 06.30.2023



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Engineer of Record
Divisions 26, 28
Timothy Van Ostran
Electrical Engineer
Salas O'Brien, LLC
OK 32650 / EXP 03.31.2023
CA 7058 / EXP 06.30.2023



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TIME FOR COMPLETION AND LIQUIDATED DAMAGES:

- A. Upon execution of the contract agreement between the Owner and the Contractor, it shall become an obligation of the contractor to complete all work to be performed under this agreement for the Construction of the new Highland East Junior High School STEM Classroom Addition to be located at 1200 Southeast 4th Street, Moore, OK - **within 270 Calendar Days.**
- B. Penalty for noncompliance by the above date shall be cessation of all further periodical payments until the work is completed and can be fully used for the purpose intended.

PAYMENTS:

- A. The Owner's payment schedule indicating the payment dates established by Moore Public Schools shall be provided to the contractor to establish a monthly payment schedule.
- B. **Certificates of payment shall be submitted to the Architect on or before 7 days prior to Owner's cut-off date.**
- C. Until the Work is 50 percent complete, the Owner will pay 95 percent of the amount due the Contractor on account of progress payments. At the time the Work is 50 percent complete, any **remaining** partial payments shall be paid at 97.5 percent of amount due. The retainage shall be retained until the project is completed.

INSURANCE AND BONDS:

- A. Insurance provided shall be with a company or companies licensed to do business in the state of Oklahoma.
- B. Policies shall be provided in the following types and amounts:
 - 1. a. Workmen's Compensation-Statutory
 - b. Employer's Liability-\$500,000 each accident.
 - 2. Comprehensive General Liability:
 - a. Bodily Injury - \$1,000,000 each occurrence.
 - b. Personal Injury - \$1,000,000
 - c. Property Damage - \$1,000,000 each occurrence
 - 3. Automobile Liability:
 - a. Bodily Injury - \$500,000 each person/\$1,000.000

- each occurrence
- b. Such Comprehensive Automobile Liability Insurance shall include all owned and non-owned hired motor vehicles.
4. Owner's Protective Liability - Same limits as above.
 5. Products and Completed Operations - Same limits as above.
 6. Contractual Liability - Same limits as above.
- C. Furnish one copy of Certificates herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by Subparagraphs 11.1 and 11.2. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.
 - D. **The Contractor shall provide property insurance in the amount of the initial contract sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. This insurance coverage shall be the "all-risk" form for completed value.**

TEMPORARY SERVICES:

- A. Sanitary Facilities: The Contractor shall provide and maintain necessary sanitary conveniences for the use of those employed on/or about the work. The sanitary facilities shall be properly secluded from public observation and shall be such locations as shall be approved by the Owner, and their use shall be strictly enforced.

SHOP DRAWINGS and SUBMITTALS:

- A. Unless otherwise specified, the shop drawings and product data shall be submitted **electronically**. Physical samples of materials shall be submitted to the Architect as required.
- B. Construction Manager is responsible for obtaining and distributing required prints of shop drawings to his subcontractors and material suppliers after as well as before final approval.
- C. Shop drawings and samples shall be dated and marked to show the names of the Project, Architect, CM, originating Sub-Contractor,

manufacturer or supplier, and separate detailer if pertinent. Shop drawings shall completely identify Specifications section and locations at which materials or equipment are to be installed. Reproduction of Contract Drawings are acceptable as Shop Drawings only when specifically authorized in writing by the Architect.

- D. If materials or specified items other than those specified in these Contract Documents are supplied - and approved by the Architect - it shall be the Construction Manager's responsibility to provide ALL additional materials, accessories, substrates, utility connection, etc. for a complete and operational installation at NO additional cost to the Owner.

CHANGES IN THE WORK:

- A. Cost shall be limited to the following: cost of materials, including sales tax and cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits under collective bargaining agreements; workmen's compensation insurance; bond premiums; and rental value of power tools and equipment. Overhead shall include the following; supervision, superintendence, wages of time keepers, watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost".
- B. Change Order markups shall be limited to 10% overhead and 10% profit. No other markups shall be allowed.

AS BUILT DRAWINGS:

- A. Provide and maintain in proper order and in good, clean condition in the field office at the project site, one complete full-size set of all working drawings. On this set of drawing prints, in red ink, neatly and accurately inscribe any and all changes in the work.
- B. Upon completion of work, the Contractor shall furnish one set of "as built" drawings. These drawings shall be contract drawings corrected in **red ink** to show any differences between contract drawings and actual construction. All changes made during construction shall be noted. Each drawing showing changes in dimensions, details, or containing supplemental information shall be plainly marked "**As Built**" and shall contain the signature of both the Architect and the Contractor.

CLOSEOUT SUBMITTALS:

Prepare project data in the form of an instructional manual supplied electronically on media as requested by Owner (CD or flash drive). The following information shall be included and arranged under a Table of Contents:

1. Directory listing names, addresses, and telephone numbers of the Architect/Engineer(s), General Contractor, Subcontractors, and major material/equipment suppliers.
2. Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and Suppliers. Include equipment, parts list for each, operating instructions, maintenance instructions for equipment, special finishes, etc.
3. Project documents and certificates, including shop drawings and product data, air and water balance reports, photocopies of warranties.
4. Record As-Built Drawings as described above.
5. Completed Non-Asbestos Affidavit.

DEBRIS DISPOSAL:

Waste disposal shall be the responsibility of the Contractor. The Contractor shall make arrangements with the local authorities having jurisdiction for accommodation of all waste disposal. If local facilities are not available the contractor shall be responsible for all other arrangements for waste disposal.

SUPPLEMENTARY CONDITIONS AND SPECIAL CONDITIONS:

In the following sections where the term "General Conditions" is used, it shall include the "Supplementary Conditions" and/or "Special Conditions" bound in this project manual.

MISCELLANEOUS PROVISIONS:

A. TESTS AND INSPECTIONS

Add the following clarification: **Regardless of how it is described elsewhere in the drawings and specifications, the CM shall engage all testing laboratories / subcontractors as approved by the Architect; and, pay for ALL testing as required by the drawings and specifications.** The CM shall pay for any additional testing due to defective work. The Owner shall pay for any additional testing requested and found to be non-

defective.

B. EQUAL OPPORTUNITY

The Contractor shall maintain policies of employment as follows:

The Construction Manager and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated fairly during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment advertising; layoff or termination; rates of pay or any other forms of compensation; and selection for training, including apprenticeship. The CM agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

C. COOPERATION WITH BUILDING OFFICIALS

Cooperate with applicable Federal, State, City or other governmental officials and inspectors at all times. If such officials or inspectors deem special inspections are necessary, provide assistance and facilities that will expedite their inspection.

Construction Manager shall be responsible for obtaining and paying for ALL building permits required for this project. This cost shall be included in the Construction Manager's General Conditions.

D. MEASUREMENTS

Before doing any work or ordering any materials, the Contractor shall verify all measurements of existing and new work, and shall be responsible for their correctness.

Any differences which may be found shall be submitted to the Architect for consideration before proceeding with the work. No extra compensation will be allowed because of differences between actual dimensions and measurements indicated on the working drawings.

E. MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS

Install all manufactured items of materials or equipment in strict accordance with manufacturer's recommended specifications, except that the specifications herein, where more stringent, shall be complied with.

At the completion of the project and prior to final acceptance by the Owner, provide the Owner with three complete sets of operating and maintenance instructions, and demonstrate to him the procedures for proper operation and maintenance of all equipment.

F. JOB MAINTENANCE

During the course of their work, all crafts and trades shall protect all work which preceded theirs from damage, and they shall make repairs or replacements to any damage caused either directly or indirectly by them.

G. COMPLIANCE WITH STATE AND FEDERAL LAWS

Construction Manager assumes full responsibility for the payment of all contributions and payroll taxes (state and federal) as to all subcontractors and employees engaged in the performance of work pursuant hereto and further agrees to check and meet all requirements that might be specified under regulations of the administrative officials or board charged with the enforcement of any state or federal act on the subject referred. CM agrees to furnish Owner, upon request, a certificate or other evidence of compliance therewith.

H. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA)

The Construction Manager shall comply with the latest edition and revision of The Federal Occupational Safety and Health Act of 1970 for construction.

I. GUARANTY BONDS

1. Prior to the Owner signing the contract agreement, he will require the Construction Manager to furnish performance and payment bonds covering the faithful performance of the entire construction contract agreement. The performance bond and the payment bond shall each be made out in one hundred percent (100%)

of the contract sum and shall be in a company or companies against which the Owner has no reasonable objection.

2. Bonds shall be signed by an official of the bonding company, and shall be accompanied by the bonding agent's written power-of-attorney in order that one copy may be attached to each copy of the contract agreement.
3. The Construction Manager shall include in his proposal amount the total premiums for all required bonds.
4. The Contractor does hereby warrant and/or guarantee against defects in all workmanship and materials performed or furnished by him directly or by his subcontractors for a period of one (1) year from the date of completion, as evidenced by the date of the Final Certificate or final acceptance of the project. Said warranty and/or guarantee shall be in the form of a good and sufficient bond in a sum equal to one hundred percent (100%) of the contract price.

End of Special Conditions



Project Number: 05462142-3
July 16, 2020

Professional Service Industries, Inc.
11825 S. Portland Avenue
Oklahoma City, OK 73170
Phone: (405) 735-6052
Fax: (405)735-6086

Mr. Michael L. Abl, AIA
AGP – The Abl Griffin Partnership, LLC
201 North Broadway, Suite 210
Moore, OK 73160

Re: Report of Geotechnical Engineering Services
Proposed Moore Public Schools Pre-Planning Services
Highland East Junior High School
New Classroom Addition
SEQ SE 4th Street and S. Bouziden Drive
Moore, Oklahoma

Dear Mr. Abl:

Thank you for choosing Professional Service Industries, Inc. (PSI), an Intertek company. The information you requested is attached.

PSI performed the geotechnical exploration that you requested on February 25, 2020. PSI transmits the geotechnical report with this letter.

We thank you for your business and we look forward to finding ways to grow our partnership, expand our services, and continue Building Better Together.

For Professional Service Industries, Inc.
CA NO. 1111 Expires 06/30/21



Yicheng Zhang, EI
Project Manager
Geotechnical Services



Adedamola I.O. Oyesanya, P.E.
Senior Geotechnical Engineer
Geotechnical Services





Report of Geotechnical Engineering Services

Proposed Moore Public Schools Pre-Planning
Services

Highland East Junior High School
New Classroom Addition
SEQ SE 4th Street and S. Bouziden Drive
Moore, Oklahoma

Prepared for

AGP – The Abla Griffin Partnership, LLC
201 North Broadway, Suite 210
Moore, OK 73160

Prepared by



Professional Service Industries, Inc.
11825 S. Portland Avenue
Oklahoma City, OK 73170

July 16, 2020

PSI Project 05462142-3



Yicheng Zhang, EI
Project Manager
Geotechnical Services



Adedamola I.O. Oyesanya, P.E.
Senior Geotechnical Engineer
Geotechnical Services

7/16/2020

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1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI), an Intertek company, has completed a geotechnical exploration for the proposed Moore Public Schools Pre-Planning Project's New Classroom Addition at the Highland East Junior High School in Moore, Oklahoma. PSI's services were authorized by Mr. Michael Abla, Principal, Abla Griffin Partnership, by signing PSI's proposal on February 25, 2020. This exploration was accomplished in general accordance with PSI Proposal No. P0546-303281 dated February 18, 2020.

1.2 PROJECT DESCRIPTION

Project information was provided by Mr. Clay Griffin, Principal, AGP. The proposed construction will consist of classroom additions to the southwest areas of the existing Highland East Junior High main building in Moore, Oklahoma. The proposed construction will also include a new road at the west side of the school site from SE 4th Street (Highway 37) to the south side of the new construction and terminating at existing and new parking areas to the southeast and east sides of the existing building. The existing school buildings in the areas of the proposed addition are essentially single-story. Detailed information about the construction type is not available to PSI; however, PSI anticipates the construction will be typical and not unusual for the type of project and use proposed. Available information includes the following:

Loading:

- Maximum column loads on the order of 10 to 200 kips.
- Maximum wall loads on the order of 4 kips per linear feet (estimated by PSI)
- Floor slab load not exceeding 250 pounds per square feet.

The report is also based on the following:

Grading:

- Cut and fill on the order of 0 to 2 feet to achieve design grade.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to explore the subsurface conditions at the site and prepare recommendations for geotechnical design considerations for the proposed building addition. PSI's scope of services included drilling a total of 4 soil test borings as requested, laboratory testing of select soil samples, and preparation of this geotechnical report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and includes the approximate boring locations, boring logs, and recommendations regarding the following:

- General site development and subgrade preparation.
- Foundation types and depths, allowable bearing capacities, and estimates of potential settlement.
- Seismic site class and site coefficients according to the 2015 IBC criteria.
- Lateral soil load parameters for retaining wall design.
- Comments regarding factors that may impact construction and performance of the proposed project.



The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below, or around this site. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

PSI did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminants in or around any structures, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence of, or recurrence of, mold amplification.

Laboratory consolidation testing for detailed analysis of settlement characteristics is not included in the present scope. However, consolidation settlements are not anticipated to be an issue for this project site.



2 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The site for the proposed New Classroom Addition is at the Highland East Junior High School located at the southeast quadrant of SE 4th Street and S. Bouziden Drive in Moore, Oklahoma. The latitude and longitude of the proposed construction site are approximately 35.3331°N and 97.4698°W, respectively. The site is the existing Highland East Junior High School and surface of the proposed project area is generally covered with grass and concrete sidewalk, and visually appears generally flat. Underground utilities exist in the areas of the proposed development. The truck-mounted drill rig experienced no mobility difficulty in accessing the boring locations.

2.2 SUBSURFACE CONDITIONS

The site subsurface conditions were explored with 4 soil test borings. The borings were located in the field by the drilling crew with a handheld GPS device and by estimating distances from known site reference points.

The exploration was performed with two ATV-mounted CME-750 drill rigs equipped with automatic hammers using 140-pound hammers dropping 30 inches. Soil samples were routinely obtained during the drilling process. Drilling and sampling techniques were accomplished generally in accordance with ASTM procedures. The approximate location of the borings performed are presented on the boring logs.

Select soil samples were tested in the laboratory for evaluation and determination of material properties including moisture content, Atterberg limits, and fines content. Laboratory testing was accomplished generally in accordance with ASTM procedures.

The subgrade materials encountered in the borings consisted of lean and fat clays with various sand contents to depths of approximately 3½ to 7½ over shaley clays that extended to depths of approximately 7½ to 11 feet below the surface. These materials are underlain by shale and siltstone bedrock that extended to the boring depths of approximately 25 feet below the surface. Please refer to the attached boring logs for more specific information. The following table briefly summarizes the range of results from the field and laboratory testing programs:

General Range of Material Property Values						
Soil Description	Approx. Depth Range, ft.	Standard Penetration, N, blows/foot	TCP inches/100 Blows	Moisture Content, %	Percent Fines (Passing # 200 Sieve)	Liquid Limit, % Plastic Limit, % Plasticity Index
Lean CLAY (various sand contents)	0 – 5.5	10 – 21	-	15 – 21	95.7 – 98.1	LL=34 – 42 PL=16 – 17 PI=18 – 25
Fat CLAY (various sand contents)	0 – 7.5	6 – 13	-	20 – 25	88.2 – 89.4	LL=51 PL=17 – 18 PI=33 – 34
Shaley CLAY	3.5 – 11	34 – 58	-	10 – 14	-	-



General Range of Material Property Values						
Soil Description	Approx. Depth Range, ft.	Standard Penetration, N, blows/foot	TCP inches/100 Blows	Moisture Content, %	Percent Fines (Passing # 200 Sieve)	Liquid Limit, % Plastic Limit, % Plasticity Index
SHALE & SILTSTONE (Bedrock)	7.5 – 25	PR	3.8 – 10.0	13 – 17	-	-

PR – Practical Refusal

2.2.1 SOIL CORROSIVITY LABORATORY TESTING

PSI performed laboratory testing on a select soil sample of Boring DB-1 to assess the pH and water-soluble sulfate content. The water-soluble sulfate testing was performed in general accordance to the ODOT’s OHD L-49. The pH testing was performed in general accordance to the ASTM G51. The results of the tests are summarized and provided in the table below:

Water Soluble Sulfate Test Results				
Boring	Depth (ft)	Soil pH	Sulfate Content	
			ppm (mg/kg)	Percent by Weight
DB-3	3	8.7	280	0.028

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring log included in the Appendix should be reviewed for specific information at the boring location. The boring log includes soil/rock descriptions, stratifications, penetration resistances, and locations of the samples. The stratifications shown on the boring log represent the conditions only at the actual boring location. Variations may occur and should be expected at other building section locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on the boring log. The samples that were transported to the laboratory will be retained for 60 days from the date of this report and then discarded.

2.3 GROUNDWATER INFORMATION

Groundwater was not observed to collect in the borings during drilling nor upon completion of drilling, indicating measurable groundwater may be below the maximum depths of the borings or the groundwater will require additional time to stabilize in the open holes. Groundwater can exist at varying depths during other times of the year depending upon climatic and rainfall conditions. Discontinuous zones of perched water can exist within the overburden materials and/or at the contact with bedrock.



3 EVALUATION AND RECOMMENDATIONS

3.1 GEOTECHNICAL DISCUSSION

The geotechnical related recommendations presented in this report have been developed on the basis of the subsurface conditions encountered and PSI's understanding of the proposed project. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to the recommendations will be required. The performance of the construction will be dependent upon site preparations and the shear strength of the overburden soils and the underlying bedrock.

There is a primary geotechnical related concern at this project site that should be expected to affect lightly loaded grade supported elements such as floor slab type construction regards the shrink/swell potential of the subgrade soils encountered in the borings. The concern is discussed in the report subsection below.

3.1.1 SWELL POTENTIAL CLAYS

Medium high to high plasticity clay soils with moderate to high shrink/swell potential were encountered in the borings. These moderate to high shrink/swell potential materials are expected to exhibit significant volume changes with variations in subgrade moisture. The calculated Potential Vertical Rise (PVR) for slab-on-grade type construction at this project site is on the order of 2 to 2½ inches for these soils, assuming that the medium high to high plasticity subgrade materials are allowed to increase in moisture content from a relatively dry condition to a relatively wet condition over a depth of approximately 8 feet. The relatively dry condition can occur with severe dry weather situations, thereby resulting in a significant degree of shrinkage and eventual potential swell in the foundation material. Differential movements are expected to be about ½ of the PVR. However, it should be noted that for extreme conditions (i.e., soils dry and shrink in one area with soils in another area being exposed to water and swelling) differential movement can be equal to or even double the PVR.

A reduction in potential vertical movement can be achieved by supporting the floor slab on a minimum of 2½ feet of properly compacted low plasticity structural fill or modified existing soils to reduce the calculated PVR to 1 inch or less. However, due to the potential for "bathtub effect" usually created by granular structural fill replacing and overlying relatively low permeability clay material in undercut areas, PSI recommends the amount of material in the structural fill passing the #200 sieve not be less than 60 percent, at least in replacing the undercut. The greater the structural fill or modified existing soil (used as structural fill) thickness beneath the slab, the less the probability of structural distress due to shrinkage and swelling of the clay soils. The structural fill should extend a minimum of 5 feet beyond the edges of the structure. The desired thickness of fill can be provided by raising the site grade with the properly compacted recommended materials or undercutting and replacing with the recommended materials. Proof-rolling and visual observation, as discussed later in this report, should be accomplished to aid in identifying soils which should be removed from the floor slab area prior to fill placement and/or floor slab construction.

3.1.1.1 LIME, CEMENT, OR FLY ASH STABILIZATION

The existing medium high plasticity clay subgrade soils with medium to medium high shrink/swell potential can also be modified with hydrated lime, Portland cement, or class 'C' fly ash from a source approved by ODOT and used as structural fill. This will also reduce potential for "bathtub" effect when used as backfill in undercuts. Stabilizing the subgrade soil with an estimated 5 to 7 percent cement or lime or an estimated 12 to 14 percent fly ash, by dry weight, will reduce the potential volumetric changes due to the high shrink/swell potential soils.



The actual cement, lime, or fly ash percentage should be determined based on laboratory tests after the source of the stabilizing agent has been determined.

3.1.2 BUILDING ADDITIONAL CONSIDERATIONS

Information about the existing building foundations is not available to PSI. For new footings in proximity of existing foundation, additional stress may and should be expected to be exerted on the subsurface material supporting the existing footings. The additional stress may result in additional settlement of the footings supporting the existing structures. Generally, the deeper the new foundation and the closer the new foundation will be to the existing foundation, the higher the potential for the additional settlements. If shallow foundation is considered and if practical for the shallow new foundation, PSI recommends as much separation as possible between the old and new foundation. Evaluation of the influence may be based on a straight-line projecting outward and downward at an angle of 45° from the bottom of the new footing. The line not intersecting the lower existing footing and vice versa may be considered adequate and non-influential; else, additional stress analysis will be required. However, it is recommended the existing footing also be monitored during construction.

3.2 GEOLOGIC UNIT

Division Three publication of the “Engineering Classification of Geologic Materials” manual published by ODOT indicates the project site is underlain by the Hennessey Unit (Phy) in Cleveland County.

This unit consists of red platy to blocky clay shales and mudstone. The mudstones are hard and appear blocky. The red clay shale of the Hennessey Unit is characterized by numerous bands of streaks of white or light green color ranging from a few inches to four feet in thickness. Small spheres of light green color up to 10 inches in diameter are an odd characteristic of the unit.

The total thickness of the unit varies from 400 to 600 feet.

The Hennessey Unit outcrops in a 5 to 20 miles wide north-south band across Cleveland, McClain, and Garvin Counties in Division 3.

Topographically, the unit is near level to gently rolling prairies, but most of the more level outcrops of the unit are cultivated.

3.3 SEISMIC INFORMATION

The 2015 International Building Code requires a site class for the calculation of earthquake design forces. This class is a function of soil type (i.e. depth of soil and strata types). Based on the type of materials encountered to the boring termination depths and the estimated shear strength of the soil at the boring locations, Site Class C is recommended. The IBC-2015 probabilistic ground motion values near the project site are as follows:



Seismic Design Parameters			
Period (seconds)	2% Probability of Event in 50 years (g)	Site Coefficient F_a	Site Coefficient F_v
0.2 (S_s)	0.269	1.2	N/A
1.0 (S_1)	0.078	N/A	1.7

S_{DS} : 0.216g
 S_{D1} : 0.089g
PGA: 0.159g
 PGA_M : 0.191g (Site modified peak ground acceleration)
Seismic Design Category (SDC): B

3.4 SITE PREPARATION

Vegetation, topsoil, deleterious materials, and soft and loose soil in the construction area should be stripped from the site and either wasted or stockpiled for later use in non-load bearing areas such as landscaping. The depth of removal should be determined by a representative of the Geotechnical Engineer at the time of construction.

After stripping and excavating to the proposed subgrade level, the construction area should be proof rolled with a tandem axle dump truck or similar rubber-tired vehicle. Soils which are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load (typically 9 tons/axle) should be undercut and recompacted in place or replaced with properly compacted recommended fill. The recompacted soil or imported structural fill or engineered fill should be moisture conditioned during placement. The proof-rolling and undercutting activities should be witnessed by a representative of the Geotechnical Engineer and should be performed during a period of dry weather. Access to compaction equipment may be limited in some of the proposed construction areas due to the existing building. Other modes of compaction and site preparation, such as walk-behind portable compaction machine may be applicable.

After proof-rolling and correcting soft areas or areas exhibiting rutting or pumping, the subgrade soils should be scarified and compacted for a depth of at least 8 inches below the surface.

After subgrade preparation and testing have been completed, fill placement that will be required to establish site design grades should begin. The first layer of fill material should be placed in a relatively uniform horizontal lift and adequately keyed into the stripped and scarified subgrade soils. PSI recommends fill materials be free of organic or other deleterious material, have a maximum particle size less than 3 inches, have a liquid limit not more than 35 and plasticity index in the range of 5 to 18 and percent of fines passing the #200 sieve not less than 60 percent at least in replacing undercuts. The on-site soils generally do not appear suitable for use as structural fill without modification/stabilization as previously discussed but may be stockpiled for later use in non-load bearing areas such as landscaping. Accurate moisture control will be required to achieve the recommended degree of compaction. Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by ASTM D698.

Fill should be placed in maximum lifts of 8 inches of loose material and should be compacted at a moisture content ranging from -2 to +3 percentage points of optimum moisture content. Stabilized materials should be placed at a minimum water content of 2 percentage points above the optimum moisture content. If water must be



added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts. The edges of compacted fill should extend a minimum of 5 feet beyond the edges of the proposed structure prior to sloping on as flat a gradient as practical. Care should be taken to apply compaction effort throughout the entire fill area.

For structural fill, PSI recommends that such fill be tested by a Geotechnical Technician and directed by a Geotechnical Engineer to monitor and document the placement of fill material. It should be noted that the Geotechnical Engineer of record can only certify the testing that is performed, and the work observed by that engineer or staff in direct report to that engineer. PSI recommends that the fill be monitored in general accordance with the following table:

Fill Placement Criteria				
Material Tested	Proctor Type	Min % Dry Density	Placement Moisture Content Range from OMC	Frequency of Testing (Based on 8-inch lifts)
Structural Fill	Standard	95%	-2 to +3%	1 per 2,500 ft ² of fill placed
Stabilized Existing Soil			≥+2%	
Random Fill (non-load bearing)	Standard	90%	-2 to +3%	1 per 10,000 ft ² of fill placed
Utility Trench Backfill	Standard	95%	-1 to +3%	1 per 200 cy of fill placed

A minimum of 3 field density tests per lift is recommended. If the borrow or source of fill changes, a new reference moisture/density test should be performed.

The overall performance of the construction will also depend on how well the site drains during the construction and the life of the structure. Grading of the site around the structure’s pads should be accomplished to enable positive drainage away from the pads by providing an adequate gradient. The surface gradient provided will be dependent on the landscaping type and vegetation. Water infiltration and seepage into the foundation should be avoided as much as possible. If it is possible for water to collect beneath the foundation and foundation areas, it will be necessary to use interceptor drains to remove the collected water.

Excavation for utility trenches should be performed in accordance with OSHA regulations as stated in 29 CFR Part 1926. It should be noted that utility trench excavations have the potential to degrade the properties of the adjacent fill materials. Utility trench walls that are allowed to move laterally can lead to reduced bearing capacity and increased settlement of adjacent structures and structural elements.

Backfill for utility trenches is as important as the original subgrade preparation or structural fill placed to support foundations. Unless otherwise specified, the backfill for the utility trenches should be placed in 4- to 6-inch loose lifts and compacted to a minimum of 95% of the maximum dry density achieved by the standard Proctor test. The backfill soil should be moisture conditioned in the range of 1 percentage point below to 2 percentage points above the optimum moisture content value as determined by the standard Proctor test. Up to 4 inches of bedding material placed directly under the pipes or conduits placed in the utility trench can be compacted to the 90% compaction criteria with respect to standard Proctor maximum dry density. Compaction testing should be performed for every 200 cubic yards of backfill placed or for each lift within 200 linear feet of trench, whichever



is less. Backfill of utility trenches should not be performed with water standing in the trench. Structural fill should be used as the trench backfill material.

3.5 SHALLOW FOUNDATION RECOMMENDATIONS

The types and depths of foundations suitable for given structure depend on several factors including the subsurface conditions, the functions of the structure, the loads they will carry, the external (lateral and uplift) forces they will resist, and the cost of the foundations. A conventional type spread footing foundation system or a monolithic slab-on-grade foundation system (reinforced or post-tensioned) may be considered for support of the building units. PSI has provided in this report section parameters that may be considered for the recommended shallow foundation systems.

A shallow foundation system may be considered for the support of the building, based on the subsurface conditions encountered by the borings. PSI has provided recommendations for both a conventional type spread footing foundation system and a monolithic slab-on-grade foundation system (reinforced or post-tensioned) for consideration and support of the proposed structure.

3.5.1 CONVENTIONAL SPREAD FOOTING RECOMMENDATIONS

The planned structure may be supported on conventional spread footing foundations. Spread footings for columns and continuous wall footings bearing on the existing soil or properly compacted structural fill or modified existing fill, as discussed, can be designed for allowable unit bearing pressures of 2,500 psf and 2,000 psf, respectively, based on dead load plus design live load. However, footings extended to a minimum depth of 5 feet below the present grade can be designed for higher bearing capacities of 3,500 psf and 2,500 psf for spread and continuous footings, respectively, based on dead load plus design live load. Foundation elements should bear a minimum depth of 2 feet below the final grade for frost protection. The allowable bearing capacities are based on a factor of safety of 3.

It is important that PSI observes and documents the footing excavations prior to concrete placement. Minimum dimensions of 24 inches for square footings and 18 inches for continuous wall footings should be used in design of the footings to reduce the possibility of a local bearing capacity failure.

The foundation excavations should be observed by a representative of PSI prior to steel or concrete placement to document that the foundation materials are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of acceptable residual soils or adequately compacted structural fill as directed by the Geotechnical Engineer. The bottom of the footings should be probed to identify and locate soft areas. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with lean concrete or properly compacted structural fill.

The uplift resistance of the foundations will be limited by the weight of the foundation concrete and soil above them and the dead weight of the structure. For design purposes, the ultimate uplift resistance should be based on effective unit weights derived from presumptive total unit weights of 120 pcf and 150 pcf for soil and concrete, respectively. A factor of safety of 2 should be applied to the uplift resistance.

Footing excavations should be observed, and concrete placed as quickly as possible to avoid exposure of the footing bearing surfaces to wetting and drying. Surface run-off water should be drained away from the



excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If footing excavations are left open for more than 1 day, they should be protected to reduce evaporation or entry of moisture.

Based on the known subsurface conditions, site geology, laboratory testing, anticipated loading, and allowable bearing pressures, properly designed and constructed footings for the building supported on the properly compacted recommended materials should experience maximum total and differential settlements between adjacent columns of less than 1 inch and $\frac{3}{4}$ inch, respectively.

3.5.2 MONOLITHIC SLAB-ON-GRADE FOUNDATION RECOMMENDATIONS

As an alternative to remediation of the existing subgrade for the new construction due to the medium high to high plasticity clay and the existing undocumented fill, the use of alternative type of foundation such as a monolithic slab type foundation may be considered. PSI has not performed a cost/benefit analysis of suitable foundation type for the project.

If additional movements can be tolerated, a steel-reinforced (conventional or post-tension reinforcing) slab on-grade foundation system (with or without waffle-type grade beam configuration) may be considered for support of the proposed structure. The slab-on-grade foundation system may be supported on the existing subgrade material, provided the associated expected movements can be tolerated, or structural fill as recommended. The thickened edge portion may also be supported on the existing soils or the structural fill.

Structural fill should consist of materials as described in the Site Preparation and Fill Materials section of this report. Proof rolling, as discussed earlier in this report, should be accomplished to identify any soft or unstable soils that should be removed from the slab area prior to fill placement and floor slab construction. Select fill required to achieve grade should extend a minimum 5 foot beyond the perimeter of the slab. Fill soil below the slab should be moisture conditioned.

Thickened edges supported on properly compacted existing soils or structural fill materials may be designed using a maximum allowable unit bearing capacity of 2,000 pounds per square foot based on dead load plus design live load considerations. The grade beams should have a minimum width of 10 inches even if actual bearing pressure is less than the design value. If frost heave is a design consideration, the perimeter grade beams should bear at least 24 inches below adjacent surface grades. If soft or very loose soils are encountered at the design bearing level, they should be undercut to stiff residual soils and the excavation backfilled with concrete or controlled low strength material (CLSM) or properly compacted fill.

Several design methods use the modulus of subgrade reaction, k , to account for soil properties in design of flat grade-supported floor slabs. Based on our laboratory test results and the slab recommendations provided in this document, k -value of 120 pounds per cubic inch (pci) may be used in the grade slab design based on values typically obtained from 1 ft x 1 ft plate load tests. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the expression/formula presented in the “Floor Slab Recommendations” section of this report.

Uniform compaction of fill materials is important to reduce total and differential settlements. If the site is prepared as recommended, and based on the anticipated loading conditions, total and differential settlements of the foundation should be about 1 inch and $\frac{1}{2}$ inch, respectively, or less. To reduce moisture problems below the floor slab, a vapor retarder such as polyethylene sheeting should be provided beneath the slab. PSI



recommends that a minimum four-inch-thick, free draining granular mat be placed beneath the slab. Adequate construction joints, as necessary, and reinforcement should be provided to reduce the potential for cracking of the floor slab due to differential movement. The design should take into account the added effect of trees and non-seasonal moisture sources, such as irrigation, plumbing or drainage leaks and poor surface drainage.

The foundation excavations should be observed by a representative of PSI prior to concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the excavations should be removed to the level of firm soils or adequately compacted fill or stabilized soil as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with lean concrete or fill, as determined by the Geotechnical Engineer.

Surface run-off water should be drained away from the excavations and not be allowed to pond. The structures' foundation concrete should be placed during the same day the excavation is made. If it is required that excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture. Consideration should be given to the use of interceptor drains to collect and remove water accumulating around the perimeter and underneath the slab. The interceptor drains could be incorporated with the storm drains of other utilities located on-site.

3.6 DRILLED PIER FOUNDATION RECOMMENDATIONS

It is anticipated drilled pier foundations are also under consideration for support of the proposed classroom additions. Properly sized straight shaft cast-in-place concrete drilled piers bearing in the shaley clay and/or shale bedrock material below a depth of 15 feet from the existing surface can be used for the project.

The piers should be founded in the shaley clay and/or shale bedrock a minimum of 2 feet or one pier diameter, whichever is greater, and should be a minimum length of 10 feet or a length to diameter ratio (L/D) not less than 3, whichever is deeper, below the grade beam. The piers founded as recommended can be designed for allowable unit end-bearing capacity of 12,400 psf and allowable unit skin friction capacity of 1,000 psf, based on dead load plus design live load. The skin friction capacities are applicable to the portion of drilled shaft extended beyond the recommended minimum length into the bearing material. The allowable values are based on factors of safety of 2 and 3 for end bearing and skin friction, respectively.

The piers should be reinforced for the full depth to resist uplift forces due to the expansive clays. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the clay soils equal to 600 psf over the upper 8 feet of the pier shaft. The piers should be designed after considering the dead load, the friction force in the rock, and the uplift force within the active depth.

Piers should be designed with a shaft diameter of at least 18 inches. Properly constructed piers bearing in the recommended bearing materials should experience total maximum settlement on the order of ½ inch or less.

It may be difficult for the drilling contractor to determine or identify proper recommended bearing material. Therefore, it is recommended PSI perform the pier construction observations and documentation.

The pier construction should also be observed by a representative of the Geotechnical Engineer to assess that the foundation materials have adequate strength to support the design loads and are consistent with the



materials recommended in this report. Particular attention should be given to observation at locations where soil sloughing or groundwater inflow problems may occur.

Soft or loose soil zones encountered at the bearing level should be removed from the drilled shafts. If the exposed bearing material becomes significantly wet or dry, it should be removed, and the pier deepened until more uniform moisture conditions are achieved. Concrete should be placed in the piers the same day they are excavated to prevent weakening of the shaft wall and bottom.

Although not anticipated, slurry and/or casing may be required to advance the drilled piers, especially if sloughing soil or groundwater is encountered. Concrete placed in the piers should have a slump in the range of 5 to 7 inches. This range of slump will help to reduce the potential for formation of voids, especially as casing is extracted. The concrete mix should be designed to attain the required strength when placed at such a slump. The drilled shafts should be filled with concrete as soon as practical to reduce the potential of groundwater related problems and weathering of the excavation wall. During simultaneous concrete placement and casing removal operations, sufficient concrete head should be maintained inside the casing to offset hydrostatic head outside the casing, and to prevent the intrusion of soil and possible groundwater into the pier concrete, if present.

3.6.1 LATERAL RESISTANCE DESIGN PARAMETERS

For drilled shafts, the soils and bedrock as well as the rigidity of the shaft will resist the lateral loads applied to the shaft. Lateral load analysis can be performed based on methods ranging from chart solutions to the 'p-y' approach utilizing computer programs such as LPILE or the public domain COM624.

The lateral design information regarding the 'p-y' data is provided in this section. The relationship between the soil resistance (p) and pile deflection (y) is commonly referred to as 'p-y'. Along the depth of the shaft, soil resistance (p) is expressed as a non-linear function of lateral shaft deflection (y). Various researchers developed 'p-y' criteria for different kinds of soils. The 'p-y' curves can be automatically generated utilizing the computer program LPILE or the public domain COM 624. The program LPILE was developed by Lymon Reese and Shin-Tower Wang, Ensoft, Inc. and based on the COM 624 developed for the FHWA by the authors and made available by the FHWA. The parameters for generation of 'p-y' criteria from LPILE as well as COM 624 are provided for the analyses of the shafts.

Parameters to Be Used in the Lateral Load Analyses					
Stratum	'p-y' Criteria	**Total Unit Weight, γ (pcf)	ϕ (deg.) or S_u or Q_u (psf)	*** K_s or $K_{unsat.}$ (pci) or K_c or $K_{sat.}$ (pci) or E (psi)	*** ϵ_{50} or K_{rm} or RQD
I*	Clay Criteria	120	$S_u = 1,000$	$K_s = 240$ or $K_c = 80$	$\epsilon_{50} = 0.0082$
II	Clay Criteria (Shaley)	130	$S_u = 5,000$	$K_s = 1,660$ or $K_c = 660$	$\epsilon_{50} = 0.0043$
III	Rock Criteria	135	$Q_u = 10,000$	$E = 50,000$	$k_{rm} = 0.0005$ RQD = 50% (idealized)



Note: S_u : Undrained Shear Strength (psf); Q_u : Unconfined Compressive Strength (psf); ϕ , Angle of Internal friction; k_{unsat} : modulus of subgrade reaction (pci) for unsaturated soil condition; k_{sat} : modulus of subgrade reaction (pci) for saturated soil condition; k_s : modulus of subgrade reaction (pci) for static loading condition; k_c : modulus of subgrade reaction (pci) for cyclic loading condition; E : Initial modulus (psi); ϵ_{50} : strain corresponding to one-half the principle stress. K_{rm} : a constant for overall stiffness; RQD: Rock Quality Designation.

* Neglect the top 3' of Stratum I soils for the lateral load analysis appropriately based on the location of the pile head
** For submerged portion of pier, use effective unit weight γ'
***It may be possible to default to the computer program generated values

PSI can assist in performing the lateral response analysis under a separate work proposal.

3.7 FLOOR SLAB RECOMMENDATIONS

The building's grade supported floor slab used in conjunction with the conventional spread footing or drilled pier and grade beam foundation system should be supported on a minimum 2½ feet of properly compacted structural fill or modified existing soil used as fill. When supported on a minimum 2½ feet of the recommended materials, the potential vertical rise (PVR) is expected to be 1 inch or less. Proof-rolling, as discussed earlier in this report, should be accomplished to identify soft or unsuitable soils that should be removed from the floor slab areas prior to fill placement and floor slab construction. Fill soils under the slabs should be moisture conditioned at or above the optimum moisture content throughout the construction process.

For the properly compacted structural fill and existing soil, modulus of subgrade reaction, k , value of 120 pounds per cubic inch (pci) may be used in the grade slab design based on a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soils:

Modulus of Subgrade Reaction,

$$k_s = \frac{k}{B} \text{ for cohesive soil, and}$$

$$k_s = k \left(\frac{B+1}{2B} \right)^2 \text{ for cohesionless soil (not recommended for replacing undercut in}$$

relatively impermeable soils)

where:

- k_s = coefficient of vertical subgrade reaction for loaded area,
- k = coefficient of vertical subgrade reaction for 1x1 square foot area,
- B = width of area loaded, in feet (or effective width, B' , for grade beam, continuous footing, or mat/raft foundation)

PSI recommends that a minimum four-inch thick free draining granular mat be placed beneath the building floor slabs to enhance drainage. Prior to placing drainage layer, the subgrade should be graded to drain and not provide pockets to trap water. In moisture sensitive areas for equipment and flooring, vapor retarder should be installed with the grade supported slab construction according to ACI criteria. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage.



3.7.1 STRUCTURAL SLAB

As an alternative to providing a minimum of 2½ feet of suitable material below grade supported floor slab, a structural slab with a minimum of 5 inches of void space along with the drilled pier and grade beam foundation system may be considered. The 5-inch void space should be provided below the slab and the grade beam elements. If a structural slab as recommended above is used, removing and replacing 2½ feet of the existing soil will not be required.

3.8 LATERAL EARTH PRESSURE RECOMMENDATIONS

It is anticipated a below grade earth retention system may be required as part of the proposed construction. To control hydrostatic loading on earth retention systems, it is recommended that a perforated drainpipe be installed at the footing level. The drainpipe should be sloped to provide positive drainage to a sump where water can be collected and removed or to a site storm sewer/drainage. The drain line should be wrapped with filter fabric to prevent intrusion of fines and backfilled with free draining granular material extending vertically above the drain line to within 1 foot of final grade. The granular section behind the earth retention system should have a minimum width of 1 foot and should be encapsulated in a suitable filter fabric to minimize intrusion of fines. The remaining portion of the excavation should be backfilled with structural fill or completed with granular material. The use of a prefabricated drainage blanket on the earth retention system may also be considered to prevent hydrostatic loading. Drainage blankets should be installed in accordance with manufacturer’s recommendations.

The actual earth pressure on the walls will vary according to the type of material to be retained and backfill materials used and how the backfill is compacted. The equivalent fluid pressures (γ_{eq}) presented below, provide lateral earth pressures for design of walls using compacted granular backfill where the cut slope, if applicable, is 60° or less from the horizontal and for existing soil and structural backfill soil, and are applicable for a horizontal surface behind the earth retention system.

Lateral Soil Resistance Design Parameters								
Soil Supported	Angle of Internal Friction, ϕ	Lateral Coefficient, K			Presumptive Total Unit Weight, pcf	Equivalent Fluid Unit Weights, γ_{eq} , psf/ft		
		Active, K_a	Passive, K_p	At-Rest, K_o		Active	Passive	At-Rest
Granular Soil Placed	32°	0.31	3.25	0.47	115	35	374	54
In-Situ Shaley Clay Soil	25°	0.41	2.46	0.58	130	53	320	75
In-Situ Clay Soil	20°	0.49	2.04	0.66	120	59	245	79

The at-rest values should be used if walls cannot yield at top during backfilling and service conditions and passive pressure values should be used where the structure will push into the soil. The active condition is applicable where the ratio of the horizontal movement of the top of the wall to the wall height is equal to or greater than 1/240.

If granular soil is utilized at the base of the structure, ultimate base friction coefficient of 0.53 may be considered and if granular support is not provided at the base of the structure an ultimate base adhesion value of 600 psf may be considered. An appropriate factor of safety should be applied.



Typically, only half of the passive pressure may be used to resist lateral loads due to the amount of strain required to fully mobilize the passive pressure. The above values of equivalent fluid pressure are based upon horizontal grade at the top of the wall including no surcharge loads within a distance that is twice the wall height.

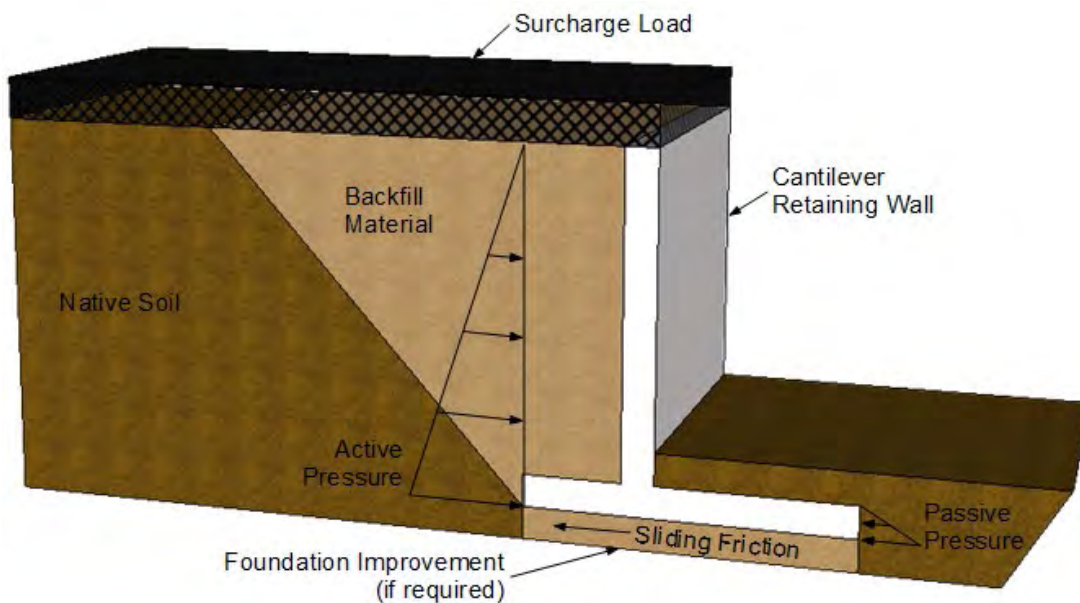
Since specific information about potential backfill material is not available for this report, PSI estimates the material may also consist of compacted clays or silts, apart from sand or structural fill assumed above, or combinations. For compacted lean clay and sandy silt, the following lateral pressure coefficient values behind the wall can be considered when applicable.

Compacted Soil Lateral Pressure Coefficients				
Soil Type	Active		At-Rest	
	K_a	γ_{eq} , psf/ft	K_o	γ_{eq} , psf/ft
Clay	0.59	74	0.74	93
Silt	0.53	66	0.69	86

γ_{eq} , - equivalent fluid pressure

When loads including traffic are present near wall, the wall should be designed to resist an additional uniform lateral load based on the active coefficient. This additional traffic load may be taken as a 2-foot surcharge load with a total unit weight of 125 pcf. Care should be exercised during the backfilling of the walls to prevent overstressing and damage to the walls. Sub-drains should be installed to avoid the buildup of hydrostatic pressure behind the retaining walls.

The following illustration provides general requirements for the design and installation of retaining walls.





3.9 CORROSIVITY OF SOIL

The concentration of water-soluble sulfates is considered to be a good indicator of the potential for chemical attack on concrete. PSI performed pH and soil water soluble sulfate content tests of a select soil sample from the project site. The results are reproduced below:

Water Soluble Sulfate Test Results				
Boring	Depth (ft)	Soil pH	Sulfate Content	
			ppm (mg/kg)	Percent by Weight
DB-3	3	8.68	280	0.028

Based on the ACI Manual of Concrete Practice (ACI 201.2R-10) or (ACI 318/318R-33), the amount of water-soluble sulfates in soil can be used to evaluate the need for protection of concrete based on the following table:

REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE	
Water Soluble Sulfate in soil (percent by weight)	Sulfate Exposure
0.00 to 0.10	Negligible or Class 0 Exposure
0.10 to 0.20	Moderate or Class 1 Exposure
0.20 to 2.00	Severe or Class 2 Exposure
Over 2.0	Very Severe or Class 3 Exposure

Based on the test result, the water-soluble sulfates ion concentration is relatively low and the potential for reactions within concrete exposed to sulfates is in the Negligible or Class 0 exposure. The evaluation of soluble sulfate content contained within the selected sample indicates that any cement type may be used at this site. The actual cement type to be used should be determined by the project Structural Engineer.

The corrosion potential of the soils as regards buried conduits and metals is dependent on the acidity and/or basicity (pH value) of the soil. The result of laboratory pH tests performed on a selected soil sample obtained from drilling is indicated in the following table:

Resistivity (ohm-cm) and pH			
Boring No.	Depth (ft)	pH	Corrosivity
DB-3	3	8.68	Moderately Corrosive

Based upon the corrosivity test results, the soils can be considered moderately corrosive to underground metallic conduits. Therefore, metal pipe may be used, but is recommended to be analyzed by the structural/corrosion engineer for protection recommendations.

However, generally for risk of corrosion, it should be noted that the building area contained 2 main mapped soil series, the Kingfisher-Ironmound complex that occupies majority of the new building areas and the Renfrow-



Huska complex that occupies the southwest corner of the site, based on the USDA/NRCS web based published information. The USDA/NRCS classification of the components of the soil series are summarized in the following table:

Map symbol and soil name	Risk of corrosion	
	Uncoated steel	Concrete
9—Kingfisher- Ironmound complex, 1 to 5 percent slopes		
Kingfisher	Moderate	Low
Ironmound	Low	Low
65—Renfrow- Huska complex, 3 to 5 percent slopes, eroded		
Renfrow, eroded	High	Low
Huska, eroded	High	High



4 PAVEMENT RECOMMENDATIONS

4.1 SUBGRADE SOIL PREPARATION

PSI has based its recommendation on subgrade soils prepared to achieve a minimum CBR value of 3, with proper proof-rolling and the site not being wet at the time of construction. The pavement subgrade should be prepared as discussed in the “Site Preparation” section of this report.

4.2 PAVEMENT DESIGN

The PSI scope of services did not include extensive sampling or CBR testing of the existing subgrade or potential sources of imported fill for the specific purpose of detailed pavement analysis. Instead, PSI has estimated pavement related design parameters that are considered to be typical for the area and soil types.

The recommended pavement sections presented below are considered minimum for the pavement design parameters used. PSI understands that non-technical considerations sometimes result in thinner pavement sections than those presented. However, the client, the owner, and the project principals should be aware that thinner pavement sections might result in increased maintenance costs and lower than anticipated pavement life.

Pavement sections were evaluated using Pavement Assessment Software (PAS) which is based on the 1993 AASHTO Design equations; a reliability factor of 85%; and a flexible pavement 18-kip single axle load (ESAL) of 13,000 for standard duty (car parking) and 48,000 for heavy duty parking areas and drive areas. The design life for standard duty and heavy-duty pavements are 10 years and 20 years, respectively. Flexible Pavements were evaluated based on an initial serviceability of 4.2 and a terminal serviceability of 2.0. Rigid pavements were evaluated based on an initial serviceability of 4.5, a terminal serviceability of 2.0, and an unreinforced concrete mix with a 28-day modulus of rupture of 650 psi (approximately 3,500 psi compressive strength). The pavement sections presented for the rigid pavements represent minimum thickness recommendations by PSI and the ESAL loads are in excess of 0.2 million. PSI should be contacted if traffic loads, especially truck traffic in loading areas and the frequency idealized, are greater than used in the analysis. Pavement materials should conform to local and state guidelines, if applicable.

Flexible Pavement Thickness (Inches)		
Pavement Materials	Light Duty	Heavy Duty
Asphaltic Surface Course	1½	2
Asphaltic Base Course	2½	3
Stabilized Subgrade	8	8
ODOT Type A Aggregate Base (Optional)	6	
Rigid Pavement Thickness (Inches)		
Pavement Materials	Light Duty (minimum)	Heavy Duty (minimum)



Portland Cement Concrete	5	6
Stabilized Subgrade	8	8
ODOT Type A Aggregate Base (Optional)	4	

Water should not be allowed to pond behind curbs. In down grade areas, base stone should extend through the slope to allow any water entering the base stone a path to exit.

Proper finishing of concrete pavements requires the use of appropriate construction joints to reduce the potential for cracking. Construction joints should be designed in accordance with current Portland Cement Association (PCA) guidelines. Joints should be sealed to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils.

The design of steel reinforcement should be in accordance with accepted codes. The concrete should have a minimum compressive strength of 3,500 psi at 28 days. The concrete should also be designed with 5±1 percent entrained air to improve workability and durability. All pavement materials and construction procedures should conform to ODOT or appropriate city and county requirements.

Large front-loading trash dump trucks frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting or cracking of the pavement and ultimately, pavement failures. **Therefore, we recommend that the pavement in trash pickup areas consists of a minimum 7 inches thick, reinforced concrete slab placed over a minimum 4-inches thick crushed stone base in addition to the required subgrade stabilization.**

4.2.1 CEMENT, LIME, OR FLY ASH STABILIZATION FOR PAVEMENTS

To reduce the shrink/swell potential of the subgrade soils, the upper 8 inches of the subgrade soil should be stabilized with Portland cement, hydrated lime, or Class 'C' fly ash from a source approved by ODOT. Stabilizing the soil with an estimated 5 to 7 percent cement or lime or an estimated 12 to 14 percent fly ash, by dry weight, will reduce the potential volumetric changes due to the medium high to high shrink/swell potential soil and extend the life of the pavement. The actual cement, lime or fly ash percentage should be determined based on laboratory tests after the source of the stabilizing agent has been determined.



5 CONSTRUCTION CONSIDERATIONS

5.1 EXCAVATIONS

The following is provided in this report for the client's information. In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". It is mandated by this Federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is PSI's understanding that these regulations are being strictly enforced and if not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and Federal safety regulations.

PSI is providing this information solely as a service to the client. PSI does not assume responsibility for construction site safety or the contractor's compliance with local, state, and Federal safety or other regulations.



6 REPORT LIMITATIONS

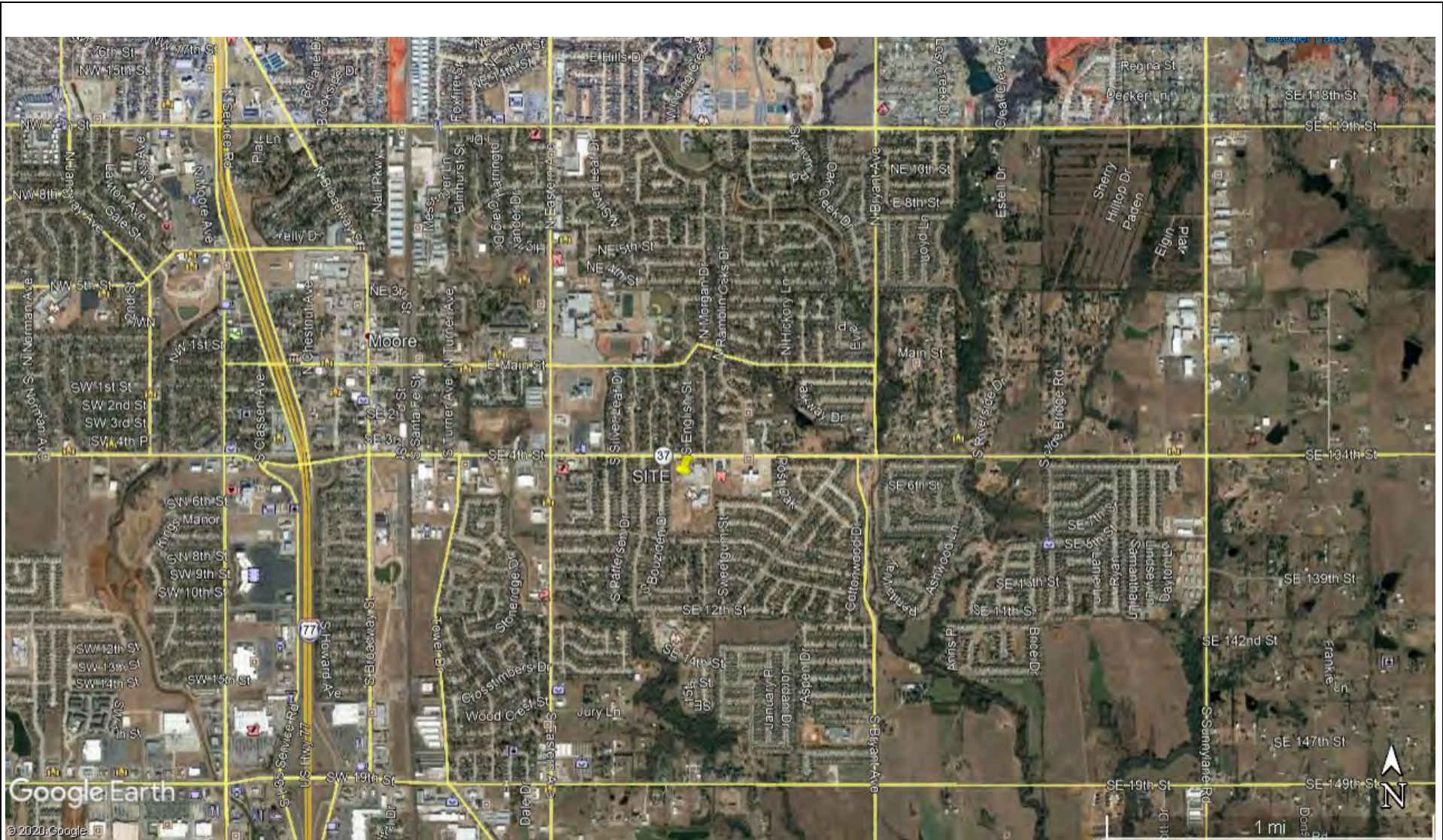
The recommendations submitted are based on the available subsurface information obtained by PSI and details furnished by AGP for the proposed project. If there are revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

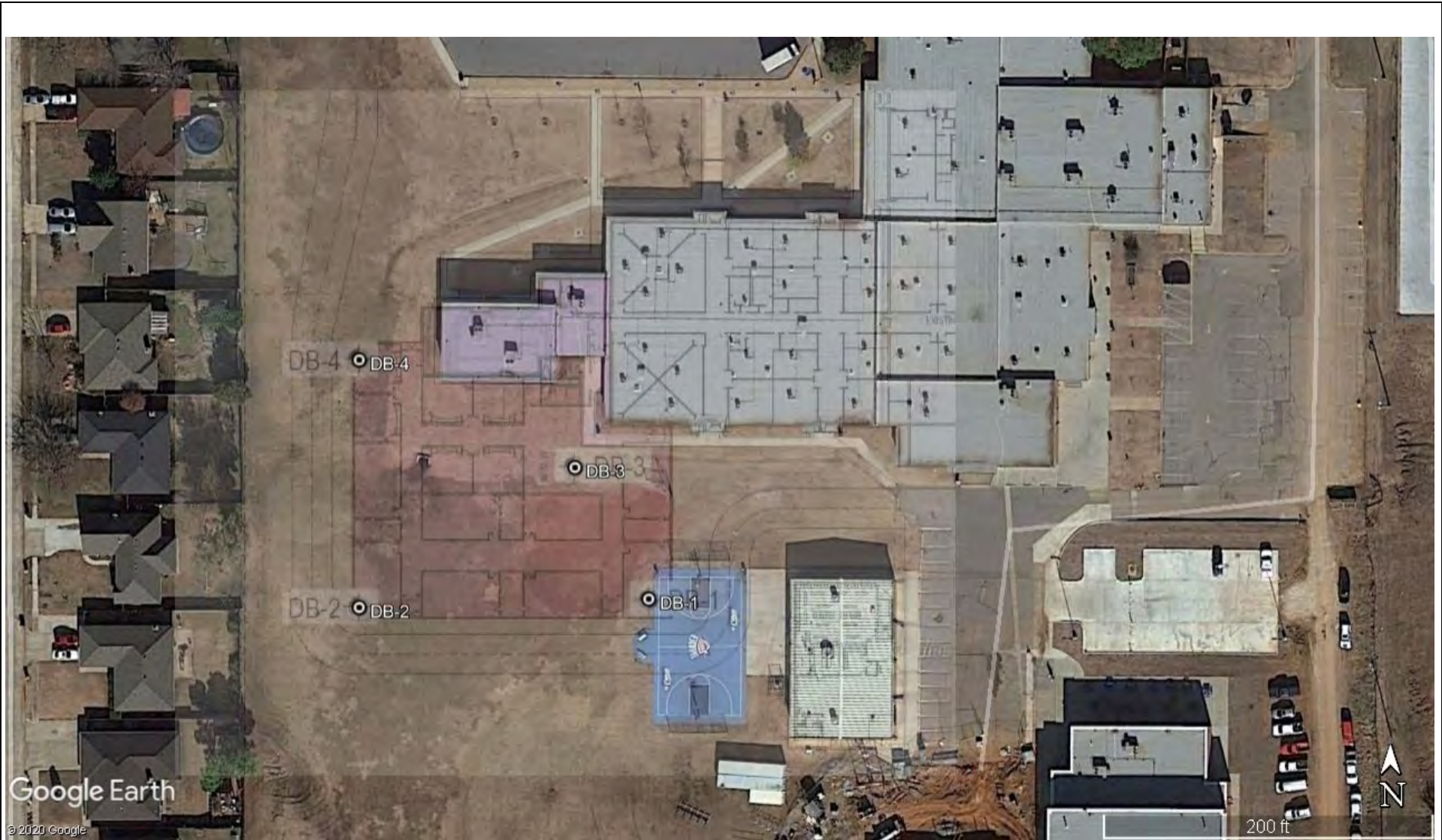
After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that PSI's engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of AGP for the specific application to the proposed Moore Public Schools Highland East Junior High School New Classroom Addition in Moore, Oklahoma.



FIGURES



Project	HIGHLAND EAST JUNIOR HIGH SCHOOL ADDITION—MOORE, OK	
Drawing	SITE VICINITY	Project No. 05462142-3
Drawn By	Y. Zhang	Figure FIGURE 1
Date	July 2020	



<i>Project</i>	HIGHLAND EAST JUNIOR HIGH SCHOOL ADDITION—MOORE, OK		
<i>Drawing</i>	BORING LAYOUT PLAN	<i>Project No.</i>	05462142-3
<i>Drawn By</i>	Y. Zhang	<i>Figure</i>	FIGURE 2
<i>Date</i>	July 2020		



LIST OF APPENDICES



APPENDIX A – BORING LOGS AND PROFILES

DATE STARTED: 3/26/20 **DRILL COMPANY:** DSO
DATE COMPLETED: 3/26/20 **DRILLER:** T. Simpson **LOGGED BY:** B. Long
COMPLETION DEPTH: 25.0 ft **DRILL RIG:** ATV
BENCHMARK: N/A **DRILLING METHOD:** Soild Flight Auger
ELEVATION: 100 ft **SAMPLING METHOD:** SS/TC
LATITUDE: 35.33288° **HAMMER TYPE:** Automatic
LONGITUDE: -97.46951° **EFFICIENCY:** N/A
STATION: N/A **OFFSET:** N/A **REVIEWED BY:** A. Oyesanya

BORING DB-1

Water	▽ While Drilling	None observed
	▼ Upon Completion	None observed
	▽ Delay	N/A

BORING LOCATION:

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
0				1		Lean CLAY, brown to reddish-brown, fine roots					
				2		Lean CLAY, very stiff, reddish-brown, calcareous inclusions, fine roots at 1'	CL	3/6/12 N=18			LL = 42 PL = 17 Fines=98.1%
				3		Shaley CLAY, hard, red, calcareous inclusions		14/20/24 N=44			
95	5			4				18/25/33 N=58			>>⊕
				5		SHALE, highly weathered, moderately hard to hard, red with gray		33 50 (4.00")			>>⊕
90	10			6		SILTSTONE, highly weathered, moderately hard, red		50 (5.50") 50 (2.25")			>>⊕
				7				50 (6.00") 50 (4.00")			>>⊕
85	15			8				50 (5.00") 50 (3.50")			>>⊕
80	20			9				50 (5.00") 50 (4.00")			>>⊕
75	25			9		End of boring		50 (5.00") 50 (4.00")			>>⊕



Professional Service Industries, Inc.
 11825 S. Portland Avenue
 Oklahoma City, OK 73170
 Telephone: (405) 735-6052

PROJECT NO.: 05462142-3
PROJECT: Highland East Junior High School Addition
LOCATION: Moore, OK

DATE STARTED: 3/26/20 **DRILL COMPANY:** DSO
DATE COMPLETED: 3/26/20 **DRILLER:** T. Simpson **LOGGED BY:** B. Long
COMPLETION DEPTH: 25.0 ft **DRILL RIG:** ATV
BENCHMARK: N/A **DRILLING METHOD:** Soild Flight Auger
ELEVATION: 100 ft **SAMPLING METHOD:** SS/TC
LATITUDE: 35.33287° **HAMMER TYPE:** Automatic
LONGITUDE: -97.4701° **EFFICIENCY:** N/A
STATION: N/A **OFFSET:** N/A **REVIEWED BY:** A. Oyesanya

BORING DB-2

Water	▽	While Drilling	None observed
	▼	Upon Completion	None observed
	▽	Delay	N/A

BORING LOCATION: _____

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	STANDARD PENETRATION TEST DATA N in blows/ft ⊙ Moisture × PL LL ⊕ LL STRENGTH, tsf ▲ Qu * Qp	Additional Remarks
0				1		Fat CLAY , dark brown, fine roots			25	
				2		Fat CLAY , medium stiff to stiff, reddish-brown		3/3/3 N=6	22	
				3			CH	3/3/6 N=9	23	LL = 51 PL = 18 Fines=89.4%
95	5			4				4/4/7 N=11	24	
				5		Shaley CLAY , hard, red, calcareous inclusions		14/22/31 N=53	21	
90	10			6				13/21 50 (5.00")	14	
				7		SILTSTONE , highly weathered, moderately hard to hard, red with gray		50 (3.50") 50 (3.00")		
85	15			8				50 (3.00") 50 (1.50")		
80	20			9				50 (3.50") 50 (1.75")		
75	25			9		End of boring				



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 Oklahoma City, OK 73170
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PROJECT NO.: 05462142-3
PROJECT: Highland East Junior High School Addition
LOCATION: Moore, OK

DATE STARTED: 3/26/20
DATE COMPLETED: 3/26/20
COMPLETION DEPTH: 25.0 ft
BENCHMARK: N/A
ELEVATION: 100 ft
LATITUDE: 35.3331°
LONGITUDE: -97.46966°
STATION: N/A **OFFSET:** N/A
REMARKS:

DRILL COMPANY: DSO
DRILLER: T. Simpson **LOGGED BY:** B. Long
DRILL RIG: ATV
DRILLING METHOD: Soild Flight Auger
SAMPLING METHOD: SS/TC
HAMMER TYPE: Automatic
EFFICIENCY: N/A
REVIEWED BY: A. Oyesanya

BORING DB-3

Water	▽ While Drilling	None observed
	▼ Upon Completion	None observed
	▽ Delay	N/A

BORING LOCATION:

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STRENGTH, tsf	Additional Remarks
0				1		Lean CLAY with Sand, brown, fine roots					
				2		Lean CLAY, stiff, reddish-brown, fine roots to 4.5', calcareous inclusions at 1', ferrous nodules	CL	3/4/6 N=10			LL = 34 PL = 16 pH = 8.7 SO ₄ = 280.0 mg/Kg Fines=95.7%
				3				5/9/12 N=21			
95	5			4		Shaley CLAY, hard, reddish-brown, dark gray inclusions, calcareous inclusions		9/16/22 N=38			
				5		SHALE, highly weathered, moderately hard, reddish-brown, dark gray inclusions, calcareous inclusions		21/33 50 (3.00")			
90	10			6		SILTSTONE, highly weathered, moderately hard to hard, red with gray		50 (5.50")			
				7				50 (3.50") 50 (1.75")			
85	15			8				50 (2.75") 50 (2.00")			
80	20			9				50 (3.25") 50 (2.00")			
75	25					End of boring					



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PROJECT NO.: 05462142-3
PROJECT: Highland East Junior High School Addition
LOCATION: Moore, OK

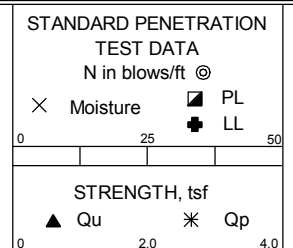
DATE STARTED: 3/26/20 **DRILL COMPANY:** DSO
DATE COMPLETED: 3/26/20 **DRILLER:** T. Simpson **LOGGED BY:** B. Long
COMPLETION DEPTH: 25.0 ft **DRILL RIG:** ATV
BENCHMARK: N/A **DRILLING METHOD:** Soild Flight Auger
ELEVATION: 100 ft **SAMPLING METHOD:** SS/TC
LATITUDE: 35.33328° **HAMMER TYPE:** Automatic
LONGITUDE: -97.4701° **EFFICIENCY:** N/A
STATION: N/A **OFFSET:** N/A **REVIEWED BY:** A. Oyesanya

BORING DB-4

Water	▽ While Drilling	None observed
	▼ Upon Completion	None observed
	▽ Delay	N/A

BORING LOCATION:

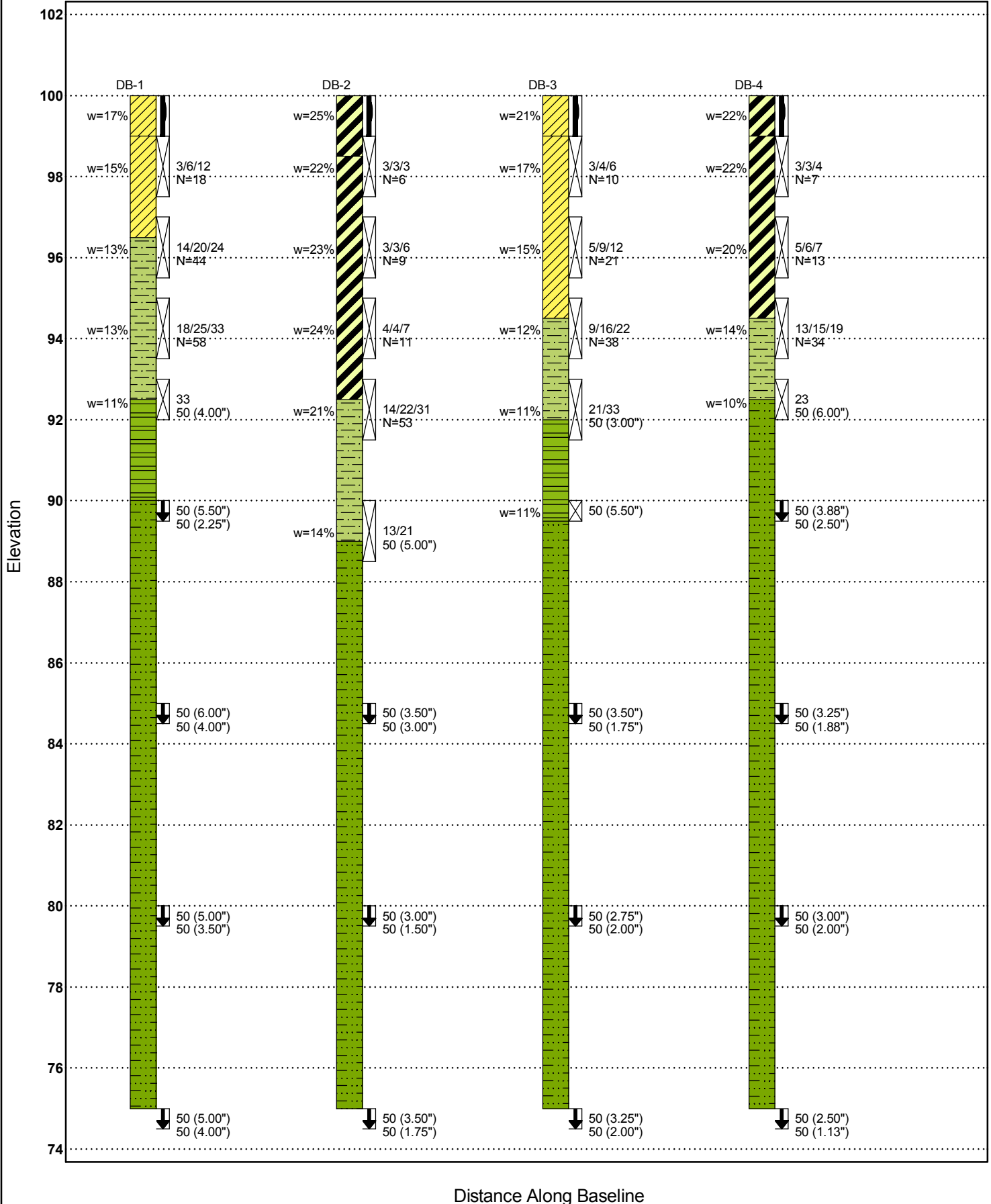
Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) Texas Cone (TC)	Moisture, %	STRENGTH, tsf	Additional Remarks	
0	0			1		Fat CLAY , dark brown, fine roots						
	2			Fat CLAY , stiff to very stiff, reddish-brown, fine roots and ferrous nodules at 1'	CH	3/3/4 N=7						
	3			...calcareous inclusions		5/6/7 N=13						
95	5			Shaley CLAY , hard, reddish-brown, calcareous inclusions		13/15/19 N=34						
	4					23 50 (6.00")						
	5			SILTSTONE , highly weathered, moderately hard to hard, red with gray		50 (3.88") 50 (2.50")						
90	10					50 (3.25") 50 (1.88")						
85	15					50 (3.00") 50 (2.00")						
80	20					50 (2.50") 50 (1.13")						
75	25					End of boring						



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 11825 S. Portland Avenue
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PROJECT NO.: 05462142-3
PROJECT: Highland East Junior High School Addition
LOCATION: Moore, OK

Profile



Distance Along Baseline



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 11825 S. Portland Avenue
 Oklahoma City, OK 73170
 Telephone: (405) 735-6052

Highland East Junior High School Addition
 PSI Project Number: 05462142-3



APPENDIX B – LABORATORY TEST REPORTS



APPENDIX C – GENERAL NOTES

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.	☒ SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
HSA: Hollow Stem Auger - typically 3 1/4" or 4 1/4" I.D. openings, except where noted.	■ ST: Shelby Tube - 3" O.D., except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry	▮ RC: Rock Core
R.C.: Diamond Bit Core Sampler	⬇ TC: Texas Cone
H.A.: Hand Auger	☞ BS: Bulk Sample
P.A.: Power Auger - Handheld motorized auger	☑ PM: Pressuremeter
	CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N ₆₀ : A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q _u : Unconfined compressive strength, TSF
Q _p : Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL), %
DD: Dry unit weight, pcf
▼, ▼, ▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

<u>Relative Density</u>	<u>N - Blows/foot</u>
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50+

ANGULARITY OF COARSE-GRAINED PARTICLES

<u>Description</u>	<u>Criteria</u>
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

<u>Component</u>	<u>Size Range</u>
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

<u>Description</u>	<u>Criteria</u>
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term</u>	<u>% Dry Weight</u>
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

<u>Q_u - TSF</u>	<u>N - Blows/foot</u>	<u>Consistency</u>
0 - 0.25	0 - 1	Very Soft
0.25 - 0.50	2 - 3	Soft
0.50 - 1.00	4 - 6	Medium Stiff
1.00 - 2.00	7 - 12	Stiff
2.00 - 4.00	13 - 26	Very Stiff
4.00 +	26+	Hard

MOISTURE CONDITION DESCRIPTION

<u>Description</u>	<u>Criteria</u>
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term</u>	<u>% Dry Weight</u>
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

<u>Description</u>	<u>Criteria</u>	<u>Description</u>	<u>Criteria</u>
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick	Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick	Lensed:	Inclusion of small pockets of different soils
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing	Layer:	Inclusion greater than 3 inches thick (75 mm)
Slickensided:	Fracture planes appear polished or glossy, sometimes striated	Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
		Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

<u>Q_u - TSF</u>	<u>Consistency</u>
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

<u>Description</u>	<u>Criteria</u>
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

<u>Voids</u>	<u>Void Diameter</u>
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

<u>Component</u>	<u>Size Range</u>
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

<u>Rock Mass Description</u>	<u>RQD Value</u>
Excellent	90 - 100
Good	75 - 90
Fair	50 - 75
Poor	25 - 50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS (LITTLE OR NO FINES)	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES)			GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
		CLEAN SANDS			SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)			SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES			SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)			SC	CLAYEY SANDS, SAND - CLAY MIXTURES
					ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		CH	INORGANIC CLAYS OF HIGH PLASTICITY	
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	
HIGHLY ORGANIC SOILS						

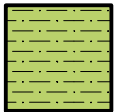
Graphic Symbols for Materials and Rock Deposits



CONCRETE
Portland Cement Concrete



BITUMINOUS CONCRETE



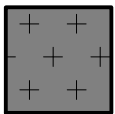
CLAYSTONE



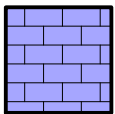
COAL
Coal, Anthracite Coal



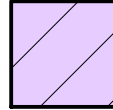
CONGLOMERATE/BRECCIA
Conglomerate, Breccia



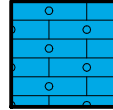
IGNEOUS ROCK
Anorthosite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodionite, Homfels, Pegmatite, Rhyolite/Metarhyolite



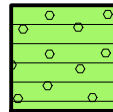
LIMESTONE
Limestone, Dolomite



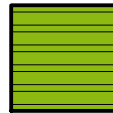
METAMORPHIC ROCK
Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentinite, Slate



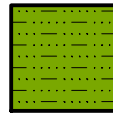
CHERT



SANDSTONE
Sandstone, Orthoquartzite (Sandstone)



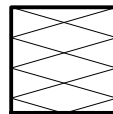
SHALE



SILTSTONE



NO RECOVERY



VOID

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

Part 1 - General

1.01 Work Included:

- A. The General Conditions, Bidding Requirements, and Division I are hereby made a part of each of the technical sections that follow, and shall be understood to apply and shall apply in full to all individuals or corporations who contract or subcontract to perform any part or all of the project work.
- B. Indications on the working drawings or in any section of the specifications of an article or material, operation, or method, requires that the Contractor shall provide each item or service or quality or is subject to qualifications noted; and, the Contractor shall perform each operation prescribed according to the conditions stated providing, therefore, all necessary labor, equipment and incidentals to complete the project work.
- C. The project:
 - 1. Name: Highland Junior High School STEM Addition - Moore Public Schools.
 - 2. Location: 1200 SE 4th Street - Moore, Oklahoma.

1.02 Summary of Work:

- A. **Base Bid:** Provide and pay for all materials, labor, services, equipment, licenses, taxes, permits, and other items necessary for the complete construction of an (approximately) 21,582 s.f. new STEM classroom addition including new sidewalks, and site utilities. Contractor shall maintain all barriers, guards and other environmental items required at the site during construction.
- B. Owner: Moore Public Schools
 - 1. Owner's Representative:
Jeff Horn, Assistant Superintendent, Operations
Moore Public Schools
1500 SE 4th Street
Moore, OK 73160
405-735-4221
- C. Design Team:
 - 1. Architect:
Mike Abla, Principal Architect
AGP
201 N. Broadway, Suite 210
Moore, OK 73160
405-735-3477
 - 2. Structural Engineer:
Brandon Birch, Structural Engineer
KFC Engineering, Inc.
205 NW 63rd, Suite 390
Oklahoma City, OK 73116

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

3. Mechanical, Electrical and Plumbing Engineers:
Dwayne Gordon, Mechanical Engineer
MEP Associates, LLC
2600 Van Buren St., Suite 2604
Norman, OK 73072
405-364-9926
 4. Civil Engineer:
David Wyatt, Civil Engineer
 4. Construction Manager:
Joe Sherga, Project Manager
Omni Construction LLC
1909 S. Eastern Ave.
Moore, OK 73160
405-735-3992
- 1.04 Work to be Provided and Installed By Others:
Not applicable.
- 1.05 Use of the Site:
- A. Confine operations at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed.
 - B. Keep facility free from accumulation of waste material, rubbish or construction debris.
- 1.06 Safety of Persons and property:
- A. Contractor shall at all times protect the building from damage from rainwater.
 - B. Contractor shall provide barricades and clearly mark work zone areas.
 - C. Refer to Special Conditions "Temporary Services" for additional information.
 - D. During the period of construction, the OSHA Standards shall be followed as applicable by law.
 - E. The Contractor shall post emergency telephone numbers.
- 1.07 Preconstruction Conference:
- A. A preconstruction meeting will be held at a time and place designated by the Architect or Owner's Representative, for the purpose of identifying responsibilities of the Owner=s and the Architect=s personnel and explanation of administrative procedures.
 - B. The Contractor shall use this meeting for the following minimum agenda:
 1. Construction Schedule/Project Phasing.
 2. Use of areas of the site.
 3. Delivery and storage.
 4. Safety.
 5. Security.
 6. Cleaning up.
 7. Subcontractor procedures relating to:
 - a. Submittals.
 - b. Change orders.
 - c. Applications for payment.
 - d. Record documents.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

- C. The attendees shall include:
 - 1. The Owner's Representatives.
 - 2. The Architect.
 - 3. The Contractor and its superintendent.
- 1.08 Project Scheduling:
 - A. The Contractor is responsible for the scheduling of construction and must prepare a schedule and charting system described below. This schedule is to ensure adequate planning and execution of the work by the contractor and to assist the Architect in appraising the schedule and evaluating the progress of the work.
 - B. The project schedule shall be presented within ten (10) days after receipt of the Notice to Proceed. Electronic copies of the schedule shall be submitted to the Architect for review and approval.
 - C. The schedule logic must be in the form of a "fenced" bar chart or Critical Path Method network indicating the planned start and completion dates of the activity, logical constraints between activities, and total float of each activity.
 - D. An updated project schedule shall be provided when requested by the Architect.
- 1.09 Environmental Controls:
 - A. Water Resources:
 - 1. Oily substances: prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.
 - 2. Mosquito abatement: prevent ponding of stagnant water conducive to mosquito breeding habitat.
 - B. Land Resources:
 - 1. Erodible soils: plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use the areas developed. Immediately protect side slopes and back slopes upon completion of rough grading.
 - C. Air resources:
 - 1. Prevent creation of dust, air pollution, and odors.
 - 2. Use water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to locate practical level.
 - 3. Store volatile liquids, including fuels and solvents, in closed containers.
 - 4. Properly maintain equipment to reduce gaseous pollutant emissions.
 - D. Comply with all applicable environmental control guidelines as required by the City of Moore.
- 1.10 Temporary Utilities:
 - A. The Contractor shall provide and pay for all temporary utilities required for the complete construction of the project including, but not limited to, electricity, lighting, heating, cooling, ventilating, telephone, water, sanitary facilities, exterior and interior enclosures, access roads and parking areas, cleaning and waste removal, project identification and

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010-SUMMARY OF THE WORK

signs, etc.

1.11 Cleaning:

- A. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
- B. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
- C. Complete cleaning operations prior to requesting a Final / Substantial Completion Inspection.

1.12 Project Sign:

- A. Provide and install painted plywood project sign on wooden posts securely erected at the project site in a location approved by the Owner.
- B. No other project signs or advertisement shall be allowed at the project site unless approved by the Owner.
- C. Graphics and form of letter of the project sign shall be as indicated in the attached detail.

End of Section

8'-0"

YOUR BOND FUNDS AT WORK



MOORE Public Schools
LEARNING FOR LIFE

HIGHLAND EAST JUNIOR HIGH SCHOOL STEM CLASSROOM ADDITION

ARCHITECT:

AGP - ABLA GRIFFIN PARTNERSHIP L.L.C.
MOORE, OKLAHOMA

CONTRACTOR:

OMNI CONSTRUCTION, L.L.C.
MOORE, OKLAHOMA

4'-0"

NOTES:

1. WHITE LETTERS ON DARK BLUE BACKGROUND
2. 3/4" EXTERIOR PLYWOOD - PAINTED ALL SIDES
3. MOUNT ON 4" X 4" WOOD POST
4. CONTRACTOR TO HAVE LAYOUT APPROVED PRIOR TO INSTALLATION

DIVISION 2 - SITE WORK

SECTION 02050 - DEMOLITION

Part 1 - General

1.01 Work Included:

- A. The General Conditions and applicable sections of Division 1 shall apply to this entire section.
- B. All materials, labor, services and incidentals necessary for the completion of this section of the work.
- C. Complete demolition of the existing paving and curbs; complete demolition of the existing curbs as necessary to construct new entry driveways; removal of existing trees; and all site materials as shown on the Drawings.
- D. Removal of all materials, debris and rubbish from site. Refer to Part 3 for ownership of materials.

1.02 Submittals:

- A. Scheduling of Alteration and Demolition Work:
 1. Before commencing any alteration removal or demolition work the contractor shall prepare and submit for approval by the Architect, a schedule showing the commencement, the order, and the completion dates of the various parts of this work.
 2. Before starting any work relating to existing utilities (electrical, heat, gas, etc.) that will temporarily discontinue or disrupt services to any existing building, the Contractor shall be required to give notice to the Architect and obtain his approval in writing before proceeding with this phase of work.

Part 2 - Materials (not applicable)

Part 3 - Execution

3.01 General Requirements:

- A. Permits, Licenses, Ordinances and Regulations:

All work shall comply with local and other governing ordinance, codes and regulations, but this requirement does not relieve the Contractor of responsibility of complying with these specifications. Complying with requirements of state, county or local laws, ordinances and regulations regarding demolition work is the responsibility of the Contractor, who shall pay any and all fees, and give any notices necessary in connection therewith.

3.02 Demolition of Work To Be Modified:

- A. Alterations and demolition shall be as indicated on the Drawings and in accordance with applicable technical sections of the specifications. The Contractor shall do all necessary demolition or removal of existing work as required in connection with this project, including shoring, bracing, etc. and removal of unwanted material and debris from the site. Demolish existing items only as necessary to tie on new construction as detailed. This work shall be done in a most careful manner, as the Contractor will be held responsible for any damage which

DIVISION 2 - SITE WORK

SECTION 02050 - DEMOLITION

- may be caused thereby to any part or parts of existing streets, neighboring buildings, and grounds.
- B. When alterations occur, or new and old work join, the immediate adjacent surfaces or so much thereof as required by the involved conditions, shall be cut, removed, patched, repaired or refinished and left in as good a condition as existed prior to the commencing of the work, and matching the remainder of the existing paving, etc.
 - C. Conduit and piping found underground on the site, or other areas involved in demolition or alteration shall be removed, re-rerouted or protected as required by the Drawings. Where these items are found; but not covered in the drawings, the Contractor shall notify the Architect for disposition instructions.
 - D. Maintain existing utility services to remain and protect from damage during demolition operations.
 - E. The Contractor shall furnish and install adequate guards, barricades and other temporary protection to prevent injury to persons.
 - F. The Contractor shall make every effort to control the amount of dust and the noise level generated by demolition operations.
- 3.03 Ownership and Disposition of Materials:
- A. Classification of removed materials (re: Drawings for applicable items):
 - 1. **Reinstalled:** Items are those items which, after removal, are to be used, reinserted, remounted or otherwise built back into the work under this contract.
 - 2. **Salvaged:** Items are those items which, after removal, are to be retained by the Owner and delivered for storage on the Owner=s premises.
 - 3. **Scrapped:** Items are all other removed materials or equipment. This includes all items which are not noted or specified for reinstallation or salvage.
 - B. Disposition by Classification:
 - 1. **Reinstalled:** Items of material or equipment shown on the work shall be jointly inspected by the Contractor and the Architect prior to dismantling or removal. An agreement shall be reached briefly setting forth the apparent condition of the material or equipment and approved by the Architect. Simple operating test of operative equipment will be included with this joint inspection if feasible. Such items shall be reinstalled as specified in the applicable sections of the specifications covering new items of similar categories.
 - 2. **Salvaged:** Materials and equipment noted on the Drawings or listed to be salvaged shall be carefully handled and protected and shall be delivered to storage areas, as designated by the Architect, on the Owner=s premises.
 - 3. **Scrapped:** All removed materials and equipment not noted on the drawings specified to be reinstalled, shall be considered as scrap and shall be disposed of by the

DIVISION 2 - SITE WORK

SECTION 02050 - DEMOLITION

Contractor off the Owner=s premises and credit for the value thereof, if any, shall have been reflected in the Contractor's bid price.

3.04 Clean-Up:

- A. Disposition of all material, debris and rubbish shall be the responsibility of the Contractor. Leave site clean. Completely remove all materials, debris, and rubbish from site. Absolutely no burning of debris on the site will be allowed.
- B. **The Contractor shall submit proposed refuse dumping sites to the Architect and shall receive written approval from the Architect concerning acceptable dumping sites prior to the disposition of any material, debris or rubbish generated by this project.**

End of Section

DIVISION 2 - SITE WORK

SECTION 02100 - SITE PREPARATION

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary for the completion of this section of the work.
- B. Erection and maintenance of a temporary construction fence, as noted on the Drawings, shall be provided by the Contractor.

1.02 Protection of Trees and Shrubs:

- A. All existing trees and shrubs in or near the construction area that are not indicated to be removed shall be protected. Should damage occur, the Contractor shall replace the tree or shrub with a similar size and species.
- B. Periodically water as required to limit dust and dirt during construction.
- C. Protect any adjacent property and improvements from damage, and replace any portions damaged through this operation.

Part 2 - Products

2.01 Materials:

- A. Temporary Fencing: **Refer to Section 02110.**

Part 3 - Execution

3.01 Clearing and Grubbing:

- A. Limits of clearing shall be all areas within contract limit lines.
- B. Remove all organic or undesirable materials from areas where concrete is to be placed.
- C. Within building lines and exterior concrete slabs remove roots, debris, rubbish, etc., and cut roots of adjacent trees and shrubs to remain, not less than 12" from concrete work.
- D. From building lines and exterior concrete walks and slabs out to the limits of earth cut and fill, remove all exposed stumps and roots, brush, rubbish, etc.
- E. Remove completely all existing trees designated on Drawings.
- F. Remove topsoil to depth of organic matter and stockpile on site for use in grading.

3.02 Removal of Improvements:

- A. Remove all above-grade and below-grade improvements indicated on the Drawings or as necessary for the installation of new work.

DIVISION 2 - SITE WORK

SECTION 02100 - SITE PREPARATION

3.03 Disposal of Debris:

- A. Burning of combustible materials on the site will not be permitted. Completely remove from site and legally dispose of all materials and debris.

End of Section

DIVISION 2 - SITE WORK

SECTION 02110 - TEMPORARY CONSTRUCTION FENCING

Part 1 - General

1.01 Summary

- A. Section includes: Erection, maintenance and dismantling of temporary fencing around construction site and materials storage areas. This section does not apply where security fencing is required.
- B. Refer to Drawings for temporary fencing layout and location of gates.

1.02 Submittals

- A. Submit the following:
 - 1. Shop drawing indicating layout of temporary fencing, location and size of gates, existing pavement and roads, access to fire hydrants and hose connections, and other site specific conditions. Prepare drawing after site observation and verification of existing conditions.

Part 2 - Products

2.01 Temporary Chain Link fencing:

- A. Unless otherwise indicated, type of temporary chain link fencing shall be Contractor's option. Following types are acceptable:
 - 1. New materials or previously used salvaged chain link fencing in good condition.
 - 2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
 - 3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.
 - 4. Height: Minimum Height shall be 8'-0".
- B. Gates: Provide personnel and vehicle gates of the quantity and size indicated on the Drawings or required for functional access to site.
 - 1. Fabricate of same material as used for fencing.
 - 2. Vehicle gates:
 - a. Minimum width: 20 feet to allow access for emergency vehicles.
 - b. Capable of manual operation by one person.

Part 3 - Execution:

3.01 Layout:

- A. Installation of temporary fencing shall not deter or hinder

DIVISION 2 - SITE WORK

SECTION 02110 - TEMPORARY CONSTRUCTION FENCING

access to existing and new hose connections and fire hydrants.

1. Maintain 3 feet diameter clear space around fire hydrants.
 2. Where fire hydrant or hose connection is blocked by fencing, provide access gate.
- B. Access: Provide gates for personnel, delivery of materials, and access by emergency vehicles.

3.02 Installation:

- A. Chain link posts:
1. Space at 10'-0" maximum.
 2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.
 3. For soft and unstable ground conditions, cast concrete plug around post.
 4. Posts over pavement: Use steel post plates or precast concrete blocks.
 5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.
- B. Fabric: Securely attach to posts.
- C. Gates: Install with required hardware.
- D. Plastic mesh fencing: Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie mesh to posts.

3.03 Maintenance and Removal:

- A. Maintain fencing in good condition. If damaged, immediately repair.
- B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

End of Section

DIVISION 2 - SITE WORK

SECTION 02110 - TEMPORARY CONSTRUCTION FENCING

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Site Preparation - Section 02100
- B. Paving and Surfacing - Section 02500
- C. Cast-In-Place Concrete - Section 03300

1.03 Quality Assurance:

- A. Standards:
 - 1. American Society for Testing and Materials
 - a. ASTM D-1556, Density of soil in place
- B. **Testing: All required tests, and their fees, shall be the responsibility of the Contractor. The Contractor shall engage and pay for the services of an independent testing laboratory approved by the Architect.**
 - 1. Qualified according to ASTM E-329 and ASTM D-3740 for testing.
- C. Comply with 29 CFR 1926, Subpart P - Excavations (OSHA Regulations).

1.04 Submittals:

- A. Product data for each type of manufactured products required.
- B. Qualification data for testing agency.
- C. Material Test Reports for each borrow soil material proposed for engineered fill and backfill as follows:
 - 1. Classification according to ASTM D-2487.
 - 2. Laboratory compaction curve according to ASTM D-698.

1.05 Project Conditions:

- A. Traffic: minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authority Having Jurisdiction. Provide alternate routes around obstructions as required by authorities.

Part 2 - Products

2.01 Materials:

- A. Backfill Material: Approved low volume change material. If additional material required, it shall be low plasticity cohesive material (plasticity index between 5 and 18 and a maximum liquid limit of 35 percent). The moisture content of the low volume change soil should be adjusted to its optimum value, or above, before compaction. The suitability of materials, including off-site soils, shall be approved by the Geotechnical Engineer hired by the Contractor. Frozen material shall not be acceptable for backfilling.
- B. Top Soil: Material shall be native, fertile, neutral top soil of loamy character, free from heavy clay, coarse sand, stones,

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

- lumps, plants, roots, or other foreign matter.
- C. Gravel: Course gravel - 100% passing a 2" screen, 90% retained on a 1/4" screen.
- D. Aggregate Base Course: Aggregate base - meet ASTM D448 size 57, 100 percent passing the 12" sieve, less than 5 percent passing the #8 sieve, plasticity index less than or equal to 6.
- E. Hydrated Lime: meet requirements of ASTM C977.

Part 3 - Execution

3.01 Excavations:

- A. General:
 - 1. Excavations shall be made to the elevations and dimensions shown on Drawings.
 - 2. If excavations are made deeper than called for on plans, no backfilling is permitted. Any additional depth or size shall be made up by additional concrete at no increase in contract price.
 - 3. Foundations shall be plumb, bottoms level and of type indicated on Drawings with allowance for erection of any required forms or shoring, and inspection of footings, etc.
 - 4. Shore and brace excavations where necessary to prevent cave-ins, and in accordance with all safety laws and codes, including all OSHA requirements.
 - 5. If an excavation must remain empty through a shutdown period, cover hole with suitable protection materials and clean out immediately prior to placing concrete.
 - 6. Keep excavations free of water by use of pumps.
 - 7. Keep area around excavations and concrete work clean for a distance of 3 feet all directions until concrete is placed and has set.
- B. Footings / Grade Beams:
 - 1. Footing bottoms shall be level, clean, clear of loose and objectionable material, and true to size.
 - 2. Concrete for footings shall be poured as soon as possible after excavation has been completed. Excavations shall be protected until concrete has been poured.
- C. Exterior and Pavement Sections:
 - 1. Excavate to underside of walks, curb, gutter, and miscellaneous items.
 - 2. Excavation shall be away from sides of grade beams and retaining walls below grade to a sufficient distance for erecting and removing forms with assured safety for workmen.
 - 3. Bottoms of excavated areas shall be level and kept clean of loose and objectionable materials at all times.
- D. All excavations for concrete footings, foundations or slabs shall be kept dry at all times, and shall be completely dry

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

at the time of any concrete pour. The Geotechnical Engineer, **hired by the Contractor**, shall make final approval of all excavations prior to the start of any concrete placement.

3.02 Classification of Excavation:

- A. All excavation shall be unclassified and the term "unclassified excavation" shall be understood to mean all and any materials encountered during excavation - including old floors, pavement, foundations, rock, earth, piping and debris. No adjustment in the contract price will be made on account of the presence or absence of rock, hard or soft sandstone, shale, masonry, or other materials.

3.03 Unknown Utilities:

A. Unknown Utilities:

1. If any unknown and uncharted utilities are encountered during excavation, promptly notify the Architect and wait for his instructions before proceeding.
2. If it is ascertained by the Architect that such utility line has been abandoned, the Contractor shall properly cap the line at depth of 12" or more below finish grade.
3. If such unknown utilities are encountered and work is continued without contacting the Architect for instruction, and damage is caused to said utilities, the Contractor shall repair, at his own expense, such damage to the satisfaction of the utility company concerned.

B. Unknown Obstacles:

1. If any unknown obstacles such as house or small building foundations or such as residential size basements, cisterns, etc., are encountered, the Contractor at his own expense shall remove the foundations, fill basements or cisterns or perform any work necessary to complete the work of this contract.
2. Should the Contractor encounter any unforeseen major obstacle in excavation, such as an abandoned water-well, subsurface streams, or "cave-ins" etc., which prove to be unduly expensive to overcome, it is the intention to cause a survey to be made to determine a course of action that will relieve the Contractor of undue expense.

3.04 Fill and Backfill:

A. Preparation for Concrete slab item on Fill:

1. Site preparation shall include removing existing vegetation, and any other unsuitable materials encountered. Refer to Soils Report and Structural Drawings concerning additional preparation procedures. The prepared area shall extend beyond the building footprint a minimum of 5 feet laterally. After performing the required cuts, proofroll existing site with a loaded, tandem-axle dump truck weighing at least 25 tons. Proofrolling shall involve overlapping passes in mutually perpendicular directions. After proofrolling, unstable soil should be overexcavated and replaced with a low volume change soil. Scarify existing soil at base of fill to

DIVISION 2 - SITE WORK

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- a minimum depth of 8"; moisture content of scarified soil shall be adjusted to a minimum of 2% above the material=s optimum content, as determined by the standard Proctor method ASTM D-698, and be compacted to at least 95 percent of its maximum dry density.
2. Provide fill material to bring site to required grade. Refer to 2.01A.
 3. **Compaction:** Compact fill in lifts not exceeding 8" in loose thickness. Compact soil according to table below. Tests shall be required and paid for by the Contractor. Any additional moisture required to achieve compaction in a layer should be added and the entire lift mixed to obtain the uniform moisture content.
 4. Compaction shall not be attempted using water settling.
 5. **Care shall be taken to maintain the minimum recommended moisture content in the subgrade until floor slabs are constructed. Positive drainage shall also be developed away from building to prevent water from ponding along the perimeter and affecting future floor slab performance.**
- B. Preparation for Paving items on fill:
1. Before compaction, the top 8" of the stabilized soil zone shall be modified with a minimum of 7% hydrated lime. The lime shall be thoroughly blended into the subgrade and allowed to cure for 48 to 72 hours before being remixed and compacted. Before compaction, the treated soil zone shall be adjusted to within 2 percentage points of optimum moisture as determined by the standard Proctor method (ASTM D-698); then compacted to at least 98 percent of the material=s maximum standard Proctor dry density.
- C. Backfill at Walls (including footing and foundation walls):
1. Fill material shall be approved backfill material except as noted on Drawings.
 2. Backfill around footing and foundation walls must be compacted.
- 3.05 Exterior Fill and Grading:
- A. Fill:
1. Subgrade fill as shown on plot plan, placed in 4" to 8" layers, to within 6" of finish. Compact according to table below.
 2. Top 6" of graded surface shall be approved top soil.
- B. Lines and Grades:
1. Work shall conform to lines and grades shown on the Drawings. Ruts holes and depressions shall be filled with approved material.
 2. The slopes between contours or between spot elevations shall be smooth, uniform slopes and the surface shall be finished to a tolerance of 2" in 10' under a straight edge.

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3.06 Compaction (fills less than 8'-0" thick):

Soil Compaction Criteria

Minimum Compaction (%) per ASTM D698

Use	Exposed in-situ subgrade soil	Fill	Base Course
Beneath foundation components	95	95	95
Beneath pavements, curbs and sidewalks (Stabilized on-site soil)	98	98	95
Aggregate base (at slab) Aggregate base (at pavements)			98
Beneath exterior slabs and utility trench backfill (stabilized on-site soil)	95	95	95
Miscellaneous backfill (non-load bearing)		90	

3.08 Testing:

- A. Make at least one density test of subgrade for every 2500 square feet of paved area or building slab, but in no case less than 5 tests.
- B. In each compacted fill layer, make one density test for every 2500 square feet of overlaying building slab or paved area, but in no case less than 8 tests.

3.09 Trenching and Backfilling of Utilities:

- A. The Contractor shall do all excavation and backfilling necessary for the installation of all utilities, including shoring, bailing, and pumping required to maintain the excavations in a safe and dry condition.
- B. All excavations shall be backfilled in 4" to 6" layers and thoroughly compacted one layer at a time with a mechanical tamper. Backfill material under areas where walks, drives, slab, parking areas, etc., are to be constructed shall be fill sand (free of all dirt). Backfill material in other areas shall be excavated material. Where excavation is not to be built over, replace the top 12" with existing top soil. Remove superfluous materials from job site.

End of Section

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SECTION 02202 - EARTHWORK FOR UTILITIES

Part 1 - General

- 1.01 Applicable Publications: The publications of the organizations listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- A. American Society for Testing and Materials (ASTM) Publications:
1. Sieve or Screen Analysis of Fine and Coarse Aggregates.
 2. Liquid Limit of Soils.
 3. Plastic Limit and Plasticity Index of Soils.
 4. Moisture Density Relations of Soils and Soils Aggregate Mixtures Using 5.5 lb. (2.49 KG.) Rammer and 12 in. (305.mm) Drop.
 5. Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
 6. Density of Soil in Place by the Sand Cone Method.
 7. Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54KG) Rammer and 18 in. (457 mm) Drop.
 8. Breaking Load and Elongation of Textile Fabrics.
 9. Underground Installation of Flexible Thermoplastic Sewer Pipe.
 10. Classification of Soils for Engineering Purposes.
 11. Underground Installation of Thermoplastic Pressure Piping.
 12. Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
- B. American Water Works Association (AWWA) Publications:
1. The Selection of Asbestos Cement Distribution Pipe, 4 in. Through 16 in., for Water and Other Liquids.
 2. Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances.
 3. Installation of Asbestos Cement Pressure Pipe.
 4. Steel Pipe Design and Installation, 1964 Edition.
- 1.02 Description: This section covers all earthwork requirements for piping systems specified in Section 02550 - Sanitary Sewer Gravity and Section 02551 - Water Lines. This section covers requirements for excavation and for compaction of succeeding layers after backfill has been placed around pipe as specified in the respective sections for these systems.
- 1.03 Quality Assurance:
- A. Standards:
1. American Society for Testing and Materials
 - a. ASTM D-1556, Density of soil in place
- B. Comply with 29 CFR 1926, Subpart P - Excavations (OSHA Regulations).
- C. **Testing: All required tests, and their fees, shall be the responsibility of the Contractor. The Contractor shall**

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engage and pay for the services of an independent testing laboratory approved by the Architect.

1.04 Submittals:

- A. Certified Test Reports: Submit certified test reports for the following:
 - 1. Sand tested in accordance with ASTM C136 and ASTM D2487.
 - 2. Porous fill tested in accordance with ASTM C136.
- B. Shoring and Sheeting Plan: Before starting work submit a shoring and sheeting plan as required to meet O.S.H.A. regulations.
- C. Manufacturer's Data: Submit manufacturer's descriptive literature, detailed specifications, available performance test data, instructions, and recommendations for buried warning and identification tape.

1.05 Delivery and Storage: Deliver and store materials in a manner to prevent deterioration, contamination or segregation.

1.06 Criteria For Bidding: Base bids on the criteria listed below. Hard material is defined as solid rock, firmly cemented unstratified masses, or conglomerate deposits possessing the characteristics of solid rock which can not ordinarily be removed without systematic drilling and blasting, and any boulder, masonry, or concrete except pavement, exceeding 1/2 cubic yard in volume.

- A. That the surface elevations are as indicated.
- B. That no pipes or other artificial obstruction, except those indicated will be encountered.
- C. That the character of the material to be removed is as indicated.

1.07 Protection:

- A. Shoring and Sheeting: Provide shoring and bracing where required for compliance with O.S.H.A. regulations.
- B. In addition to any other requirements set forth in this Contract, meet the following requirements:
 - 1. Prevent undermining of pavements and slabs.
 - 2. Banks may be sloped where space permits and as directed.
 - 3. Where shoring and sheeting materials must be left in place in the completed work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 3 feet below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.
- C. Shoring and Sheeting Plan: Shall include detailed drawings and the following:
 - 1. Design calculations by a Registered Professional Engineer.
 - 2. The sequence and methods of installation and removal.
 - 3. The materials, sizes, and arrangement of members

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proposed for use as shoring and bracing.

1.08 Minimum Burial Depths:

- A. Water Lines: refer to Drawings.
- B. Sewer Lines: refer to Drawings.

Part 2 - Products

- 2.01 Soil Materials: In general, shall be free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, frozen, deleterious, or objectionable materials.
- A. Backfill: Shall conform to the general requirements for soil materials above and shall be material excavated on the site of this project. This material is unclassified and no testing will be required before use as backfill.
 - B. Sand: Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as SW by ASTM D2487 of which no more than 10 percent by weight shall be finer than the No. 200 sieve.
 - C. Gravel: Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as GP by ASTM D2487 of which no more than 10 percent by weight shall be finer than the No. 200 sieve.
 - D. Crushed Stone: Shall conform to the general requirements for gravel above and a minimum of 10 percent of the particles shall have at least one fractured face and the maximum particle size shall be 3/4 inches.
 - E. Porous Fill: Shall conform to the general requirements for gravel above and shall pass a 2 inch sieve and be retained on a 1/2 inch sieve.
 - F. Bedding:
 - a. Shall Be SW sand for water lines.
 - b. Bedding shall be ASTM type 57 crushed stone for sanitary sewer lines.
 - G. Materials For Use in Pipe Installations: Bedding and backfill materials shall conform to requirements specified herein, except as modified herein by the respective specifications and requirements listed following:

PIPE MATERIALS	MATERIAL REFERENCE
1. Ductile Iron Soil Pipe	AWWA C600, except refill of overcut shall be crushed stone. Bedding shall be GW.
2. Metallic Water Service Line Pipe (Steel, Copper Tube).	AWWA C600

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3. Polyethylene (PE) Pressure ASTM D2774, except bedding pipe, shall be SW and all material surrounding the pipe shall have maximum particle size of 1/2 inch.
 4. Polyvinyl Chloride (PVC) ASTM D2321, except bedding shall be SW and all material surrounding the pipe shall have maximum particle size of 1/2 inch.
 5. Polyvinyl Chloride (PVC) Pressure Pipe. ASTM D2774, except bedding shall be SW and all material surrounding pipe shall have maximum particle size of 1/2 inch.
- H. Topsoil: Shall be material free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.
- I. Borrow: Shall be materials conforming to the requirements for backfill.
- J. Embankment: Embankment material shall be in accordance with Borrow material and shall be approved by the Architect.
- 2.02 Buried Warning And Identification Tape: Shall be polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines. Tape shall be provided in rolls, 6 inches minimum width, color coded for intended service with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED (Intended Service) LINE BELOW" or similar wording. Code and letter coloring shall be permanent, unaffected by moisture and other substances contained in trench backfill material.

Part 3 - Execution

3.01 Surface Preparation:

- A. Stockpiling Topsoil: Strip suitable soil from the site where excavation or grading is indicated and stockpile separate from other excavated material. Material unsuitable for use as topsoil shall be stockpiled and used for backfilling. Locate topsoil such that the material can be used readily for the finished grading. Where sufficient

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existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and maintain in segregated piles until needed.

- B. Cutting Pavement, Curbs, and Gutters: Make cuts with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits.
- 3.02 General Excavation: Shall be to the elevations and dimensions indicated or otherwise specified. Keep excavations free from water while construction is in progress. Notify the Architect immediately in writing if it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of top of the pipe. Excavate ledge rock, boulders, or hard material to an overdepth at least 4 inches below the bottom of the pipe unless otherwise indicated or specified. Blasting will not be permitted. Stabilize soft, weak, or wet excavations as indicated. Use bedding material to refill overdepth to the proper grade and place in 6 inch maximum layers. At the option of the Contractor, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded and dimension to ensure that the bell does not bear on the bottom of the excavation.
- 3.03 General Bedding: For utility lines and utility line structures shall be one of the materials and depths indicated. Place bedding in 6 inch maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.
- A. Refill: Is defined as material placed in excavation to correct overcut in depth.
- B. Concrete Cradles: Specified in lieu of other types of bedding for a particular type of pipe material, shall be as indicated.
- 3.04 General Backfilling: Surround pipes with backfill as indicated. Ensure that backfill is placed completely under pipe haunches. Place in 6 inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length, of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 12 inch maximum loose lifts unless otherwise

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specified. Compact each loose lift as specified in Paragraph "General Compaction" before placing the next lift. Do not backfill in freezing weather, where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade of 4 feet for water mains. Where unacceptable settlements occur in trenches and pit due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Provide buried warning and identification tape.

3.05 General Compaction: Use hand operated plate type vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Be careful to avoid damaging pipes and protective pipe coatings. Compaction shall be in accordance with the following unless otherwise specified.

A. Compaction shall conform to Soil Compaction Criteria listed in Section 02200 - Earthwork for Buildings.

3.06 All trenches created for utility access under the building shall be effectively sealed to restrict water intrusion and flow along the trenches. Use a clay soil to construct an effective trench plug that extends at least 5 feet out from the face of the building. The clay should have a minimum plasticity index of 15 and be placed in controlled lifts not exceeding 9 inches in loose thickness so as to surround the utility line and fill the trench. Each lift of clay backfill should be compacted to at least 95 percent of the material's maximum dry density as determined by the standard Proctor test method (ASTM D-698). The moisture content of the clay backfill should be adjusted to its optimum value or above before compaction.

3.07 Finish Operations:

A. Grading: Shall be to finished grades indicated within one tenth of a foot. Provide sod or topsoil in areas to be seeded as indicated. Grade areas to drain water away from structures. Existing grades which are to remain but are disturbed by the Contractor's operations shall be graded as directed.

B. Spreading Topsoil: Areas indicated to receive topsoil for the finished surface shall be free of materials that would interfere with planting and maintenance operations. Spread topsoil uniformly grade and compact to the thicknesses, elevations, and slopes indicated. Do not place topsoil when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading.

C. Borrow Areas: Shall be graded to drain properly.

D. Disposition of Surplus Material: Surplus or other soil material not required or suitable for filling, backfilling or grading shall be disposed of as directed by the

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Architect.

- E. Protection of Surfaces: Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or re-establish damaged grades, elevations, or slopes.
 - F. Pavement Repair: Repair pavement, curbs, and gutters as indicated. Do not repair pavement until trench or pit has been backfilled and compacted as herein specified. Provide a temporary road surface of crushed stone over the backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum one way traffic shall be maintained at all times on roads and streets crossed by trenches; roads and streets shall be fully opened to traffic as quickly as possible.
- 3.08 Field Sampling and Testing: Test sand, gravel, bedding, and backfill for conformance to gradation limits in accordance with ASTM C136. Test sand, gravel, backfill and material used as subgrade under roads and other paved areas for material finer than the No. 20 sieve in accordance with ASTM D1140. Test backfill material used as subgrade under roads and other paved areas for liquid limit in accordance with ASTM D423 and for plasticity index in accordance with ASTM D424. Test bedding and backfill materials for moisture density relations in accordance with ASTM D698 & D1557. Perform at least one of each of the required tests for each material used. Provide additional tests as specified above for each source change. Perform density tests in randomly selected locations and in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017 as follows: one test per 100 lineal feet in each lift.

End of Section

DIVISION 2 - SITE WORK

SECTION 02280 - SOIL TREATMENT

Part 1 - General

1.01 Work included:

- A. The General Conditions and applicable sections of Division 1 shall apply to this entire section.
- B. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Soil shall be treated by an established, licensed pest control firm thoroughly familiar with local soils and chemicals.
- B. Contractor shall submit documentation for type of treatment to be used to the Architect for approval prior to commencing the work covered by this section.

1.03 Product Delivery, Storage and Handling:

- A. Precaution: Soil Termite Control is a toxic by ingestion, absorption through the skin, or inhalation and absorption through the respiratory tract. Strict adherence to the instructions printed by the manufacturer on the labeled containers shall be maintained while handling, mixing, and applying this material. Refer to label on containers for antidote and first aid. Erect and maintain suitable warning signs or barriers while application is underway and until treated surfaces are covered by new construction or soil fill.

Part 2 - Products

2.01 Materials:

- A. Soil Termite Control:
 - 1. Use working solutions containing any one of the following emulsion soil chemicals at the listed minimum concentrations:
 - a. Premise 75, Bayer 0.1% concentrate

Part 3 - Execution

3.01 General:

- A. All stumps, roots, fallen timber and other wood or wood products shall be removed from foundation area before treatment.
- B. To avoid surface flow of the chemical from the treated area, treatments shall not be made when the soil or fill is excessively wet or immediately after heavy rains.
- C. When treating under slabs, care shall be taken not to disturb perimeter excavations.

3.02 Installation - based on 0.1% dilution:

- A. Under Concrete Slab: Apply solution at the rate of one gallon per 10 sq. ft. of fill. Apply two gallon per 5 lin. ft. under

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SECTION 02280 - SOIL TREATMENT

foundation beams and at all plumbing risers.

- B. Adjacent to concrete slabs: Provide a maximum 8" deep trench continuous at perimeter of slab and apply solution at the rate of one gallon per 5 lin. ft. of trench. Fill trench with soil and repeat application of solution at the rate of one gallon per 5 lin. ft. Cover final application with top soil.

End of Section

DIVISION 2 - SITE WORK

SECTION 02430 - DRAINAGE STRUCTURES

Part 1 - General

- 1.1 Work Included: This section consists of all work for drainage structures for storm and sanitary sewers as shown on the plans and specified herein. Drainage structures shall include manholes and catch basins.
- 1.2 Related Work Specified Elsewhere: The following items of related work are specified and included in other sections of these Specifications:

Section 02100	Site Preparation
Section 02200	Earthwork
Section 02202	Earthwork for Utilities
Section 02550	Gravity Sanitary Sewer
Section 02551	Water Lines
Section 02552	Storm Sewer Lines

- 1.3 Submittals: Shop drawings for drainage structures, castings and appurtenances shall be submitted in accordance with the General Requirements as specified herein.

Part 2 - Products

- 2.01 Drainage Structures: Precast concrete drainage structures shall be manufactured in conformance with the standards and specifications of ASTM 478. Drainage structures shall be of the type and style shown on the Plans. Joints in drainage shall be O-Ring gasketed joints. Structure bases may be cast monolithically with the bottom barrel sections. Manhole tee sections shall be provided as shown on the Plans.
- 2.02 Pipe Connections: The connections of pipes to drainage structures shall conform to the following:
- A. Storm Sewer Systems: Storm sewer pipes shall be grouted into drainage structures with nonmetallic nonshrink grout unless shown otherwise on the Plans.
 - B. Sanitary Sewer and Subsurface Drainage Systems:
 - 1. Pipes for sanitary sewers and subsurface drainage systems shall be connected to drainage structures by means of flexible rubber boots. The boots shall be clamped to the structure by means of a stainless steel expansion type band. The pipe shall be secured to the boot by means of a stainless steel pipe clamp.
 - 2. Rubber link seals with stainless steel bolts shall be used where ductile iron pipes or pipes too large for rubber boots penetrate drainage structures. The link seals shall be as manufactured by Thunderline, or equal.

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SECTION 02430 - DRAINAGE STRUCTURES

2.1 Bedding Material: All drainage structures shall bear on Class II bedding as defined below. Class II bedding shall also be used to backfill beneath all pipes which connect to the structure that enters the structure excavation. This bedding shall extend from the bottom of the excavation to the midheight of each pipe.

- A. Class II Bedding: Class II bedding shall consist of coarse sands and gravel with a maximum particle size of 1 ½ inches. The bedding material shall be well graded and shall have no more than 35 percent by weight passing the number 200 sieve.

Part 3 - Execution

General: Drainage structures shall be set to the lines and grades shown on the Plans. The subgrade shall be excavated to a level 6 inches below the base of the structure. The excavation shall be brought to the final grade with Class II bedding material which shall be compacted and leveled. The use of imported granular bedding shall not be required, subject to the approval of the Engineer, if the excavated material is a granular material.

3.02 Structural Inverts: The inverts of drainage structures shall be shaped with fresh concrete where prefinished precast inverts are not provided. Any water flowing into or through the structure shall be diverted away from the fresh concrete until it has cured for at least 24 hours.

3.03 Setting Castings:

- A. Structure heights shall permit the placement of adjusting rings or block courses. On circular manholes the structure height shall be such as to provide room for at least 3 and not more than 6 standard 2-inch precast concrete adjusting rings. On rectangular structures, the structure height shall be such as to provide room for at least one, but not more than three 2-inch courses of concrete masonry units. The width of the concrete masonry units shall be more or less equal to the width of the walls of the structure.
- B. Leveling courses and adjusting rings shall be set in mortar beds. A coat of mortar shall be applied to the inner and outer surfaces of the adjusting rings or blocks.
- C. The casting shall be set in a bed of mortar. In paved areas the finish grade of the casting shall be set ¼ inch to ½ inch below the finish grade of the pavement

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SECTION 02430 - DRAINAGE STRUCTURES

3.04 Connections to Piping:

- A. Pipe connections to drainage structures shall be made without distorting the pipe joints beyond the tolerances allowed for joint integrity.
- B. Storm sewer pipes shall be connected to drainage structures by means of nonmetallic nonshrink grout within the annulus between the pipe and structure wall.
- C. Sanitary sewer lines shall be connected to drainage structures by means of flexible rubber boots. Where sanitary sewer lines intersect a drainage structure more than 24 inches above the invert of the structure, the connection to the structures shall be made by means of an outside drop connection. Where outside drop connections are required, the structure base beneath the drop connection shall be monolithic with the structure base.

3.05 Backfill: Backfill around structures shall be placed in accordance with the requirements of Earthwork/Site Grading/Structure and Utility Excavations as specified herein. Class II bedding material shall be used as backfill from the bottom of the structure up to the midheight of each pipe which is within the excavation limits for the structure.

3.06 Wastewater Retention: All major wastewater facilities shall be constructed to be water tight. At the Architect/Engineer's request, the Contractor shall fill any structure with water. This structure shall then show no loss of water in 12 hours.

End of Section

DIVISION 2 - SITE WORK

SECTION 02500 - PAVING AND SURFACING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary to complete all Paving Work as shown on the Drawings, and specified herein.

1.02 Related Work Specified Elsewhere:

- A. Site Preparation - Section 02100
- B. Earthwork for Buildings - Section 02200
- C. Cast-In-Place Concrete - Section 03300

1.03 Quality Assurance:

- A. Standards:
 1. American Society for Testing and Materials (ASTM).
 2. American Association of State Highway and Transportation Officials (AASHTO).
 3. Oklahoma Department of Transportation (ODOT) Standard Specifications for Highway Construction.
- B. **Testing: All required tests, and their fees, shall be the responsibility of the Contractor. The Contractor shall engage and pay for the services of an independent testing laboratory approved by the Architect.**

1.04 Paving Quality Requirements:

- A. General: In addition to other specified conditions, comply with the following minimum requirements:
 1. Test concrete as required under Section 03300 - Cast-In-Place Concrete.
 2. Test subgrade preparation as required under Section 02200 - Earthwork for Buildings.
- B. Provide final surfaces of uniform texture, conforming to required grades and cross-sections. Finished surface tolerance - 1/2" in 10'-0" under a straightedge.
- C. Thickness: In-place compacted thickness shall not be acceptable if not meeting the minimum thickness indicated on the Drawings.

1.05 Coordination:

- A. Coordinate work and cooperate with any other trades whose work relates to paving in any way.

1.06 Personnel:

- A. All work shall be directed by trained and experienced applicators, thoroughly adept at the procedures and equipment required by this section.

1.07 Weather Limitations:

- A. Do not install paving when the subgrade is frozen or show any evidence of excessive moisture.
- B. Do not install paving when the air temperature is less than 40 degrees Fahrenheit nor when temperature of the surface on

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SECTION 02500 - PAVING AND SURFACING

which mixture is to be placed is below 40 degrees Farenheit unless directed otherwise by Architect.

Part 2 - Products

2.01 Material Applications:

A. Subgrade Preparation:

1. Description: Refer to Section 02200 - Earthwork, Part 3, 3.01 and 3.04.

B. Concrete Walks:

1. Description: A 4,000 p.s.i. reinforced concrete slab on a sand base. Provide expansion and saw cuts as shown on the Drawings.

2.02 Expansion Control:

A. Construction Joint Form: Tongue and groove keyway, premolded asphaltic or wood form, designed to provide 1 1/2" keyway.

B. Joint Filler: Resilient, non-extruding bituminous-impregnated fiberboard expansion joint material by thickness shown on the Drawings, ASTM D-1751.

C. Joint Sealers: Hot applied, non-tracking asphalt-rubber compound, ASTM D-1190.

D. Anchorage Inserts: Malleable cast iron adjustable wedge, or threaded, type with 3/4" bolt size unless indicated otherwise on the Drawings.

E. Embedded Items: Provide materials as sized and/or indicated on the Drawings, or as required.

Part 3 - Execution

3.01 General:

- ###### A. Make careful inspection of excavated surface on which paving is to be placed and check on bottom and top grades of paving throughout the area to be paved, prior to starting work under this section. Notify the Contractor of any unsatisfactory conditions. Do not begin paving work until such conditions have been corrected and area is ready to receive paving.

3.02 Workmanship:

A. Backfill shall be placed behind the sidewalks in a manner that will not cause displacement of the section nor damage to the exposed edges. All damaged sidewalks shall be replaced at the direction of the Architect at the Contractor=s expense.

B. Adjoining Paving: where new work adjoins existing, warp carefully to flush surface, with seal over joint.

C. Construction Joints: As noted on the Drawings or as directed by the Architect:

1. At joints, thoroughly clean surfaces and remove all

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- laitance.
2. In addition, vertical surfaces shall be thoroughly wetted and coated with cement grout before placing new concrete.
- D. Expansion Joints: As noted on the Drawings, or as directed by the Architect:
1. Provide 1/2" expansion joints where sidewalks join structural concrete.
 2. Hold filler material down 1/2", fill top with sealant.
- E. Control Joints: Provide scored lines and weak plane joints on exterior and interior concrete slabs as indicated on the Drawings, and as approved by the Architect. Fill with sealant.
- F. Finishes:
1. Concrete Walks:
 - a. Provide trowel and medium broom finish. Refer to drawings.
 - b. Broom after concrete is hard enough to retain scoring, using a stiff fiber, or wire, broom. Broom perpendicular to direction of traffic.
- G. Repair any damage to finished pavement surfaces that may result from subsequent construction to a smooth, true, and uniform surface.
- H. Clean-up: After completion of paving operations, remove all excess materials, equipment and debris (dispose of away from the site). Leave all work in clean condition.
- I. Protection:
1. Provide barricades and warning devices as required to protect pavement and the general public.
 2. Cover any openings of structures in area of paving until permanent coverings are installed.
 3. Prohibit all traffic on paving until it has reached atmospheric temperature.

End of Section

DIVISION 2 - SITE WORK

SECTION 02550 - SANITARY SEWER GRAVITY

Part 1 - General

1.01 Work Included:

- A. All materials, equipment, labor, services and incidentals necessary for the completion of this section of work.
- B. Work specified herein will include installation of sewer service lines, sewer mains, joints, clean outs, and associated testing.
- C. Backfilling shall be accomplished after inspection by the Architect.
- D. Work covered by this section will not be accepted until backfilling connected with the work has been completed satisfactorily.

1.02 Related Work Specified Elsewhere:

- A. Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02202 - Earthwork for Utilities (except as modified herein).

1.03 Submittals: Contractor shall submit 30 days after date of receipt of notice to proceed, a complete list of materials and equipment showing the types, sizes, catalog number, manufacturer=s name for each of the following items to ensure compliance with the specifications.

1.04 Wye and Service Line Record: The Contractor shall keep a wye record showing the distance in feet from the manhole to each wye or connection placed in the sewer main. A service line record shall be kept showing the length of pipe installed and the location in relationship to the house and wye connection point. The record shall also locate all clean outs and bends. No payment for sewer work will be made until the wye and service line record is furnished to the Architect.

1.05 **Minimum Burial Depth: refer to drawings.**

Part 2 - Products

2.01 Pipes:

- A. PSM Polyvinyl Chloride (PVC) Pipe and Fitting: ASTM D3034; SDR 35.
 - 1. Elastomeric Gaskets for Compression Joints ASTM F477.
- B. Ductile Iron Pipe (Class 52) and Cast Iron Fittings: ASTM A536 with physical properties of Grade 60-42-10.
 - 1. Rubber Gaskets for Compression Joints AWWA Designation C111 (ANSI A21.11).

2.02 Cleanouts: Cleanouts shall be iron ferrule with metal counter sunk screw plugs set in formed square concrete collar. Re: Mechanical.

DIVISION 2 - SITE WORK

SECTION 02550 - SANITARY SEWER GRAVITY

Part 3 - Execution

3.01 Pipe Laying:

- A. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.
- B. Pipe laying shall proceed upgrade with bell ends upgrade. Each pipe shall be laid accurately to the line and grade shown on the Drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. The alignment of the installed pipe shall appear straight to the naked eye and shall be such that a full circle of light can be seen between manholes, etc., when sighting along all points of the pipe circumference.
- C. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted joined, and adjusted to obtain the degree of water tightness required.
- D. Water and Sewer Line Separation: Where the location of the sewer line is not clearly defined in dimensions on the Drawings, the sewer line shall not be laid closer horizontally than 10 feet from a water line except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the sewer line shall not be laid closer horizontally than 6 feet from the water pipe. Where water lines cross under gravity flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete. Where a water main crosses over an existing sanitary sewer main, the sewer line shall be uncovered to its spring line and a concrete cradle constructed for a distance of 10 feet each side of the water main. The water line shall not pass through or come into contact with any part of a sewer manhole.
- E. Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for a long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.
- F. Bedding: Sanitary sewer shall be bedded in crushed stone (ASTM Type 57) from 4 inches below pipe to 4 inches above the pipe. Bedding shall be placed as soon as possible after the joint is made to prevent pipe

DIVISION 2 - SITE WORK

SECTION 02550 - SANITARY SEWER GRAVITY

movement off line or grade.

- G. Width of Trench: If the maximum width of the trench at the top of the pipe, as specified in Section 02202: Earthwork for Utilities is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding as may be required to satisfactorily support the added load of the backfill.
 - I. Joints between different pipe materials shall be made as herein before specified, using approved jointing materials.
 - J. Handling and Storage: Pipe, fittings and joints material shall be handled and stored in accordance with the manufacturer=s recommendations.
 - K. All pipe shall be bedded per Section 02202: Earthwork for Utilities, unless otherwise indicated on the plans or ordered by the Architect.
 - L. Where a project out falls into an existing sanitary sewer, construction of the physical connection to the existing line shall be delayed until all upstream underground construction, including exfiltration testing, is complete and accepted unless special permission is granted by the Architect. Care shall be exercised during construction, flushing and testing operations of this connecting link to assure that water is not diverted into any portion of a sanitary sewer line in service or a sanitary sewer line which is not a portion of the construction project for which the Contractor is responsible.
 - M. No pipe shall be laid when the bottom of the ditch or the sides to one foot above the pipe is frozen. No backfill containing frozen material shall be placed within 3 feet of the pipe, nor shall the trench be left open during freezing weather so that temperatures of the material near the pipe goes below freezing.
- 3.02 Wye Branches: Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping, for connections shall not be done except in special approved cases. When conditions are such that the connecting pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no cost to the Owner.
- 3.03 Testing:
- A. Alignment and Grade: As the pipe laying progresses, and after partial backfilling, the interior of the sewer shall be visually inspected for alignment and grade, by means of artificial or reflected light. Necessary corrections shall be made by the Contractor at no additional cost to the Owner.

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- B. Sewer and Manholes: Sewer and manholes shall be subject to test for leakage after the lines have been partially backfilled, in accordance with the following:
1. General:
 - a. The Contractor shall clean all sanitary sewer installed, and in addition to this all sanitary sewer pipe shall be flushed. All sand, debris, mortar and other foreign materials shall be removed from sanitary sewer pipe and manholes prior to testing or final inspection.
 - b. All sanitary sewer pipe installed will be subject to either an infiltration test or an exfiltration test. In those areas where, in the opinion of the Architect, the water table is high enough to subject the pipe to a satisfactory infiltration test, it is not anticipated that an exfiltration test will be required. In checking leakage there will be no allowance made for external hydrostatic head.
 - c. Where in the opinion of the Architect, the water table is not high enough to provide a satisfactory infiltration test, an exfiltration test will be required.
 - d. The type of test (either infiltration or exfiltration) shall be determined by the Architect.
 - e. All wyes, tees, or ends of side sewer stubs shall be plugged or capped and the plug or cap shall be securely fastened to withstand the internal test pressures. Such plugs and caps shall be readily removable and their removal shall provide a socket suitable for extending the lateral connection.
 2. Exfiltration Test (Using Water):
 - a. On completion of a section of sanitary sewer between manholes or otherwise, the Architect will require that the ends of all pipe be plugged, including service connections, and the pipe subjected to a hydrostatic pressure. Generally, all testing is to be conducted after backfilling prior to resurfacing and after service connections are made. The lengths of service connections shall be included in the computations to determine the allowable leakage for the test section.
 - b. A minimum head of 6 feet of water above the crown at the upper end of the test section shall be maintained for a period of 4 hours during which time it will be presumed that full absorption of the pipe

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body has taken place and thereafter for a further period of 1 hour for the actual test leakage. During this 1 hour period the measured loss shall not exceed the rate given in the following formula:

$$E=0.004DL$$

E=Allowable leakage in gallons per hour.
D=Nominal inside diameter of pipe in inches.
L=Length of pipe being tested in feet.

3. Infiltration Test:
 - a. Infiltration testing may be allowed at the Architect's option when the natural ground water table is 6 feet or more above the crown of the higher end of the test section. The maximum allowable limit for infiltration shall be as determined by the Formula $E=0.004DL$.
 - b. The Contractor shall furnish all tools, equipment and labor necessary to complete the tests and shall know from his own observations, or preliminary tests, that each line conforms with this Specification before requesting the Architect to observe and record the actual leakage. The Contracting Officer may require the Contractor to repair obvious leaks even though the total length of the test section falls within the maximum allowable leakage for the test used.
4. Deflection Test: All sanitary sewer must pass deflection test by use of pulled mandrel. Contractor to supply the mandrel to be inspected and approved by engineer. Deflection shall not exceed 5% of pipe diameter. Deflection test to be performed not less than 30 days after final backfilling.
5. Air Testing: Air tests shall be conducted on each manhole-to-manhole section of sewer. The air test shall be performed in accordance with the following specifications:
 - a. **Equipment** - Cherne Air-Loc Equipment as manufactured by Cherne Industrial of Hopkins, Minnesota or approved equal. Equipment used shall meet the following requirements:
 - 1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

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- 2) Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.
 - 3) All air used shall pass through a single control panel.
 - 4) Three (3) individual hoses shall be used for the following connections: (a) from the control panel to pneumatic plugs for inflation; (b) from the control panel to sealed line for introducing the low pressure air; and (c) from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- b. **Procedures** - All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to twenty-five (25 psig) pounds per square inch gauge. The sealed pipe shall be pressurized to five (5 psig) pounds per square inch gauge. If a ground water level over the top of the pipe is present, the pressure in psig shall be increased by the height of ground water level above top of pipe at upstream manhole divided by two and one third (2.3). The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to twenty-five (25 psig) pounds per square inch gauge. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches four (4 psig) pounds per square inch gauge. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (three and one half (3.5 psig) pounds per square inch gauge minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from three and one half (3.5) to two and one half (2.5 psig)

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SECTION 02550 - SANITARY SEWER GRAVITY

pounds per square inch gauge is not less than that shown in the following table:

Pipe Nominal Size (Inches)	Minimum Test Time (min:sec)	Length for Minimum Time (Feet)
6	2:50	751
8	3:47	564
10	4:43	450
12	5:40	376
15	7:05	302
18	8:30	250
21	9:55	215
24	11:20	188
27	12:45	167
30	14:10	150
33	15:35	138
36	17:00	125
42	19:50	107
48	22:40	94
54	25:30	83
60	28:20	75
66	31:10	68
72	34:00	63
78	36:50	58
84	39:40	54
90	42:35	51
96	45:20	47

For lengths in excess of "Length for Minimum Time" given in table above, additional testing time to be added to the "Minimum Test Time" is determined from the following equation:

$$t = 0.011 (d^2) (L)$$

where t = additional testing time, seconds
 d = nominal pipe diameter, inches
 L = additional length, feet.

If the air leakage in any reach exceeds the allowable, it shall be

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re-tested after the leaks are repaired.

4. The Contractor shall furnish and report on the test results prior to acceptable of the system including the following:
 - a. Date of test.
 - b. Name of person in responsible charge for the tests.
 - c. Segments of pipe tested.
 - d. Outline of test procedures used.
 - e. Elapsed time for container to empty.
 - f. Calculated minimum test duration times and calculated loss rate (exfiltration method).

End of Section

DIVISION 2 - SITE WORK

SECTION 02551 - WATER LINES

Part 1 - General

- 1.01 Work Included: This section covers water distribution lines, water service lines, and connections to buildings services at a point approximately 5 feet outside all buildings and structures to which service is required, complete as indicated on civil Drawings. Pipe and accessories shall be new and unused unless otherwise approved.
- 1.02 Piping for Water Service Lines Less Than 3 Inches in Diameter:
- A. Piping for water service lines less than 3 inches in diameter shall be poly vinyl chloride (PVC) plastic, polyethylene (PE) or copper tubing, unless otherwise shown or specified. Piping for water service lines for sizes 3 inches and larger shall be ductile iron, or poly vinyl chloride (PVC) plastic through 12-inch nominal diameter, unless otherwise shown or specified.
- 1.03 Piping for Water Distribution Lines 3 Inches or Larger: Piping for water distribution lines 3 inches or larger shall be ductile iron, or poly vinyl chloride (PVC) plastic through 12-inch nominal diameter, unless otherwise shown or specified.
- 1.04 Recommendations of the Manufacturer: The Contractor shall, as a part of the shop Drawings, submit to the Architect the manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times.
- 1.05 Related Work Specified Elsewhere:
- A. Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02202 -Earthwork For Utilities.
- 1.06 **All water distribution and service lines shall have a burial depth adequate for protection from freezing. The burial depth shall be as indicated on the drawings, and the actual depth shall be approved by the Architect prior to any installation of water lines.**

Part 2 - Products

- 2.01 Pipe:
- A. Copper Tubing: ASTM B88, Type K, annealed.
- B. Ductile-Iron Pipe: ANSI A21.51, working pressure not less than 150 pounds per square inch unless otherwise shown or specified. Pipe shall be cement-mortar lined.
1. Cement-Mortar Lining: ANSI A21.4. Linings shall be standard thickness.
- C. Poly Vinyl Chloride (PVC) Plastic Pipe: All pipe, couplings and fittings shall be manufactured of material conforming to ASTM D1784, Class 150 1245A or 1245B, designated as PVC 1120.

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SECTION 02551 - WATER LINES

- 1. Pipe Less Than 4-Inch Diameter:
 - a. Screw-Joint: Pipe, couplings, and fittings to dimensional requirements of ASTM D1785, with joints meeting requirements of 150 psi working pressure, 200 hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings and fittings must be hydrostatically tested as required by AWWA C900. Screw joints for Schedule 80 pipe only.
 - b. Elastomeric-Gasket Joint: Pipe couplings, and fittings shall be dimensional requirements of ASTM D1785, Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe, couplings and fittings conforming to requirements of ASTM D2241, elastomeric joint, with the following applications:

<u>SDR</u>	<u>Maximum Working Pressure</u>	<u>Minimum Hydrostatic Pressure</u>
21	120	160
17	150	200
13.5	200	266

In addition to the above requirements the pipe, couplings and fittings must be hydrostatically tested as required by AWWA C900, and must be iron pipe size dimensions.

- 2. Pipe 4-Inch Through 12-Inch Diameter: Pipe, couplings and fittings 4-inch through 12-inch diameter shall conform to the requirements of AWWA C900, Class 150, C.I. pipe dimensions only, elastomeric gasket joint only, unless otherwise shown or specified.
- D. Polyethylene (PE) Pressure Pipe: PE pipe tubing and fittings shall conform to AWWA C901, Type III, Grade 34 Class C material, Dr=7.0 for 160 psi design pressure.

2.02 Joints:

- A. Copper Tubing: Joints shall be compression-pattern flared and shall be made with fittings hereinafter specified.
- B. Ductile-Iron Pipe:
 - 1. Mechanical Joints shall be of the stuffing box type and shall conform to ANSI A21.11 as modified by ANSI A21.51.
 - 2. Push-on joints shall conform to ANSI A21.51.
 - 3. Rubber gaskets and lubricant shall conform to applicable requirements of ANSI A21.11.
- C. Poly Vinyl Chloride Pipe and Polyethylene Pipe: Joints for

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SECTION 02551 - WATER LINES

pipe, fittings, and couplings for pipe less than 4-inches in diameter shall be as given in Paragraph 3.07.D.1, and pipe 4-inch through 12-inch diameter shall be as given in Paragraph 3.07.D.2. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation as approved by the Architect.

2.03 Fittings and Specials:

- A. For Copper Tubing: Fittings and specials shall be flared and shall conform to ANSI B16.26.
- B. For Ductile-Iron Pipe: Fittings and specials shall be suitable for 150 pounds per square inch pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to ANSI A21.10. Fittings and specials for use with push on joint pipe shall conform to ANSI A21.10 and ANSI A21.11. Fittings and specials shall be cement-mortar lined in accordance with ANSI A21.4. Linings shall be standard thickness.
- C. For Poly Vinyl Chloride (PVC) Pipe:
 1. For Pipe Less Than 4-Inch Diameter: Screw-joint conforming to the requirements of ASTM D1785, threaded to conform to the requirements of ASTM D2464 for use with Schedule 80 pipe and fittings only, all other pipe less than 4-inch diameter shall be elastomeric-gasket bell and socket fittings with built-in stops, pipe ends tapered to fit the socket or elastomeric-gasket couplings with built-in stops, pipe end tapered to fit the coupling. Gasket shall conform to the requirements of ASTM D1869.
 2. For Pipe 4-Inch Through 12-Inch Diameter: Fittings and specials shall be cast iron, bell end in accordance with ANSI A21.10, 150 pounds per square inch pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with the requirements of AWWA C900. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with ANSI A21.4. Fittings shall be for bell and spigot pipe or plain end pipe, as applicable.

2.04 Couplings:

- A. Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

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SECTION 02551 - WATER LINES

2.05 Valves:

- A. Gate valves shall conform to AWWA C500 and be designed for a working pressure of not less than 150 pounds per square inch. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

- 2.06 Valve Boxes: Valve boxes shall be cast iron. Cast iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast in the cover. The boxes shall be of such lengths as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Locking covers required.

2.07 Fire Hydrants:

- A. Fire Hydrants shall be 5 1/4" dry barrel, Traffic breakable - AWWA C502, refer to Drawings.

2.08 Miscellaneous Items:

- A. Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.
- B. Goosenecks: Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B88, K annealed. Length of cable requirements connections shall be in accordance with standard practice.
- C. Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections or compression-pattern flared tube couplings, and be designed for hydrostatic test pressure not less than 200 pounds per square inch.
- D. Service boxes shall be cast iron. Extension service boxes of the required length and having either screw or slide-type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the service stop and shall be complete with identifying covers.
- E. Disinfection: Chlorinating materials shall conform to:
 - 1. Chlorine, Liquid: AWWA B301.
 - 2. Hypochlorite, Calcium and Sodium: AWWA B300.
- F. Polyethylene Encasement: AWWA C105.

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SECTION 02551 - WATER LINES

Part 3 - Execution:

3.01 **Pipe Burial Depth:** refer to drawings.

3.02 **Handling:** Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for alining or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place. Poly vinyl chloride pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

A. Polyethylene encasement shall be used on buried ductile iron piping valves and fittings.

3.03 **Cutting of Pipe:** Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Architect, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed.

3.04 **Adjacent Facilities:**

A. **Sewer Lines:** Where the location of the water pipe is not clearly defined in dimensions on the Drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the

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- sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.
- B. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electrical wiring.
- C. Copper tubing shall not be installed in the same trench with ferrous piping materials.
- D. Nonferrous Metallic Pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.

3.05 Joint Deflection:

- A. Ductile-Iron Pipe: The maximum allowable deflection will be as given in AWWA C600. Table 1 shows maximum deflection for 18 feet lengths of pipe. For other lengths the deflection will vary proportionately.

TABLE 1. DEFLECTION IN INCHES

<u>Diameter In Inches</u>	<u>Push-On Joint Pipe</u>	<u>Bell-and-Spigot Joint Pipe</u>	<u>Mechanical Joint Pipe</u>
3	19	22.2	31
4	19	16.7	31
6	19	16.7	27
8	19	14.6	20
10	19	14.0	20
12	19	11.9	20
14	11	10.1	13.5
16	11	8.8	13.5

- B. Poly Vinyl Chloride (PVC) Pipe: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Architect, but in no case shall it exceed 5 degrees.

3.06 Placing and Laying: Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the waterline materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Architect, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relayed. Pipe that has the grade or shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joining is completed. When work is not in

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progress, open ends, of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped and anchored as shown.

- A. Connections: Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. Standards methods are available for making connections to various types of pipe, made under pressure, these connections shall be installed as approved by the Architect.
- B. Pipe passing through walls of valve pits and structures shall be provided with cast-iron wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.07 Jointing:

- A. Copper Tubing: Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.
- B. Ductile-Iron Pipe: Mechanical and push-on type joints shall be installed in accordance with AWWA C600, modified as necessary by the recommendations of the manufacturer to provide for special requirements of ductile-iron pipe.
- C. Poly Vinyl Chloride (PVC) Plastic Pipe:
 - 1. Pipe Less Than 4-Inch Diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved thread lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than two threads past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of AWWA C600 and AWWA C603, as applicable, and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be pre-lubricated to prevent displacement. Care shall be exercised to assure the gasket and ring groove in the bell or coupling match. The manufacturer of the pipe or fitting must also supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint.

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- 2. Pipe 4-Inch Through 12-Inch Diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Joints utilizing or requiring solvent-cement will not be accepted. Jointing procedure shall be specified for pipe less than 4-inch diameter with configuration utilizing elastomeric ring gasket.
 - D. Polyethylene Pipe: Joints shall be made in accordance with the recommendations of the manufacturer.
 - E. Connections between different types of pipe and accessories shall be made with transition fittings approved by the Architect.
- 3.08 Service Lines: Service lines shall include the lines to and connections with the building service at a point approximately 5 feet outside the building where such building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Architect. Such service lines shall be closed with plugs or caps. All services stops and valves shall be provided with extension service boxes of the lengths required by the depth of service line stops or valves. Service lines shall be constructed in accordance with the following requirements:
- A. Service lines 2 inches and smaller shall be connected to the main by a direct-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in Table II.

TABLE II. SIZE OF CORPORATION STOPS AND OUTLETS

<u>Pipe Size Inches</u>	<u>Corporation Stops, Inches For Cast Iron InchesPipe</u>	<u>Outlets W/Service Clamps, Single & Double Straps</u>
3	---	1
4	1	1
6	1-1/4	1-1/2
8	1-1/2	2
10	1-1/2	2
12 & Larger	2	2

Where two or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

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1. Service lines 1 1/2 inches and smaller shall have a service stop.
 2. Service lines 2 inches in size shall have a gate valve.
 - B. Service lines larger than 2 inches shall be connected to the main by a rigid connection and shall have a gate valve.
- 3.09 Tapped Tees and Crosses: Tapped tees and crosses for future connections shall be installed where shown.
- 3.10 Thrust Blocks: Plugs, caps, tees and bends deflecting 22 1/4 degrees or more, either vertically or horizontally, on water-lines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust blocking, as directed. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2 1/2 sand: 5 gravel and having a compressive strength of not less than 2,000 pounds per square inch after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair.
- 3.11 Hydrostatic Tests: Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. The method proposed for disposal of waste water from hydrostatic tests and disinfection shall be submitted to the Architect for approval prior to performing hydrostatic tests.
- 3.12 Pressure Test: After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of water distribution or water service piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 150 pounds per square inch. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, valves, and hydrants shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Architect when one or more of the following conditions is encountered:
- A. Wet or unstable soil conditions in the trench.
 - B. Compliance would require maintaining barricades and walkways

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around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

C. Maintaining the trench in an open condition would delay completion of the contract.

D. An unforeseeable cause which would result in excess cost. The Contractor may request the waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02202, Earthwork for Utilities. Piping and specials requiring replacement, as disclosed by the hydrostatic tests, and all work connected therewith, shall be at the Contractor's expense.

3.13 Leakage Test: Leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be at least 2 hours. Test pressure shall be at least 50 psi greater than maximum System pressure (minimum of 100 psi). Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula.

$$L = 0.00054 ND / P$$

In which L equals the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. The allowable leakage in gallons per hour, per joint at 100 pounds per square inch average test pressure shall be as in Table III.

TABLE III. ALLOWABLE LEAKAGE, LIMITS

Pipe Diameter (Inches)	Gallons Per Hour
2	0.0108
3	0.0162
4	0.0216
6	0.0324
8	0.0432
10	0.0540

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Should any test of pipe disclose leakage greater than that specified in the foregoing table, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

- 3.14 Time for Making Test: Except for joint material setting or where concrete reaction backing necessitates a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.
- 3.15 Concurrent Hydrostatic Tests: The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results or pressure tests, leakage test, and disinfection shall be satisfactory as specified. All replacement, repair, or retesting required shall be accomplished by the Contractor at no additional cost to the Government.
- A. Pressure test and leakage test may be conducted concurrently.
- B. Hydrostatic tests and disinfection may be conducted concurrently using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.
- 3.16 Disinfection: Before acceptance for potable water operation, each unit of completed water distribution line and water service line shall be disinfected as specified herein. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph Products. The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the water lines in an approved manner. Poly vinyl chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case will the agent be introduced into the line in a dry solid state.
- The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 p.p.m of chlorine throughout the line at the end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 p.p.m. During the flushing period, each fire hydrant on the line shall be

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opened and closed several times. From several points in the unit, the Contractor will take samples of water in properly sterilized containers for bacterial examination. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

- 3.17 Clean-Up: Upon completion of the installation of the water distribution lines, water service lines, irrigation system, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

End of Section

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SECTION 02552 - STORM SEWER LINES

Part 1 - General

- 1.1 Work Included: This section of the specifications includes the installation of all utilities, fittings, valves, appurtenant equipment and all work incidental thereto as shown on the Plans and specified herein.
- 1.2 Related Work Specified Elsewhere: The following items of related work are specified and included in other sections of these Specifications:

Section 02200	Earthwork
Section 02430	Drainage Structures

Part 2 - Products

- 2.1 Drainage Pipe: Drainage pipe and fittings for storm sewers shall be constructed of the materials as shown on the Plans. The respective materials shall conform to the following:
- A. Precast Concrete Pipes: Precast concrete pipe for storm sewer applications shall be manufactured to meet the standards and specifications of ASTM C76 and ASTM C655. Joints for new pipes shall be gasketed. The joints and gaskets shall conform to ASTM C443 and C361. Joints for storm sewer and culvert extensions shall conform to the joint type of the existing pipe. The Contractor shall verify the type of existing pipe joints prior to the preparation of shop drawings. Concrete pipe shall be of the class required by the manufacturer for the cover loadings and bedding shown on the Plans and specified herein.
- B. PVC Storm Sewer Pipe: PVC Gravity Sewer Pipe: Pipe for Storm Sewers shall be polyvinyl chloride sewer pipe conforming to the standards and specifications of ASTM D3034 - SDR 35 for sizes 4 inch to 15 inch and ASTM F679 for size 18 inch to 27 inch. The bell of each pipe shall consist of integral wall section with a factory installed elastomeric seal conforming to the standards and specifications of ASTM F-477. The gasket shall be securely locked into position to prevent its displacement when the pipes are assembled. PVC sanitary sewer pipe (SDR 35) may be substituted for ribbed PVC gravity sewer pipe. The pipe shall be colored green for identifications as sewer pipe.
- C. Pipe Ties: Ties shall be galvanized. Adjustable ties shall be used.

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SECTION 02552 - STORM SEWER LINES

Part 3 - Execution

3.1 General:

- A. Alignment: Underground utilities shall be installed to the lines and grades shown on the plans and as specified herein. Excavation and backfilling of utility trenches shall be in conformance with the provisions of EARTHWORK of these Specifications. All storm and sanitary sewer lines and water lines shall be bedded and encased in granular bedding as specified in EARTHWORK.
- B. Inspection: The Contractor shall inspect all pipe fittings and appurtenances for damage and defects when the materials are unloaded. The Contractor shall also inspect these materials when they are installed to detect any damage which may have occurred due to handling. Particular attention shall be given to jointing surfaces. All defective or damaged materials shall be promptly removed from the site by the Contractor.

C. Pipe Laying:

1. Trench excavation and bedding preparation shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench, and they shall be kept clean by approved means during and after laying. The pipe materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.
2. At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate to support the pipe throughout its length. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. All pipes shall have a minimum of 4" of bedding material below the pipe.
3. When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position,

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SECTION 02552 - STORM SEWER LINES

and they shall remain so covered until removal is necessary for connection of an adjoining unit.

4. As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with granular bedding material, which shall be thoroughly compacted by tamping around the pipe to a height of at least 12 inches above its top. Acceptable tamping techniques include hand tamping and use of hand operated mechanical tamping devices.
5. At all times when pipe laying is not in progress, including lunch breaks and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.
6. When connecting to existing utilities, the Contractor shall take every precaution necessary to prevent dirt or debris from entering the existing lines. All necessary work to make the connection shall be considered incidental and no additional compensation shall be made therefore.

D. Alignment and Lengths:

1. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Pipe shall be cut with approved mechanical cutters. The electric-arc cutting method, using carbon or steel rod, will be approved for use on larger size ductile or gray pipe where mechanical cutters are not available. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used; the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.
2. Connection and assembly of joints shall be accomplished during the setting, aligning, and fitting operations.

E. Joints:

1. Pipe joints for PVC pipe and fittings shall be assembled in strict conformance to the manufacture's recommendations. Where connections are to be made to existing pipes, the Contractor shall verify the necessary dimensions required for all couplings and

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SECTION 02552 - STORM SEWER LINES

appurtenances. No line shall be removed from service as may be necessary for making a connection until the proper measurements have been taken and the Contractor has verified that all necessary and properly sized fittings and appurtenances are on hand.

2. All surfaces of the joints, including gaskets, shall be thoroughly cleaned to remove all oil, dirt, grit or other foreign matter before any joint lubricant is applied.
3. After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place within the bell evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts-tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

F. Records: The Contractor shall prepare and maintain an accurate record of underground utility locations and depths. This shall include utility lines which are installed and those that are exposed during the course of work. The Contractor shall use references such as lot corner, building corners, manholes and other similar surface improvements or monuments. Said record shall be submitted to the Owner upon completion of the work.

G. Separations:

1. Where sufficient depth allows at least 18 inches of vertical clearance shall be maintained beneath the bottom of all water lines and the tops of sanitary and storm sewer lines where said utilities cross. Where conditions will not permit this clearance existing sewers shall be excavated and encased in no less than 6 inch thickness of concrete for a distance of 10 feet, measured perpendicular to the water line, each way from the water line. Where the sewer is of new construction that portion of the sewer which is within 10 feet of the water line (20 feet total length) shall be constructed to a material equal to waterline standards where sizes are available. Otherwise, the sewer line shall be encased in no less than 6 inches of concrete for a distance of 10 feet, measured perpendicular to the water line, each way from the water line.
2. Water lines passing beneath sewer lines shall be separated from the sewer lines by at least 18 inches. In all cases where water lines cross sewer lines, the

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SECTION 02552 - STORM SEWER LINES

length of the water pipe shall be centered about the sewer line so that the joints of the water line will be as far as possible from the sewer line.

3. Water lines shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible. When local conditions prevent a horizontal separation of 10 feet a water line may be laid closer to a storm or sanitary sewer provided that:
 - a. The bottom of the water line is at least 18 inches above the top of the sewer.
 - b. Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water line standards of construction and shall be pressure tested to assure watertightness prior to backfilling.
 4. All materials, labor and equipment necessary for the encasement, realignment and fitting of pipes as required to meet the requirements of this subsection shall be considered incidental to the work and no additional compensation shall be made therefore.
- H. Cleanup: The Contractor shall maintain the work in a clean and orderly condition at all times. All surplus materials, rubbish and debris shall be removed from the site. In no instance shall it be permitted to dispose of any waste materials, rubbish, pallet materials or other debris in the backfill of utility trenches.
- 3.2 Cleaning: Prior to televising newly installed sewer pipe, the Contractor shall remove all accumulated construction debris, rock, gravel, sand, silt, and other foreign matter from the storm sewer with an appropriately sized cleaning ball. The Contractor shall be responsible for all work necessary to make the storm sewer acceptable for usage including removal of all mud, silt, rocks, or blockages that made said sewer unacceptable for final acceptance and usage. Also included is all work necessary in the manholes and all cleanup work required prior to final acceptance. The Contractor is responsible for cleaning lines prior to televising the storm sewer. In the event that the line is not acceptable for televising, the Contractor will reclean the line and retelevising the storm sewer at no additional cost to the Owner. It is probable that the Contractor will also have to clean the storm sewer just before final acceptance.
- 3.3 Televising: All newly installed storm sewer pipes shall receive a television inspection by the Contractor. The television inspection shall consist of viewing the inside of

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SECTION 02552 - STORM SEWER LINES

all storm sewer pipe installed to determine proper alignment, jointing, infiltration, etc. The Contractor shall correct, at his own expense, any defects discovered because of televising the pipe. Any areas of repair shall be retelevised at no additional cost to the Owner.

If defective workmanship or material or construction is noted, the Contractor at no expense to the Owner, shall correct the deficiency. The Contractor will perform additional television inspections to review if the repairs were made properly and in accordance with the Specifications. The Contractor shall be responsible for all related cost, including concrete or asphalt resurfacing if the street has been surfaced. The Contractor shall be required to repair all areas of infiltration and other deficiencies. This televising shall be from the nearest upstream manhole, to the downstream manhole. Videos must be in color. The Contractor shall furnish two (2) televising reports and two (2) videotapes to the Owner for each pipe televised, the cost of which shall be incidental to the price bid for televising.

Televising shall be performed before any aggregate base or pavement is placed.

End of Section

DIVISION 2 - SITE WORK

SECTION 02900 - TURF ESTABLISHMENT

Part 1 - GENERAL

1.01 Summary:

- A. This section generally describes the work, equipment, and materials required to furnish and landscape the site. The Contractor shall provide all necessary labor, equipment and materials to construct and complete site work landscaping. All work shall be completed in conformance with the recommendations of plant material suppliers.
- B. As a minimum, the Contractor must be able to provide the following materials and services:
 - 1. Supply and grade of fill material
 - 2. Environmentally approved control/elimination of weeds/grasses.

1.02 References:

- A. Drawings and general provisions of the Project Manual and Contract, including General and Supplementary Conditions and Division I Specification sections, apply to Work of this Section.

1.03 Submittals:

- A. Architect approval is required. The following shall be provided:
 - 1. Pesticide and Herbicide Treatment Plan, giving proposed sequence of pesticide and herbicide treatment work, before work is started. The pesticide and herbicide trade name, chemical composition, formulation, concentration, application rate of active ingredients and methods of application for all materials furnished, and the name and state license number of the state certified applicator shall be included.
 - 2. Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Reports for the following materials shall be included:
 - a. Fertilizer: For chemical analysis and composition percent.
 - b. Pesticide and Herbicide Material: For EPA registration number and registered uses.

1.04 Quality Assurance:

- A. All plant materials shall be guaranteed for one (1) year, following Architect=s acceptance of the project.
- B. The Contractor shall maintain the project by weeding, watering, and other tasks as required, through final acceptance of the project by the Owner. Weeds, trimmings, etc. shall be removed from the site on the day work is performed and the area cleaned. Contractor shall immediately replace any and all defective

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SECTION 02900 - TURF ESTABLISHMENT

components or dead or dying plant materials.

- C. The Architect shall inspect all planting materials upon delivery to the site and reserves the right to reject any or all materials which do not conform to the intent of this specification.

1.05 Delivery, Storage and Handling:

- A. Pesticide and herbicide materials shall be delivered to the site in the original unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration numbers and the registered uses.
- B. Sod not installed on the day of arrival at the site shall be stored and protected in areas designated by the Architect. Sod shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. All sod shall be kept in a moist condition by watering with a fine mist spray until planted.
- C. Soil amendments shall be stored in dry locations away from contaminants. Pesticide and herbicide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Architect.
- D. Care shall be taken to avoid injury to sod. Materials shall not be dropped from vehicles.

Part 2 - Products

2.01 Materials:

- A. Plants:
 - 1. Turf grass shall be Bermuda sod. Sod shall be freshly cut (no more than 5 days). Water all areas to receive sod 1/4" less than 24 hours prior to installation of new sod. Sod all disturbed and exposed soil within the project limits as indicated on the Drawings.
 - 2. Substitutions will not be permitted without written request from the Contractor for approval by the Architect.
 - 3. Sod shall be grown under climatic conditions similar to those in the locality of the project.

2.02 Topsoil:

- A. Acceptable topsoil includes selectively excavated material that is representative of soils in the vicinity that produces growth of grass typical of the project area. Topsoil should be reasonably free from underlying subsoil, clay lumps, objectionable weeds, litter, brush, matted roots, toxic substances or any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations. Topsoil shall not contain more than five percent

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SECTION 02900 - TURF ESTABLISHMENT

by volume of stones, stumps or other objects larger than 3/4 inch in any dimension.

2.03 Fertilizer:

- A. The commercial grade of fertilizer shall be suitable for the locations and season approved by the Architect. The P-N-K content shall be determined on the basis of soil conditions and the plants involved.
- B. Prepackaged fertilizer delivered to the site shall be packaged in new, sealed, clean containers which bear a label fully describing the contents, the chemical analysis of each nutrient, the fertilizer grade, the net bulk, and the brand name and address of the manufacturer. Bulk fertilizer delivered to the site shall be accompanied with certification describing the contents, the chemical analysis of each nutrient, the fertilizer grade, the net bulk, and the brand name and address of the manufacturer. No fertilizer which becomes caked or otherwise damaged will be accepted.

2.04 Water:

- A. Water shall not contain elements toxic to plant life.
- B. The Contractor is responsible for ensuring that new lawns are adequately watered at all times.
- C. During prolonged periods of drought, watering guidelines established by local water district shall apply.

Part 3 - Execution

3.01 Examination:

- A. The Architect shall verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed.
- B. The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.02 Site Preparation:

- A. Prior to placing topsoil, the ground surface shall be cleared of all brush, snags, and rubbish.
- B. Previously constructed grades shall be repaired if necessary so that areas to be topsoiled conform to the final grades upon completion of topsoil placement.
- C. The topsoil shall be uniformly distributed on the designated areas and evenly spread to a minimum thickness of 6 inches. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or tillage. The surface resulting from topsoiling shall meet the finish surface requirements as specified. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry,

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SECTION 02900 - TURF ESTABLISHMENT

or in a condition otherwise detrimental to proper grading or the proposed planting.

- D. All topsoiled areas covered by the project shall be uniformly smooth graded. The finished surface shall be reasonably smooth and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations. The finished surface shall be free of depressed areas where water would pond.

3.03 Application of Pesticide Material:

- A. When pesticide becomes necessary to remove a disease or pest, a state-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Architect as specified in paragraph SUBMITTALS.

3.04 Restoration and Clean Up:

- A. Planting areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.
- B. Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

End of Section

DIVISION 2 - SITE WORK

SECTION 02910 - TEMPORARY EROSION CONTROL

Part 1 - General

- 1.01 Work Included: The work under this section of the Specifications shall include all temporary erosion control measures including, but not necessarily limited to, rapid stabilization, rock entrance, silt fence, bale checks, bio rolls, and interim mulch as may be necessary to control soil erosion and sedimentation. The work shall include furnishing all materials, labor and equipment required for the construction and maintenance of erosion and sediment control devices as shown on the Drawings or as directed by the Architect. The work shall also include all inspections and reports as required by the storm water discharge permit for construction activities.
- 1.02 Reference Specifications:
- A. The erosion prevention requirements of the City of Moore shall be considered as a part of this Specification.
 - B. All testing required by the Jurisdiction Having Authority shall be performed by the independent testing laboratory retained by the Contractor. The costs of said testing shall be borne by the Contractor.
- 1.03 Stormwater Pollution Prevention - General Permit: if a Permit is required by the local Jurisdiction Having Authority, it shall be obtained from said authority and all fees and/or costs shall be paid by the Contractor.
- A. The Contractor will furnish a copy of the completed application package and General Permit to the Architect.
 - B. The back and side lot ditches shall be sodded immediately after they have been graded and top soil spread.

Part 2 - Products

- 2.01 Erosion Control Blankets: Erosion control blankets shall conform to applicable requirements.
- 2.02 Silt Fence: refer to the Drawings.
- A. The geotextile fabric shall be free of flaws such as tears or other defects. Any geotextile fabric which becomes damaged shall be replaced. The geotextile fabric shall meet or exceed the following requirements:

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SECTION 02910 - TEMPORARY EROSION CONTROL

- | | |
|--|---------------------|
| 1. Grab Strength (ASTM D 4632) | 100 lbs. |
| 2. Apparent Opening Size (ASTM D 4751) | 20 - 70 sieve range |
| 3. Width | 36 inches |

Part 3 - Execution

3.01 General:

- A. Temporary erosion control measures such as erosion control blankets, bio rolls, rock entrance, and silt fences shall be coordinated with the site work and turf establishment. No site work will be permitted until ALL necessary temporary erosion control measures are completed and in place in order to prevent excessive soil erosion and subsequent siltation from entering wetlands, streams or storm sewers. The construction of erosion control measures shall not relieve the Contractor of the responsibility for preventing or minimizing the potential for erosion or siltation. The Contractor shall be responsible for all damages and clean up and the costs therefore, resulting from erosion of the soils and any siltation which may occur, regardless of the temporary erosion control measures taken.
- B. The alignment and location of erosion control measures shall be as show on the Drawings or as directed by the Architect. Minimum measures are shown on the Drawings. The Contractor shall incorporate further measures into the work as the Contractor's progress may dictate. Inspections of the temporary erosion control measures and reports thereof, shall be made by the Contractor in accordance with the storm water discharge permit for construction activities.
- C. Structural practices:
 - 1. Perimeter Ditches - Perimeter ditches will be installed to collect runoff from the disturbed area and direct runoff to the sedimentation basin.
- D. Rapid stabilization shall be used in the following areas as well as the areas shown on the Plans.
 - 1. Disturbed areas around culvert inlets and streams.
 - 2. Ditches draining from the construction sites.
 - 3. Disturbed slopes near storm drain inlets.

3.02 Timing of Controls/Measures: Any ditches and stabilized construction entrances shall be constructed prior to grading of any other portions of the site. Areas where construction

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SECTION 02910 - TEMPORARY EROSION CONTROL

activity temporarily ceases for more than 21 days will be stabilized with a temporary seed and mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area, that area will be stabilized with permanent sod turf.

- 3.03 Removal of Temporary Erosion Control: Temporary erosion control devices shall remain in place until the permanent measures (turf establishment) have become established as determined by the Architect. All areas disturbed by the removal of temporary erosion control measures shall receive the same turf establishment as the areas adjacent thereto.
- 3.04 Installation Requirements:
- A. Bio Rolls shall be installed as required to reduce erosion.
 - B. Silt Fence shall be constructed on 2 x 2 wood posts that are spaced no more than 6 feet and embedded no less than 2.0 feet. The geotextile fabric shall be secured to the upstream face of the posts. The geotextile fabric shall be embedded in an anchor trench along the upstream side of the silt fence. The anchor trench shall be 12 inches deep by 12 inches wide and shall extend the full length of the silt fence. The geotextile fabric shall line both sides and the bottom of the anchor trench. The anchor trench shall be backfilled with the excavated material, which shall be firmly compacted into place.
 - C. Rate of slurry application shall be variable depending on surface roughness, slope configuration and degree of undulation but it is expected that 6 M gallons per acre. This rate is equivalent to applying Type 6 Hydraulic Soil Stabilizer at 2100 pounds per acre. Amount of material applied shall be such to obtain 100% soil surface coverage. In inaccessible areas, the mix may be pumped through a hose. To obtain coverage, two (2) passes may be necessary. In inaccessible areas, the mix may be pumped through a hose.
- 3.05 Maintenance:
- A. It shall be the Contractor's responsibility to maintain all erosion control measures and to inspect same after each rainfall event. All displaced bio rolls shall be replaced and silt fences shall be repaired where sagging or otherwise damaged. The Contractor shall review the temporary erosion control measures and make revisions as necessary in order to minimize damage due to future rainfalls. All costs of temporary erosion control shall be considered incidental and the responsibility of the Contractor.
 - B. The rock entrances may need occasional maintenance to prevent the tracking of mud onto paved roads. This may

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require periodic top-dressing with additional rock or removal and reinstallation of the entrances. The cost of maintenance of rock entrances shall be the responsibility of the Contractor.

3.06 Waste Disposal:

- A. Waste Materials: All waste materials will be disposed of as described in the "Construction Storm Water Pollution Prevention Plan".

3.07 Offset Vehicle Tracking: One (1) stabilized construction entrances shall be constructed to help reduce vehicle tracking of sediments. The paved parking lot adjacent to the site entrance shall be swept as needed to remove any excess mud, dirt or rock tracked from the site. Dump trucks hauling material from the construction site shall be covered with a tarp.

3.08 Maintenance/Inspection Procedures:

- A. Erosion and Sediment Control Inspection and Maintenance Practices:

1. All control measures will be inspected at least once each week and following any storm event of 0.5 inches or greater.
2. All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of report.
3. Build up sediment will be removed from silt fence when it has reached one-third the height of the fence.
4. Silt fence will be inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground.
5. Ditches will be inspected and any erosion promptly repaired.

- B. Non-Storm Water Discharges: All non-storm water discharges will be directed to a location selected by the Contractor and approved by the Architect. It is expected that the following non-storm water discharges will occur from the site during the construction period:

1. Water from water line flushing.
2. Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
3. Uncontaminated groundwater (from dewatering excavation).

3.09 Spill Prevention:

- A. Material Management Practices.

The following good housekeeping practices shall be followed onsite during the construction project.

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1. Good Housekeeping:
The following good housekeeping practices shall be followed onsite during the construction project:
 - a. An effort shall be made to store only enough product required to do the job.
 - b. All materials stored onsite shall be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
 - c. Products shall be kept in their original containers with the original manufacture's label.
 - d. Substances shall not be mixed with one another unless recommended by the manufacturer.
 - e. Whenever possible, all of a product shall be used up before disposing of the container.
 - f. Manufacturers' recommendations for proper use and disposal shall be followed.
 - g. The site superintendent shall inspect daily to ensure proper use and disposal of materials onsite.
 2. Hazardous Products: These practices are used to reduce the risks associated with hazardous materials.
 - a. Products shall be kept in original containers unless they are not re-sealable.
 - b. Original labels and material safety data shall be retained; they contain important product information.
 - c. If surplus product must be disposed of, manufacturer's, or Local and State recommended methods for proper disposal shall be followed.
- B. Product Specific Practices: The following project specific practices shall be followed onsite:
1. Petroleum Products:
All onsite vehicles shall be monitored for leaks and receive regular preventative maintenance to reduce the change of leakage. Petroleum products shall be stored in tightly sealed containers which are clearly labeled. Any asphalt substances used onsite shall be applied according to the manufacturer's recommendations.
 2. Fertilizers:
Fertilizers used shall be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer shall be worked into the soil to limit exposure to storm water. Storage shall be in

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a covered shed. The contents of any partially used bags of fertilizer shall be transferred to a sealable plastic bin to avoid spills.

3. Paints:

All containers shall be tightly sealed and stored when not required for use. Excess paint shall not be discharged to the storm sewer system but shall be properly disposed of according to manufactures' instructions or State and Local regulations.

4. Concrete Trucks:

Concrete trucks shall not be allowed to wash out or discharge surplus concrete or drum wash water on the site.

C. Spill Control Practices:

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices shall be followed for spill prevention and cleanup:

1. Manufacturer's recommended methods for spill cleanup shall be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
2. Materials and equipment necessary for spill cleanup shall be kept in the material storage area onsite. Equipment and materials shall include but not be limited to brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
3. All spills shall be cleaned up immediately after discovery.
4. The spill area shall be kept well ventilated and personnel shall wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous material shall be reported to the appropriate State or Local government agency, regardless of the size.
6. The spill prevention plan shall be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures shall also be included.

End of Section

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SECTION 02920 - LANDSCAPE GRADING

Part 1 -General

1.01 Summary:

- A. This section describes the labor, materials and installation requirements necessary to complete the fine grading, incidental grading, and related items as indicated or specified.

1.02 Site Conditions:

- A. Protect landscaping and other features remaining as final work.
- B. Protect any existing structures, roads, sidewalks, paving and curbs, or other features pertinent to the site in this project.

Part 2 - Products NOT USED

Part 3 - Execution

3.01 Examination:

- A. The areas to be graded will be free of waste or debris developed by other trades.
- B. Contractor shall field verify all dimensions and/or layout prior to starting work.

3.02 Preparation:

- A. Prepare site by applying Round Up, or approved equal, as per label directions to weed growth on site.
 - 1. Scarify planting areas to a minimum depth of six (6) inches and thoroughly water to settle all soil.

3.03 Grading:

- A. Contractor shall grade all planting areas, swales or other areas as noted on drawings.
 - 1. Contractor shall provide incidental grading of all areas adjacent to curbs and sidewalks. Provide a finish grade one (1") inch below curbs or sidewalks.
 - 2. Contractor shall fine grade turf areas, eliminating rough or low areas to ensure positive drainage.
 - 3. Any other areas not covered specifically above shall be graded to leave a generally smooth appearance conforming to standard landscape practices defined as: The final surface shall be raked; all objectionable materials, trash, brush, weeds, and stones larger than one inch shall be removed from the site and disposed of properly off base.
 - 4. When sod is being installed, the appropriate sub-grade shall be graded prior to the installation of such materials. See applicable specifications, in any, for additional requirements.

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End of Section

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PART 1 - GENERAL

1.01 Section Includes

- A. Concrete formwork.
- B. Slabs on grade.
- C. Concrete foundation walls and retaining walls.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads and equipment pits.
- G. Concrete curing.

1.02 Related Requirements

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints, construction joints and isolation joints in slabs.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- D. ACI 301 - Specifications for Structural Concrete.
- E. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
- F. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- G. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- H. ACI 305R - Guide to Hot Weather Concreting.
- I. ACI 305.1 - Specification for Hot Weather Concreting.
- J. ACI 306R - Guide to Cold Weather Concreting.
- K. ACI 308R - Guide to External Curing of Concrete.
- L. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- M. ACI 347R - Guide to Formwork for Concrete.
- N. ACI SP-66 - ACI Detailing Manual.
- O. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- P. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

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- Q. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- R. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- S. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- T. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- U. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- V. ASTM C150/C150M - Standard Specification for Portland Cement.
- W. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- X. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- Y. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
- Z. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- AA. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- AB. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- AC. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- AD. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- AE. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- AF. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
- AG. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- AH. CRSI (DA4) - Manual of Standard Practice.
- AI. ICC (IBC)-2015 - International Building Code.

1.04 Definitions

- A. Cold Weather: A period when for more than three successive days the average daily outdoor temperature drops below 40 F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50 F occur during more than half of any 24 hr duration, the period shall no longer be regarded as cold weather.

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- B. Hot Weather: Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise causing detrimental results:
 - 1. High ambient temperature
 - 2. High concrete temperature
 - 3. Low relative humidity
 - 4. Wind speed
 - 5. Solar radiation

1.05 Submittals

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 26 - Concrete Documents and Inspection.
- D. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- G. Formwork Design Submittal: As required by authorities having jurisdiction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 Quality Assurance

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

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- D. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for placement as required by the manufacturer's warranty.

1.07 Warranty

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- C. Slabs with Moisture Vapor Reducing Admixture (MVRA):
Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.
 - 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
 - 2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

PART 2 PRODUCTS

2.01 Formwork

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces of trenched footings unless expressly allowed in the General Notes in the structural drawings. Natural rock formations that maintain a stable vertical edge may be used as side forms for below-grade concrete.
 - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 4. Form Ties: Cone snap type that will leave no metal within the clear cover zone of the concrete surface as specified in the Minimum Concrete Cover for Cast-in-Place Non-Prestressed Members table included in the General Notes of the structural drawings.

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2.02 Reinforcement Materials

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars, weldable.
 - 1. Unfinished.
- C. Reinforcement Accessories:
 - 1. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (60,000 psi) plain-steel bars, cut true to length with ends square and free of burrs.
 - 2. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 3. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Continuous slab bolsters shall be used to support the bottom reinforcing bars of all reinforced slabs-on-grade.
 - 4. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement of reinforcing steel within 1-1/2 inches of weathering surfaces and for concrete surfaces that will be exposed to view.
- D. Fabrication of Reinforcing:
 - 1. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
 - 2. Welding of reinforcement is permitted only with the specific approval of Architect/Engineer. Perform welding in accordance with AWS D1.4/D1.4M.
 - 3. Locate reinforcing splices not indicated on drawings at point of minimum stress.

2.03 Concrete Materials

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 - 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 Admixtures

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- D. Water Reducing Admixture: ASTM C494/C494M Type A.

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- E. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
 - 1. Provide admixture in slabs to receive adhesively applied flooring.
 - 2. Manufacturers:
 - a. Barrier One, Inc; Barrier One Moisture Vapor Reduction Admixture: www.barrierone.com/#sle.
 - b. Substitutions: Substitutions shall comply with the use of concrete staining/dye products. See Section 01 6000 - Product Requirements.
- 2.05 Accessory Materials
- A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
- 2.06 Bonding And Jointing Products
- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
 - B. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
 - C. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
 - D. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness.
 - 1. Material: ASTM D1751, cellulose fiber.
- 2.07 Evaporation Retarders
- A. Evaporation Retarder: Liquid thin film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement. These products provide a protective film shield over plastic concrete, dissipate as soon as the concrete is no longer plastic, and are not curing products.
 - 1. Manufacturers:
 - a. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.
 - b. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com/#sle.
 - c. W. R. Meadows, Inc ; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

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2.08 Curing Materials

- A. Moisture-Retaining Sheet: ASTM C171.
 - 1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
 - 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.
- B. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- C. Water: Potable, not detrimental to concrete.

2.09 Concrete Mix Design

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete: Refer Structural General Notes for mix requirements for various classes of concrete.

2.10 Mixing

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 Examination

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 Preparation

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent according to bonding agent manufacturer's instructions.

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1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 2. Use latex bonding agent only for non-load-bearing applications.
- E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, clean out drilled holes, inject the adhesive indicated on drawings and/or General Notes, and insert steel dowels, all in accordance with adhesive manufacturer's installation instructions.
- G. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade in accordance with manufacturer's instructions, ASTM E1643, ASTM F710 and ACI 302.2R.
1. Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
 2. Lap vapor retarder sheet over footings and seal to previously placed concrete foundations.
 3. Lap joints minimum 6 inches (150 mm).
 4. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
 5. No penetration of vapor retarder is allowed except for reinforcing steel and permanent utilities.
 6. Repair damaged vapor retarder before covering with other materials.
 7. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
- 3.03 Installing Reinforcement And Other Embedded Items
- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
 - B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
 - C. Verify that anchors, seats, plates, reinforcement, waterstops and other items to be cast into concrete are

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accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 Placing Concrete

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 48 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish slab-on-grade and shored elevated floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 Slab Jointing

- A. Locate and install joints as indicated on drawings and Slab-On-Grade Schedule or as submitted by Contractor and approved by structural engineer.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler, total height equal to thickness of slab, set flush with top of slab.
 - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints shall be installed with early-entry dry-cut saw before concrete begins to cool, within 1 to 4 hours after completing the slab finishing operations; commence in approximately 1 hour in hot weather or approximately 4 hours in cold weather. Use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab. Refer to Slab-On-Grade Schedule in drawings for additional requirements.

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3.06 Floor Flatness And Levelness Tolerances

- A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.
- B. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
 - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
 - 3. Under Carpeting: 1/4 inch in 10 feet.
- C. Correct the slab surface if surface variations exceed specified tolerances.
- D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 Concrete Finishing

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
 - 4. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

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- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal (approximately 1/8 inch per foot).

3.08 Curing And Protection

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Uniformly apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss due to evaporation approaching 0.2 lb/sq.ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing. A methodology for calculating the moisture loss due to evaporation is provided in ACI 305.1.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven (7) days.
- D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- E. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven (7) days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for seven (7) days.
 - b. Spraying: Spray water over floor slab areas and maintain wet.
 - c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
 - 2. Final Curing: The surface shall be protected against rapid moisture loss upon the termination of initial curing by replacing wet burlap or similar coverings with plastic sheets until the surface has dried under the sheets.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

3.09 Field Quality Control

- A. An independent testing agency will perform Special Inspections and field quality control tests as required by

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SECTION 03300 - CAST-IN-PLACE CONCRETE

Chapter 17 of ICC (IBC)-2015. The testing outlined below includes some, but not all, of the testing and observations required to meet the Special Inspection provisions of the building code. Refer to the following parts of the structural drawings for additional Special Inspection requirements:

1. Statement of Special Inspection Notes
 2. Table 1705.3 titled "Required Special Inspections and Tests of Concrete Construction"
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - C. Submit approved mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
 - E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure four concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed each day.
 - F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
 - H. Air Content: ASTM C173/C173M, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - I. Concrete Temperature: ASTM C1064/C1064M, one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 - J. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.
- 3.10 Defective Concrete
- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
 - B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
 - C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

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D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 Protection

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

DIVISION 4 - MASONRY

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.01 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

- A. Section Includes:
 - 1. Concrete block.
 - 2. Clay facing brick.
 - 3. Mortar and grout.
 - 4. Reinforcement and anchorage.
 - 5. Lintels.
 - 6. Accessories.

1.03 Related Sections:

- A. Section 05500 - Metal Fabrications: Loose steel lintels and fabricated steel items.
- B. Section 07620 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- C. Section 07900 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.04 References:

- A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2008.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2005a.
- D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- E. ASTM C 129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2006.
- F. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.
- G. ASTM C 150 - Standard Specification for Portland Cement; 2005.
- H. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2007.
- I. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2006.

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- J. ASTM C 476 - Standard Specification for Grout for Masonry; 2002.
- 1.05 Submittals:
 - A. Product Data: Provide data for masonry units, mortar, and masonry accessories.
 - B. Samples: Submit 10 samples of facing brick units to illustrate color, texture, and extremes of color range.
- 1.06 Quality Assurance:
 - A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents
- 1.07 Pre-Installation Meeting:
 - A. Convene one week before starting work of this section.
- 1.08 Delivery, Storage, and Handling:
 - A. Deliver, handle, and store masonry materials by means that will prevent mechanical damage and contamination by other materials.
- 1.09 Project Conditions:
 - A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
 - C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

- 2.01 Concrete Masonry Units:
 - A. Type: Lightweight (Standard Modular Sizes).
 - B. Quality: ASTM C-90, Type 1, Grade N, steam cured for a minimum of 8 hours at 350 degrees Fahrenheit under 150 psi. CMU shall be made by the Johnson CO 2 or Autoclave method. Other methods shall have approval by the Contracting

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Officer.

- C. Face Dimension: As indicated on the drawings.
 - D. Thickness: As indicated on the drawings.
 - E. Shapes: Provide all shapes as shown on the drawings or others as required.
 - F. Units shall be uniform in all dimensions and texture, straight and free from cracks, spalls and other defects.
- 2.02 Face Brick (Veneer):
- A. Type and Finish: Velour Modular Brick.
 - B. Quality: ASTM C-216, Type FBS.
 - C. Size: Nominal 4" x 2 2/3" x 8" or match existing.
 - D. Units shall be uniform in all dimensions and texture, straight and free from cracks, spalls and other defects.
 - E. Color: refer to Color Schedule - match existing.
- 2.03 Mortar and Grout Materials:
- A. Portland Cement: ASTM C 150, Type I.
 - 1. Hydrated Lime: ASTM C 207, Type S.
 - 2. Mortar Aggregate: ASTM C 144.
 - 3. Grout Aggregate: ASTM C 404.
 - B. Water: Clean and potable.
- 2.04 Reinforcement and Anchorage:
- A. Manufacturers of Joint Reinforcement and Anchors:
 - 1. Dur-O-Wal: www.dur-o-wal.com.
 - 2. Hohmann & Barnard, Inc: www.h-b.com.
 - 3. Masonry Reinforcing Corporation of America: www.wirebond.com.
 - 4. Substitutions: as approved by Architect / Engineer.
 - B. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280) deformed billet bars; galvanized.
 - C. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, mill galvanized to ASTM A 641/A 641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
 - D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face.
 - E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup

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SECTION 04810 - UNIT MASONRY ASSEMBLIES

through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.

2. Wire ties: Triangular shape, 0.1875 inch (4.75 mm) thick.
3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.05 Flashings:

- A. Metal Flashing Materials: Galvanized Steel as specified in Section 07600.

2.06 Accessories:

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35%; formulated from neoprene, urethane or PVC.
- C. Bond Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt felt).
- D. Weeps: Free-draining mesh made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe.
 1. Manufacturers:
 - a. Mortar Net USA, Ltd; Product - Mortar Net Weep Vents: www.martarnet.com
 - b. Substitutions: as approved by Architect / Engineer.

Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 Mortar and Grout Mixes:

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Limit cementitious materials in mortar to portland cement and lime.
- B. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
 1. All masonry: Type S.
 - a. Portland Cement Mixture: One part Grey Portland Cement; 1/4 to 1/2 part lime; sand, not less than 2-1/4 and not more than three times the sum of the volumes of cement and lime used, measured in

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damp, loose conditions.

b. Colors at exterior face brick to be selected by Architect to match existing.

- C. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measure according to ASTM C 143/C 143M.
- D. Mortar Mixing
1. All mortars shall be machine mixed in equipment that is free of dirt, oil or grease and which is thoroughly cleaned and rinsed after each day's use. Mix no more mortar than can be used before setting takes place.
 2. Mortars shall be mixed placing all dry ingredients in the mixer first and mixing until uniform in color. Then mixed for 3 to 5 minutes with the maximum amount of water to provide workable consistency.
 3. No add-mixtures shall be used at any time in the mortar on this project, unless approved in writing by the Engineer.
 4. A waterproofing additive will be used in the mortar for brick.
 5. Construct one or two wooden boxes 12"x12"x6" deep and use them to measure the sand required in a batch. Add the cement or lime by the bag. Then add water, measuring by pail. When the desired consistency of mix is determined, mark the level of the mortar in the mixing drum. Use that as the mark for later batches when sand will be added by the shovel full. Repeat the measuring process halfway through the day or whenever the inspector requests it.
 6. Testing: General Contractor will observe a minimum of three (3) observed mixing sessions to verify that the quantities are being mixed as described in the proportions paragraph for Type "S" mortar.

PART 3 - EXECUTION

3.01 Examination:

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.

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- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 Erection:

- A. Construction Requirements (Masonry Being Worked On)
 1. Air Temperature 40 F to 32 F: Heat sand or mixing water to minimum of 70 F and maximum of 160 F.
 2. Air Temperature 32 F to 25 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F.
 3. Air Temperature 25 F to 20 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Use salamanders or other sources of heat on both sides of walls under construction. Employ windbreaks when wind is in excess of 15 mph.
 4. Air Temperature 20 F and Below: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Provide enclosure and auxiliary heat to maintain air temperature above 32 F. Temperature of units when laid shall be not less than 20 F.
- B. Protection Requirements (Completed Masonry or Sections Not Being Worked On)
 1. Mean Daily Air Temperature 40 F to 32 F: Protect masonry from rain or snow for 24 hrs.
 2. Mean Daily Air Temperature 32 F to 25 F: Completely cover masonry for 24 hrs.
 3. Mean Daily Air Temperature 25 F to 20 F: Completely cover masonry with insulating blankets for 24 hrs.
 4. Mean Daily Air Temperature 20 F and Below: Maintain masonry temperature above 32 F for 24 hrs. by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps or other approved method.
- C. No masonry shall be laid when the ambient temperature is below 40 degrees F. All masonry shall be laid plumb, true to line and level, with accurately spaced courses, with each course breaking joints with the course below, unless noted otherwise on the drawings. A story pole and template shall be used and work checked with a surveying instrument to maintain level coursing.
- D. Work required to be built into masonry, including anchors, frames, bolts, sleeves, inserts, compressible fillers, expansion joints and flashing shall be built in as erection progresses. Concrete block into which anchor bolts will be installed shall be filled solid with mortar.
- E. Laying Out Block Work: All concrete block work shall be

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laid out with uniform joints approximately 3/8" thick and shall be bonded at corners where possible and as consistent with good appearance. Where cutting is required, the cuts shall be made symmetrical above openings and as a general rule with no cuts less than 4" with power equipment designed for purpose.

- F. Corners shall be made using half blocks in order to maintain head joints centered over block in adjoining courses above and below. Where intersecting masonry partitions occur, galvanized Durowall Joint Reinforcing shall be used at every 2nd course.
 - 1. Concrete blocks shall be laid dry in a full bed of mortar and ends buttered on both edges. Care shall be used to prevent smearing mortar on exposed faces of the blocks and such accumulations that occur shall be removed immediately. The exposed face of blocks shall be wiped clean with burlap as the work proceeds. Those surfaces exposed to sight in their final position shall be further cleaned to provide for the application of finishes as required.
 - 2. Joints in block work shall be tooled concave in such a manner as to squeeze the mortar back into the joints and to ensure complete contact is made along the edges of the units, compressing and sealing the surface of the joints.
 - 3. Control joints shall be provided in concrete block partitions at door heads where masonry extends above the door frames, where partitions abut exterior walls and elsewhere as noted on the drawings. Joints shall be raked out 3/8" deep and caulked as specified in Division 7. Bond beams shall be installed as indicated and shall be filled with concrete and reinforced with two (2) No. 4 bars unless noted otherwise.
- G. Lintels shall be provided where shown and for all openings in masonry work where other types of lintels have not been provided. Concrete block lintels shall bear not less than six inches (6") on each jamb. Lintel blocks shall be solid bottom trough block filled with concrete and reinforced as detailed on drawings.
- H. Masonry Reinforcement: Joint reinforcement shall be installed in all concrete block partitions in the joints of every second block course for the full height of the wall.
- I. Brick: Provide a 3/8" mortar bed with concave tooled

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horizontal and vertical joints. Refer to drawings for vertical coursing as related to openings and other features. Brickwork is to be brushed down daily to remove large pieces of mortar slag. At completion of brick masonry work, all exposed masonry surfaces shall be thoroughly cleaned and washed down with clean water and a stiff bristled brush or as recommended by the brick manufacturer and as approved by the Design/Builder. The brick masonry work shall be left in a state exhibiting properly and fully pointed joints and completely clean surfaces. Subcontractor shall build-in all features of brickwork as shown or indicated on the drawings including weeps, special coursing and or patterned elements.

- J. The Subcontractor shall be responsible for furnishing all required labor, tools, and equipment as required to complete all areas of masonry work on the project. This shall be inclusive of all scaffolding, walk-boards and bracing as required to support the work until fully incorporated into the structure.
- K. Subcontractor shall also furnish all materials save for the brick units as called out above. These materials include concrete block, mortar, reinforcing, ties and other accessories necessary for the execution of the masonry work.

3.03 Preparation:

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.04 Coursing:

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.
- D. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).

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3. Mortar Joints: Concave.

3.05 Placing and Bonding:

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Masonry work shall be laid true to dimensions, plumb, square and in bond and properly anchored with vertical joints in line, plumb and true.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- E. Remove excess mortar and mortar smears as work progresses.
- F. Interlock intersections and external corners.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Provide a 3/8" joint around hollow metal door jambs and window frames to allow for sealant and expansion.

3.06 Weeps/Cavity Vents:

Install weeps in veneer walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.07 Reinforcement and Anchorage - General:

- A. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.
- B. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (900 mm) around perimeter.
- C. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

3.08 Reinforcement And Anchorage - Concrete Masonry Units:

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 8 inches (200 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first and second

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- joint below top of walls.
 - D. Lap joint reinforcement ends minimum 6 inches (150 mm).
 - E. Reinforce joint corners and intersections with strap anchors 16 inches on center.
- 3.09 Reinforcement And Anchorage - Masonry Veneer:
- A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- 3.10 Masonry Flashings:
- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
 - B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.
 - C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.
- 3.11 Lintels:
- A. Install loose steel lintels over openings.
- 3.12 Control Joints:
- A. Do not continue horizontal joint reinforcement through control joints.
 - B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
 - C. Size control joint in accordance with Section 07900 for sealant performance.
- 3.13 Built-In Work:
- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
 - B. Install built-in items plumb, level, and true to line.
 - C. Bed anchors of metal door frames in adjacent mortar joints.

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Fill frame voids solid with grout.

- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 Tolerances:

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.15 Cutting And Fitting:

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 Cleaning:

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

3.17 Protection Of Finished Work:

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

End of Section

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 Section Includes

- A. Structural steel framing members.
- B. Base plates, shear stud connectors and anchor rods.
- C. Grouting under base plates.

1.02 Related Requirements

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. AISC (MAN) - Steel Construction Manual.
- C. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
- D. AISC 360 - Specification for Structural Steel Buildings.
- E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
- F. ASTM A29/A29M - Standard Specification for Steel Bars, Carbon Alloy, Hot-Wrought, General Requirements.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- J. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- K. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- L. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- M. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- O. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric).

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

- P. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - Q. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
 - R. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - S. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
 - T. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
 - U. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
 - V. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry.
 - W. ASTM E709 - Standard Guide for Magnetic Particle Testing.
 - X. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
 - Y. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - Z. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - AA. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - AB. AWS D1.1/D1.1M - Structural Welding Code - Steel.
 - AC. ICC (IBC)-2015 - International Building Code.
 - AD. MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.
 - AE. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
 - AF. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
 - AG. SSPC-SP 3 - Power Tool Cleaning.
 - AH. SSPC-SP 6 - Commercial Blast Cleaning.
- 1.04 Submittals
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
 - B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Indicate cambers and loads.
 - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL FRAMING

- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
 - D. Product Data: For shop primers, include manufacturer's technical information including basic materials analysis and application instructions.
 - E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- 1.05 Quality Assurance
- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
 - B. Fabricator Qualifications:
 - 1. A steel fabricator specializing in performing the work of this section with minimum 10 years of experience.
 - C. Erector Qualifications:
 - 1. An erector specializing in performing the work of this section with minimum 5 years of experience.
- 1.06 Delivery, Storage And Handling
- A. Comply with the requirements of the General Conditions and of ASTM A6/A6M, including the following.
 - B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
 - C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.01 Materials

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
- D. Pipe: ASTM A53/A53M, Grade B, Finish black.

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- E. Headed Stud Anchors: AWS D1.1 Type B, ASTM A29 Grades 1010 through 1020.
- F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.
- G. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- H. Tension Control Bolts: Twist-off type: ASTM F1852.
- I. Unheaded Anchor Rods: ASTM F1554, Grade 55, Supplementary Requirement S1, Weldable, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436/F436M Type 1 washers.
- J. Deformed Bar Anchors: AWS D1.1/D1.1M Type C, ASTM A1064 Grade 70.
- K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- L. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 3000 pounds per square inch.
 - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
 - 3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
- M. Shop and Touch-Up Primers: As required below, complying with VOC limitations of authorities having jurisdiction.
 - 1. Steel Exposed to Exterior Weather or an Uncontrolled Environment: Two-component, high performance, zinc-rich, aromatic urethane, compatible with topcoat and complying with SSPC-Paint 20.
 - 2. Interior Steel: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat.
- N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

2.02 Fabrication

- A. Shop fabricate to greatest extent possible. Fabricate according to AISC 303 and to AISC 360.
- B. Fabricate connections for bolt, nut, and washer connectors.
- C. Develop required camber for members.
- D. Fabricated uncambered beams with rolling camber up.

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2.03 Finish

- A. Prepare structural component surfaces in accordance with SSPC-SP3 for interior steel or SSPC-SP6 for all steel exposed to exterior weather or an uncontrolled environment.
- B. Shop prime structural steel members:
 - 1. Do not prime surfaces that will be galvanized, fireproofed, field welded, in contact with concrete, or [in slip surfaces of slip-critical connections].
 - 2. All steel exposed to exterior weather or an uncontrolled environment shall be blast cleaned and primed with a submitted and approved zinc-rich primer.
 - 3. Interior steel shall be shop primed with the fabricators standard shop primer.
- C. Galvanize structural steel members to comply with ASTM A123/A123M.

2.04 Source Quality Control & Quality Assurance

- A. Unless the fabricator is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel, an independent testing agency will perform Special Inspections and field quality control and quality assurance tests in the fabricator's shop as required by Chapter 17 of ICC (IBC)-2015 and Chapter N of AISC 360. Refer to the following parts of the structural drawings for additional Special Inspection requirements.
 - 1. Statement of Special Inspection Notes
 - 2. Two tables titled "Required Verification and Inspection of Steel Construction"

PART 3 - EXECUTION

3.01 Examination

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 Erection

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Refer to the "Construction Loads and Stability" section of the General Notes in the Project Drawings for additional information and requirements.
- C. Field weld components, deformed bar anchors and shear studs indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on

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drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

- E. Do not field cut or alter structural members without approval of Structural Engineer.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 Field Quality Control & Quality Assurance

- A. An independent testing agency will perform Special Inspections and field quality control and quality assurance tests as required by Chapter 17 of ICC (IBC)-2015 and Chapter N of AISC 360. Refer to the following parts of the structural drawings for additional Special Inspection requirements:
 - 1. Statement of Special Inspection Notes
 - 2. Two tables titled "Required Verification and Inspection of Steel Construction"

END OF SECTION

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SECTION 05210 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 Section Includes

- A. Open web steel joists, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for floor and roof openings greater than 8 inches.

1.02 Related Requirements

- A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 1200 - Structural Steel Framing: Superstructure framing.
- C. Section 05 3100 - Steel Decking: Bearing plates and angles.
- D. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 Reference Standards:

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- E. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- F. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings.
- G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.
- K. ICC (IBC)-2015 - International Building Code.
- L. SJI JG-10 - Standard Specification for Joist Girders.
- M. SJI K-10 - Standard Specification for Open Web Steel Joists, K-Series.

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- N. SJI LH/DLH-10 - Standard Specification for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-series.
 - O. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders.
 - P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
 - Q. SSPC-SP 2 - Hand Tool Cleaning.
- 1.04 Submittals
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
 - B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
 - C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
 - D. Manufacturer's Qualification Statement.
 - E. Comprehensive engineering analysis of all joists signed and sealed by the qualified professional engineer licensed in the state of the project responsible for its preparation.
 - F. Manufacturer's Certification: At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner's authorized agent for submittal to the building official as specified in Section 1704.5 of ICC (IBC)-2015 stating that work was performed in accordance with approved construction documents and with the SJI specifications listed herein.
- 1.05 Quality Assurance
- A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI JG-10, SJI K-10, and SJI LH/DLH-10 and SJI Technical Digest No. 9.
 - B. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.
- 1.06 Delivery, Storage, And Handling
- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 - PRODUCTS

2.01 Materials

- A. Open Web Joists: Types as indicated on drawings:
 - 1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.

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2. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
 3. Finish: Shop primed.
 - B. Anchor Bolts, Nuts and Washers: ASTM A307, hot-dip galvanized per ASTM A153/A153M, Class C.
 - C. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 with matching compatible ASTM A563 nuts and ASTM A436 washers.
 - D. Headed Stud Anchors: [AWS D1.1 Type B, ASTM A29 Grades 1010 through 1020].
 - E. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
 - F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
 - G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- 2.02 Finish
- A. Shop prime joists as specified.
 1. Do not prime surfaces that will be fireproofed.
 - B. Prepare surfaces to be finished in accordance with SSPC-SP2.
- 2.03 Source Quality Control
- A. Welded Connections: Visually inspect all shop-welded connections.

PART 3 - EXECUTION

- 3.01 Examination
- A. Verify existing conditions prior to beginning work.
- 3.02 Erection
- A. Erect joists in compliance with SJI Technical Digest No. 9 and all applicable provisions of OSHA safety standards.
 - B. Erect joists with correct bearing on supports.
 - C. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
 - D. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
 - E. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
 - F. Position and field weld joist chord extensions and wall attachments as detailed.
 - G. Install supplementary framing for floor and roof openings greater than 8 inches.

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SECTION 05210 - STEEL JOIST FRAMING

- H. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
 - I. Do not field cut or alter structural members without approval of joist manufacturer.
 - J. After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.
- 3.03 Tolerances
- A. Maximum Variation From Plumb: 1/4 inch.
 - B. Maximum Offset From True Alignment: 1/4 inch.
- 3.04 Field Quality Control
- A. An independent testing agency will perform Special Inspections and field quality control as required by Chapter 17 of ICC (IBC)-2015. Refer to the following parts of the structural drawings for additional Special Inspection requirements.
 - 1. Statement of Special Inspection Notes
 - 2. Table 1705.2.3 titled "Required Special Inspections of Open-Web Steel Joists and Joist Girders"

END OF SECTION

DIVISION 5 - STRUCTURAL STEEL

SECTION 05310 - STEEL DECKING

PART 1 - GENERAL

1.01 Section Includes

- A. Roof deck.
- B. Supplementary framing for openings up to and including 8 inches.
- C. Bearing plates and angles.

1.02 Related Requirements

- A. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 8 inches and shear stud connectors.
- B. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 8 inches.
- C. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- F. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- G. ICC (IBC)-2015 - International Building Code.
- H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.
- I. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck.
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.04 Submittals

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- D. Submit manufacturer's installation instructions.

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SECTION 05310 - STEEL DECKING

- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- 1.05 Quality Assurance
- A. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI (QA/QC).
 - B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.
- 1.06 Delivery, Storage, And Handling
- A. Cut plastic wrap to encourage ventilation.
 - B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 - PRODUCTS

- 2.01 Steel Deck
- A. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G60/Z180 galvanized coating.
 - 2. Structural Properties: As indicated in General Notes.
- 2.02 Accessory Materials
- A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
 - B. Welding Materials: AWS D1.1/D1.1M.
 - C. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
 - D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
 - E. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.
- 2.03 Fabricated Deck Accessories
- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gauge, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.
 - B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

DIVISION 5 - STRUCTURAL STEEL

SECTION 05310 - STEEL DECKING

PART 3 - EXECUTION

3.01 Examination

- A. Verify existing conditions prior to beginning work.

3.02 Installation

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch bearing.
- C. On steel supports provide minimum 2 inch bearing at discontinuous ends of deck and minimum 3 inch bearing length of continuous roof deck over interior supports.
- D. Fasten deck to steel support members as indicated at spacings indicated on the drawings using methods specified.
- E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- F. Where roof deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Attach both sides of cover plate to roof deck below with the same fasteners and spacings as required for deck to supports.
- G. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- H. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

3.03 Field Quality Control

- A. An independent testing agency will perform Special Inspections and field quality control tests as required by Chapter 17 of ICC (IBC)-2015 and SDI (QA/QC). Refer to the following parts of the structural drawings for additional Special Inspection requirements:
 - 1. Statement of Special Inspection Notes
 - 2. Table titled "Required Inspection of Cold-Formed Steel Deck"
- B. Concurrent with the submittal of special inspection reports to the Owner's Representative, the special inspector shall submit to the Owner's Representative and the Installer a list of nonconforming items.

END OF SECTION

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

- A. This Section includes the following:
 - 1. Exterior and interior non-load-bearing wall framing.
 - 2. Soffit joist framing.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.03 Performance Requirements

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: Design loads shall be calculated components and cladding load per ASCE/SEI 7 edition indicated on the drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of wall height at areas backing up brick veneer, and 1/240 of wall height at areas backing up other materials.
 - b. Soffit Joist Framing: Vertical deflection of 1/240 of the span.
 - 3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

1.04 Submittals

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Research/Evaluation Reports: For cold-formed metal framing.

1.05 Quality Assurance

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.06 Delivery, Storage, And Handling

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 2 - PRODUCTS

2.01 Manufacturers

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. Allied Studco.
 2. AllSteel Products, Inc.
 3. California Expanded Metal Products Company.
 4. Clark Steel Framing.
 5. Consolidated Fabricators Corp.; Building Products Division.
 6. Craco Metals Manufacturing, LLC.
 7. Custom Stud, Inc.
 8. Dale/Incor.
 9. Design Shapes in Steel.
 10. Dietrich Metal Framing; a Worthington Industries Company.
 11. Formetal Co. Inc. (The).
 12. Innovative Steel Systems.
 13. MarinoWare; a division of Ware Industries.
 14. Quail Run Building Materials, Inc.
 15. SCAFCO Corporation.
 16. Southeastern Stud & Components, Inc.
 17. Steel Construction Systems.
 18. Steeler, Inc.
 19. Super Stud Building Products, Inc.
 20. United Metal Products, Inc.

2.02 Materials

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: ST33H (ST230H).
 2. Coating: G60 (Z180).
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50 (340), Class 1 or 2.
 2. Coating: G90 (Z275).

2.03 Exterior Non-Load-Bearing Wall Framing

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inches (1.09 mm).
 2. Flange Width: 1-5/8 inches (41 mm).

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inches (1.37 mm)
 - 2. Flange Width: 1-1/2 inches.
- C. Vertical Deflection Clip Option: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Single Deflection Track Option: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
- E. Double Deflection Track Option: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

DIVISION 5 - METALS

SECTION 05400 - COLD-FORMED METAL FRAMING

2.04 Soffit Joist Framing

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depth indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on drawings.
 - 2. Flange Width: 1-5/8 inches (41 mm) minimum.

2.05 Framing Accessories

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.06 Anchors, Clips, And Fasteners

- A. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

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2.07 Miscellaneous Materials

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.08 Fabrication

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening

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requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 Examination

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation, General

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for

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which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 Exterior Non-Load-Bearing Wall Installation

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Fast both flanges to top track if required by deflection option selected. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Single Deflection Track Option: Install single-leg deflection tracks and anchor to building structure.
 - 2. Double Deflection Track Option: Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Deflection Clip Option: Connect vertical deflection clips to infill studs and anchor to building structure.

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- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track Option:
Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at maximum 96-inch (2440-mm) centers and as shown on approved Shop Drawings.
 - 2. Bridging Options:
 - a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - c. Proprietary bridging bars installed according to manufacturer's written instructions.
 - F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.
- #### 3.04 Joist Installation
- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
 - B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Unless shown otherwise in drawings, install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on drawings.
 - C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated.

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- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
 - E. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - F. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.
- 3.05 Field Quality Control
- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - B. Field and shop welds will be subject to testing and inspecting.
 - C. Testing agency will report test results promptly and in writing to Contractor and Architect.
 - D. Remove and replace work where test results indicate that it does not comply with specified requirements.
 - E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.06 Repairs And Protection
- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
 - B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures the cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DIVISION 5 - STRUCTURAL STEEL

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 Section Includes

- A. Shop fabricated steel items.

1.02 Related Requirements

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- F. Section 05 5100 - Metal Stairs.

1.03 Reference Standards

- A. For all reference standards listed below, comply with the version year in the governing building code adopted by the Authority Having Jurisdiction. For those reference standards that are not directly referenced by the building code, use the latest edition unless noted otherwise.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- K. MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.
- L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

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SECTION 05500 - METAL FABRICATIONS

1.04 Submittals

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
 - a. Include the following, as applicable:
 - 1) Design criteria.
 - 2) Engineering analysis depicting stresses and deflections.
 - 3) Member sizes and gauges.
 - 4) Details of connections.
 - 5) Support reactions.
 - 6) Bracing requirements.

PART 2 - PRODUCTS

2.01 Materials - Steel

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: As required below, complying with VOC limitations of authorities having jurisdiction.
 - 1. Steel Exposed to Exterior Weather or an Uncontrolled Environment: Two-component, high performance, zinc-rich, aromatic urethane, compatible with topcoat and complying with SSPC-Paint 20.
 - 2. Interior Steel: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat.

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SECTION 05500 - METAL FABRICATIONS

- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- 2.02 Fabrication
- A. Fit and shop assemble items in largest practical sections, for delivery to site.
 - B. Fabricate items with joints tightly fitted and secured.
 - C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
 - D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- 2.03 Fabricated Items
- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and joists; prime paint finish.
 - B. Lintels: As detailed; prime paint finish.
 - C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.
 - D. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
 - E. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.
- 2.04 Finishes - Steel
- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
 - B. Prepare surfaces to be primed in accordance with SSPC-SP3 for interior steel or SSPC-SP6 for all steel exposed to exterior weather or an uncontrolled environment.
 - C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
 - D. Prime Painting: One coat.
 - E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
 - F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- 2.05 Fabrication Tolerances
- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
 - B. Maximum Offset Between Faces: 1/16 inch.

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SECTION 05500 - METAL FABRICATIONS

- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.01 Examination

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

3.02 Preparation

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

3.03 Installation

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 Tolerances

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

DIVISION 6 - WOOD & PLASTIC

SECTION 06100 - ROUGH CARPENTRY

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Wood Treatment - Section 06300

1.03 Quality Assurance:

- A. Grades specified shall conform to the most recent grading rules as established by the following bureaus and associations.
 - 1. PS 20 - American Softwood Lumber Standard.
 - 2. Western Wood Products Association
 - 3. Southern Pine Inspection Bureau
- B. Grade and trade mark each piece of lumber or bundle on bundled stock. Use only the recognized official marks of association under whose rules it is graded. Grade and trade marks will not be required if each shipment is accompanied by certificate of inspection issued by grading association.

1.04 Submittals:

- A. Product Data: for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing and finishing treated material.
 - 2. As requested by authorities having jurisdiction include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials both before and after exposure to elevated temperatures when tested according to ASTM D5516 and ASTM D 5664.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

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SECTION 06100 - ROUGH CARPENTRY

4. Research / evaluation reports - for the following, showing compliance with building code in effect for Project:
 - a. Fire-retardant treated wood.
 - b. Power-driven fasteners.
 - c. Power-actuated fasteners.
 - d. Expansion anchors.
 - e. Metal framing anchors.

1.05 Delivery, Storage and Handling:

- A. Stack lumber, plywood, sheathing, and other materials: provide spacers between each bundle to provide air circulation around bundled material. Provide proper air circulation between stacks and under coverings.

Part 2 - Products

2.01 General:

- A. Provide best quality of respective grades and kinds. Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship". Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum moisture content of lumber 19%.
- C. Provide dressed lumber (S4S) unless otherwise indicated.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.02 Grades and Applications of Lumber:

- A. Framing lumber for the following shall be "Standard" grade Douglas Fir (WCLIB or WWPA).
 1. Concealed blocking/nailers, cants, grounds, and miscellaneous wood items used in conjunction with the roofing work and as indicated on the Drawings.
 2. Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the Grading Agency indicated.

2.03 Fire-retardant Treated Materials:

- A. General - where fire-retardant treated materials are required by authorities having jurisdiction, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant treated wood with appropriate classification

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SECTION 06100 - ROUGH CARPENTRY

marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

2.04 Panel Products:

- A. Miscellaneous Concealed Plywood: shear wall sheathing, span rating to suit framing in each location, and thickness indicated. Refer to Structural Drawings.
- B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, C-D Plugged, fire-retardant treated, in thickness indicated, or if not indicated, not less than ½ inch thick.

2.05 Fasteners:

- A. All nails, spikes, bolts, connectors and other fasteners used in connections with this work shall be galvanized.
 - 1. Nails, wire, brads and staples - FS-FF-N-105.
 - 2. Power-driven Fasteners - CABO NER-272.
 - 3. Wood screws - ASME B18.6.1.
 - 4. Screws for fastening to cold formed metal framing: ASTM C954 length as recommended by screw manufacturer for material to be fastened.
 - 5. Lag bolts - ASME B18.2.1.
 - 6. Bolts - steel bolts complying with ASTM A 307, Grade A with ASTM C563 hex nuts and, where indicated, flat washers.
 - 7. Expansion anchors - anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material for interior applications: carbon steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Material for exterior applications: stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, alloy group 1 or 2.

2.06 Metal Framing Anchors:

- A. General: provide galvanized steel framing anchors of structural capacity, type, and size indicated and acceptable to authorities having jurisdiction.
- B. Galvanized Steel Sheet: hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

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SECTION 06100 - ROUGH CARPENTRY

Part 3 - Execution

3.01 Sizes and Applications (General Framing):

- A. Members shall be accurately cut and fitted, true to line and level, avoiding shims and wedges as much as possible. Discard material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Where applicable, apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- C. At wood ground, blocking and nailer installation: install where indicated and required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- D. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless noted otherwise.

3.02 Rough Hardware:

- A. Provide all sufficient nails, screws, etc. to insure rigidity and structural soundness. Provide hot-dipped galvanized fasteners at all weather exposed locations.
- B. Spiking and nailing shall be done using largest size spikes and nails practicable and as indicated on the drawings. Securely attach carpentry according to applicable codes and recognized standards.
- C. Bolt nailers and blocking to steel or concrete members with bolts of proportionate strength of members attached, length required, spaced 4'-0" o.c. maximum and 4" from each end, except as otherwise indicated. Countersink fastener heads on exposed carpentry work and fill holes with wood fiber.
- D. Pre-drill members when necessary to avoid splitting of wood.

3.03 Panel Product Installation:

- A. Wood structural panels: comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential and Commercial", for types of structural-use panels and applications indicated. Comply with "Code Plus" provisions in above referenced guide.

End of Section

DIVISION 6 - WOOD & PLASTIC

SECTION 06200 - FINISH CARPENTRY

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.
- B. The erection of wall and partition wood finish materials, installation of door and hardware, and shelving incidentals necessary to finish the carpentry.

1.02 Related Work Specified Elsewhere:

- A. Wood Doors - Section 08200
- B. Hardware and Specialties - Section 08700

1.03 Quality Assurance:

- A. Standards:
 - 1. Architectural Woodwork Institute:
 - a. Architectural Woodwork Quality Standards.
 - 2. National Electrical Manufacturers Association:
 - a. NEMA Publication LD-1.
 - 3. Western Wood Products Association:
 - a. Standard Grading Rules for Western Lumber.
 - 4. American Plywood Association:

1.05 Product Delivery, Storage and Handling:

- A. All finish materials, trim, etc. shall be inspected to insure that no sub-grade, defective, or machine-marked pieces are installed.

Part 2 - Products

2.01 General:

- A. Grades specified shall conform to the most recent grading rules of the association or bureau under whose rules the lumber is produced.
- B. Quality standards specified shall conform to the latest edition of the Architectural Woodwork Institute's "Quality Standards".
- C. Lumber shall be kiln-dried to 10% to 12% moisture content which shall be maintained during the fabrication of millwork and cabinetry.

Part 3 - Execution

3.01 Miscellaneous Trim and Frames:

- A. Install all trim in longest possible lengths. Stagger joints in adjacent member. Cope at returns and miter at corners. Attach securely in place with fine finishing nails where exposed; set for filling.

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SECTION 06200 - FINISH CARPENTRY

- B. Immediately prior to final inspection of building, the contractor shall repair or replace all millwork or cabinetry items which have been damaged in any way.

End of Section

DIVISION 6 - WOOD & PLASTIC

SECTION 06300 - WOOD TREATMENT

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. American Wood Preservers Association:
 - a. AWPA Standard P-5 (Preservative)
 - b. AWPA Standard Commodity Standards (Treating Process).
 - 2. Federal Specifications:
 - a. TT-W-550 (Preservative).
 - b. TT-W-571 (Treating Process).
- B. All lumber and plywood receiving wood treatment shall bear the trademark of the process used.
- C. Submit certificate and guarantee of the lumber treated.

Part 2 - Products

2.01 Materials:

- A. Description: Waterborne chemical salts intended for pressure impregnation as a wood preservative. Preservatives with a petroleum vehicle are not permitted.

Part 3 - Execution

3.01 Installation:

- A. Location of treated lumber:
 - 1. All blocking, plates, nailers and curbs used in conjunction with gravel guards, roof edges and all other wood components used in the roofing project.
- B. Materials shall be pressure treated in accordance with the standards of the American Wood Preservers Institute and the chemical manufacturer's specifications.
- C. Treated material shall conform to AWPB LD-2 and treated to a maximum retention of 0.23 pound of oxide per cubic foot.
- D. Moisture content of finish products shall not exceed 19%.

End of Section

DIVISION 6 - WOOD & PLASTICS

SECTION 06410 - CUSTOM CASEWORK

Part 1 - General

1.01 Section Includes:

- A. Special fabricated cabinet units as indicated on drawings.
- B. Countertops.
- C. Hardware
- D. Preparation for site finishing.
- E. Preparation for installing utilities.
- F. Related Documents: The Contract Documents apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- G. **NOTE: FRAMELESS CABINETS / EUROPEAN CONSTRUCTION STYLE CABINETS ARE ACCEPTABLE. Provide proposed details, etc. during shop drawing submittal phase for approval by Architect.**

1.02 Related Sections:

- A. Section 06100-Rough Carpentry: Grounds and support framing.
- B. Section 06200-Finish Carpentry: Related trim not specified in this section.
- C. Section 09900- Paints and Coatings: Finishing cabinet exterior and interior where applicable.

1.03 References:

- A. ANSI/BHMA A156.9-Cabinet Hardware.
- B. AWI-Quality Standards
- C. FS L-F 508-Plastic Sheet, Laminated, Decorative and non-Decorative.
- D. FS MM-L-736-Lumber, Hardware.
- E. FS MMM-A- 130-Adhesive, Contact.
- F. NEMA LD-3-High Pressure Decorative laminates.
- G. PS 1-Construction and Industrial Plywood.
- H. PS 20-American Softwood Lumber Standard.
- I. PS 51-Hardwood and Decorative Ply.

1.04 Submittals:

- A. Shop Drawings: Indicated materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.

1.05 Quality Assurance: Perform work in accordance with AWI Custom quality.

1.06 Qualifications: Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.07 Delivery, Storage, and Handling:

- A. Protect units from moisture damage.

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- B. Store materials in ventilated, interior locations under constant, minimum temperatures of 60 degrees F. And maximum relative humidity of 55 percent.
- 1.08 Field Measurements: Verify that field measurements are as indicated on shop drawings.
- 1.09 Coordination: coordinate work with plumbing and electrical rough-in.

Part 2 - Products

2.01 Wood Materials:

- A. Softwood Lumber:PS20; graded in accordance with AWI Custom; average moisture content of 6 percent; species and grades as follows:

<u>Item</u>	<u>Species</u>	<u>Cut</u>
Cabinet Frame	Douglas Fir	Economy
Internal Construction	Douglas Fir	Economy
Miscellaneous framing	Douglas Fir	Economy
Sub-Tops	Douglas Fir	Economy

- B. Hardwood Lumber FS MM-L-736; graded in accordance with AWI Custom; average moisture content of 6 percent; species and grade as follows:

<u>Item</u>	<u>Species</u>	<u>Cut</u>
Exposed Stiles and Rails	Red Oak	Economy
Miscellaneous Trim	Red Oak	Economy

2.02 Sheet Materials:

- A. Softwood Plywood: PS 1; graded in accordance with; core material of veneer or lumber, species and cut as follows:

<u>Item</u>	<u>Face</u>	<u>Cut</u>
Drawer Construction	Douglas Fir	Economy
Gables and Backs	Douglas Fir	Custom
Sub-tops	Douglas Fir	Economy
Non-sight exposed shelving	Douglas Fir	Custom
Miscellaneous	Douglas Fir	Custom

- B. Hardwood Plywood: PS 51; AM graded in accordance with AWI; core material for veneer or lumber; type of glue recommended for application; face veneer and cuts as follows:

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<u>Item</u>	<u>Face Species</u>	<u>Cut</u>
Door and Drawer Fronts	Red Oak	Economy
Drawer Construction	Red Oak	Economy
Gable and Backs	Red Oak	Economy

- C. Wood Particles-PS 1;AM standard, composed of wood= chips, medium density, made with high waterproof resin binders; of grade to suit application; sanded faces, located as follows:

Item
Drawer Construction

- D. Hardboard: Pressed wood fiber with resin binder, tempered grade, 1/4 inch thick, smooth one side, located as follows:

Item
Drawer Bottoms

2.03 Laminated Materials: Plastic Laminated: NEW LD-T; 00550 inch General Purpose Grade; suede surface finish, color and pattern as selected by Architect. All sight exposed surfaces (excluding countertops and backsplash) for cabinets to be laminate finished.

2.04 Accessories:

- A. Adhesive: FS MMM-A-130 contact adhesive, water base type, recommended by laminate manufacturer to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins and Screws: Of size and type to suit application; galvanized finish in concealed locations and cadmium plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Lumber for Shimming, Blocking, and Miscellaneous Applications: Softwood lumber of Douglas Fir species.
- F. Primer. Alkyd primer sealer type.
- G. Wood filler: Solvent base, tinted to match surface finish color.
- H. Plastic Grommets: provide at openings in countertop as indicated on the Drawings. Color to be "black".

2.05 Architectural Cabinet Solid Surface Tops (Countertops):

- A. Design Load: deflection limited to 1/360.
- B. Type of Top: homogeneous solid sheets of filled plastic resin complying with the following:
 - 1. Colors and Patterns: as selected by Architect from manufacturer's full range.
 - 2. Special Features: eased edge treatment.
 - 3. Accessories:

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- a. Adhesives: for seams and drop edges, Formica Solid Surfacing Seaming Cartridges, 9 ounce, color to blend with sheet material.
 4. Fabrication: assemble work at shop and deliver to job ready for installation. Manufacture in largest practical pieces for handling and shipping without seams.
 - a. Fabricate work square and to required lines.
 - b. Recess and conceal fasteners connections and reinforcing.
 - c. Design, construction, and installation: details to allow for expansion and contraction of materials. Properly install material with hairline joints held rigidly in place.
 - d. Fabricate countertops and vanities with back splash and side splash pieces to profiles and sizes indicated.
 - e. Fabricate items to profiles shown with connections and supports as indicated or as required for complete installation in accordance with manufacturer's written instruction and approved submittals.
 - f. Provide cut-outs for plumbing fixtures and trim, washroom accessories, appliances, and related items: confirm layout with manufacturer's cut-out templates before beginning work. Round corners of cut-outs and sand edges smooth.
 - g. Do not exceed manufacturer's recommended unsupported overhang distances.
 - h. Finish exposed surfaces smooth and polish to low sheen.
 - i. Radius corners and edges.
 - j. Tolerances: variations in size or openings shall not exceed +/-1/4".
 5. Acceptable manufacturer: Formica Solid Surfacing as manufactured by Formica Group / Fabrications, Cincinnati, Ohio **or approved equal.**
- 2.06 Factory Finishing of Interior Architectural Woodwork:
- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
 - B. The finish of custom casework is included under this Section, regardless of whether factory applied or applied after installation.
 - C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of

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custom casework, as applicable to each unit of work.

- D. Factory Finishing: The extent to which the final finish is applied to architectural woodwork a factory is Contractor's option, except factor apply at least prime/base coat to the greatest extent possible before delivery.
- E. Transparent finish for Open-Grain Woods: Comply with requirements indicated below for grade Finish system, staining, effect, and sheen, with sheen measured on 60 degree gloss meter per ASTM D 523.
 - 1. Grade: Custom
 - 2. AWI Finish System No. 5: Catalyzed polyurethane.
 - 3. Staining: Match Architect=s sample.
 - 4. Effect: Closed grain (filled finish).
 - 5. Sheen: Medium-gross ribbed effect 35-45 deg.
- F. Transparent Finish for Closed-grain Woods: Comply with requirements indicated below for grade, finish system staining, effect, and sheen.
 - 1. Grade: Custom
 - 2. AWI Finish System No. 5: Catalyzed polyurethane.
 - 3. Staining: Match Architect's sample.
 - 4. Effect: Closed grain.
 - 5. Sheen: Medium-gloss rubbed effect 35-45 deg.

2.07 Fabrication:

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fit shelves, doors and exposed edges with 3/8 inch matching hardwood edging. Use full length pieces only.
- C. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- D. Door and Drawer Fronts: 3/4 inch thick; overlay style.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- G. Mechanically fasten back splash to countertops with sleet brackets at 16 inches on center.
- H. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes; and fixtures and fitting. Verify locations of cutouts from on-site dimensions. Prime paint contact surfaces of cut edgy.

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2.08 Finishing:

- A. Sand work smooth and set exposed nails and screw.
- B. Apply wood filler in exposed nail (and screw) indentations.
- C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- D. Seal, stain and varnish exposed to view surfaces. Brush apply only.
- E. Seal and varnish internal exposed to view and semi-concealed surfaces. Brush apply only.
- F. Seal internal surfaces of cabinets with one coat of shellac. Brush apply only.
- G. Seal surfaces in contact with cementitious materials.

2.09 Hardware:

- A. Shelf Standard and Supports: KV-256 and KV-255.
- B. Drawer and Door Pulls: Chrome, U-shaped wire pulls.
- C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed.
- D. Catches: Magnetic, Stanley SF-45 and SP-46. Provide other types required for special conditions.
- E. Drawer Slides: Knappe and Vogt: KV1284 typical with KV1485 full extension ball bearing tracks.
- F. Hinges: Blum Model 170-concealed hinges with 170 degree opening or Grass System 1200 (176 degree opening) self-closing with 1000-80 base plate. Two hinges per door up to 36" and 3 hinges per door up to 48" and 4 per door up to 60" high.
- G. Grommets: Provide plastic grommets at all penetrations through countertop for cabling, power cords, etc. as indicated on the Drawings.

Part 3 - Execution

3.01 Examination: Verify adequacy of backing and support framing.

3.02 Installation:

- A. Install woodwork to comply with AWI Section 1700 for same grade specified above for type of casework involved.
- B. Set and secure casework in place; rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for waif mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinet and counter bases to floor using appropriate

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SECTION 06410 - CUSTOM CASEWORK

- angles and anchorages.
 - G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
 - H. Install without distortion so that doors and drawers fit openings properly and are accurately aligned.
 - I. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
 - J. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork,
- 3.03 Adjusting:
- A. Adjust moving or operating parts to function smoothly and correctly.
- 3.04 Cleaning:
- A. Clean casework, counters, shelves, hardware, fittings and fixtures.
- 3.05 Schedules:
- A. Furnish and install all items listed in this schedule at location indicated on the Drawings, complete as to function intended.
 - B. Casework indicated on the Drawings; custom grade construction.
 - 1. Counter Tops.
 - 2. Base Cabinets.
 - 3. Overhead Cabinets.
 - 4. Wall Cabinets.
 - 5. Shelving-adjustable and fixed.
 - 6. Other items such as shims and fillers as indicated on the Drawings or as required for a complete cabinetwork installation.

END OF SECTION

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SECTION 07100 - WATERPROOFING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. Federal Specifications:
 - a. SS-C-153B, Cement, Bituminous, Plastic.
 - b. SS-A-701B, Asphalt, Weatherproofing.
 - c. LLL-1-535A, Insulation Board, Thermal.

1.03 Submittals:

- A. Provide submittals in the form of samples, and documentation, to the Architect for review.

Part 2 - Products

2.01 Materials:

- A. Solvent Based Asphalt Water Barrier: FS-SS-A-701B.
- B. Flashing Membrane: 20 mil elastomeric modified sheet vinyl.
- C. Asphalt Plastic Cement: SS-C-153B, Type 1.
- D. Accessories: As recommended by manufacturer.
- E. Protection Board: Insulation Board, FS-LLL-1-535A, Class A.
- F. Vapor Barrier under floor slab: refer to Section 07195 - Vapor Retarder.

Part 3 - Execution

3.01 Installation - Wall Waterproofing:

- A. Location: Apply to all exterior concrete and masonry wall surfaces below grade.
- B. General:
 - 1. Repoint all holes cracks and joints and allow to dry before waterproofing.
 - 2. Do not apply until all surfaces are completely dry and clean. Apply only during favorable weather conditions.
- C. Joint Membrane:
 - 1. Location: Apply to all joints in exterior concrete walls below grade.
 - 2. Embed a strip of flashing membrane in plastic cement. Membrane shall be a minimum of 12" wide.
- D. Water Barrier:
 - 1. Hold 4" down from finish grade line so that at no time is the mastic or membrane exposed to view.
 - 2. Apply two (2) coats to form a membrane water barrier, allowing the first coat to dry before applying the second

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coat. Apply in strict accordance with manufacturer's instructions. Do not apply until surfaces are completely dry.

3. Apply in a continuous unbroken film free from pin holes or other surface breaks. Take care to seal around all ties, inserts, anchor slots, conduit, pipes, electrical boxes, etc.

E. Protection:

1. Install protection board over all waterproofing prior to backfilling.
2. All back filling shall be carefully done to protect waterproofing. Repair all damaged areas.

3.02 Under Slab Vapor barrier:

- A. Refer to Section 07260 - Vapor Barrier.

End of Section

DIVISION 7 - THERMAL & MOISTURE PROTECTION

SECTION 07150 - DAMPPROOFING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Waterproofing - Section 07100
- B. Sealants - Section 07900

1.03 Quality Assurance

- A. Standards:
 - 1. Federal Specifications:
 - a. SS-C-153B, Cement, Bituminous, Plastic.
 - b. SS-A-701B, Asphalt, Weatherproofing.
 - 2. American Society for Testing and Materials:
 - a: ASTM D-250, Asphalt Saturated Asbestos Felts.

Part 2 - Products

2.01 Materials:

- A. Solvent Based Asphalt Water Barrier: FS-SS-A-701B
- B. Flashing Membrane: 20 mil elastomeric modified sheet vinyl.
- C. Asphalt Plastic Cement: SS-C-153B, Type 1.
- D. Asphalt Saturated Felt: ASTM D-250, Un-perforated, #15.
- E. Accessories: As recommended by manufacturer.

Part 3 - Execution

3.01 Installation - Cavity Wall Dampproofing:

- A. General - Masonry and Concrete:
 - 1. Repoint all holes, cracks and mortar joints and allow to dry before waterproofing and dampproofing.
 - 2. Sweep wall base, including concrete slab, clean of dirt and mortar droppings immediately prior to application of waterproofing and dampproofing cavity walls.
 - 3. Do not apply until all surfaces are completely dry and clean.
 - 4. Do not apply until all surfaces are completely dry and clean.
 - 5. Sight exposed mastic and membrane not allowed.
- B. Wall Base Waterproofing:
 - 1. Location: Apply at base of outer face of concrete walls and outer face of inner wythe at all exterior masonry cavity walls.
 - 2. At intersection of outer face of inner wythe with concrete slab, provide a 2" radius cove built up with asphalt plastic cement.

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3. At wall base, embed a strip of plastic flashing in Plastic Cement. Lap all joints 8" minimum and seal with joint sealant. Seal completely around piping, conduit, etc. provide minimum joints using longest sheets of flashing practicable. Seal all punctures. Top edge of membrane shall be a minimum of 8" above concrete slab, worked into curve of plastic cement cover, down, and outward on concrete slab or steel shelf angle to outer wythe.
- C. Cavity Wall Dampproofing:
1. Apply to outer face of inner wythe masonry cavity walls.
 2. Apply two (2) coats to form a membrane water barrier, allowing the first coat to dry before applying the second coat. Apply in strict accordance with manufacturer's instructions. Do not apply until surfaces are completely dry.
 3. Apply in a continuous unbroken film free from pin holes or other surface breaks. Take care to seal around all masonry ties, inserts, anchor slots, conduit, pipes, electrical boxes, etc.

End of Section

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SECTION 07200 - INSULATION

Part 1 - General

1.01 Work Included:

- A. All materials, labor and services and incidentals necessary for the completion of this section of work.

1.02 Quality Assurance:

A. Standards:

1. Federal Specifications:

- a. HH-I-524C, Type IV, Class C, Rigid Insulation.
- b. ASTM C 665-84, Type 1, Insulation Blankets.
- c. ASTM D1621, Compressive Strength.
- d. ASTM E84, Flame Spread and Smoke Developed.

B. Submittals:

- 1. Provide submittals in the form of samples, and documentation, to the Architect for review.

1.03 Product Delivery, Storage and Handling:

- A. Rigid insulation board is combustible. During storage and insulation, observe good fire safety practice, including job site housekeeping.

1.04 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

A. Rigid Insulation: FS-HH-I-1972/1, Class 2 Rigid Insulation.

- 1. Type: Glass fiber reinforced polyisocyanurate core with foil facing each side (glass fiber facing at roof insulation), and a compressive strength of 25 p.s.i. and a maximum water vapor transmission rate of >.03 perm-inch.
 - a. Application: 2 layers of rigid insulation. First layer shall be 2" thick / second layer shall be 1.5" thick for a total thickness of 3.5" with a minimum total thermal resistance of R-20, for installation above metal roof decking and exterior wall at cavities. Refer to Drawings.
- 2. Type: expanded polystyrene insulation.
 - a. Application: 2" thick with a thermal resistance of R-10.4, **for foundation wall perimeter below grade installation only.**
- 3. Adhesive: as recommended by manufacturer of rigid

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SECTION 07200 - INSULATION

insulation board.

- B. Fibrous Insulation: ASTM C 665-84, Type 1
 - 1. Type:
 - a. 6" thick (approx.) mineral wool or fiberglass fire resistant insulating blanket or batt, with kraft paper facing. Thermal resistance R-19. Refer to Drawings for locations.
- C. Vapor Retarder:
 - 1. Roof Deck Installation:
 - a. Two layers of high strength kraft paper laminated with an adhesive, and reinforced at edges with fiberglass yarns.
 - b. Type Example: Permstop - Owens Corning.

Part 3 - Execution

3.01 Installation - Rigid Insulation:

- A. Install rigid insulation horizontally against back-up wall, or to roof deck, as shown on the Drawings.
- B. **Rigid insulation and other components applied to metal decking at membrane roofing shall be fastened with approved fasteners at the rate of 1 per 2 square feet to meet FM I-90 requirements.**
- C. Install 2 layers of rigid insulation to metal roof deck. Stagger joints of insulation to provide continuous insulation coverage.
- D. Cut insulation by means of a saw, knife, or other sharp tool to fit around obstructions across the wall, such as vents, louvers, pipes and conduit.
- E. If mastic adhesive is used to supplement holding the insulation in place, observe label directions.

End of Section

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07260 - VAPOR BARRIER

PART 1 - GENERAL

1.01 Work Included

- A. Furnish all labor, materials, services and equipment required in conjunction with or properly incidental to the installation of under-slab vapor barriers described herein and/or as shown on the drawings.

1.02 Related Work

- A. Section 03300: Cast-In-Place Concrete.

1.03 Job Conditions

- A. Subbase: Smooth and level, free from damaging protrusions that would puncture vapor barrier.

1.04 References

- A. ASTM E 1643 - Standard Practice for Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. ASTM E 1745 - Standard Specification for Plastic Water Vapor Barriers Used in Contact with Soil or Granular Fill under Concrete Slabs: Exceeds Class B
- C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E 154 - Standard Test Methods for Water Vapor Barriers Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- E. ASTM D 1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- F. ASTM F 1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
- G. ACI 302.1R - Vapor barrier component (plastic membrane) not less than 10 inches thick.

1.05 Submittals

- A. Submit in accordance with Division 1 requirements.
- B. Product Data: Provide manufacturers printed product literature and description, including tests and standards that have been performed on the vapor barrier material.
- C. Samples: Submit two, 8 1/2 x 11 inch in size, illustrating the vapor barrier and two (2) 8-1/2-in long sample strips of the joint tape.
- D. One each of all accessories that will be used in the installation.
- E. Verification by Independent testing labs indicating that materials comply with specified requirements.
- F. Certificates: Certify that products of this section meet or exceed specified requirements.

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SECTION 07260 - VAPOR BARRIER

- G. Manufacturer's Instructions: Indicate complete installation instructions.

PART 2 - PRODUCTS

2.01 Available Products

- A. Stego Wrap 15 mil Vapor Barrier by Stego Industries, L.L.C.
- B. Perminator™ 15 mil by W.R. Meadows .
- C. Vapor Block 15 (mil) by Raven Industries, Inc.
- D. Moistop Ultra 15 (mil) by Fortifiber Building Systems Group
- E. Viper Vaporcheck II 15 mil by Insulation Solutions, Inc.

2.02 Source Quality Control And Testing

- A. Vapor barrier membrane shall have following properties:
 - 1. Water Vapor Barrier: Meets or exceeds Class A according to ASTM E 1745.
 - 2. Water Vapor Transmission Rate: 0.012 grains/ft²/hour or lower according to ASTM E 96.
 - 3. Water Vapor Permeance: 0.01 perms or lower according to ASTM E 154 Sec. 7 or F 1249 (max.).
 - 4. Tensile Strength: 45.0 lbf/in according to ASTM E 154 Sec. 9.
 - 5. Puncture Resistance: 2200 g according to ASTM D 1709, Method B

2.03 Accessories

- A. Tape:
 - 1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4".
- B. Pipe Boot:
 - 1. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 - EXECUTION

3.01 Examination

- A. Verify that conditions are acceptable for the placement of the vapor barrier.

3.02 Preparation

- A. Ensure that subsoil is approved by Geotechnical Engineer.
 - 1. Vapor Barrier shall be installed on top of the aggregate, sand or tamped earth base or carton forms. At carton forms provide a vertical leg down to grade and adhered the vapor barrier to the grade beam at or just below the dirt line. Vapor barrier may be placed either above or beneath any carton form slip sheet.

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SECTION 07260 - VAPOR BARRIER

3.03 Installation

- A. Install vapor barrier per manufacturer's instructions, illustrations and ASTM E 1643 Standard Practice for Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 1. Level and tamp or roll granular base.
 - 2. Place Vapor Barrier with the longest dimension parallel with the direction of the pour.
 - 3. Lap Vapor Barrier over footings and seal to foundation walls. Seal all penetrations.
 - 4. Lap joints 6 inches and seal with the recommended pressure sensitive tape.
 - 5. Seal pipe penetrations with pipe boot made from vapor barrier and tape.
 - 6. Protect vapor barrier from damage during installation of reinforcing steel and utilities.
 - 7. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with pressure sensitive tape.

3.04 Interface With Other Work

- A. Coordinate work of all other trades related to the slab base and utility services.

END OF SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07410 - WALL PANEL SYSTEMS

Part 1 - General

1.01 Work Included:

- A. Single-skin, concealed fastener, prefinished metal wall panels.
- B. Metal trim, accessories, fasteners, and sealants related to the wall panel system.

1.02 Quality Assurance:

- A. Manufacturer shall demonstrate a minimum of ten (10) years of experience in the specified products and applications.
- B. American Architectural Manufacturer=s Association (AAMA):
 - 1. AAMA 620
 - 2. AAMA 621
- C. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. ASTM A653/A653M
 - 2. ASTM A755/A755M
 - 3. ASTM B209
 - 4. ASTM 920
 - 5. ASTM C1007
 - 6. ASTM E283

1.03 Panel Performance Requirements:

- A. Structural designs shall have been established from tests per ASTM E72 chamber method. Ultimate loads shall be established without the use of exposed or back-side fastening.
- B. Air Infiltration: maximum 0.06 cfm/s.f. per ASTM E283 at a static-air-pressure difference of 1.57 lbf/s.f., using minimum 10x10 foot test panel that includes side joints.
- C. Water Penetration, Static Pressure: no uncontrolled water penetration per ASTM E331 at a minimum static differential pressure of 6.24 lbf/s.f., using a minimum 10x10 foot test panel that includes side joints.
- D. Structural Performance: provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E72.
 - 1. Maximum allowable deflection limited to L/180 deflection of panel perimeter normal to plane of wall with no evidence of failure.
- E. Provide metal wall panels and panel accessories from a single manufacturer.

1.04 Submittals:

- A. Product data, including certified independent test data indicating compliance with requirements.

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SECTION 07410 - WALL PANEL SYSTEMS

- B. Shop Drawings including full elevations showing openings and penetrations. Include details of each condition of installation and attachment.
 - 1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.
 - 2. Indicate details of fastening, including clip spacing.
 - C. Load span tables including evaluation of panel clip and panel side joint interaction.
 - D. Samples of each component.
 - E. Installer Project References: minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
- 1.05 Warranty:
- A. Manufacturer shall warrant for a period of two (2) years that the panels, trim and accessories furnished by the manufacturer will be free from defects in materials and factory workmanship.
 - 1. Provide Special Panel Finish Warranty: Manufacturer shall agree to repair or replace metal wall panels that evidence deterioration of finish for the period of twenty (20) years from date of substantial completion.
- 1.06 Delivery, Storage, and Handling:
- A. Protect metal wall panel products during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.
- 1.07 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Panel Design

- A. Panel units shall consist of Metallic-Coated Steel Face Sheet:
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Class Z275), structural steel quality.
 - 2. Aluminum-zinc alloy-coated Steel Sheet: ASTM A792/A792M, Class AZ50 Grade 50 (Class ASM150, Grade 275), structural steel quality.
 - 3. Face Sheet: minimum 22 gage nominal uncoated thickness.
- B. Panel edges shall have an overlapping design with factory applied vapor sealant in side laps. Structural fasteners and clips shall be concealed.
- C. Panel unit shall be equal to M-Panel, as manufactured by Berridge Manufacturing Company.

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SECTION 07410 - WALL PANEL SYSTEMS

2.02 Metal Wall Panel Finish:

- A. Prefinished Galvalume.
- B. Color: to be selected by Architect from Manufacturer's standard colors.

2.03 Fabrication

- A. Steel trim shall be the same finish and gage as the exterior and/or interior of the panels.
- B. Panels and trim bundles shall be protected with water resistant paper and provided with wood collars to permit handling and stacking in the field.

2.04 Secondary Metal Subgirt Framing:

- A. Miscellaneous framing components, general: cold-formed metallic-coated steel sheet, ASTM A653/A653M, G90 (Z180).
 - 1. Hat Channels: 0.053 inch / 16 ga. minimum.
 - 2. Sill Channels: 0.053 inch / 16 ga. minimum.

2.05 Base Metal and Finish: match metal wall panel base metal and finish.

Part 3 - Execution

3.01 Inspection:

- A. Building tolerances on the panel support steel shall not exceed those defined by the panel manufacturer.
 - 1. 1/4 inch in any 20 foot length vertically or horizontally.
 - 2. 1/2 inch in any building elevation.
- B. Alignment of the panel support system should be checked for defects and corrected prior to installing panels.
- C. Verify that window, door, and other penetrations match layout on shop drawings.

3.02 Secondary Framing Installation:

- A. Install secondary metal framing components to tolerances indicated, as shown on approved shop drawings. Install secondary metal framing and other metal panel supports per ASTM C1007 and metal wall panel manufacturer=s recommendations.

3.03 Installation:

- A. Install metal wall panels in accordance with approved shop drawings and manufacturer=s recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement.
- B. Trim, accessories, and sealants shall be installed in accordance with approved shop drawings to insure a functional and weather tight installation.
 - 1. Install clips to supports with self-tapping fasteners. Fasteners shall be stainless steel.
 - 2. Provide weatherproof escutcheons for pipe and conduit

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SECTION 07410 - WALL PANEL SYSTEMS

penetrating exterior walls.

3. Dissimilar Materials: where elements of metal wall panel system come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
 - C. Dry wipe-down of the exterior surface should be done as the panels are installed.
 - D. Joint Sealers: install joint sealants where indicated on approved shop drawings.
- 3.04 Cleaning and Protection:
- A. Remove protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt and sealant. Maintain in a clean condition during construction.
 - B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.
- 3.04 Closeout Submittal:
- A. Provide maintenance data.

End of Section

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SECTION 07415 - PREFINISHED METAL SOFFIT PANELS

Part 1 - General

- 1.01 Work Included:
- A. The General Conditions and applicable sections of Division 1 shall apply to this entire section.
 - B. All materials, labor, services and incidentals necessary for the completion of this section of the work.
- 1.02 Related Work Specified Elsewhere:
- A. Metal Fabrications - Section 05500
 - B. Flashing and Sheet metal - Section 07600
- 1.03 Quality Assurance:
- A. Qualifications of Installer: Competent and skilled sheet metal applicator familiar with this type installation with successful completion of projects of familiar scope. Applicator shall have at least two years of experience in prefinished sheet metal applications.
- 1.04 Shop Drawings:
- 1.1 Submit complete shop drawings on all prefinished metal applications, showing layouts of seams, joints, details, and installation methods. Show details of weatherproofing at edges, terminations and penetrations in metal work.
- 1.05 Applicator and Guarantee:
- C. All work shall be done by one contractor with 5 years minimum experience in this type of metal work.
 - B. Provide ten (10) years guarantee written on contractor's letterhead for work of this Section.
- 1.06 Warranty:
- A. Provide a 20-year manufacturer's warranty covering color fade, chalk, and film integrity at no charge.
- 1.07 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

- 2.01 Acceptable Manufacturers:
- A. Quality of Manufacturers: The products, colors and finishes herein are of AEP-Span products to establish standards of quality and appearance. The products of other manufacturers are acceptable subject to meeting or exceeding the requirements of these specifications, and the approval of the Architect.
- 2.02 Materials -
- A. Prefinished Metal Soffits:
 - 1. Flush Panel, (FP 12-2) 24 gauge steel with embossed finish.

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SECTION 07415 - PREFINISHED METAL SOFFIT PANELS

2. Color: to be selected by Architect from Manufacturer's standard colors.
3. Flashings, Closures, and Trim shall be fabricated from same material, gauge, and finish as panels.
4. Finish: Kynar 500.

Part 3 - Execution

3.01 Installation:

- A. Fabricate and install prefinished metal facings in accordance with drawings and recognized sheet metal practices using conventional hand or power tools. Keep cut edges sharp, clean, properly dressed and closely aligned. Exercise care during fabrication and erection to avoid damage.
- B. Structural framing members and fasteners shall be sized and located as recommended by the panel manufacturer. The applicator shall insure that the correct fastener has been chosen for size and length necessary for loading requirements. Special care shall be exercised installing fasteners so as not to overdrive or misdirect fasteners which could cause damage to panels or trim. Use colored pop rivets on trim items and where exposed fasteners are necessary. Keep exposed fasteners to very minimum.
- C. Only minor scratches and abrasions will be allowed to be touched up. Any other damaged material shall be replaced.

End of Section

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SECTION 07550 - MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM

Part 1 - General

1.01 Section Includes:

- A. Preparation of Substrate to Receive Roofing Materials
- B. Roof Insulation Application to Prepared Substrate
- C. Roof Membrane Application
- D. Roof Flashing Application
- E. Incorporation of Sheet Metal Flashing Components and Roofing Accessories into the Roof System

1.02 Products Installed But Not Furnished Under This Section:

- A. Sheet Metal Flashing and Trim
- B. Sheet Metal Roofing Specialties

1.03 Related Sections:

- A. Roof Decks - Section 05310
- B. Rough Carpentry - Section 06100
- C. Insulation - Section 07200
- D. Flashing & Sheet Metal Section 07600

1.04 Reference Standards:

References in these specifications to standards, test methods and codes, are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies which may be used as references throughout these specifications.

ASTM	American Society for Testing and Materials Philadelphia, PA
FM	Factory Mutual Engineering and Research Norwood, MA
NRCA	National Roofing Contractors Association Rosemont, IL
OSHA	Occupational Safety and Health Administration Washington, DC
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Chantilly, VA
UL	Underwriters Laboratories, Northbrook, IL

1.05 Description Of Work:

- A. **Project Type:** New installation.
Deck: Metal Slope: **3/8 inch ±** per foot.
- B. **Rigid Insulation:**
 - 1. Top and Bottom Layers: Polyisocyanurate, having a total thickness of **3.5"** - top layer of 1 1/2" and bottom layer of 2". Refer to Section 07200, Insulation.
 - 2. Crickets: Polyisocyanurate (tapered) providing a roof slope to roof drains (refer to Drawings.)
- C. **Gypsum sheathing panel:** having a thickness of 1/2 inch, mechanically attached, as per FM I-90 requirements.
- D. **Roof System:** Modified Bitumen Base, applied in cold

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adhesive; stripping and Flashing, applied in cold adhesive.
Modified Bitumen Finish Ply, applied in cold adhesive.

- E. **Flashing System:** SBS with continuous metal-foil surfacing, torch applied.

1.06 Submittals:

- A. Submittals Prior to Contract Award:
 - 1. Letter from the proposed primary roofing manufacturer confirming that the bidder is an acceptable Contractor authorized to install the proposed system.
 - 2. Letter from the primary roofing manufacturer stating that the proposed application will comply with the manufacturer's requirements in order to qualify the project for the specified guarantee.
- B. Submittals Prior to Project Close-out:
 - 1. Manufacturer's printed recommendations for proper maintenance of the specified roof system including inspection frequencies, penetration addition policies, temporary repairs, and leak call procedures.

1.07 Quality Assurance:

- A. Acceptable Products: Primary roofing products, including each type of sheet, all manufactured in the United States, shall be supplied by a single manufacturer which has been successfully producing the specified types of primary products for not less than 10 years. The primary roofing products shall have maintained a consistent composition for a minimum of five years.
- B. Agency Approvals: The proposed roof system shall conform to the following requirements. No other testing agency approvals will be accepted.
 - 1. Underwriters Laboratories Class A acceptance of the proposed roofing system without additional requirements for coatings.
- C. Acceptable Contractor: Contractor shall have a minimum of 10 years of experience in successfully installing the same or similar roofing materials and be certified in writing by the roofing materials manufacturer to install the primary roofing products for a minimum of 5 years prior to the date of bid opening.
 - 1. Torch Applicators: Contractor shall employ torch applicators who have successfully passed the CERTA (Certified Roofing Torch Applicator) program requirements as provided by the National Roofing Contractors Association (NRCA).
 - 2. The Contractor shall have an office, warehouse with supplies, and permanent roofing crews within a 50 mile radius of Moore, Oklahoma. Contractor shall have had "NDL" (No Dollar Limit) approval for 5 years AT THIS

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AREA OFFICE from manufacturer and shall perform a minimum of ten (10) NDL manufacturer guarantees per year.

3. **Owner's Roofing Contractor (Universal Roofing and Sheet Metal located in Moore, Oklahoma) shall be utilized on this project. The bid shall be based on the provided drawings and specifications, and agreed-to pricing.**

- D. Scope of Work: The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full-time supervision, experienced roof mechanics, all materials, tools, and equipment necessary to complete, in an acceptable manner, the roof installation in accordance with this specification. Comply with the latest written application instructions of the manufacturer of the primary roofing products. In addition, application practice shall comply with requirements and recommendations contained in the latest edition of the Handbook of Accepted Roofing Knowledge (HARK) as published by the National Roofing Contractors Association, amended to include the acceptance of a phased roof system installation.
- E. Local Regulations: Conform to regulations of public agencies, including any specific requirements of the city and/or state of jurisdiction.
- F. Manufacturer Requirements: Ensure that the primary roofing materials manufacturer provides direct trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conducts a final inspection upon successful completion of the project.
- G. Contractor shall have one of the following approved Contractor Certification levels prior to bid opening:
- Johns Manville - Peak Advantage Contractor
 - Soprema - Soprema Certified Applicator
 - Siplast - Siplast Select Applicator
 - GAF - Master Select Contractor
- 1.08 Product Delivery Storage And Handling:
- A. Delivery: Deliver materials in the manufacturer's original sealed and labeled containers and in quantities required to allow continuity of application.
- B. Storage: Store materials out of direct exposure to the elements. Store roll goods on a clean, flat and dry surface. All material stored on the roof overnight shall be stored on pallets. Rolls of roofing must be stored on ends. Store materials on the roof in a manner so as to preclude overloading of deck and building structure. Store materials such as solvents, adhesives, and asphalt cutback

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products away from open flames, sparks, or excessive heat. Cover all material using a breathable cover such as a canvas. Polyethylene or other non-breathable plastic coverings are not acceptable.

- C. Handling: Handle all materials in such a manner as to preclude damage and contamination with moisture or foreign matter. Handle rolled goods to prevent damage to edges or ends.
- D. Damaged Material: Any materials that are found to be damaged or stored in any manner other than stated above will be automatically rejected, removed, and replaced at the Contractor's expense.

1.09 Project/Site Conditions:

- A. Requirements Prior to Job Start
 - 1. Notification: Give a minimum of 5 days notice to the Owner and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.
 - 2. Permits: Obtain all permits required by local agencies and pay all fees which may be required for the performance of the work.
 - 3. Safety: Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.
- B. Environmental Requirements:
 - 1. Precipitation: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.
 - 2. Temperature Restrictions: At ambient temperatures between 40F and 50F, prepare / warm adhesive as directed by manufacturer.
- C. Protection Requirements:
 - 1. Membrane Protection: Provide protection against staining and mechanical damage for newly applied roofing and adjacent surfaces throughout this project.
 - 2. Torch Safety: Designate one person on each crew to perform a daily fire watch. The designated crew member shall watch for fires or smoldering materials on all areas of roof construction. Continue the fire watch after roofing material application has been suspended for the day.
 - 3. Limited Access: Prevent access by the public to materials, tools, and equipment during the course of

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the project.

4. Debris Removal: Remove all debris daily from the project site and take to a legal dumping area authorized to receive such materials.
5. Site Condition: Complete, to the owner's satisfaction, all job site clean-up including building interior, exterior and landscaping where affected by the construction.

1.10 Guarantee/Warranty:

- A. Roof Membrane Guarantee: Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with **the manufacturer's ten year labor and materials membrane guarantee**. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and shall be issued at no additional cost to the Owner. This guarantee shall not exclude random areas of ponding from coverage.

1.11 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Only the four systems listed in 2.02 Description of Systems below will be accepted for installation on this project.**

Part 2 - Products:

2.01 Roofing System Assembly/Products:

- A. Rigid Roof Insulation: Roof insulation shall be UL and FM approved. Insulation shall be approved in writing by the insulation manufacturer for intended use and for use with the specified roof assembly. Refer to Section 07200.
- B. Recover Board Sheathing Panel for Roof Membrane Substrate: A panel composed of high density fiberboard, non-structural water resistant core material integrally bonded having a nominal thickness of 1/2 inch.
 1. Acceptable Manufacturer: Fiberboard Coated High Density Roof Insulation, by Huebert.
- C. Gypsum Sheathing Panel for Wood/Plywood Surfaces to Receive Flashing Coverage: A panel composed of a gypsum based, non-structural water resistant core material integrally bonded with fiberglass mats on both sides having a nominal thickness of 1/2 inch. The panel surface shall be factory primed with a non-asphaltic primer.
 1. Acceptable Manufacturer: DensDeck Prime Gypsum Roof Board, by Georgia Pacific Corporation; Atlanta, GA

2.02 Description Of Systems:

- A. Roofing Membrane Assembly: A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer

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modified asphalt membrane, applied over a prepared substrate. Both reinforcement mats shall be impregnated/saturated and coated each side with an SBS modified bitumen blend. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14F - or show evidence of other independent testing indicating resistance fatigue, membrane cracking and delamination. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.

1. Acceptable Manufacturer: Johns Manville roof system:
 - a. Modified Bitumen Base, Stripping, and Flashing Reinforcing Ply.
JM DynaBase
 - b. Modified Bitumen Finish Ply
JM DynaGlas FR
 - c. Stripping Ply and Flashing Reinforcing Sheet
JM DynaPly
- B. Flashing Membrane Assembly: A flashing membrane assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.
 1. Acceptable Manufacturer: Johns Manville flashing system, aluminum finish
 - a. Cant Backing Sheet for Wood/Plywood Surfaces to Receive Flashing Coverage: applicable JM product.
 - b. Metal-Clad Modified Bitumen Flashing Sheet: JM DynaClad Flashing
 - c. Cant Strip: JM FesCant Plus Cant Strips
- C. Catalyzed Acrylic Resin Flashing System: A specialty flashing system consisting of a liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared or primed substrate. The flashing system consists of a catalyzed acrylic resin primer, basecoat and topcoat, combined with a non-woven polyester fleece. The resin and catalyst are pre-mixed immediately prior to installation. The use of the specialty flashing system shall be specifically approved in advance by the membrane

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manufacturer for each application.

1. Acceptable Manufacturer: Flashing System by Johns Manville; Denver, CO
- D. Additional Roof Systems: The following additional roof systems are acceptable for use in lieu of the specified roof system.
 1. GAF Materials Corp., Wayne, NJ
 - Base Ply - Ruberoid Mop Smooth
 - Finish Ply - Ruberoid Mop FR - cap ply Plus
 - Flashing Sheet - Ruberoid Ultraclad SBS
 - Stripping Ply and Flashing Reinforcing Sheet - Ruberoid Mop Smooth
 2. Soprema, Inc., Wadsworth, OH
 - Base Ply - Elastophene Sanded 2.2
 - Finish Ply - Elastophene LS FR GR
 - Flashing Sheet - Sopralast 50 TV ALU
 - Stripping Ply and Flashing Reinforcing Sheet - Elastophene Sanded 2.2

2.03 Roofing Accessories:

- A. Roofing Adhesives:
 1. Membrane Cold Adhesive: An asphalt, solvent blend conforming to ASTM D 3019, Type III requirements.
 - a. Acceptable Manufacturer: MBR Cold Application Adhesive by Johns Manville; Denver, CO
- B. Bituminous Cutback Materials:
 1. Primer: An asphalt, solvent blend conforming to ASTM D 41 requirements.
 2. Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges conforming to ASTM D 4586 Type II requirements.
- C. Sealant: A moisture-curing, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials.
- D. Ceramic Granules: No. 11 grade specification ceramic granules of color scheme matching the granule surfacing of the finish ply.
- E. Metallic Powder: A finely graded metal dust as supplied or approved by the membrane manufacturer, used for covering of bitumen overruns over the foil surfaced membrane.
- F. Perlite Cant Strips: A cant strip composed of expanded volcanic minerals combined with waterproofing binders. The top surface shall be pre-treated with an asphalt based coating. The face of the cant shall have a nominal 4 inch dimension.

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G. Fasteners:

1. Gypsum Sheathing Panel Fasteners for Roofing Substrates and Wood/Plywood Flashing Surfaces: Gypsum sheathing panel fasteners and plates shall be FM Approved, and/or approved by the manufacturer of the primary roofing products. The fastening pattern for each panel to be used shall be as recommended by the panel manufacturer and approved by the manufacturer of the primary roofing products. Acceptable panel fastener manufacturers for specific substrate types are listed below.
 - a. Wood/Plywood Flashing Surfaces: Gypsum sheathing panel mechanical fasteners shall be factory coated for corrosion resistance. The fastener shall conform meet or exceed Factory Mutual Standard 4470 and when subjected to 30 Kesternich cycles, show less than 15% red rust. Acceptable fastener types for wood/plywood substrates are listed below.
 - 1) A fluorocarbon coated screw type roofing fastener having a minimum 0.220 inch thread diameter. Plates used in conjunction with the fastener shall be a metal type having a minimum 3 inch diameter, as supplied by the fastener manufacturer.
 - b. Acceptable Manufacturer's:
 - 1) Ultrafast Fastener with UltraFast Round Metal Plates by Johns Manville; Denver, CO
 - 2) Dekfast #12 with Dekfast Steel Hexagonal Plates by Construction Fasteners, Inc.; Wyomissing, PA
 - 3) Standard Roofing Fastener by Olympic Manufacturing Group, Agawam; MA
2. Flashing Reinforcing Sheet Fasteners: Fasteners shall be approved by the manufacturer of the primary roofing products. Acceptable fasteners for specific substrate types are listed below.
 - a. Wood/Plywood Substrates
 - 1) A 12 gauge, spiral or annular threaded shank, zinc coated steel roofing fastener having a minimum 1 inch head.
 - 2) Square Cap by W.H. Maze Co.; Peru, IL
12 Gauge Simplex Nail by the Simplex Nail and Manufacturing Co., Americus, GA
 - 3) Fasteners shall be applied to meet FM-I90 requirements. At crickets, if insulation thickness prohibits satisfactory application

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of fasteners, use adhesive similar to Para-STIK insulation adhesive.

- H. Walktread: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface.
 - 1. Thickness: 0.25 in
 - 2. Width: 32 in
 - 3. Acceptable Manufacturer: DynaTred Roof Walkway Pads by Johns Manville; Denver, CO
- I. Pipe Supports Typical:
 - 1. Roller System: A "roller-bearing" pipe support for roof-mounted gas pipes, RTU condensate lines, and electrical conduit up to 4" I.D. or 5"O.D. Pipes rest on a self-lubricating roller system which is made of a stainless steel or glass-filled nylon rod and a sturdy polycarbonate resin roller. Pipe support base shall be manufactured of polycarbonate resin with a roller rod of glass-filled nylon, and stainless steel metal parts.
 - 2. Load Weight: Maximum load weight may not exceed 125 lbs. per pipestand.
 - 3. Spacing: Not to exceed 10 foot centers. Do not exceed 125 lbs. load weight and adjust pipe stand in height to even load.
 - 4. Acceptable Manufacturer: Pillow Block Pipestand Model 4-R, Miro Industries, Inc., 1780 West 2300 South, Salt Lake City, Utah 84119.
- J. Pipe Supports at Turns In Large Piping:
 - 1. Pipe Support Hangers: A "clevis hanger" pipe support hanger for roof mounted gas pipes at all large (over 4" I.D.) piping corners, bends, and "tees"/pipe intersections. Pipes rest on a clevis hanger with a support base of stainless steel polycarbonate. All other metal parts are hot-dip galvanized steel.
 - 2. Load Weight: Maximum load weight not to exceed 310 lbs. per pipestand or 155 lbs. on each base.
 - 3. Spacing: Locate "clevis" type pipe hangers at all corners, bends, and "tees"/pipe intersections not to exceed 10'-0" o.c. maximum. Do not exceed 310 lbs. load weight (155 lbs. on each base) and make certain each pipestand is adjusted in height to even load at all pipestands.
 - 4. Acceptable Manufacturer: Pillow Block Pipestand Model 6-H, Miro Industries, Inc., 1780 West 2300 South, Salt Lake City, Utah 84119.
- K. Penetration Dam/Sealer Pockets shall be similar to:
ChemCurb System: gray polyester resin exterior forms,

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structural sealant and One (1) part self-leveling moisture cure pourable sealer (gray).

Part 3- Execution

3.01 Preparation:

- A. General: Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing.

3.02 Substrate Preparation - Metal Deck / Insulation:

- A. Preparation of Wood/Plywood Substrates to Receive Flashing Materials: Mechanically attach the gypsum sheathing panels to all wood/plywood substrates that will be covered with the specified flashing membrane, using the specified screws/plates, at 12 inches o.c. staggered. Cut the cant backing sheet into 12 inch widths and peel the release film from the back of the sheet. Set the sheet into place extending 6 inches onto the field of the roof area and 6 inches up the gypsum sheathing panel surface utilizing minimum 3 inch side laps. Set the cant into place prior to installation of the roof membrane base ply.
- B. Insulation Panel - two layers: Mechanically attach the insulation panels, using the specified fasteners, at a rate of 1 fastener for every 2.7 square feet of panel area (12 per 4' x 8' panel). Increase the fastening frequency by 50% at the perimeter of the roof area and by 75% at the corners. Meet FM I-90 requirements.
- C. Gypsum Sheathing Panels: Install sheathing panels, and any tapered insulation in hot asphalt, with end joints offset; edges of the panels shall be in moderate contact without forcing applied in strict accordance with the insulation manufacturer's requirements and the following instructions.

3.04 Roof Membrane Installation:

- A. Membrane Application: Apply roofing in accordance with roofing system manufacturer's instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet and/or insulation as a continuous operation.
- B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials including granules and metallic powder, and exercise care in ensuring that the finished application is acceptable to the Owner.
- C. Priming: Prime metal and concrete and masonry surfaces with a uniform coating of the specified primer.

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- D. Membrane Adhesive Application: Membrane adhesive can be applied by roller, squeegee or spray unit. Apply cold adhesive in a smooth, even, continuous layer without breaks or voids. Utilize an application rate of 2 to 2 1/2 gal/sq over irregular or porous substrates. Utilize an application rate of 1 1/2 to 2 gal/sq for interply applications. Double the adhesive application rate at the end laps of granule surfaced sheets. In the areas surrounding details that are to receive the catalyzed acrylic resin primer and flashing system, apply membrane plies in a full coating of the specified elastomeric sealant in lieu of the solvent based adhesive a minimum 8 inches from the base of the penetration or curb.
- E. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- F. Roofing Application: Apply all layers of roofing free of wrinkles, creases, or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
1. Apply all layers of roofing perpendicular to the slope of the deck.
 2. Fully bond the base ply to the prepared substrate, utilizing minimum 3 inch side and end laps. Apply each sheet directly behind the asphalt applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3 feet.
 3. Fully bond the finish ply to the base ply, utilizing minimum 3 inch side and end laps. Apply each sheet directly behind the cold adhesive applicator. Stagger end laps of the finish ply a minimum 3 feet. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of the finish ply a minimum 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum 3 feet from end laps in the underlying base ply.
 4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications

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to applicable roof slopes.

- G. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot or the adhesive is soft, to ensure a monolithic surface color.
- H. Flashing Application - masonry surfaces: Flash masonry parapet walls and curbs using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3 inch side laps and extend a minimum of 3 inches onto the base ply surface and 3 inches up the parapet wall above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4 inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9 inch centers. (See manufacturer's schematic for visual interpretation).
- I. Flashing Application - surfaces sheathed with gypsum sheathing panels: After the gypsum sheathing panel and cant backing sheet have been installed, flash parapet walls and curbs with the specified reinforcing sheet and the metal foil flashing membrane. The reinforcing sheet shall have minimum 3 inch side laps and extend a minimum of 3 inches onto the base ply surface and to the top of the parapet wall or curb. Using the specified fasteners, mechanically attach the reinforcing sheet through the field of the sheet to the vertical flashing surface on 12 inch centers from the top of the cant to the top of the wall or curb. Fully adhere the remainder of the flashing reinforcing sheet that extends over the cant and roof level. Using a Leister Hand Welding Tool, seal the laps between flashing reinforcing sheets. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing

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coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4 inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9 inch centers. (See manufacturer's schematic for visual interpretation).

- J. Catalyzed Acrylic Resin Flashing System: Install the liquid-applied primer and flashing system in accordance with the membrane system manufacturer's printed installer's guidelines and other applicable written recommendations as provided by the manufacturer.
 - K. Use of Metallic Powder: Broadcast metallic powder over all bitumen overruns on the metal foil membrane surface while the bitumen is still hot to ensure a monolithic surface color.
 - L. Water Cut-Off: At end of day's work, or when precipitation is imminent, construct a water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to the resumption of roofing.
- 3.05 Roof System Interface With Related Components:
- A. Walktread: Cut the walktread into maximum 5 foot lengths and allow to relax until flat. Adhere the sheet using the specified plastic cement. Apply the specified cement in a 3/8 inch thickness to the back of the product in 5 inch by 5 inch spots in accordance with the pattern as supplied by the walktread manufacturer. Walk-in each sheet after application to ensure proper adhesion. Use a minimum spacing of 2 inches between sheets to allow for proper drainage.
 - B. Sealant: Apply a smooth continuous bead of the specified sealant at the exposed finish ply edge transition to metal flashings incorporated into the roof system.
- 3.06 Field Quality Control And Inspections:
- A. Site Condition: Leave all areas around job site free of debris, roofing materials, equipment, and related items

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- after completion of job.
- B. Notification Of Completion: Notify the manufacturer by means of manufacturer's printed Notification of Completion form of job completion in order to schedule a final inspection date.
 - C. Final Inspection:
 - 1. Post-Installation Meeting: Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
 - D. Issuance Of The Guarantee: Complete all post installation procedures and meet the manufacturer's final endorsement for issuance of the specified guarantee.

End of Section

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SECTION 07600 - FLASHING AND SHEET METAL

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Modified Bitumen Membrane Roofing System - Section 07550
- B. Sealants - Section 07900

1.03 Quality Assurance:

- A. Standards:
 - 1. American Society of Testing and Materials
 - a. ASTM A-526, Steel Sheet, Zinc-Coated (Galvanized), Commercial Quality.
 - b. ASTM B-32, Solder Metal
 - 2. Federal Specifications:
 - a. SS-C-153B, Cement, Bituminous, Plastics
 - 3. Sheet Metal and Air Conditioning Contractors National Association:
 - a. Architectural Sheet Metal Manual

- 1.04 Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Prefinished Sheet Metal overflow scuppers and Prefinished Metal Coping:
 - 1. Galvanized iron, prefinished one side.
 - 2. Gauge: 24 gauge, of design and width as detailed.
 - 3. Acceptable manufacturer: Color Klad - Vincent Brass and Aluminum Co.
 - 4. Finish: Kynar 500 - Refer Color Schedule
- B. Sheet Metal:
 - 1. Galvanized Sheet Steel: ASTM A-526, Commercial Quality.
 - 2. Gauge: 22 Gauge minimum or as required by Drawings or Specifications.
- C. Fasteners: Nails, screws, and other fasteners used in conjunction with this work shall be galvanized or cadmium plated.
- D. Solder: ASTM B-32, alloy grade 58, 50% tin, 50% lead.
- E. Flux: Muriatic acid with zinc.
- F. Sealants: Rubber based compound - refer to Section 07900.
- G. Bituminous Plastic Cement: FS SS-C-153B.

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- H. Accessories: Provide accessories as recommended by manufacturer or as indicated on Drawings.

Part 3 - Execution

3.01 Fabrication:

- A. Shape and install sheet metal as indicated on Drawings. Comply with recommendations of SMACNA "Architectural Sheet Metal Manual."
- B. Form exposed faces flat and free of buckles, excessive wave and tool marks. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
- C. Hem all exposed edges.
- D. Make waterproof corner joints by soldering solidly. Joints shall be full-lapped.
- E. Soldering: Shall be done slowly with well heated coppers to thoroughly heat the sheet and completely sweat the solder through the full width of the seam. Ample solder shall be used and the seam shall show a least one full inch of evenly flowed solder. Soldering coppers: Shall be heavy and blunt design, properly tinned before using. Neutralize all excess flux.
- F. Provide for thermal expansion of running trim, flashing and other items exposed for more than 15'-0" continuous length. Locate expansion seams at 10'-0" intervals and 2'-0" each side of corners and intersections.
- G. Angle bottom edges of exposed vertical surfaces to form drips.

3.02 Installation and Application:

- A. General:
 - 1. Furnish those items to be installed by other trades to proper grade for installation.
 - 2. Cooperate with and coordinate installation of sheet metal with roofing work as specified under Modified Bitumen Membrane Roofing System - Section 07550.
 - 3. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
 - 4. Embed all flashing in plastic cement. Coat dissimilar metals from contact with bituminous coating.
- B. Metal Coping:
 - 1. Material: 24 gauge, prefinished sheet metal.
 - 2. Fabricate and install in accordance with drawings, and recognized sheet metal practices.
 - 3. Secure coping bedded in plastic cement to blocking.
 - 4. At joints, bed coping in plastic cement and secure on side to backing strip by soldering solid. Do not use screws

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SECTION 07600 - FLASHING AND SHEET METAL

or nails in exposed face to coping.

5. Lower edge of coping to be securely hooked to hook strip. Secure to wood blocking with No. 8 x 1" galvanized sheet metal screws at 8 o.c.

End of Section

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SECTION 07840 - FIRESTOPPING

Part 1 - General

1.01 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 Definitions:

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 General Description of the Work:

- A. Only tested firestop systems shall be used in specific locations as follows:
 - 1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
 - 2. Safing slot gaps between edge of floor slabs and curtain walls.
 - 3. Openings between structurally separate sections of wall or floors.
 - 4. Gaps between the top of walls and ceilings or roof assemblies.
 - 5. Expansion joints in walls and floors.
 - 6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
 - 7. Openings around structural members which penetrate floors or walls.

1.04 Related Work Specified Elsewhere:

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Section 03300 - Cast-In-Place Concrete
 - 2. Section 04810 - Masonry
 - 3. Section 07900 - Sealants
 - 4. Section 09250 - Gypsum Wallboard
 - 5. Section ***** - Fire Suppression Piping
 - 6. Section ***** - Common Work Results for Plumbing
 - 7. Section ***** - Common Work Results for HVAC
 - 8. Section ***** - HVAC Insulation
 - 9. Section ***** - Basic Electrical Materials and Methods

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SECTION 07840 - FIRESTOPPING

1.05 References:

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops".
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems".
- D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
 - f. Joint Systems (XHBN)
 - g. Perimeter Fire Containment Systems (XHDG)
 - 2. Alternate Systems: "Omega Point Laboratories Directory" (updated annually).
- E. Test Requirements: ASTM E 1966, "Standard Test Method for Fire Resistive Joint Systems".
- F. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops".
- H. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- J. All major building codes: ICBO, SBCCI, BOCA, IBC
- K. NFPA 101 - Life Safety Code
- L. NFPA 70 - National Electric Code

THROUGH-PENETRATION UL CLASSIFICATION SYSTEM

	Fire Stopping Systems	Construction Penetrated	Type Of Construction	System Identification
1	No Penetrating Items:	F, W, C	A, B, J, K, L	0001-0999
2	Metallic Pipes, Conduit or Tubing:	F, W, C	A, B, J, K, L	1001-1999
3	Nonmetallic Pipe, Conduit or Tubing:	F, W, C	A, B, J, K, L	2001-2999
4	Electric Cables:	F, W, C	A, B, J, K, L	3001-3999
5	Cable, Trays with Electric Cables:	F, W, C	A, B, J, K, L	4001-4999
6	Insulated Pipes:	F, W, C	A, B, J, K, L	5001-5999

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7	Electrical Bussduct Penetrations:	F, W, C	A, B, J, K, L	6001-6999
8	Mechanical Ductwork Penetrations:	F, W, C	A, B, J, K, L	7001-7999
9	Multiple Penetrations Through Common Openings:	F, W, C	A, B, J, K, L	8000-8999

Construction Penetration

F	Floor penetration
W	Wall penetration
C	Either floor or wall penetration

Type of Construction

A-	Concrete floors equal to or less than 5-inches thick
B-	Concrete floors greater than 5-inches thick
J-	Concrete or masonry walls equal to or less than 8-inches thick
K-	Concrete or masonry walls greater than 8-inches thick
L-	Framed walls

JOINT UL CLASSIFICATION SYSTEM

Fire-Resistant Joint Systems		UL Classification System		
		Joint System	Movement Capability	Joint Width
1	Floor-to-Floor	FF	D	0000-0999
2	Wall-to-Wall	WW	D	0000-0999
3	Floor-to-Wall:	FW	D	0000-0999
4	Head of Wall:	HW	D	0000-0999

Movement Capability

D-	Has movement capability
----	-------------------------

Joint Width

0000-0999 Less than or equal to 2-inches

1.06 Quality Assurance

A. Installer Responsibilities: A firm experienced installing through-penetration firestop systems similar in material, design and extent to that indicated for this Project, whose

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SECTION 07840 - FIRESTOPPING

work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

- B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- E. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

1.07 Submittals:

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions.
- B. Submit Manufacturer's engineering judgment identification number and drawing details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- C. Submit material safety data sheets provided with product delivered to job-site.

1.08 Installer Qualifications:

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
- B. The work is to be installed by a contractor with at least one of the following qualifications:
 - 1. FM 4991 Approved Contractor
 - 2. UL Approved Contractor
 - 3. Hilti Accredited Fire Stop Specialty Contractor
- C. Installer shall have not less than 3 years of experience with fire stop installation.

1.09 Delivery, Storage and Handling:

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
- C. Store materials under cover and protect from weather and

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damage in compliance with manufacturer's requirements, including temperature restrictions.

- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 Project Conditions:

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.11 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers, providing they meet or exceed that specified.**

Part 2 - Products

2.01 Firestopping, General:

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

2.02 Acceptable Manufacturers:

- A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers

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as identified below:

1. Hilti, Inc., Tulsa, Oklahoma
800-879-8000 / www.us.hilti.com

2.03 Materials:

- A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
 1. Hilti CP 680-P Cast-In Place Firestop Device
 - a. Add Aerator adaptor when used in conjunction with aerator ("solvent") system.
 2. Hilti CP 681 Tub Box Kit for use with tub installations.
 3. Hilti CP 680-M Cast-In Place Firestop Device for use with noncombustible penetrants.
 4. Hilti CP 653 Speed Sleeve for use with cable penetrations.
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 604 Self-leveling Firestop Sealant
 3. Hilti CP 620 Fire Foam
 4. Hilti CP 606 Flexible Firestop Sealant
 5. Hilti CP 601s Elastomeric Firestop Sealant
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 1. Hilti CP 601s Elastomeric Firestop Sealant
 2. Hilti CP 606 Flexible Firestop Sealant
 3. Hilti FS-ONE Intumescent Firestop Sealant
- E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
 1. Hilti CP 672 Speed Spray
 2. Hilti CP 601s Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant
 4. Hilti CP 604 Self-leveling Firestop Sealant
- F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.
 1. Hilti CP 777 Speed Plugs
 2. Hilti CP 767 Speed Strips

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- G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - 1. Hilti FS-ONE Intumescent Firestop Sealant
- H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti FS-ONE Intumescent Firestop Sealant
 - 2. Hilti CP 620 Fire Foam
 - 3. Hilti CP 601s Elastomeric Firestop Sealant
 - 4. Hilti CP 606 Flexible Firestop Sealant
- I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti CP 618 Firestop Putty Stick
 - 2. Hilti CP 658T Firestop Plug
- J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
 - 1. Hilti CP 617 Firestop Putty Pad
 - 2. Hilti Firestop Box Insert
- K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 - 1. Hilti CP 643N Firestop Collar
 - 2. Hilti CP 644 Firestop Collar
 - 3. Hilti CP 648E/CP648S Wrap Strips
- L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti CP 637 Firestop Mortar
 - 3. Hilti FS 657 FIRE BLOCK
 - 4. Hilti CP 620 Fire Foam
 - 5. Hilti CP 675T Firestop Board
- M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti FS 657 FIRE BLOCK
 - 2. Hilti CP 675T Firestop Board
- N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
 - 1. Hilti CP 672 Speed Spray
 - 2. Hilti CP 601s Elastomeric Firestop Sealant

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3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 604 Self-Leveling Firestop Sealant
- O. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
 1. Hilti FS 657 FIRE BLOCK
 2. Hilti CP 658T Firestop Plug
- P. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- Q. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

Part 3 - Execution

3.01 Preparation:

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 Coordination:

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 Installation:

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
 1. Seal all holes or voids made by penetrations to ensure

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SECTION 07840 - FIRESTOPPING

an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic.

3.04 Field Quality Control:

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 Identification:

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's Name, address, and phone number.
 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of Installation.
 5. Through-Penetration firestop system manufacturer's name.
 6. Installer's Name.

3.06 Adjusting and Cleaning:

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

End of Section

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SECTION 07900 - SEALANTS

Part 1 - General

1.01 Work Included:

- A. All materials, labor services, and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. TT-S-00230C, Sealing Compound, One Component.
 - 2. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.03 Submittals:

- A. Submit manufacturer's specifications and color chart for each type of sealant.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Product test reports.
- E. Preconstruction compatibility and adhesion test reports.
- F. Preconstruction field-adhesion test reports.
- G. Field-adhesion test reports.

1.04 Warranty:

- A. All work done under this section of the work shall be guaranteed for a period of two years from date of final acceptance of the building. Guarantee shall include materials and workmanship required to repair any leaks or the repairs thereof.
- B. Special Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section for a period of 10 years from date of final acceptance.

1.05 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Building Sealant: One part high performance polyurethane waterproofing sealant, FS-TT-S-00230C.
 - 1. Acceptable Manufacturer: Sonneborn NP1 Building Sealant.
 - 2. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall

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SECTION 07900 - SEALANTS

comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Architectural Sealants: 250 gIL.
 - b. Sealant Primers for Nonporous Substrates: 250 gIL.
 - c. Sealant Primers for Porous Substrates: 775 gIL.
3. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - a. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
 4. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
 5. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- B. Silicone Joint Sealants:
1. Mildew-Resistant Neutral-Curing Silicone Joint Sealant: ASTM C 920.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. BASF Building Systems.
 2. Dow Corning Corporation.
 3. GE Advanced Materials - Silicones.
 4. Pecora Corporation.
 5. Sika Corporation; Construction Products Division.
 6. Tremco Incorporated.
- C. Urethane Joint Sealants: Urethane Joint Sealant: ASTM C 920.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work

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- include, but are not limited to, the following:
- a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lyntal, International, Inc.
 - d. Pecora Corporation.
 - e. Sika Corporation; Construction Products Division.
 - f. Tremco Incorporated.
- D. Latex Joint Sealants: Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Pecora Corporation.
 - d. Tremco Incorporated.
- E. Preformed Joint Sealants: Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Specialty Chemicals.
 - b. EM SEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.
- F. Acoustical Joint Sealants: Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation.
 - b. USG Corporation.

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- G. Joint Sealant Backing: cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type 0 (open-cell material) or any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.
- H. Miscellaneous Materials: as recommended by sealant manufacturer.
 - 1. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
 - 2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
 - 3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
 - 4. Joint Cleaner
 - 5. Joint Primer/Sealer
 - 6. Bond Breaker Tape
 - 7. Joint Backer-Rod: Closed-cell compressible rod stock, size and shape as required by application.
- I. Caulking compound: Watertight, gun consistency, conforming to FS-TT-C-598, Type 1.
- J. Accessories: As recommended by sealant manufacturer.
- K. Color: to be selected from manufacturer's standard colors.

Part 3 - Execution

- 3.01 Preparation:
 - A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to

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areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- 3.02 Installation: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- A. Do not leave gaps between ends of sealant backings.
 - B. Do not stretch, twist, puncture, or tear sealant backings.
 - C. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 - D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
 - E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - G. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.
 - H. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning

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materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

- 3.03 Joint Sealant Schedule:
- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non traffic surfaces.
 - E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces.
 - F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non traffic surfaces.
- 3.04 Additional Information:
- A. Application: All sight exposed caulking, and all exterior applications.
 - B. Comply with sealant manufacturer's printed instructions.
 - C. Any surfaces requiring priming, shall be prepared according to manufacturer's recommendations.
 - D. Install sealants to depths as shown or as recommended by sealant manufacturer. Smooth uneven surfaces.
 - F. Do not disturb compound by touching, washing, or otherwise until it has cured tack free.
 - G. Excess compound shall be removed from surfaces after curing.
 - H. Follow manufacturer's recommendations for painting over sealant.

End of Section

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SECTION 08100 - METAL DOORS AND FRAMES

Part 1 - General

1.01 Work Included:

- A. All material labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Hardware and Specialties - Section 08700

1.03 Quality Assurance:

A. Standards:

- 1. American Society for Testing and Materials
 - a. ASTM A-366, Steel Sheets, Carbon, Cold-Rolled, Commercial Quality.
 - b. ASTM A-569, Steel, Carbon, Hot-rolled Sheet and strip, commercial quality.
- 2. Underwriters' Laboratories, Inc.
- 3. Steel Door Institute (SDI): Recommended specifications for Steel Doors and Frames.

- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

- D. Fire-Rated Door Frame Assemblies: Assemblies complying with IBC 2009 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire protection ratings indicated.

- 1. Test Pressure: Test according to NFPA 252. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
- 2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
- 3. Smoke-Control Door Assemblies: Comply with NFPA 105.

1.04 Submittals:

- A. Shop Drawings: Product Data: Include construction details, material descriptions, core descriptions, label compliance, and finishes for each type of steel door and frame specified.

- 1. Submit shop Drawings showing details for each frame and door type, elevations and details of construction. Provide a schedule of doors and frames referenced to detail and openings as shown on the Drawings.
 - a. Elevations of each door design.
 - b. Details of doors, including vertical and horizontal edge details.
 - c. Frame details for each frame type, including dimensioned profiles.
 - d. Details and locations of reinforcement and

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- preparations for hardware.
 - e. Details of each different wall opening condition.
 - f. Details of anchorages, accessories, joints, and connections.
 - g. Details of glazing frames and stops showing glazing.
 - h. Details of conduit and preparations for electrified door hardware and controls.
 - 2. It is the manufacturer's responsibility to obtain templates of finish hardware. The shop Drawings must indicate all hardware applications to the doors and frames.
 - 3. Begin fabrication only after receiving approved shop Drawings.
 - 4. Qualification Data: For Installer.
- 1.05 Product Delivery, Storage and Handling:
- A. All materials shall be protected for shipping so that they may arrive at the job site without undue damage or damage from storage at the job.
 - B. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 - C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - D. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 14-inch space between each stacked door to permit air circulation.
- 1.06 Project Conditions:
- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.
- 1.07 Coordination:
- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves,

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concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry. Deliver such items to Project site in time for installation.

1.08 Warranty: Provide manufacturer's standard warranty.

Part 2 - Products

2.01 Acceptable Manufacturers:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CURRIES Company; an ASSA ABLOY Group Company.
2. Steelkraft; and Ingersoll-Rand Company.
3. Or Approved Equal.

2.02 Materials:

- A. Cold-Rolled Steel Sheet: ASTM A 100S/A 100SM, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591A 59 1M, Commercial Steel (CS), Class B coating; mill phosphatized.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements in Division 5 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- J. Grout: In masonry construction use grout for masonry as specified in Division 4. In stud walls use cementitious sprayed fire-resistive material manufactured by the following:

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1. Monokote Type MK-6; W.R. Grace Construction Products.
 2. Cafco 300; Isolatek International Corp.
- 2.03 Requirements: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
- A. Doors - Flush Panel: (SDI Door Type III, Style 2, Seamless):
1. Door, as indicated on the Drawings shall be constructed of 16 gauge cold-rolled, stretcher leveled sheet steel. Doors shall be insulated with foamed urethane, full length and width of doors. Construct doors with smooth, flush surfaces without visible joints or seams on exposed face or vertical edges. Doors shall be 1-3/4" thick unless noted otherwise.
 2. Close top and bottom edges with a recessed channel end closure or a flush end closure treatment.
 3. Vertical Edges for Single-Acting Doors: Square edge unless beveled edge is indicated.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
 6. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- B. Frames:
1. Hollow metal frames shall be of 16 gauge cold-rolled, pickled steel, except that all frames for single doors over 3'-0" wide, frames for pairs of doors over 4'-0" wide and frames for doors over 9'-0" high shall be of 14 gauge steel. Frames shall be neatly mitered and continuously welded and ground smooth for invisible joints.
 2. Furnish anchors as shown on Drawings or as recommended by manufacturer, to secure frames to adjacent construction, formed of not less than 18 gauge galvanized steel. Install anchors at a maximum of 24' centers of jamb height.
 3. Frames against masonry or concrete are to be slush filled.
 4. Knock-down frames are not permitted.
 5. Frames against masonry or concrete are to be slush filled.
 6. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T - shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated

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- straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - c. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
 - d. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch-wide steel.
 - e. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.
7. Sidelight Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
- C. Hardware Reinforcement:
1. Reinforcements for locks shall be 3/16" for fronts, with 14 gauge for roses and escutcheons. Hinge reinforcements shall be at least 10 gauge x 1 2" x 9". Provide steel strike and hinge reinforcement cover for frames.
- D. Jamb Anchors: Provide number and spacing of anchors as follows:
1. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - a. Two anchors per jamb up to 60 inches in height.
 - b. Three anchors per jamb from 60 to 90 inches in height.
 - c. Four anchors per jamb from 90 to 120 inches in height.
 - d. Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 inches in height.
 2. Stud-Wall Type: Locate anchors not more than 18 inches

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- from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
- a. Three anchors per jamb up to 60 inches in height.
 - b. Four anchors per jamb from 60 to 90 inches in height.
 - c. Five anchors per jamb from 90 to 96 inches in height.
 - d. Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - e. Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
- E. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
1. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 2. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- F. Stops and Moldings:
1. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
 2. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.
 3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.
- G. Labeled Doors and Frames:
1. Where doors and frames are called for on Drawings as labeled, their construction shall conform to all requirements and bear the appropriate U.L. label.
- H. Steel Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Finish standard steel door and frames after assembly.
 2. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

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- a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
3. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No.3, "Commercial Blast Cleaning."
4. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

Part 3 - Execution

3.01 Fabrication:

- A. All doors, and frames shall be cleaned of rust, grease and other impurities, and all welds ground and filled smooth, Metallic filler to conceal defects is not acceptable.
- B. Doors and frames shall be mortised, reinforced, drilled, and tapped for all mortise hardware in accordance with Hardware schedule and templates furnished by the hardware supplier, except that drilling and tapping for surface door closers, door closer brackets, surface panic devices and/or other surface applied hardware shall be done in the field. Frames shall be accurate and done in a neat, workmanlike manner.

3.02 Installation:

- A. Standard Steel Frames: Install standard steel frames for doors sidelights borrowed lights and other openings, of size and profile indicated. Comply with SDI 105.
 1. Bituminous coating and grout: Any material lost, removed or damaged during transportation or installation shall be replaced.
 2. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary

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braces, leaving surfaces smooth and undamaged.

- a. At fire-protection-rated openings, install frames according to NFP A 80.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.
- a. Floor anchors may be set with powder-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
7. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
- a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

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SECTION 08100 - METAL DOORS AND FRAMES

- B. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFP A 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
 - C. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.
- 3.03 Adjusting and Cleaning:
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
 - B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
 - C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 - D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions. Do not use abrasive, caustic or acid cleaning agents.
 - E. Protect doors and frames from damage until final acceptance by Architect. Replace/repair any damaged items as directed above.

End of Section

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SECTION 08200 - WOOD DOORS

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Finish Hardware - Section 08700

1.03 Quality Assurance:

A. Standards:

- 1. Architectural Woodwork Institute:
 - a. Architectural Woodwork Quality Standards
- 2. Underwriter's Laboratories, Inc.

- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-Accredited certification body.

- C. Source Limitations: Obtain flush wood doors from single manufacturer.

- D. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

- E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at according to NFPA 252 and UL 10B.

- 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- 3. Fire-Rated Doors must be provided with fire labels.

1.04 Submittals:

A. Shop Drawings:

- 1. It is the manufacturer's responsibility to obtain templates of finish hardware. The shop Drawings must indicate all hardware applications to the doors.
- 2. Begin fabrication only after receiving approved shop Drawings.
- 3. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
- 4. Samples for Initial Selection: Color charts consisting

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of actual materials in small sections.

5. Samples for Verification:
 - a. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
6. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.05 Products Delivery, Storage and Handling:

- A. When doors are delivered to job site, doors shall receive first coat of finish. Store in a protected area.
- B. Comply with requirements of referenced standard and manufacturer's written instructions.
- C. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- D. Mark each door on bottom rail with opening number used on Shop Drawings.

1.06 Warranty:

- A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span, or do not comply with tolerance limitations in referenced quality standard.
 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 2. Warranty shall be in effect during the following period of time after date of Final Completion.
 - a. Solid Core Interior Doors: Life of installation.

Part 2 - Products

2.01 Doors (non-labeled):

- A. Doors shall be 1 3/4" thick interior grade, veneered, with a particleboard core. Construction shall meet AWI 1300 PC, "Custom" standard. Doors shall have I.S. "Premium" grade

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SECTION 08200 - WOOD DOORS

faces - Plain Sliced Red Oak. Provide hardwood top, bottom, and side edges.

2.02 Doors (labeled):

- A. Doors shall be 1 3/4" thick interior grade, veneered, with a mineral core (refer to Drawings for ratings). Construction shall meet AWI 1300 FD, "Custom" standard. Doors shall have I.S. "Premium grade faces - Plain Sliced Red Oak. Provide hardwood top, bottom, and side edges.
- B. Where doors are called for on drawings as labeled their construction shall conform to all U.L. requirements and bear the appropriate U.L. label.

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

1. Algoma Hardwoods, Inc.
2. Ampco, Inc.
3. Buell Door Company Inc.
4. Chappell Door Co.
5. Eagle Plywood & Door Manufacturing, Inc.
6. Eggers Industries.
7. Graham; an Assa Abloy Group company.
8. Haley Brothers, Inc.
9. Ideal Architectural Doors & Plywood.
10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
13. Marshfield Door Systems, Inc.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
16. Poncraft Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

2.04 Door Construction - General:

- A. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade 1L-1, made with binder containing no ureaformaldehyde resin.
 2. Blocking - Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- B. Fire-Protection-Rated Doors: Provide core specified or

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mineral core as needed to provide fire protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 3. Pairs: Provide formed-steel edges and astragals with intumescent seals.
- C. Factory Finishing: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
 2. Finish doors at factory.
 3. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
 4. Transparent Finish:
 1. Grade: Premium.
 2. Finish: WDMA TR-6 catalyzed polyurethane.
 3. Staining: Water-based stain with transparent ultraviolet cured catalyzed polyurethane. Color as selected by Architect from manufacturer's full range.
 4. Effect: Open-grain finish.
 5. Sheen: Semigloss.

Part 3 - Execution

3.01 Examination:

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation:

- A. Provide clean properly sized and accurately placed mortises

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and drilled holes for all mortise and surface mounted finish hardware, in accordance with Hardware Schedule and templates furnished by the hardware supplier.

- B. Comply with the tolerance requirements of AWI for prefitting. Install in accordance with the requirements of the NWMA Door Guarantee.
 - C. Repair or replace doors damaged during installation. Repair doors which do not swing or operate properly.
 - D. Hardware: For installation, see Division 08 Section "Door Hardware."
 - E. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - F. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFP A 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
 - G. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
 - H. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- 3.03 Adjusting:
- A. Operation: Rehang or replace doors that do not swing or operate freely.
 - B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

End of Section

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

Part 1 - General

1.01 Work Included:

- A. All materials, labor services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Finish Carpentry - Section 06200
- B. Custom Casework - Section 06410
- C. Metal Doors and Frames - Section 08100
- D. Wood Doors - Section 08200

1.03 Quality Assurance:

- A. This material shall be procured from a source of supply approved by the Architect as having a member of their firm registered by the American Society of Contracting Architectural Hardware Consultants, and with a proven record of several years of satisfactory experience in contract builder's hardware, both in furnishing material and properly servicing jobs. The supplier also must be an established contract builder's hardware firm who meets all the above requirements, and who maintains and operates an office, display room and stock.

1.04 Submittals:

- A. Prepare a complete schedule including all items processed for each opening and other miscellaneous items and submit four copies to the Architect for approval within 30 days submitted within that time, the supplier shall furnish the hardware specified by catalog number.
- B. Indicate on schedule name of manufacturer after each item.
- C. Upon receiving the approved schedule, the hardware supplier shall immediately forward a copy to the metal frame suppliers, where applicable; and as soon as they receive approved shop drawings, they will immediately forward a complete set to the hardware supplier who can then check the applications and make any necessary minor revisions. If revisions are necessary, notify Architect immediately.
- D. Mark each item of hardware for opening on which it is to be used and deliver a complete schedule to the contractor when hardware is delivered.

1.05 Schedule:

- A. This specification describes the quality, character and function that is required of items of hardware; however, it is not intended to mention each particular item.
- B. It is the responsibility of the supplier to thoroughly detail the entire project to assure that the items specified will properly function in the indicated locations.
- C. Quantities shall be determined by the bidder. Part 2, following, indicates the type and function of material applicable to the typical opening. Should an unlisted opening require different type of function of hardware than that specified, for similar opening, notify the Architect, and provide hardware for unlisted openings within the bid.

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

Part 2 - Products

2.01 Finish Hardware:

A. Standards of Quality:

1. Codes, specifications and published recommendations, latest editions of the following are hereby made part of this section of the specifications in so far as they apply to the material or work called for.
 - a. National Builders Hardware Association (NBHA)
 - b. American Society for Testing Materials (ASTM)
 - c. Underwriters Laboratories (UL)
 - d. National Fire Protection Association (NFPA)
 - e. Code of Ethics of ASAH & NBHA
 - f. Federal Emergency Management Agency (FEMA)
2. Federal Specification, (ANSI Specifications):
 - a. Hinges: FF-H-116C (ANSI A156.1)
 - b. Locks and Door Trim: FF-H-106A (ANSI A 156.2)
 - c. Auxiliary Locks: FF-H-106A (ANSI A 156.5)
 - d. Exit Devices: FF-H-106A, FF-H-111B, FF-L486 (ANSI A156.3).
 - e. Door Closers: FF-H-121C (ANSI A 156.4)
 - f. Shelf and Miscellaneous Hardware: FF-H-00116 (ANSI A156.6).
 - g. All Door hardware: Comply with ADAAG where applicable.

B. General:

1. All hardware relating to hollow metal doors and frames shall be to standard templates of each respective hardware manufacturer for items furnished.
 - a. The related suppliers such as hollow metal doors and frames and such others as may be required will furnish the hardware supplier one copy of each of their approved shop drawings for proper coordination of their work and the finish hardware.

C. Manufacturers and Requirements:

1. Hardware manufacturers and brand names are for a guide as to type and standard required and all such hardware furnished must meet these standards as far as quality, weight, finish and design.

D. Keying:

1. All locks and cylinders to be masterkeyed as directed by the Architect/Owner.
2. Keys: Furnish the following keys:
 - a. 2 change keys each lock or cylinder
 - b. 6 masterkeys
 - c. **all EXTERIOR locks and cylinders shall be Primus Schlage Key System and keyed to Owner's Primus Master Key system. All remaining interior locks and cylinders shall be Classic Schlage and keyed to the Owner's Primus Master Key System.**

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

2.02 Hardware Sets:

Hardware Group No. 001: Provide each PR EXTERIOR doors with the following:

Quantity		Description	Model Number	Finish	Mfr
2	EA	CONTINUOUS HINGE	224HD HEIGHT AS REQUIRED	628	IVE
1	EA	MULLION	KR4954 HEIGHT AS REQUIRED	689	VON
1	EA	PANIC HARDWARE	CD99EO LENGTH AS REQUIRED	626	VON
1	EA	PANIC HARDWARE	CD99NL-OP LENGTH AS REQUIRED	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
3	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
4	EA	PRIMUS CORE ONLY	20-740	626	SCH
2	EA	OFFSET DOOR PULL	8190-0-0	630	IVE
2	EA	SURFACE CLOSER	4041 SCUSH MTG BRKTS, SPCRS & PLATES AS REQ	689	LCN
2	EA	DOOR SWEEP C627A	LENGTH AS REQUIRED	AL	NGP
1	EA	THRESHOLD	896V LENGTH AS REQUIRED	AL	NGP
1	SET	SEALS 700SA H & J	(INSTALL PRIOR TO OTHER HARDWARE)	AL	NGP

Hardware Group No. 002: Provide each DBL STORAGE doors with the following:

Quantity		Description	Model Number	Finish	Mfr
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P OR FB41P AS REQUIRED	630	IVE
1	EA	STOREROOM LOCK	L9080T 03N	626	SCH
1	EA	CLASSIC CORE	30-001	626	SCH
2	EA	SURFACE CLOSER	4041 OR P4041 MTG BRKTS, SPCRS & PLATES AS REQ	689	LCN
1	EA	COORDINATOR	COR X FL X MTG BRKTS X HW PREPS X LENGTH AS REQ	628	IVE
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	WALL STOP	WS407CCV OR FS436 AS REQUIRED	628	IVE
1	SET	SEALS 5050BR H & J		CLR	NGP

Hardware Group No. 003: Provide each SGL OFFICE door with the following:

Quantity		Description	Model Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050T 03N	626	SCH
1	EA	CLASSIC CORE	30-001	626	SCH
1	EA	WALL STOP	WS407CCV OR FS436 AS REQUIRED	628	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 004: Provide each SGL CLASSROOM door with the following:

Quantity		Description	Model Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070T 03N	626	SCH
1	EA	CLASSIC CORE	30-001	626	SCH
1	EA	SURFACE CLOSER	4041 OR P4041 MTG BRKTS, SPCRS & PLATES AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV OR FS436 AS REQUIRED	628	IVE
1	SET	SEALS 5050BR H & J	(USE SILENCERS @ NON-RATED DOORS)	CLR	NGP

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

Hardware Group No. 005: Provide each SGL SERVICE door with the following:

Quantity		Description	Model Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 03N	626	SCH
1	EA	CLASSIC CORE	30-001	626	SCH
1	EA	SURFACE CLOSER	4041 OR P4041 MTG BRKTS, SPCRS & PLATES AS REQ		689 LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV OR FS436 AS REQUIRED		628 IVE
1	SET	SEALS 5050BR H & J (USE SILENCERS @ NON-RATED DOORS)			CLR NGP

Hardware Group No. 006: Provide each SGL door(s) with the following:

Quantity		Description	Model Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CORRIDOR LOCK	L9456T 03N	626	SCH
1	EA	SURFACE CLOSER	4041 OR P4041 MTG BRKTS, SPCRS & PLATES AS REQ		689 LCN
1	EA	CLASSIC CORE	30-001	626	SCH
1	EA	WALL STOP	WS407CCV OR FS436 AS REQUIRED		628 IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 007: Provide each PR EXTERIOR doors with the following:

Quantity		Description	Model Number	Finish	Mfr
2	EA	CONTINUOUS HINGE	224HD HEIGHT AS REQUIRED	628	IVE
1	EA	MULLION	KR4954 HEIGHT AS REQUIRED	689	VON
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303EZ-0 4" X 16"	630	IVE
2	EA	SURFACE CLOSER	4041 SCUSH MTG BRKTS, SPCRS & PLATES AS REQ		689 LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	5050B H & J	BLK	NGP

Hardware Group No. 008: Provide each PR INTERIOR PASSAGE doors with the following:

Quantity		Description	Model Number	Finish	Mfr
2	EA	CONTINUOUS HINGE	224HD HEIGHT AS REQUIRED	628	IVE
1	EA	MULLION	KR4954 HEIGHT AS REQUIRED	689	VON
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303EZ-0 4" X 16"	630	IVE
2	EA	SURFACE CLOSER	4041 SCUSH MTG BRKTS, SPCRS & PLATES AS REQ		689 LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM 7800 X VOLTAGE & TRANSFORMER REQ		AL LCN
1	SET	SEALS	5050B H & J	BLK	NGP

WIRE THE MAG HOLDERS TO FIRE ALARM SYSTEM. THE MAG HOLDERS ARE TO RELEASE UPON ACTIVATION OF FIRE ALARM SYSTEM.

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

The following list of products and manufactures are acceptable for this project.

<u>Product</u>	<u>Manufacture and Approved Equals</u>
1. Hinges	A. Ives B. Hager C. Bommer
2. Continuous Hinges	A. Pemko B. Roton C. Select
3. Key System	A. Schlage (No substitutions)
4. Lock/Latch	A. Schlage (No substitutions)
5. Closers	A. LCN (No substitutions)
6. Exit Devices	A. Von Duprin (No substitutions)
7. Push/Pull/Plates	A. Ives B. Rockwood C. Trimco
8. Misc. Stop, Bolts, etc.	A. Ives B. Glynn-Johnson C. Rockwood
9. Door Seal/Thresholds	A. National Guard B. Pemko C. Reese

Each Product, by category, shall be the product of one manufacture. Complete lockset, including keyed lock cylinder, shall be the product of one manufacturer unless noted otherwise.

Part 3 - Execution

3.01 Installation:

- A. Install all finish hardware in strict accordance with the manufacturer's recommendations and printed instructions. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in the a secure place during the finish application. After completion of the finishes, reinstall each item. Do not install surface mounted items until finishes have been completed on the substrate.
- B. All hardware relating to hollow metal and aluminum doors and

DIVISION 8 - DOORS & WINDOWS

SECTION 08700 - FINISH HARDWARE

frames shall be to standard templates of each respective hardware manufacturer for items furnished.

- C. Mounting Heights: Mount Hardware units at heights recommended by the National Builders Hardware Association, except as specifically indicated or required to comply with governing regulations, or as may be otherwise directed by the Architect.
- 3.02 Prior to the Final Inspection:
- A. The supplier shall check all closers for proper operation after they have been installed and adjusted by the Contractor. He shall verify the keying to insure proper location of locksets and shall assist the Contractor in correcting faulty operation of any locks.
 - B. Within 30 days after the acceptance of the entire project, the Contractor shall be responsible for this supplier meeting with the maintenance custodian at the job site for the purpose of instructing him thoroughly in the proper repair and adjustment of all finish hardware items, and items, and shall present to the custodian a full complement of tools to be used.

End of Section

DIVISION 8 - DOORS AND WINDOWS

SECTION 08800 - GLAZING

Part 1 - General

1.01 Work Included:

- A. The General Conditions and applicable sections of Division 1 shall apply to this entire section.
- B. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. Federal Specifications
 - a. DD-G-451d, Glass, Plate, Sheet (for glazing and other uses).
 - 2. Flat Glass Jobber Association: Glazing Manual.
- B. Comply with UBC 2406, and ANSI 97.1 with testing requirements of 16 CFR 1201, Cat II.

1.03 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Glass Types and Examples:
 - 1. 1/4" Tempered Glass:
 - a. Type example: 1/4" Clear Herculite - PPG.
 - 2. 1" Nominal Thickness Insulating Tempered Glass - 1/4" tinted glass @ exterior side and 1/4" 100 Low E glass @ interior side of 1/2" air space - **both sides tempered.** Low Emissivity coating on 3rd glass surface from building exterior.
 - a. Type Example: Versalux Green 2000 Insulated with Low-E, Visteon (Ford). **Note: Color will be a factor in approval.**
- B. Glazing Compounds and Preformed Glaze Sealants: Suitable type as approved for the installation, in accordance with Glazing Materials section of the FGJA Glazing Manual.
- C. Glazing Accessories: Provide miscellaneous materials such as cleaners, primers, setting blocks, spacers, filler rods, beads, etc., as required for complete installation.

DIVISION 8 - DOORS AND WINDOWS

SECTION 08800 - GLAZING

Part 3 - Execution

3.01 Installation:

A. Glazing-General:

1. Items to be glazed may be field-or shop-glazed, using glass of the quality and thickness specified or indicated. Preparation of surrounds and glazing, unless otherwise specified, shall be in conformance with the details and general conditions governing glazing in the FGMA Glazing Manual, beads or stops which are furnished with the items to be glazed shall be used to secure the glass in place.
2. All glass shall be set with the waves parallel to the sill. Glass that has been misordered, i.e. with the width and height dimensions not properly correlated with the Drawing process in manufacturing, resulting in pronounced waviness at right angles to the sill, will be rejected.
3. Install plastic glass edging strips where indicated. Joints shall be as tight and imperceptible as possible.

B. Breakage: Replace all glass broken during or after setting. Breakage due to accident or carelessness or other will be charged to trade at fault.

C. Inspection: Prior to final acceptance of project, inspect all work done under this section and make all necessary adjustments, repairs or replacements of defective work, and clean all glass surfaces.

D. Clean-up: Remove all glass cuttings, scraps, packaging and rubbish upon completion of the work.

End of Section

DIVISION 9 - FINISHES

SECTION 09120 - CEILING SUSPENSION SYSTEMS

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Gypsum Wallboard - Section 09250
- B. Acoustical Treatment - Section 09500

1.03 Quality Assurance:

A. Standards:

- 1. American Society for Testing and Materials
 - a. ASTM C-635, Metal Suspension Systems for Acoustical Tile and Lay-In-Panel Ceilings.
 - b. ASTM C-636, Recommended Practice of Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In-Panels.
- 2. All materials to comply with NFPA 101, 16-3.3.2, where applicable.

B. Submittals:

- 1. Provide submittals in the form of samples, and documentation, to the Architect for review.

1.04 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Suspended Acoustical Ceiling - Exposed Grid: ASTM C-635, intermediate structural classification.
 - 1. Main Beams, Cross Tees and Concealed Members: .015 cold rolled zinc coated steel.
 - 2. Wall Angle: .020 cold rolled zinc coated steel.
 - 3. Special Members: Provide special shaped members as shown on the Drawings.
 - 4. Member Finish: Exposed surfaces shall be flat white low-gloss grid.
 - 5. Hanger Wire: No. 12 gauge cold drawn, annealed, galvanized.
 - 6. Accessories: Provide wall clips, hold-down clips (shall be removable without damage to boards; two each panels opposite sides), beam clamps leveling splines, hanger clips, splice plates), (keep to a minimum), for a complete installation.

DIVISION 9 - FINISHES

SECTION 09120 - CEILING SUSPENSION SYSTEMS

7. Acceptable Manufacturer: 200 Snap-Grid System, Chicago Metallic Corporation
- B. Suspended Gypsum Board Ceilings:
 1. Structural Channels: Cold-rolled, 16 gauge, galvanized steel.
 2. Furring Channels: Roll-formed, hat sections, 20 gauge.

Part 3 - Execution

3.01 General:

- A. Coordinate with electrical and mechanical contractors in placement of light fixtures, grilles, etc. to conform with ceiling pattern.
- B. Construct necessary scaffolding, adequate and safe, in accordance with applicable laws and ordinances. Maintain during this work and remove after completion.
- C. Provide thorough and competent foreman and skilled mechanics.

3.02 Installation:

- A. Suspended Acoustical Ceiling:
 1. Deflection of any component shall not exceed 1/360 of the span.
 2. Main tees shall be suspended on 48" centers by 12 gauge wire spaced not more than 48" o.c. along main tee.
 3. Cross tees shall be placed at 24" o.c. or as required by the Drawings.
 4. Install wall angles at intersection of suspended ceiling and all vertical surfaces. Miter corners where wall molding intersects.
 5. Install grid system and ceiling panels with faces in a plane.
 6. Provide intersection clips at intersection of all tees.
 7. Provide additional hangar wire at four corners of light fixtures.
 8. Provide additional hangar wires to insure proper placement and alignment of grid system.
 9. Prior to the final acceptance of the building, examine and adjust water level to be certain that all planes and lines are plumb, square and smooth. Replace all marked, marred or otherwise damaged materials.
- B. Suspended Gypsum Board Ceilings:
 1. Coordinate location of hangars with other work.
 2. Install ceiling framing independent of walls, columns and above ceiling work.
 3. Install ceiling framing system in accordance with manufacturer's recommendations.
 4. Reinforce openings in ceilings in accordance with

DIVISION 9 - FINISHES

SECTION 09120 - CEILING SUSPENSION SYSTEMS

manufacturer's recommendations.

5. Laterally brace entire suspension system where required.

3.03 Clean-Up:

A. Completely remove from the job site, at the completion of the work, all cartons, packaging, etc., and all other scraps and waste caused by this trade.

End of Section

DIVISION 9 - FINISHES

SECTION 09120 - CEILING SUSPENSION SYSTEMS

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Gypsum Wallboard - Section 09250
- B. Acoustical Treatment - Section 09500

1.03 Quality Assurance:

A. Standards:

1. American Society for Testing and Materials
 - a. ASTM C-635, Metal Suspension Systems for Acoustical Tile and Lay-In-Panel Ceilings.
 - b. ASTM C-636, Recommended Practice of Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In-Panels.
2. All materials to comply with NFPA 101, 16-3.3.2, where applicable.

B. Submittals:

1. Provide submittals in the form of samples, and documentation, to the Architect for review.

1.04 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Suspended Acoustical Ceiling - Exposed Grid: ASTM C-635, intermediate structural classification.
 1. Main Beams, Cross Tees and Concealed Members: .015 cold rolled zinc coated steel.
 2. Wall Angle: .020 cold rolled zinc coated steel.
 3. Special Members: Provide special shaped members as shown on the Drawings.
 4. Member Finish: Exposed surfaces shall be flat white low-gloss grid.
 5. Hanger Wire: No. 12 gauge cold drawn, annealed, galvanized.
 6. Accessories: Provide wall clips, hold-down clips (shall be removable without damage to boards; two each panels opposite sides), beam clamps leveling splines, hanger clips, splice plates), (keep to a minimum), for a complete installation.

DIVISION 9 - FINISHES

SECTION 09120 - CEILING SUSPENSION SYSTEMS

7. Acceptable Manufacturer: 200 Snap-Grid System, Chicago Metallic Corporation
- B. Suspended Gypsum Board Ceilings:
 1. Structural Channels: Cold-rolled, 16 gauge, galvanized steel.
 2. Furring Channels: Roll-formed, hat sections, 20 gauge.

Part 3 - Execution

3.01 General:

- A. Coordinate with electrical and mechanical contractors in placement of light fixtures, grilles, etc. to conform with ceiling pattern.
- B. Construct necessary scaffolding, adequate and safe, in accordance with applicable laws and ordinances. Maintain during this work and remove after completion.
- C. Provide thorough and competent foreman and skilled mechanics.

3.02 Installation:

- A. Suspended Acoustical Ceiling:
 1. Deflection of any component shall not exceed 1/360 of the span.
 2. Main tees shall be suspended on 48" centers by 12 gauge wire spaced not more than 48" o.c. along main tee.
 3. Cross tees shall be placed at 24" o.c. or as required by the Drawings.
 4. Install wall angles at intersection of suspended ceiling and all vertical surfaces. Miter corners where wall molding intersects.
 5. Install grid system and ceiling panels with faces in a plane.
 6. Provide intersection clips at intersection of all tees.
 7. Provide additional hangar wire at four corners of light fixtures.
 8. Provide additional hangar wires to insure proper placement and alignment of grid system.
 9. Prior to the final acceptance of the building, examine and adjust water level to be certain that all planes and lines are plumb, square and smooth. Replace all marked, marred or otherwise damaged materials.
- B. Suspended Gypsum Board Ceilings:
 1. Coordinate location of hangars with other work.
 2. Install ceiling framing independent of walls, columns and above ceiling work.
 3. Install ceiling framing system in accordance with manufacturer's recommendations.
 4. Reinforce openings in ceilings in accordance with

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manufacturer's recommendations.

5. Laterally brace entire suspension system where required.

3.03 Clean-Up:

A. Completely remove from the job site, at the completion of the work, all cartons, packaging, etc., and all other scraps and waste caused by this trade.

End of Section

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SECTION 09250 - GYPSUM WALLBOARD

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

A. Standards:

1. American Society for Testing and Materials:

- a. ASTM C-36, Gypsum Wallboard
- b. ASTM C-475, Joint Treatment for Gypsum Wallboard Construction.

B. Federal Specifications:

- 1. FS-SS-L-30D, Type III, Grade X, Class 1, Gypsum Wallboard.

1.03 Submittals:

- A. Provide submittals in the form of samples, and documentation, to the Architect for review.

1.04 Product Delivery, Storage and Handling:

- A. All materials shall be delivered to the job site with manufacturer's labels intact and stored in an enclosed shelter providing protection from damage and exposure to the elements.

Part 2 - Products

2.01 Gypsum Wallboard:

- A. Type: Fire-rated, ASTM C-36.
- B. Size: 5/8" thick x 48" wide x 96" or as required.
- C. Edges: Tapered.
- D. Location: All gypsum board.

2.02 Fasteners:

- A. Screws: Self-drilling, self-tapping, bugle head, Type S.
- B. Nails: Annular ring: GWB-54.

2.03 Joint Treatment Materials:

- A. Joint Tape: Perforated Tape, ASTM C-475.
- B. Joint Compound: ASTM C-475.

2.04 Accessories:

- A. Metal Edge: Similar to United States Gypsum Trim No. 402.

Part 3 - Execution

3.01 Installation:

- A. Apply gypsum board to horizontal surfaces first, then to vertical.
- B. Install gypsum board parallel to studs at vertical surfaces.
- C. To minimize joints, use panels of maximum practical lengths.
- D. Position all ends and edges of gypsum board over nailing or fastening members. Fit ends and edges closely; do not force

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SECTION 09250 - GYPSUM WALLBOARD

- together. Stagger end joints.
- E. Cut ends, edges, scribe or make cutouts within field of panel in a workmanlike manner.
 - F. Install trim at all intersections of gypsum board and other surfaces. Provide corner bead at all vertical or horizontal corners.
 - G. Fasteners:
 - 1. Drive fasteners in field of panel first, work toward ends and edges.
 - 2. Perimeter fasteners shall be a least 3/8" from ends and edges.
 - 3. Attach panels to wood framing members with specified nails spaced out 8" for ceiling, and 8" o.c. at ends and 12" o.c. at each support.
 - 4. Drive nail head slightly below surface of panel in a uniform dimple without breaking face paper.
 - 5. Screw fasteners shall be spaced 12" o.c. at each support in the field of the board and 8" o.c. at all edges and ends.
 - 6. Screws shall be power-driven with an electric screwdriver and screw heads shall provide a slight depression below surface of panel without breaking face paper.
- 3.02 Joint Treatment:
- A. Treat all exposed joints and trim with a three-coat approved system applied in strict accordance with manufacturer's recommendations.
- 3.03 Clean-Up:
- A. Use all necessary care during execution of the Work of this Section to prevent undue scattering of drywall scraps and dust and to prevent tracking of joint and finishing compounds onto floor surfaces. On completion of each installation segment in a room or space, promptly pick up and remove from the working area all scraps, debris and surplus material.

End of Section

DIVISION 9 - FINISHES

SECTION 09300 - TILE

Part 1 - General

1.01 Work Included:

- A. All materials, labor services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. Tile Council of America:
 - a. Handbook for Ceramic Tile Installation.
 - 2. American National Standards Institute:
 - a. ANSI A108.6, Ceramic Tile installed with Epoxy Mortar.
 - b. ANSI A108.4, Ceramic Tile installed water-resistant organic adhesive.
 - c. ANSI A108.5, Ceramic Tile installed with latex Portland Cement.
 - d. ANSI A118.4, Latex Portland Cement Mortar.
 - e. ANSI A118.3, Epoxy Mortar and Grout.
 - f. ANSI A136.1, Type 1 Organic Adhesive.
 - g. ANSI A137.1, Ceramic Tile.
 - 3. American Society for Testing and Materials:
 - a. ASTM C-144, Aggregate.
 - b. ASTM C-150, Portland Cement, Type 1.
 - c. ASTM C-206, Special Finish Hydrated Lime.
- B. All materials shall meet IBC 2009, where applicable.
- C. Floor surfaces and elevation changes shall comply with ADAABAAG 302 and 303.
- D. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum.
 - 2. Step Treads: Minimum.
 - 3. Ramp Surfaces: Minimum.
- E. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- F. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- G. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Joint sealants.

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SECTION 09300 - TILE

3. Cementitious backer units.
4. Metal edge strips.

1.03 Submittals:

- A. Submit samples of all tile and grout specified under this section for approval and color selection prior to installation.
- B. Submit a "Master Grade Certificate" bearing signatures of both manufacturer and contractor.
- C. Submit tile manufacturer's maintenance guides for owner's use in maintaining all tile work specified in this section.
- D. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- F. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- G. Samples for Verification:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 24 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
 3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch lengths.
 5. Metal edge strips in 6-inch lengths.
- H. Qualification Data: For qualified Installer.
- I. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- J. Product Certificates: For each type of product, signed by product manufacturer.
 1. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.04 Product Delivery, Storage and Handling:

- A. Deliver all materials to job site in manufacturer's unopened containers with grade seal unbroken and labels intact. Keep containers dry. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be

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SECTION 09300 - TILE

- avoided.
 - D. Store liquid materials in unopened containers and protected from freezing.
 - E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- 1.05 Project Conditions:
- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- 1.05 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

- 2.01 General:
- A. All tile shall be standard grades conforming to ANSI 137.1
 - B. Both glazed and unglazed ceramic tile shall be manufactured by the same manufacturer.
 - C. **Refer to Color Schedule for tile color. Colors will a determining factor in tile approval.**
 - D. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
 - E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
 - G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Olean; Division of Dal-Tile International Inc.
 2. Crossville, Inc.
 3. Daltile; Division of Dal-Tile International Inc.

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SECTION 09300 - TILE

2.02 Ceramic Tile:

- A. Wall Tile and Floor Tile:
 - 1. Type: Polished porcelain at walls and unpolished porcelain at floors.
 - 2. Nominal Face Size: 12" x 24" - orient as per Drawings.
 - 3. Edge: All-purpose cushion.
 - 4. Acceptable Manufacturer: American Olean - Ultra Modern.
- B. Trim Shapes and Bases:
 - 1. Type: Same as floor tile.
 - 2. Includes bases, caps, stops, returns, trimmers and other shapes to finish installation.
 - a. Cove Base for Thin-Set Mortar Installations: Straight, module size 6 by 12 inches.
 - b. External Corners for Portland Cement Mortar Installations: radius stainless steel metal trim pieces at all outside corners.
 - c. External Corners for Thin-Set Mortar Installations: radius stainless steel metal trim pieces at all outside corners.
 - d. Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
- C. Setting Materials:
 - 1. Epoxy Mortar: ANSI A118.3
 - 2. Organic Adhesive: ANSI A136.1
 - 3. Latex Portland Cement Mortar: ANSI A118.4
 - 4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Boiardi Products; a QEP company.
 - b. Bonsai American; an Oldcastle company.
 - c. Bostik, Inc.
 - d. C-Cure.
 - e. Custom Building Products.
 - f. Jamo Inc.
 - g. Laticrete International, Inc.
 - h. MAPEI Corporation.
 - i. Southern Grouts & Mortars, Inc.
 - j. Summitville Tiles, Inc.
 - k. TEC; a subsidiary of H. B. Fuller Company.
- D. Grouting Materials:
 - 1. Floor Tile: Epoxy Grout.
 - 2. Wall Tile: Portland Cement Type.
 - 3. Manufacturers: Subject to compliance with requirements,

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available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Boiardi Products; a QEP company.
- b. Bonsai American; an Oldcastle company.
- c. Bostik, Inc.
- d. C-Cure.
- e. Custom Building Products.
- f. Jamo Inc.
- g. Laticrete International, Inc.
- h. MAPEL Corporation.
- i. Southern Grouts & Mortars, Inc.
- j. Summitville Tiles, Inc.
- k. TEC; a subsidiary of H. B. Fuller Company.

E. Granite Thresholds:

1. Type: Polished granite.
2. Size: 1 1/4" wide x 1/2" high, double-beveled.
3. Location: Provide marble threshold at centerline of doors at transition between ceramic tile flooring and carpet tile / exposed concrete.

F. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.

1. Color and Finish: Match adjoining glazed wall tile.

G. Elastomeric Sealants:

1. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
 - a. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, 0; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the

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following:

1. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
2. Dow Corning Corporation; Dow Corning 786.
3. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
4. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
5. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
6. Tremco Incorporated; Tremsil 600 White.

H. Miscellaneous Materials:

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for required applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 - b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
4. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 1. Bonsai American; an Oldcastle company; Grout Sealer.

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2. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
3. C-Cure; Penetrating Sealer 978.
4. Custom Building Products; Grout Sealer.
5. Jamo Inc.; Penetrating Sealer.
6. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout and 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
7. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
8. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
9. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

Part 3 - Execution

3.01 Examination:

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.0 for installations indicated.
 2. Verify that concrete substrates for tile floors installed with adhesives or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Preparation:

- A. Fill cracks, holes, and depressions in concrete substrates

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for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tilesetting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.02 Installation:

- A. All workmanship and materials shall conform in all respects to specifications and requirements and in accordance with the standard practice of the Tile Council of America.
- B. All ceramic floor tile shall be installed using the following Tile Council of America specifications.
 - 1. Floor Tile, TCA F131-2K (Concrete).
- C. Provide all required trim shapes such as cove, bullnose, angles, etc., to module with field tile, unless otherwise noted on Drawings. All corners bullnosed.
- D. Layout all tile work as to minimize cuts less than one-half tile in size. Align all joints to give straight uniform grout lines, plumb and level or parallel with walls. Strike all joints with a rounded, non-staining tool.
 - 1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - 2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 - 3. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Layout tile work and center tile fields in both directions in each space or on each wall area. Layout tile work to minimize the use of pieces

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- that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- a. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - b. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
4. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - a. Wall Tile: 1/16 inch.
 - b. Decorative Thin Wall Tile: 1/16 inch.
 5. Layout tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
 6. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
 7. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - b. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in dry-set portland cement mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.
 1. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
 8. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- E. Slope entire room or area to floor drains.

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3.03 Tile Backing Panel Installation:

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.04 Waterproofing Installation:

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 Cleaning and Protecting:

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- E. Immediately prior to final inspection, replace all damaged tile.

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- F. Contractor will supply 2% of the total quantity of each tile used. Contractor will supply 3% of the total quantity of each grout used. Place materials in clean marked containers for future use at building.

End of Section

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SECTION 09500 - ACOUSTICAL TREATMENT

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Related Work Specified Elsewhere:

- A. Ceiling Suspension Systems - Section 09120

1.03 Quality Assurance:

A. Standards:

1. American Society for Testing and Materials:
 - a. ASTM C-636 Recommended Practice of Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - b. ASTM E-84 Surface Burning Characteristics of Building Materials.
2. Federal Specifications:
 - a. SS-S-118B, Sound Controlling Blocks and Boards. Underwriter's Laboratories, Inc.

B. Submittals:

1. Provide submittals in the form of samples, and documentation, to the Architect for review.

1.04 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers**

Part 2 - Products

2.01 Acoustical Ceiling Panels:

A. 2x2 Tile - Square Edge:

1. Type: FS-SS-S-118B, Class 25
2. Size: 24" x 24" x 5/8". Provide special sizes as indicated on Drawings or as required by others.
3. Finish: Board finish shall be a factory-applied white latex paint, medium textured non-direction fissured surface with a minimum light reflection of 80%.
4. Noncombustibility: Board shall meet class 25-Federal Specification SS-S-118B, ASTM E-84; and, classified by Underwriter's Laboratories for Flame Spread Index 0-25.
5. Type Example and Manufacturer:
 - a. Armstrong Fine Fissured No. 1728, square (2x2)

B. 2x2 Tile - Tegular Edge:

1. Type: FS-SS-S-118B, Class 25
2. Size: 24" x 24" x 5/8". Provide special sizes as indicated on Drawings or as required by others.

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3. Finish: Board finish shall be a factory-applied white latex paint, medium textured non-direction fissured surface with a minimum light reflection of 80%.
4. Noncombustibility: Board shall meet class 25-Federal Specification SS-S-118B, ASTM E-84; and, classified by Underwriter's Laboratories for Flame Spread Index 0-25.
5. Type Example and Manufacturer:
 - a. Armstrong Fine Fissured No. 1732, beveled tegular 2x2).

Part 3 - Execution

3.01 Installation:

- A. Install in specified grid system per ASTM C-636 and manufacturer's recommendations, as shown on the Drawings.
- B. Provide ten (10) pieces of ceiling panels in cartons for future use. Panels shall be in perfect condition.

End of Section

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SECTION 09650 - RESILIENT FLOORING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Installation Qualification: contractors for floor covering installation shall be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified with a minimum of three years of documented experience. Installer shall be trained by flooring manufacturer and - if applicable - certified to install the specified flooring by the manufacturer.
- B. Manufacturer Qualifications: company specializing in manufacturing the specified flooring with minimum three years documented experience.

1.03 Submittals:

- A. Submit product data for each type of product indicated.
- B. Submit samples for color selection / verification.
- C. Maintenance Data and Instructions Furnish manufacturer's recommended maintenance methods and procedures.

1.04 Delivery, Storage, and Handling:

- A. Store resilient products and installation materials in dry spaces protected from the weather, at temperatures required by the product manufacturer. Store tiles on flat surfaces.

Part 2 - Products

2.01 General:

- A. Refer to color schedule - available tile colors WILL be a factor in product acceptance.

2.02 Materials:

- A. Resilient Floor Tile:
 - 1. Type Example: Luxury Vinyl Composition Tile (LVT-1 and LVT-2) as manufactured by Armstrong World Industries, Inc.
 - 2. Size: 18" x 36".
 - 3. Thickness: 0.125 inch.
 - 4. Pattern: Natural Creations Mystix.
 - 5. Location: as shown on the Drawings.
 - 6. Colors: refer to Drawings.
- B. Rubber Cove Base: ASTM F 1861, Type TP-Rubber as manufactured by Armstrong Cork Company or approved equal.
 - 1. Size: 4" high x .018 gauge.
 - 2. Provide preformed inside and outside corners.

DIVISION 9 - FINISHES

SECTION 09650 - RESILIENT FLOORING

- C. Edging Strips and Tile Reducers: size and length as required.
- D. Primer and Adhesive: As recommended by manufacturer of resilient floor tile for this particular project. All wall base and reducer strips shall be applied with epoxy adhesive.
- E. Cleaner or other finishing material: As recommended by flooring manufacturer for the particular type of floor material.

Part 3 - Execution

3.01 Installation:

- A. Comply with manufacturer's written instructions for installing specified tile flooring.
- B. The Contractor shall be responsible for the manufacturer's representative making mat moisture and PH tests and reporting condition of concrete slab to the Architect in writing prior to placing floor materials.
- C. Carefully examine the surfaces on which the above materials are to be applied, report to Architect in writing any unsatisfactory surface and do not begin work until all defective surfaces have been corrected. Otherwise, the Contractor shall assume responsibility for all failures and defects resulting from such defective surfaces.
- D. Installation shall not begin until the work of all other trades, including painting, has been completed. The Contractor shall maintain all rooms and sub-floors at a minimum of 70 degrees F. for several days before and after application of tile.
- E. The floor shall be thoroughly cleaned and any pockets or cracks shall be filled in accordance with manufacturer's instructions flush with floor surface.
- F. The material shall be applied in a first class, workmanlike manner by skilled mechanics experienced in this type of work.
- G. Primer and adhesive shall be as recommended by the manufacturer of the flooring for this particular project. The adhesive for applying all materials shall be waterproof and shall be furnished and guaranteed by the flooring manufacturer.
- H. Lay tile from center of room or space, working toward perimeter, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid cut widths of less than 3 inches at room perimeter. Lay tile square to room axis.

DIVISION 9 - FINISHES

SECTION 09650 - RESILIENT FLOORING

- I. Fit floor material neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.
 - J. Install reducer at each transition from tile to concrete floor.
 - K. After the flooring has been installed and before the waterproof adhesive has thoroughly set, the surface shall be rolled both ways with rollers made for this purpose, and all excess adhesive on the surface or in the joints shall be removed and the entire surface shall be left perfectly clean.
- 3.02 Cleaning and Waxing:
- A. When, in the opinion of the Contractor, the flooring has sufficiently sealed itself to permit cleaning, the floors shall be thoroughly cleaned with a neutral cleaner as recommended by the manufacturer of the flooring used. After the floors have been cleaned, the Contractor shall protect the floors either with building paper or by keeping traffic off the floors until the building is ready for occupancy.
- 3.03 Replacement Tile and Base:
- A. Provide enough spare floor tile, of each major color, in cartons to cover 50 square feet for future use. Provide 20 linear feet of spare rubber wall base. Resilient floor tile and wall base shall be in perfect condition.

End of Section

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

Part 1 - General

1.01 Work Included:

- A. Work includes but is not limited to providing carpet tile and installation.

1.02 Quality Assurance:

A. Standards:

- 1. The carpet manufacturer shall have no less than fifteen years of production experience with modular carpet similar to type specified. Published product literature of carpet manufacturer must clearly indicate compliance of products with requirements of this section.

B. Installer Qualifications:

- 1. The installation provider must be directly responsible for the quality of the completed floor covering installation, including both the quality of the materials and labor used in the installation. The installation provider must directly warrant to owner that all products, materials and services related to the floor covering installation (including any floor covering(s), adhesive(s) and/or other products or materials used in the installation) will meet specifications set forth herein. The product warranty required herein must be provided directly by the carpet manufacturer.
- 2. The installation provider must have successful carpet installation experience similar to the work of this Section and be recommended, trained and approved by the carpet manufacturer.

1.03 Submittals:

- A. Manufacturer's Data - copies, as required, of carpet manufacturer's specifications and installation instructions for carpet and related items specified.
- B. Fiber Verification - Certification from the fiber producer verifying use of the premium branded, Post-Consumer Content Type 6 fiber in the submitted carpet product.
- C. All applicable product warranties provided by manufacturer.

1.04 Delivery and Storage:

- A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging to contain

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

- manufacturers name, identification number and related information.
- B. Product to be delivered as required by manufacturer. Store in pallet form as supplied by manufacturer. Do not stack pallets.
 - C. Store materials in area of installation for a minimum period of 48 hours prior to installation.
- 1.05 Installation Quality Assurance:
- A. Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in the installation of these materials.
 - B. Flooring contractor and sub-contractors must be approved by the architect and/or the carpet manufacturer.
 - C. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive carpet. The carpet installation standard will be as listed in The Carpet and Rug Institute's **Standard for Installation of Commercial Carpet CRI-104**.
 - D. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than one (1) year after job completion.
 - F. Qualifications of Installers: All work shall be done by installation firms specializing in commercial carpet installation. It is required, that the firm shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Floor Covering Installation Board (FCIB).
 - G. Floor temperatures must be a minimum of 65° for 24 hours prior to installation. Floor temperature can usually vary 5-10° lower than room temperature. Modules must be conditioned to room temperature for 24 hours prior to installation. Relative humidity must be between 10%-65% maximum for 24 hours prior to installation. These conditions must also be maintained for 48 hours after completion of installation.
 - H. All carpet modules must be installed in the order they were manufactured. Select pallets in sequential order and follow the numbers located on each carton of tiles. Typically, an installation will begin with the lowest

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

carton numbers and progress through the highest numbers until project is complete.

- I. Full Spread Adhesive System: Requires a full spread adhesive system for the most trouble free installation. Fully spread adhesive using a 1/32 x 1/16 x 1/16 "U" or "V" notch trowel. Allow to completely dry so adhesive does not transfer when touched. The proper amount of adhesive is mandatory to prevent the modules from shifting or moving.

1.06 Job Conditions:

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document.
- B. Carpet installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved, and completed.
- C. Site conditions shall include those specified in the carpet manufacturer's installation manual and shall also include sufficient heat, light, and power required for effective and efficient working conditions.

1.07 Extra Materials:

- A. Provide five percent (5%) extra material for shelf stock of carpet for each color and type specified.

1.08 Warranty - Carpet:

- A. Warranties must be the standard, printed warranties on the carpet manufacturer's letterhead. All warranty items to be full term, not pro-rated for the indicated period. All warranties must be issued by the manufacturer as standard published warranties on all types of carpet within this document. If the product fails to perform as warranted when properly installed and maintained according to procedures, the affected area will be repaired or replaced at the expense of the manufacturer. The carpet manufacturer, will provide standard published written performance warranties for the following:
 1. **Lifetime against excessive surface wear.** Excessive wear means no more than 10% loss of pile fiber weight measured before and after use as tested under ASTM D-3936.
 2. **Lifetime static protection,** meaning built-in protection below 3.0 kv as tested under AATCC-134.
- B. Carpet manufacturer shall warrant carpet manufactured with secondary backing for the useful life of the original installation against product failure from:

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

1. Tuft Bind (edge ravel, yarn pulls, zippering)
 2. Delamination
 3. Moisture Penetration
 4. Dimensional Stability
- C. All warranties to be sole source responsibility of the carpet manufacturer. Second source warranties that involve parties other than the carpet manufacturer are unacceptable.
- D. Warranties shall not be written only for this purchase or purchaser. All warranties shall be standard issue nationally of official documents.
- 1.09 Performance Insurance General:
- A. Flammability Requirements:
1. Pill Test / DOC-FF-1-70 (ASTM D-2589)
Requirement: Pass
 2. Flooring Radiant Panel / ASTM E-648
Requirement: Class 1 (Above .45 w/cm)
 3. Optical Smoke Density Test / NFPA-258 NBS Smoke Chamber (ASTM E-662)
Requirement: Less than 450, Flaming Mode
 4. Comply with the Carpet and Rug Institute (CRI) VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Test
- B. Face Fiber Characteristics for **all** Carpets
1. Bulked Continuous Filament (BCF),
 2. Acceptable Fiber Systems: as manufactured by Aquafil.
- C. Sustainable Carpet Assessment Standard:
1. NSF - 140 Gold.
 2. Carpet manufacturer and/or fiber producer must be a signatory of the National Carpet Recycling Agreement memorandum of understanding.
- 1.10 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

Part 2 - Products

2.01 General:

- A. Certified test reports shall be submitted by the carpet manufacturer, for all performance assurance specifications listed below.
- B. Requirements listed below must be met by all products being submitted for approval.
- C. All submitted test numbers should represent average for standard production goods.

2.02 Product Specification - Modular carpet tile shall meet the following specifications:

- A. Style: InterfaceFLOR
 - 1) Color "A" - Field: Open Air Neutrals 410 Colorline.
 - 2) Color "B" - Accent: Aerial Flying Colors AE317.
- B. Yarn: 100% Nylon (with minimum 4% post-consumer content and +/- 60% total recycled content)
- C. Dye Method: 100% Solution / Yarn Dyed
- D. Pile Thickness: 0.093 inch
- E. Density: 6,968
- F. Backing System: CQuest GB
- G. Color: refer to Room Finish Schedule.
- H. Special Treatments: ProTekt

2.03 Minimum Construction Standards:

- A. Nylon Specification - All nylon fiber shall be branded (premium) type 6 nylon from Aquafil with performance certification from the fiber manufacturer.
- B. Antimicrobial, registered by the EPA for use in carpeting with broad spectrum efficacy against the growth of bacteria and fungi for a minimum of 15 years, assuming proper maintenance. The antimicrobial ingredient shall meet standards set by the U.S. General Services Administration (GSA) for Antimicrobial Carpet as supported by independent lab testing less than six months old.
 - 1. Intersept (AATCC 138 Washed).
 - 2. The preservative should be incorporated into the primary latex coating of the product during the manufacturing process, not topically applied to the carpet fibers.

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

3. The antimicrobial treated carpet when new must pass GSA parameters for treated carpets via AATCC method 174 parts II and III. Initial performance must be 90% reduction of the microorganisms (Staphylococcus aureus 6538 and Klebsiella pneumoniae 4352) and no fungal growth on either the primary backing or fibers both on washed (AATCC method 174) and non-washed samples.
4. The antimicrobial treated carpet must maintain, for the warranted life of the carpet, a minimum of 90% reduction of the microorganisms (Staphylococcus aureus 6538 and Klebsiella pneumoniae 4352) listed in AATCC method 171 part II, provided the carpet is maintained as specified. Additionally, the antimicrobial treated carpet must maintain a "no macroscopic growth" rating against Aspergillus niger 6275 at the primary backing in accordance with AATCC 171 part III.
5. The preservative must be environmentally responsible i.e. (biodegradable and not toxic to non-target species).
6. Efficacy of the preservative should be documented in professional peer reviewed scientific publications.

2.04 Related Carpet Materials:

- A. Leveling compound - Latex type as recommended by carpet manufacturer. Must be compatible with carpet adhesive and curing/sealing compound on concrete.
- B. Releasable pressure sensitive type adhesive - Adhesive must be water-based and allow for removal of carpet tile at any time without damage to carpet or substrate. Adhesive must contain antimicrobial preservative and have "zero" calculated VOC's.
- C. Carpet edge guard, non-metallic - Extruded or molded heavy duty vinyl or rubber carpet edge guard of size and profile indicated, and with minimum two inch wide anchorage flange; colors selected by architect/designer from among standard colors available within the industry.
- D. Miscellaneous materials - As recommended by manufacturer of carpet. Other carpeting products to be selected by installation provider to meet project requirements.
- E. Electrostatic (Dissipation low-generation):
 1. < 3.0 KV (AATCC 16-E).
- F. Lightfastness:
 1. ≥ 4.0 @ 60 AFU's.

DIVISION 9 - FINISHES

SECTION 09681 - CARPET TILE

Part 3 - Execution

3.01 Installation:

A. General

1. Comply with manufacturer's instructions and recommendations for uniformity of direction.
2. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
3. Provide cut outs where required. Conceal cut edges with protective edge guards or overlapping flanges.
4. Run carpet under open bottom items such as heating convectors and install tight against walls, columns and cabinets so that the entire floor area is covered with carpet. Cover over all floor type door closures.
5. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
6. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed.
7. Use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4'0" of feather.
8. Expansion joints - Do not bridge building expansion joints with continuous carpeting.

B. Installation

1. Install carpet according to carpet manufacturer's printed instructions and in accordance with the Carpet and Rug Institute's Installation Standard.

3.03 Cleaning and Protection:

- A. On completion of the installation in each area, all dirt, carpet scraps, etc. must be removed from the surface of the carpet.
- B. Remove debris, and sort pieces to be saved from scraps to be redirected and recycled.
- C. Construction manager shall protect carpeting against damage during construction.

3.04 Inspection:

- A. Upon completion of the installation, verify that work is complete, properly installed and acceptable.

End of Section

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this entire section of the work.
- B. Consult Drawings, finish schedules, details and specification section.

1.02 Quality Assurance:

- A. All painted surfaces shall be uniform in color, texture and finish to the satisfaction of the Architect.

1.03 Submittals:

- A. Submit manufacturer's specifications, including paint label analysis and application instructions for each material specified.
- B. Submit color samples for review of color and texture.
- C. Provide samples of all natural and stained wood finishes.
- D. Final samples: Prepare samples of finishes on the job to the satisfaction of the Architect. If required, a 4' x 8' portion of wall surface finished as final sample.

1.04 Product Deliver, Storage and Handling:

- A. Materials shall be delivered to the project site in strong, undamaged, waterproof containers with manufacturer's label intact. Materials in previously opened or unsealed containers, are not acceptable.
- B. Include on label of container: Manufacturer's name, type of paint, number and application instructions.
- C. Immediately upon delivery to the project site, all painter materials shall be stored and locked in a watertight shed with floor well off the ground. The shed shall remain locked at all times except for adding or removing materials.
- D. No materials of any manufacturer will be allowed on the project site any time during construction except those of the manufacturers specified or approved by the Architect.

1.05 Job Conditions:

- A. Comply with manufacturer's recommendations as to environmental conditions under which coating and coating systems can be applied.
- B. Do not apply finishes in areas where dust is being generated or where work in progress may affect finish quality.
- C. Protect finished work of other trades, and all surfaces not being painted concurrently, or not to be painted.

Part 2 - Products

2.01 General:

- A. The following specifications for Finishes is not intended to mention every particular item which will receive painter finish, but is intended to establish type and quality of finish which shall be required on various materials.
- B. **Products of Sherwin-Williams are specified herein to simplify descriptions of types and qualities of finishes required only.**

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.

- C. Wherever the abbreviation "SW" appears in the following detailed specification, it shall be understood to mean Sherwin-Williams.
 - D. Primers shall be as specified by manufacturers of finish paint used and as approved by the Architect.
- 2.02 Acceptable Manufacturers:
- A. Sherwin-Williams.
 - B. PPG Industries.
 - C. Cook Paint and Varnish Co.
 - D. Pratt and Lambert.
 - E. Kelly-Moore.
- 2.02 Exterior Finishes:
- A. Enamel on Ferrous Metals:
 - 1. One coat SW Kem Kromik Primer, (Alkyd primer).
 - 2. Two coats SW Industrial Enamel, (Alkyd gloss enamel).
 - B. Enamel on Exterior Door Frames and Doors:
 - 1. Shop coat by others-touch up as required.
 - 2. Two coats SW Industrial Enamel, (Alkyd gloss enamel).
 - C. Enamel on Galvanized Metal:
 - 1. One Coat SW Galvite primer.
 - 2. 2 Coats SW Industrial Enamel, (Alkyd gloss enamel).
 - D. Enamel on Exterior Concrete Block:
 - 1. One coat SW Promar Latex Block Filler B25W25.
 - 2. Two coats SW A-100 Semi-Gloss Latex Enamel.
- 2.03 Interior Finishes:
- A. Enamel on Metal: All miscellaneous and ornamental metal items which are left exposed, hollow metal doors and frames.
 - 1. Shop coat by others - touch up as required.
 - 2. Two coats SW Promar 200 Semi-Gloss. Enamel, (Alkyd semi-gloss enamel).
 - B. Enamel on Concrete Block:
 - 1. One coat SW Promar 200 Block Filler (vinyl acrylic latex).
 - 2. Two coats SW Promar 200 Semi-Gloss Enamel.
 - C. Enamel on Gypsum Board Ceilings/Facias/Walls
 - 1. One coat SW Promar 200 Wall Primer with Medium Texture. (Vinyl Acrylic Latex Wall Primer.)
 - 2. Two coats SW Promar 200 Semi-Gloss Latex Enamel.
 - D. Tape and Float: Joints on Gypsum Board.
 - 1. As per manufacturer's instructions.
 - 2. All joints shall be sanded ready for primer's finish.
 - E. Interior Millwork and Cabinetry:
 - 1. One coat SW Promar 200 Alkyd Enamel Primer/Undercoat.
 - 2. Two coats SW Promar 200 Semi-Gloss Latex Enamel.
 - F. Enamel on Wood Trim:
 - 1. One coat SW Promar 200 Alkyd Enamel Primer/Undercoat.
 - 2. Two coats SW Promar 200 Semi-Gloss Latex Enamel.
 - G. Back-Painting, Interior Work:
 - 1. Two coats SW Promar 200 Alkyd Enamel Primer/Undercoat.

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

- H. Enamel on Exposed Metal Piping:
 - 1. One coat SW Galvite primer.
 - 2. Two coats SW Promar 200 Semi-Gloss Latex Enamel.

Part 3 - Execution

3.01 Inspection:

- A. Notify Contractor of any surface not in proper condition to be finished before proceeding with the work. Starting work will constitute the painter's acceptance of preceding work, and conditions under which finish will be applied and his assumption of responsibility for results to be obtained.

3.02 Preparation of Surfaces:

- A. Wood:
 - 1. Sand to a smooth even surface, then dust off.
 - 2. Touch-up knots, resinous spots, etc., on all surfaces with shellac 18 hours before applying prime coat.
 - 3. Fill nail holes, cracks and blemishes flush after priming coat has dried.
- B. Concrete Block and Concrete:
 - 1. Repair cracks and irregularities to provide uniform surface texture.
- C. Ferrous Metal Surfaces:
 - 1. Remove rust and scale, clean grease or oil surfaces with turpentine or benzine before painting.

3.03 Application:

- A. Number of coats and quality of finish shall be in accordance with these specifications, which requires the use of material which will product first quality finish if properly applied.
- B. Apply coats of material in strict accordance with manufacturer's currently published specifications, except where requirements of these specifications are in excess or manufacturer's requirements.
- C. Except as otherwise approved by the Architect, the first two coats of painter's finish shall be applied by roller or brush application. Finish coats may be applied by spray application.
- D. Comply with recommendation of product manufacturer for drying time between succeeding coats allow additional as required until finish is dry.
- E. All work where a coat of material has been applied must be inspected and approved before application of succeeding coat, otherwise, no credit for the coat well be given. Notify Architect when a particular coat has been completed for inspection and approval.
- F. Shellacs, oils, turpentine, etc., shall be of the highest quality and subject to approval of Architect. Materials shall be mixed in and applied directly from containers which they are purchased except when use of other containers is approved.
- G. First Coat of all finishes, except of varnish and stains, shall be white.
- H. Sand lightly between coats where shellac, varnish or enamel

DIVISION 9 - FINISHES

SECTION 09900 - PAINTING

is used.

- I. Remove all hardware, accessories, machined surfaces, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations.
- 3.04 Clean-up:
- A. Clean and paint spots from work and touch-up or otherwise repair any defective or damaged work.
 - B. Remove all surplus materials and equipment after work is completed.
 - C. Leave entire job clean and acceptable to the Architect.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10100 - CHALKBOARDS AND TACKBOARDS

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. American Society for Testing and Materials:
 - a. ASTM A-424, Steel Sheets for Porcelain Enameling.
 - 2. Federal Specifications:
 - a. LL-B-810B, Hardboard.
 - 3. Military Specifications:
 - a. MIL-C-15116C, Cork Sheet.

1.03 Submittals:

- A. Shop Drawings: Submit dimensioned shop Drawings indicating location, type, size, arrangement, adhesive, backing, anchor or mounting details, trim, and accessories.
- B. Submit samples showing the full range of colors available for each unit.

Part 2 - Products

2.01 Materials:

- A. Porcelain Enamel Steel Markerboards:
 - 1. Type: Factory-built aluminum framed unit.
 - 2. Construction: Factory LCS face on 24 gauge steel laminated to 3/8" hardboard with .015 aluminum back-up.
 - 3. Color: LCS faces shall be white.
 - 4. Trim: Provide "H" bar joint cover at adjacent panels, color to match narrow leg showing, map rail with cork inserts and chalk trough.
 - 5. Accessories: Provide two map hooks with paper clips at each chalkboard unit.
 - 6. Mounting System: Concealed metal spline system. **At exterior walls provide "stand-off" mounting brackets to prevent condensation behind boards.**
- B. Tackboard:
 - 1. Type: Factory-built aluminum framed unit.
 - 2. Construction: Vinyl covered surface bonded to a 2" thick insulation board core, with a 7/8" x 5/8" aluminum frame. Refer to Color Schedule.
 - 3. Mount System: Manufacturer's standard.
 - 4. Acceptable manufacturer: Best-Rite Vin-Tak tackboards.

DIVISION 10 - SPECIALTIES

SECTION 10100 - CHALKBOARDS AND TACKBOARDS

Part 3 - Execution

3.01 Installation:

- A. Install units straight, plumb, and level with metal splice system. Refer to Drawings.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10400 - INTERIOR SIGNAGE

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this entire section of the work.

1.02 Quality Assurance:

- A. Standards:
 - 1. UFAS Fed. Std. 795-Requirements for the physically handicapped.
 - 2. MIL Spec. L-P-387a, type NDP, rated self-extinguishing, for sign materials.

1.03 Submittals:

- A. Provide manufacturer's catalog cut and data sheets, complete parts list and installation requirements for each item specified.
- B. Schedules: Indicate location and placement for all graphic items.

1.04 Product Delivery, Storage and Handling:

- A. Handle and store all items with care to prevent damage and injury to finish surfaces.

Part 2 - Products

2.01 Products of the manufacturers listed below have been specified herein to simplify descriptions of design, construction, and materials only. All items have been selected for visual and performance design quality which shall serve as a basis for acceptance of equivalent products by other manufacturers.

2.02 Signage System:

- A. Material: 1/8 inch thick, type ES melamine plastic.
- B. Size: 8" x 8" x 1/8", with 1/2" radius corners. Custom design - refer to 2.04 for text and symbols.
- C. Mounting: All graphics shall be permanently mounted to wall or door surface with tamper resistant screws.
- D. Color: refer to Color Schedule, submit color samples with submittals, prior to approval. **Colors will be a factor in product acceptance.**
- E. Letter Style: Helvetica Medium.
- F. Standard Grade 2 braille shall be below all copy, all signs.
- G. All graphic material shall meet the requirements of UFAS Fed. Std. 795, and MIL spec L-P-387a.
- H. Acceptable Manufacturer: Series 200A, Type D format, Mohawk Sign systems.

DIVISION 10 - SPECIALTIES

SECTION 10400 - INTERIOR SIGNAGE

2.03 Plaque Groupings Required (letter designation refers to 2.04):

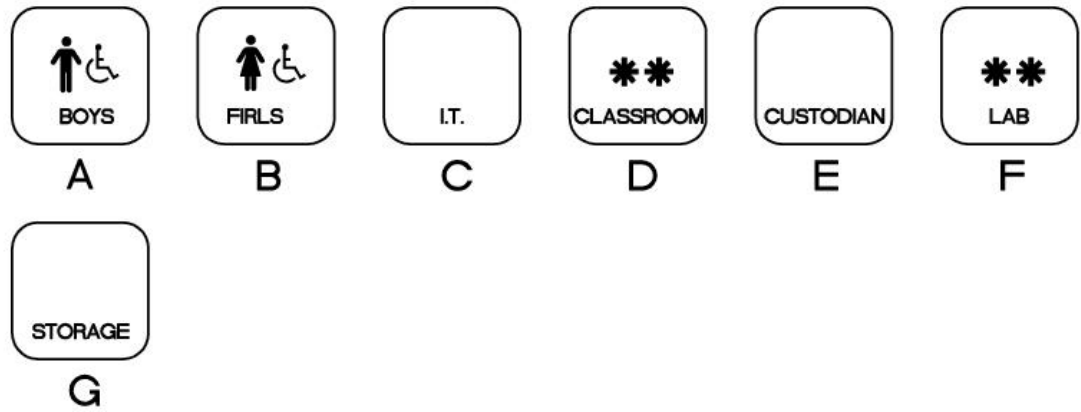
<u>Quantity</u>	<u>Plaque</u>	<u>Mounting Location</u>
-----------------	---------------	--------------------------

**Coordinate location with Architect

Plaque	Quantity	Location
A	1	@ room no. 11
B	1	@ room no. 12
C	1	@ door no. 16
D	6	@ doors no. 10, 11, 12, 13, 14, & 15
E	1	@ door no. 17
F	6	@ doors no. 20, 23, 24, 27, 28, & 31
G	1	@ door no. 9

SECTION 10400 - INTERIOR SIGNAGE

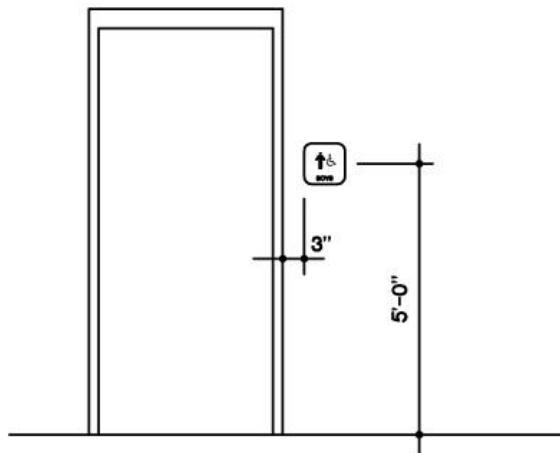
2.04 Signage Plaques Required:



** INDICATES ROOM NUMBER TO BE COORDINATED WITH ARCHITECT AND OWNER

Note: all signage plaques shall have grade 2 braille translations under text.

2.05 Typical Mounting:



Mounting Height

Typical Wall Location

Verify location with architect.

DIVISION 10 - SPECIALTIES

SECTION 10400 - INTERIOR SIGNAGE

Part 3 - Execution

3.01 Installation:

- A. Comply with manufacturer's installation instructions and details on the Drawings. Set all units plumb and level in location indicated on the Drawings or as directed.
- B. Provide all necessary accessories: Items to support or attach Identifying Devices to result in a complete installation.
- C. Protect all signage plaques to prevent damage after installation.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10420 - LETTERS AND PLAQUES

Part 1 General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary for the completion of this entire section of the work.

1.02 Submittals:

- A. Shop Drawings: Indicate details and dimensions of fabrication and installation including layouts and assemblies. Begin fabrication only after receiving approved shop Drawings.
- B. Manufacturer's Literature: Descriptive literature and installation instructions.

1.03 Product Delivery, Storage, and Handling:

- A. Handle and store all items with care to prevent damage and injury to finish surfaces.

Part 2 - Products

2.01 Cast Metal Plaque at interior location:

- A. Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish, and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Coordinate final design with Architect.
 1. Metal: aluminum.
 2. Border Style: Type 504.
 3. Background Texture: manufacturer's standard No. 2 black pebble texture.
 4. Letter Style: Helvetica upper case - raised satin aluminum finish.
 5. Mounting Method: No. 4 concealed fasteners.
 6. Finish: manufacturer's satin aluminum finish.
 7. Size: 20 inches x 24 inches.
 8. Content:

HIGHLAND EAST JUNIOR HIGH SCHOOL
STEM CLASSROOM ADDITION
MOORE PUBLIC SCHOOLS

SUPERINTENDENT OF SCHOOLS:
DR. ROBERT ROMINES

DIVISION 10 - SPECIALTIES

SECTION 10420 - LETTERS AND PLAQUES

BOARD OF EDUCATION:

STACI PRUETT	PRESIDENT
AMY REEVES	VICE PRESIDENT
ALLISON RICHEY	MEMBER
KAREN SHUEY	MEMBER
MIKE WRIGHT	MEMBER

ASSISTANT SUPERINTENDENT – OPERATIONS:

JEFF HORN

ARCHITECT:

AGP – THE ABLA GRIFFIN PARTNERSHIP LLC
MOORE, OKLAHOMA

CONTRACTOR:

OMNI CONSTRUCTION LLC
MOORE, OKLAHOMA

9. Type Example: ARK-Ramos Manufacturing Company, Inc.

Part 3 - Execution

3.01 Installation:

- A. Install units plumb and level in locations indicated on the Drawings, following manufacturer's recommendations.
- B. Provide all necessary accessories: Items to support or attach metal letters to result in a complete installation.
- C. Protect all finishes to prevent damage before, during and after installation.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10520 - FIRE PROTECTION SPECIALTIES

Part 1 General

1.01 Work Included:

- A. All materials, labor, services and incidentals necessary for the completion of this entire section of the work.

1.02 Submittals:

- A. Submit Manufacturer's Literature: Descriptive literature, product data and installation instructions.

1.03 Product Delivery, Storage and Handling:

- A. Handle and store all items with care to prevent damage to equipment. Damaged equipment shall be rejected.

1.04 Quality Assurance:

- A. Standards:
 - 1. Conform to NFPA 10 requirements for portable fire extinguishers.
- B. Provide fire extinguishers, cabinets and accessories by a single manufacturer.

1.05 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Materials:

- A. Fire Extinguishers:
 - 1. Model No. 10E - Cosmic multi-purpose dry chemical fire extinguisher. UL, 4A-60-BC.
- B. Fire Extinguisher Cabinets:
 - 1. Model No.: Academy 1026V10 with return trim as required with rolled edge.
 - 2. Door Style: Contemporary V, with flat trim.
 - 3. Glazing: 1/4" clear acrylic.
 - 4. Finish: Aluminum, mill finish, clear anodized.
 - 5. Fire Rated Enclosure: provide fire stopping material to protect integrity of fire rated partition as required by applicable codes and standards.

Part 3 - Execution

3.01 Installation:

- A. Install equipment as located on the Drawings and comply with manufacturer's written instructions for equipment provided.
- B. Prepare recesses in walls for fire extinguisher cabinets as required for type and size of cabinet and style of trim, and

DIVISION 10 - SPECIALTIES

SECTION 10520 - FIRE PROTECTION SPECIALTIES

- to comply with manufacturer's instructions.
- C. Securely fasten mounting brackets and fire extinguisher cabinets to the structure, square and plumb, to comply with manufacturer's instructions.
 - D. Check extinguishers for proper charge operation.
 - E. Remove and replace damaged, defective or under charged units.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10731 - PREFINISHED METAL CANOPIES

Part 1 - General

1.01 Work Included:

- A. Work in this section includes the furnishing and installation of roll-formed aluminum overhead hanger rod style canopies.
- B. Metal trim, accessories, fasteners, and sealants related to the canopy system.

1.02 Quality Assurance:

- A. Manufacturer shall demonstrate a minimum of five years of experience in the specified products and applications.
- B. Products must meet the minimum standards established by this specification. Materials, accessories, testing, and processes specified shall establish the minimum level of quality, performance, dimension, and appearance required of any substitution.
- C. Proposed substitutions shall include a complete description of the proposed substitution including testing, samples, and other information necessary to demonstrate the equivalency of the substitute.

1.03 Related Items and Considerations:

- A. Flashing of various designs may be required. Generic flashing shall be supplied by canopy manufacturer and installed by canopy installer.
- B. Determine wall construction, make-up, and thickness.
- C. Ensure adequate wall condition to carry canopy loads where required.

1.04 Field Measurements and Submittals:

- A. Confirm dimensions prior to preparation of shop drawings prior to fabrication of canopies.
- B. Provide manufacturer's product data and specifications for canopies.
- C. Provide shop drawings indicating structural component locations / positions, material dimensions, and details of construction and assembly.

1.05 Performance Requirements:

- A. Canopy must conform to all applicable / local building codes.
- B. Confirm specific load requirements have been established for canopies and provide stamped calculations if required by the Jurisdiction Having Authority.

1.06 Warranty:

- A. Manufacturer shall warrant for a minimum period of one year that the canopies, trim, and accessories furnished by the manufacturer will be free from defects in materials and factory workmanship.

DIVISION 10 - SPECIALTIES

SECTION 10731 - PREFINISHED METAL CANOPIES

1.07 Delivery, Storage, and Handling:

A. Deliver and store all canopy components in protected areas.

1.08 **Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

2.01 Acceptable Manufacturer:

A. Lumishade Canopy or Sunshade Canopy with prefinished Hanger Rods w/ turnbuckles as manufactured by:
Mapes Canopies
Lincoln, Nebraska
Phone: 888-273-1132
Fax: 877-455-6572

2.02 Materials:

- A. Decking shall consist of LumiShade interlocking roll-formed (minimum 0.032" aluminum) 2 ½ W-style pan or SuperShade Louvers roll-formed (minimum 0.110" aluminum) as applicable.
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness required by specified unit.
- C. Hanger rods and attachment hardware shall be powder coated.
- D. Provide compression sleeves at thru bolts as necessary. Round escutcheon plates shall be provided.
- E. Fascia shall be standard 8" extruded "J" style (minimum 0.125 aluminum).

2.03 Finishes:

A. Match existing 2019 Field House building. Final color to be selected by Architect.

2.04 Fabrication:

- A. Canopies shall be shipped in preassembled sections for ease of installation.
- B. All connections shall be mechanically assembled utilizing 3/16 inch fasteners with a minimum shear stress of 350 pounds. Pre-welded or factory-welded connections are not acceptable.
- C. Decking shall be designed with interlocking roll-formed aluminum members.
- D. Where applicable, provide concealed drainage - water shall drain from covered surfaces into intermediate

DIVISION 10 - SPECIALTIES

SECTION 10731 - PREFINISHED METAL CANOPIES

trough and be directed to the rear for ground level discharge via designated downspouts at each end of canopy.

Part 3 - Execution

3.01 Inspection:

- A. Confirm that surrounding area is ready for the canopy installation.
- B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by the manufacturer.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry, and roofing in the area is completed.

3.02 Installation:

- A. Installation shall be in strict accordance with the manufacturer's approved shop drawings. Particular attention shall be given to protecting the finish during handling and installation.
- B. Canopy installer shall demonstrate at least five years of experience installing similar products and applications.
- C. After installation is complete, entire system shall be wiped-down and left in a clean condition.

End of Section

DIVISION 10 - SPECIALTIES

SECTION 10800 - TOILET AND BATH ACCESSORIES

Part 1 - General

1.01 Work Included:

- A. All materials, labor, services, and incidentals necessary for the completion of this section of the work.

1.02 Submittals:

- A. Provide manufacturer's catalog cut and data sheets, complete parts list and installation requirements for each accessory item specified.
- B. Where applicable, submit maintenance data, operating instructions and keys required for each type of equipment and lock.

- 1.03 Products of certain manufacturers are specified herein to simplify descriptions of design, construction, and/or materials only. Proprietary names are not intended to imply that products of named manufacturer are required to the exclusion of equivalent products of other manufacturers.**

Part 2 - Products

- 2.01 The following model numbers refer to products of Bradley Corporation (except where noted otherwise).

2.02 Accessories:

- A. Grab Bars:
 - 1. Model No. 8120-001360-36".
 - 2. Quantity: 1 each @ rooms 11 and 12
- B. Grab Bars:
 - 1. Model No. 8120-001420-42".
 - 2. Quantity: 1 each @ rooms 11 and 12
- C. Grab Bars:
 - 1. Model No. 8120-001180-18".
 - 2. Quantity: 1 each @ rooms 11 and 12
- D. Tilted Stainless Steel Mirror (Frame and Surface):
 - 1. Model No. 740-1830.
 - 2. Quantity: 1 each outside rooms 11 and 12 (above washfountains)
- E. Stainless Steel Mirror (Frame and Surface):
 - 1. Model No. 781-1830
 - 2. Quantity: 1 each outside rooms 11 and 12 (above washfountains)
- F. Custodian's Utility Shelf/With Mop & Broom Holder:
 - 1. Model No. 9984, 36" long.
 - 2. Quantity: 1 @ room 17
- G. Toilet Paper Dispensers to be provided by Owner and installed by Contractor.
- H. Paper Towel Dispenser to be provided by Owner and installed by Contractor.

DIVISION 10 - SPECIALTIES

SECTION 10800 - TOILET AND BATH ACCESSORIES

- I. Soap Dispenser to be provided by Owner and installed by Contractor.

Part 3 - Execution

3.01 General:

- A. Install where noted on the Drawings and mount as indicated or per manufacturer's recommendations.
- B. Use concealed or tamper-proof fasteners of same material and finish as unit. Provide anchors, bolts, and other mounting devices and attach units securely.

End of Section

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

- A. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- B. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2007.
- F. ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded; The American Society of Mechanical Engineers; 2009.
- G. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2009).
- H. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- I. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.
- J. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.
- K. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.
- L. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.
- M. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- N. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Project Record Documents: Record actual locations of components and tag numbering.
- D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, approved by manufacturer.
- C. Welders certification: In accordance with ASME (BPV IX).
- D. Conform to UL, FM, requirements.
- E. Valves: Bear UL, FM, label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform work to NFPA 13 International Fire Code, International Building Code and specifications.
- B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A 795 Schedule 10, or ASTM A 53 Schedule 40, black or galvanized. Allied Dyna-Thread and Dyna-Flow or similar piping may be used in lieu of Schedule 40 and Schedule 10. All threadable pipe shall have a Corrosion Resistance Ratio (CRR) of 1.00 at threads. Allied BLT, XL or similar type pipe is prohibited.
 - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1 to 4 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 6 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.
- D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 GATE VALVES

- A. Up to and including 2 inches:
 - 1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
 - 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

2.5 GLOBE OR ANGLE VALVES

- A. Up to and including 2 inches:
 - 1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- B. Over 2 inches:
 - 1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.6 BALL VALVES

- A. Up to and including 2 inches:
 - 1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- B. Over 2 inches:
 - 1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.7 CHECK VALVES

- A. Up to and including 2 inches:
 - 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches:
 - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
 - 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.8 DRAIN VALVES

- A. Ball Valve:
 - 1. Brass with cap and chain, 3/4 inch hose thread.

2.9 BUTTERFLY VALVES

- A. Bronze Body:
 - 1. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amps at 115 volt AC.
- B. Cast or Ductile Iron Body:
 - 1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.10 DOUBLE CHECK VALVES (BACKFLOW PREVENTOR)

- A. 2 1/2" inches and over:
 - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check. ASSE 1015.

2.11 SUPERVISORY/TAMPER SWITCHES

- A. For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Installation shall be compliant with International Building Code (IBC) and NFPA requirements.
- H. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Do not penetrate building structural members unless indicated.
- L. Provide sleeves when penetrating footings, floors, ceilings and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- O. Provide gate or ball valves for shut-off or isolating service.
- P. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.3 OWNER TRAINING

- A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 210553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Major Control Components: Nameplates.
- B. Piping: Tags or Pipemarkers.
- C. Pumps: Nameplates.
- D. Relays: Tags.
- E. Small-sized Equipment: Tags.
- F. Valves: Tags or Nameplates

2.2 MANUFACTURERS

- A. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
- B. Seton Identification Products: www.seton.com.
- C. Brady Corporation: www.bradycorp.com.

2.3 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: Black.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: White.

2.4 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify valves in main and branch piping with tags.

F. Identify pumps with plastic nameplates. Small devices, such as in-line pumps may be identified with tags.

G. Identify piping, concealed or exposed with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. 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.

END OF SECTION

SECTION 211300

FIRE SUPPRESSION SPRINKLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

- A. Section 210500 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
- B. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- C. Section 220553 - Identification for Plumbing Piping and Equipment.
- D. Section 262702 - Equipment Wiring Systems: Electrical characteristics and wiring connections.
- E. Section 283100 - Fire System.

1.3 REFERENCE STANDARDS

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.
- C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene two weeks before starting work of this section.

1.5 SUBMITTALS

- A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- B. Shop Drawings:
 - 1. Submit working plans indicating sprinkler head locations coordinated with ceiling installation, pipe routing, fire department connections and riser locations.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
 - 3. Submit shop drawings to authority having jurisdiction for approval. Submit proof of approval to Engineer.
- C. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.

1.6 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL FM requirements.
- C. Designer Qualifications: Design system under direct supervision of a NICET Level III, experienced in design of this type of work.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.
- F. Equipment and Components: Provide products that bear UL and FM label or marking.
- G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Tyco Fire Suppression & Building Products: www.tyco-fire.com.
 - 2. Viking Corporation: www.vikinggroupinc.com.
 - 3. Reliable Automatic Sprinkler Co.: www.reliable-sprinkler.com.

2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Fire protection contractor shall provide design build services based on the requirements herein specified. System shall provide coverage for building addition as noted on plans.
- B. System Piping Location: Wet system piping shall be installed at highest elevation possible. Piping shall be installed above all mechanical equipment, ductwork, and all plumbing system piping. Fire protection contractor shall coordinate fire protection piping prior to installation.
- C. Occupancy: Shall comply with NFPA 13. See plans for occupancy areas.
- D. Water Supply: Provided by city water main – Moore, Oklahoma.
 - 1. Coordinate with owner and fire department for connection of new zone to existing sprinkler riser assembly. Field verify location for connection points. Conduct hydraulic calculations for proper connection points.
 - 2. Contractor shall determine volume and pressure from water flow test data.
- E. Interface system with building control system and fire alarm system.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser.
- G. Fire department connection - existing.

2.3 SPRINKLERS

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Enamel, color white.
 - 4. Escutcheon Plate Finish: Enamel, color white.

5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Exposed Area Type: Standard upright type. Provide head guards in areas where sprinkler heads are subject to damage.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Brass. Chrome plated.
 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Chrome plated.
 4. Escutcheon Plate Finish: Chrome plated.
 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.4 PIPING SPECIALTIES

- A. Provide proper backflow protection to fire protection system as required per Authority Having Jurisdiction.
- B. Flexible Sprinkler Drop Fittings: Corrugated Type 304 stainless steel hose with braided Type 304 stainless steel exterior cover, welded stainless steel or zinc plated steel inlet and outlet threaded fittings with EPDM seals. 175 PSI pressure rating. 225 °F temperature rating, 1" minimum internal hose diameter. 60" maximum hose length, straight or angle outlet configuration. Galvanized steel ceiling support bar and brackets selected to match project ceiling support system requirements. UL Listed and FM approved.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 120 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Inspectors Test outlet: coordinate location and type with AHJ or Local Fire Marshall:
1. Label: "Inspectors Test".
- E. Supervisory and Tamper Switches: For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.
- E. Center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements and provide piping offsets as required.
- F. Flexible sprinkler drop fittings: Install in accordance with manufacturer's installation instructions following minimum bend radii, maximum number of bends and bend distance from end requirements.
- G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

- H. Flush entire piping system of foreign matter.
- I. Install guards on sprinklers where indicated.
- J. Hydrostatically test entire system.
- K. Require test be witnessed by Fire Marshal and authority having jurisdiction.
- L. Provide flow controls and alarms at sprinkler system water source connection.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system and building controls system.

3.3 OWNER TRAINING

- A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SCOPE

- A. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Reference.
 - c. Standards.
 - d. Quality Assurance.
 - e. Sleeves and Openings.
 - f. Sealing and Firestopping.
 - g. Equipment Furnished By Others.
 - h. Provisions for Future.
 - i. Off Site Storage.
 - j. Codes.
 - k. Certificates and Inspections.
 - l. Submittals.
 - m. Operating and Maintenance Data.
 - n. Training of Owner Personnel.
 - o. Record Drawings.
 2. PART 2 – PRODUCTS.
 - a. Access Panels and Doors.
 - b. Sealing and Firestopping.
 3. PART 3 – EXECUTION.
 - a. Excavation and Backfill.
 - b. Sheeting, Shoring and Bracing.
 - c. Dewatering.
 - d. Rock Excavation.
 - e. Concrete Work.
 - f. Building Access.
 - g. Equipment Access.
 - h. Coordination.
 - i. Lubrication.
 - j. Sleeves.
 - k. Sealing and Firestopping.

1.2 REFERENCE

- A. This section applies to all Division 22 sections of plumbing.

1.3 STANDARDS

- A. Abbreviations of standards organizations referenced in this and other sections are as follows:
1. ACPA American Concrete Pipe Association.
 2. AGA American Gas Association.
 3. ANSI American National Standards Institute.
 4. ASME American Society of Mechanical Engineers.
 5. ASPE American society of Plumbing Engineers.
 6. ASSE American Society of Sanitary Engineering.
 7. ASTM American Society for Testing and Materials.
 8. AWWA American Water Works Association.

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|-----|--------|--|
| 9. | AWS | American Welding Society. |
| 10. | CISPI | Cast Iron Soil Pipe Institute. |
| 11. | CGA | Compressed Gas Association. |
| 12. | EPA | Environmental Protection Agency. |
| 13. | IAPMO | International Association of Plumbing & Mechanical Officials. |
| 14. | MCA | Mechanical Contractors Association. |
| 15. | MSS | Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc. |
| 16. | NBS | National Bureau of Standards. |
| 17. | NEC | National Electric Code. |
| 18. | NFPA | National Fire Protection Association. |
| 19. | NSF | National Sanitation Foundation. |
| 20. | PDI | Plumbing and Drainage Institute. |
| 21. | SMACNA | Sheet Metal and Air Conditioning Contractors' National Association. Inc. |
| 22. | STI | Steel Tank Institute. |
| 23. | UL | Underwriters Laboratories Inc. |

B. Standards referenced in this section:

- | | | |
|----|------------|--|
| 1. | ACI 614 | Recommended Practice for Measuring, Mixing and Placing of Concrete. |
| 2. | ASTM D1557 | Standard Test Method for Moisture-Density Relations of Soils. |
| 3. | ASTM E814 | Standard Test Method for Fire Tests of Through-Penetration Fire Stops. |
| 4. | ASTM E84 | Standard Test Method for Surface Burning Characteristics of Building Materials. |
| 5. | D.O.T. | Standard Specifications for Road and Bridge Construction, State of Oklahoma Dept. of Transportation. |
| 6. | UL1479 | Fire Tests of Through-Penetration Firestops. |
| 7. | UL723 | Surface Burning Characteristics of Building Materials. |

1.4 QUALITY ASSURANCE

- A. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.
- B. Substitution of Materials: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.5 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.6 EQUIPMENT FURNISHED BY OTHERS

- A. Coordinate with owner for location of kitchen equipment. Contractor shall rough-in and make final connections to equipment furnished by others. See Plumbing plans.

1.7 PROVISIONS FOR FUTURE

- A. Coordinate with owner for final location of valves for future building additions. See Plumbing plans.

1.8 OFF SITE STORAGE

- A. Prior approval by Owner and the Engineer will be needed. The Contractor shall submit Storage Agreement Form to Owner for consideration of offsite materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. No material will be accepted for offsite storage unless shop drawings for the material have been approved.

1.9 CODES

- A. Comply with requirements of Oklahoma Code Requirements.

1.10 CERTIFICATES AND INSPECTIONS

- A. Obtain and pay for all required State installation inspections except those provided by the Engineer in accordance with Oklahoma Code Requirements. Deliver originals of these certificates to the Owner's Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

1.11 SUBMITTALS

- A. Refer to Division 1, for submittal procedures.
- B. Not more than two weeks after award of contract but before any shop drawings are submitted, Contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer and model number. The approved plumbing system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.

PLUMBING SYSTEM DATA SHEET

<u>Item</u>	<u>Pipe Service/Sizes</u>	<u>Manufacturer/Model No.</u>	<u>Remarks</u>
Pipe.			
Hangers & Supports.			
Insulation.			
Plumbing Specialties.			
Plumbing Fixtures.			
Plumbing Equipment.			

- C. Shop drawing submittals shall be individually submitted by specification section number in PDF format. Combined submittals will be returned for contractor to divide.
- D. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.
 - 1. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
 - a. Operating and Maintenance Manuals 2 copies.
 - b. Owner 2 copies.
 - c. Architect/Engineer 1 copy.
 - d. Owner Field Office 1 copy.

1.12 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. In addition to the general content specified under applicable sections in Bidding Requirements and Division 1 - General Requirements, supply the following additional documentation:
 - 1. Records of tests performed to certify compliance with system requirements.
 - 2. Manufacturer's wiring diagrams for electrically powered equipment.
 - 3. Certificates of inspection by regulatory agencies.
 - 4. Valve schedules.
 - 5. Lubrication instructions, including list/frequency of lubrication.
 - 6. Parts lists for fixtures, equipment, valves and specialties.
 - 7. Manufacturer's installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
 - 8. Additional information as indicated in the technical specification sections.

1.13 TRAINING OF OWNER PERSONNEL

- A. Instruct Owner's personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than six (6) hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training to be during normal working hours. Videotape all instructions and provide Owner with copy.

1.14 RECORD DRAWINGS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

PART 2 PRODUCTS

2.1 ACCESS PANELS AND DOORS

- A. Concrete Walls:
 - 1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

2.2 SEALING AND FIRESTOPPING

- A. FIRE AND/OR SMOKE RATED PENETRATIONS:
 - 1. Manufacturers:
 - a. 3M: www.3m.com.
 - b. Hilti: www.hilti.com.
 - c. Rectorseal: www.rectorseal.com.
 - d. STI/SpecSeal: www.stifirestop.com.
 - e. Tremco: www.tremcosealants.com.
 - 2. All firestopping systems shall be provided by the same manufacturer.
 - 3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
 - 4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
 6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
- B. NON-RATED PENETRATIONS:
1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.
 2. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.
- B. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand. Backfill above the bedding shall be thoroughly compacted excavated material free of construction debris, large stones, organic, perishable, and frozen materials. Refer to IPC section 306 – Trenching, Excavation and Backfill.
- C. Take care during bedding, compaction and backfill not to disturb or damage piping.
- D. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.
- E. Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.
- F. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.
- G. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.
- H. Remove surplus excavated materials from site.
- I. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.
- J. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

- K. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.
- L. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and ensure there is no disturbance of bearing soil.

3.2 SHEETING, SHORING AND BRACING

- A. Provide shoring, sheet piling and bracing in conformance with the Oklahoma Code Requirements to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

3.3 DEWATERING

- A. Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances. Obtain general permit from the Oklahoma Department of Natural Resources district office for discharge of construction dewatering effluent. Comply with permit requirements.

3.4 ROCK EXCAVATION

- A. Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 1/2 cubic yard or more in volume.
- B. Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2) feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

3.5 CONCRETE WORK

- A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

3.6 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.7 EQUIPMENT ACCESS

- A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.
- B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.8 COORDINATION

- A. Coordinate all work with other Contractors prior to installation. Any work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.
- B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.9 LUBRICATION

- A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.10 SLEEVES

- A. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required.
- B. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.
- C. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.
- D. In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend 2 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.

3.11 SEALING AND FIRESTOPPING

- A. FIRE AND/OR SMOKE RATED PENETRATIONS:
 - 1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
 - 2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.
- B. NON-RATED PARTITIONS:
 - 1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
 - 2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION

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SECTION 220516

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.

1.2 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

- A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.
- B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- B. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. Metraflex Company: www.metraflex.com.
- B. Inner Hose: Stainless Steel.
- C. Exterior Sleeve: Single braided, Stainless Steel.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturer:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. Metraflex Company: www.metraflex.com.
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.

G. Application: Copper piping.

2.3 EXPANSION JOINTS

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. Metraflex Company: www.metraflex.com.

B. Shall consist of two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return assembled in such a way that piping does not change direction but maintains its course along a single axis. Approved for use with potable water.

C. Size: Use pipe sized units.

D. Application: Copper piping.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Install flexible pipe expansion loops on pipes before penetration of safe-room walls.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pressure gages and pressure gage taps.
- B. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.
- B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2007.
- C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.3 SUBMITTALS

- A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.4 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
 - 3. Omega Engineering, Inc: www.omega.com.
- B. Pressure Gages: ASME B40.100, UL 404 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube or Cast aluminum with phosphor bronze bourdon tube.
 - 2. Size: 4-1/2 inch or 3-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: Two percent.
 - 4. Scale: Psi.

2.2 PRESSURE GAGE TAPPINGS

- A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.
- B. Needle Valve: Brass or Stainless Steel, 1/4 inch NPT for minimum 150 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.3 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 3. H. O. Terrice: www.trerice.com.

- B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear glass.
 - 3. Stem: 3/4 inch NPT brass.
 - 4. Accuracy: 2 percent, per ASTM E 77.
 - 5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.
- C. Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.
- D. Install pressure gages with pulsation dampers. Provide gage cock or needle valve to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.
- E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 SCHEDULES

- A. Stem Type Thermometers, Location and Scale Range:
 - 1. Domestic Hot water supply and recirculation, 30 to 240 Deg. F.
- B. Pressure Gages, Location and Scale Range:
 - 1. Circulation pumps, 0 to 160 psi.

END OF SECTION

SECTION 220548

VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolators.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.3 QUALITY ASSURANCE

- A. Perform design and installation in accordance with applicable codes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Isolation Technology, Inc: www.isolationtech.com.
- B. Kinetics Noise Control, Inc: www.kineticsnoise.com.
- C. Mason Industries: www.mason-ind.com.
- D. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

2.2 VIBRATION ISOLATORS

- A. Restrained Open Spring Isolators:
 - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 4. Restraint: Provide heavy mounting frame and limit stops.
 - 5. For Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- B. Neoprene Pad Isolators:
 - 1. Rubber or neoprene waffle pads.
 - 2. Hardness: 30 durometer.
 - 3. Thickness: Minimum 1/2 inch.
 - 4. Maximum Loading: 50 psi.
 - 5. Rib Height: Maximum 0.7 times width.
 - 6. Configuration: Single layer.

PART 3 EXECUTION

3.1 INSTALLATION

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

END OF SECTION

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SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Major Components: Nameplates.
- B. Piping: Tags or Pipe markers.
- C. Small-sized Equipment: Tags.
- D. Tanks: Nameplates.
- E. Valves: Tags.

2.2 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
- C. Seton Identification Products: www.seton.com.
- D. Craftmark: www.craftmarkid.com.

2.3 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.4 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Identify valves in main and branch piping with tags.
- F. Identify piping, concealed or exposed with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. 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.

END OF SECTION

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

- A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.
- B. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.
- D. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience. Products shall be manufactured at facilities certified and registered to conform to ISO 9001 Quality Standard.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum with minimum three years of documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.
- B. Protect materials against damage before, during and after installation. No material shall be installed that has become damaged in any way.

1.7 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.
- B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

2.2 GLASS FIBER

- A. Manufacturers:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corporation: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
- B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.
 - 1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
 - 2. Maximum service temperature: 850 degrees F.
 - 3. Maximum moisture absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film with self-sealing longitudinal closure laps and butt strips; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive:
 - 1. Compatible with insulation.
- F. Insulating Cement/Mastic:
 - 1. ASTM C 195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
 - 3. Weave: 5x5 10x10.
- H. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Armacell International: www.armacell.com.
 - 2. Aeroflex: www.aeroflexusa.com.
 - 3. Nomaco Insulation: www.nomacoinsulation.com.
- B. Insulation: Preformed closed cell flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: -40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com.

- b. Knauf Insulation: www.knaufusa.com.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
3. Covering Adhesive Mastic:
 - a. Compatible with insulation.

2.5 INSULATION INSERTS AND PIPE SHIELDS:

- A. Manufacturers:
 1. B-Line: www.bline.com.
 2. Pipe Shields: www.pipeshieldinc.com.
 3. Value Engineered Products: www.valueng.com.
- B. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.
- C. Where Contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.
- D. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1" x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.
- E. Wood blocks will not be accepted.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
- H. Inserts and Shields:
1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
- I. Continue insulation through walls, ceilings, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. Vapor barriers shall be maintained continuous through all penetrations.
- J. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
- K. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

3.3 SCHEDULES

- A. Plumbing Systems:
1. Domestic Water Supply Above Grade: Hot Water, Cold Water and Circulating Water.
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: Mains and branch lines 1 inch.
 - 3) Thickness: Branch lines serving individual fixtures, 1 inch.
 2. Domestic Water Supply Below grade: Cold Water.
 - a. Preformed Flexible Elastomeric Cellular Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 - b. Insulation rated for direct burial.
 3. Roof Drains Bodies:
 - a. Glass Fiber Insulation, 1" thick.
 4. Roof Drainage Above Grade:
 - a. Glass Fiber Insulation.
 - b. Thickness: Mains and branch lines 1 inch.

END OF SECTION

SECTION 221005

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Storm sewer.
 - 4. Natural gas.

1.2 RELATED REQUIREMENTS

- A. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
- B. Section 220553 - Identification for Plumbing Piping and Equipment.
- C. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- D. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).
- E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).
- F. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- G. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2006.
- H. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.
- I. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- J. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.
- K. ASTM D 2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2003.
- L. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2005.
- M. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter; 2003.
- N. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.
- O. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2008.

- P. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2006.
- Q. ASTM F 441/F 441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2002.
- R. ASTM F 876, ASTM F 877 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 1. Engel or PEX-a method.
- S. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).
- T. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution; American Water Works Association; 2007 (ANSI/AWWA C900).
- U. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; American Water Works Association; 2008.
- V. AWWA C950 - Fiberglass Pressure Pipe; American Water Works Association; 2007 (ANSI/AWWA C950).
- W. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005.
- X. 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; Cast Iron Soil Pipe Institute; 2004.
- Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.
- Z. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- AA. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- BB. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.
- CC. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2009.

1.4 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Oklahoma standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welder Qualifications: Certified in accordance with ASME B31.9 Building Services Piping.
- D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of Oklahoma, City of Moore plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.

- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BELOW GRADE

- A. PVC Pipe: Schedule 40 ASTM D 2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: Schedule 40 ASTM D 2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cross-Linked Polyethylene Tubing (PEX-a or Engel method): ASTM F 876, ASTM F 877
 - 1. Fittings: ASTM F 1960.
 - 2. Joints: No joints located below grade.
 - 3. Install per manufacturer's instructions.
 - 4. Provide PVC sleeve at penetrations of concrete floor.
- B. Copper Pipe: ASTM B 88, Type K (Annealed Temper).
 - 1. Fittings: cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.
 - 2. Joints: No joints below grade.
 - 3. Application: piping for trap primers only.
- C. Tracer wire for non-metallic and plastic pipe: Magnetic detectable conductor, plastic covering, rated for underground service, imprinted with words "Water Service".

2.4 WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B 32, alloy Sn95 solder.
 - 3. Mechanical press sealed fittings, 3" size and smaller. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Fittings shall be double pressed type NSF/ANSI 61 approved and utilize EPDM sealing elements. Sealing elements shall be factory installed.
- B. Cross-Linked Polyethylene Tubing (PEX-a or Engel method): ASTM F 876, ASTM F 877
 - 1. Fittings: ASTM F 1960.
 - 2. Locations: concealed branch lines to individual fixture, no exposed tubing.
 - 3. Install per manufacturer's instructions.
 - 4. Approved for contact with potable water in accordance with NSF 61 and NSF 14.

2.5 STORM WATER PIPING BELOW GRADE

- A. PVC Pipe: Schedule 40 ASTM D 2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.6 STORM WATER PIPING ABOVE GRADE

- A. PVC Pipe: Schedule 40 ASTM D 2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.7 NATURAL GAS PIPING – ABOVE GRADE

- A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
 - 2. Joints: NFPA 54, threaded or welded to ASME B31.1,
 - 3. Mechanical press sealed fittings, 65 mm (2-1/2”) in size and smaller. Fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI LC-4/CSA 6.32 and NFPA-54. Sealing elements for press fittings shall be HNBR. Wrought carbon steel and alloy steel. Sealing elements shall be factory installed.
- B. Corrugated Stainless Steel Tubing (CSST): ANSI LC-1 Standard, ASTM A240, Type 304, 321 stainless steel with 2400 degrees F melting point.
 - 1. Jacket: UV resistant polyethylene with 350 degrees F melting point and fire-resistance tested in accordance with ASTM E84.
 - 2. Fittings: Mechanical type complying with ASTM B 16.
 - 3. Use CSST tubing for equipment connections only. Do not use for mains or exterior use.

2.8 NATURAL GAS PIPING, BURIED OUTSIDE OF BUILDING

- A. Polyethylene Pipe – Medium Density (MDPE): ASTM D 2513
 - 1. Fittings: ASTM D 2683 or ASTM D 2513 socket type.
 - 2. Joints: Fusion welded.
- B. Exterior below grade use only.
- C. Provide anodeless gas riser for transition from below grade to above grade.

2.9 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
 - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Conform to ASME B31.9 ASTM F 708 MSS SP-58, MSS SP-69, MSS SP-89.
 - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/ Inches: Malleable iron, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.
 - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- B. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F 708 MSS SP-58, MSS SP-69, MSS SP-89.
 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
 5. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.
 6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
 8. Vertical Support: Steel riser clamp.
 9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.11 BALL VALVES

- A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
 2. Nibco, Inc.: www.nibco.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union. Provide valve stem extensions for valves installed in all piping with insulation.
1. Domestic water: Valves shall be lead-free design (NSF/ANSI 372) and comply with NSF/ANSI 61 for potable water use.
- C. Natural Gas Ball valves – 4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L listed for use as natural gas shut-off.

2.12 SPRING LOADED CHECK VALVES

- A. Manufacturers:
1. Watts: www.watts.com.
 2. Apollo Valves.
 3. Nibco.
- B. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available, sweat or threaded ends.
- C. Valves shall be lead-free design and rated for domestic potable water use.

2.13 RELIEF VALVES

- A. Temperature and Pressure Relief:
1. Manufacturers:
 - a. Taco: www.taco-hvac.com.
 - b. Watts Regulator Company: www.wattsregulator.com.
 2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labeled.

2.14 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc.: www.armstronginternational.com.
 - 2. Watts: www.watts.com.
 - 3. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Size 2 inch and Under:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install water service entrance piping in accordance with requirements of school district and city of Moore.
- C. Provide tracer wire for below grade non-metallic piping.
- D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- F. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.
- J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- K. Establish elevations of buried piping outside the building to ensure proper cover.
- L. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Provide support for utility meters in accordance with requirements of utility companies.
- O. Excavate in accordance with Division 31.
- P. Backfill in accordance with Division 31.
- Q. Install valves with stems upright or horizontal, not inverted.

- R. Install water piping to ASME B31.9.
- S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.
- T. Sleeve pipes passing through partitions, walls and floors.
- U. Pipe Hangers and Supports:
 1. Installation shall be compliant with International Building Code (IBC) for Class D seismic site requirements.
 2. Install in accordance with MSS SP-58, MSS SP-69, MSS SP-89, ASME B31.9.
 3. Support horizontal piping as scheduled.
 4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 5. Place hangers within 12 inches of each horizontal and vertical elbow.
 6. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 7. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 9. Provide copper plated hangers and supports for copper piping sheet lead packing between hanger or support and piping.
 10. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 11. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 220548.
 12. Support cast iron drainage piping at every joint.
- V. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
- W. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.
- X. Install pipe identification per section 220553, this section and all applicable codes.
- Y. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The joints shall be pressed using the tool(s) approved by the fitting manufacturer.
- Z. Natural gas: Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main. Teflon tape is acceptable for use on natural gas lines. Do not install gas pipe in a ventilation air plenum.
 1. Clean all gas piping before all regulators and service valves are installed and before unit connections are made. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.
 2. Install a shut off valve at each appliance. Provide a valve connection at the main for equipment and appliances furnished by others.
 3. Each gas pressure reducing valve vent and relief valve shall have a vent limiter or vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.
 4. Paint all exposed natural gas pipe with zinc rich primer and two coats of enamel formulated paint for metal surfaces. Color to be yellow or as selected by Architect.

3.4 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.

- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install ball valves for throttling, bypass, or manual flow control services.
- E. Provide ball valves in natural gas systems for shut-off service.
- F. Provide spring loaded check valves on discharge of water pumps.
- G. Provide flow controls in water recirculating systems where indicated.

3.5 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot for piping less than 3 inches and 1/8 inch per foot slope for piping 3 inches or greater for interior piping. Install exterior piping pitched to drain at indicated elevations and slope.
- B. Water Piping: Slope piping to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system as required per state and local codes.
- B. Prior to starting work, verify system is complete, flushed and clean.
- C. 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, AWWA C652 or local authority having jurisdiction.

3.7 PIPING SYSTEM LEAK TESTS

- A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal above grade piping until it has been successfully tested.
- B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints.
- C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
- D. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.
- E. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.
- F. Entire test must be witnessed by the Authority Having Jurisdiction.
- G. Leak test: Shall conform to requirements of IPC and local codes.
 - 1. Water supply system.
 - 2. Drainage and vent system.
- H. Gas piping systems:
 - 1. Perform initial pressure test prior to concealing tubing with wall and ceiling finishes and before connecting appliances.
 - 2. Perform final pressure test after construction is complete and finishes applied, system may be re-tested to verify no damage has occurred to gas piping system.
 - 3. Connect appliances and equipment to gas piping system and test connections for leakage.

3.8 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services with connection to new sewer lines. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing. Coordinate sewer location and invert elevation with site contractor.
- B. Domestic water: Before commencing work check locations and sizes of existing cold water capped for extension. Provide new water service to addition with shut-off valve and connect to existing system. Coordinate with owner for any existing water system shut down for making new connection.
 - 1. Coordinate water service requirements with Moore school district.
- C. Provide new natural gas service from existing exterior gas meter. Gas service distribution piping after meter to have initial minimum pressure of 2 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment. New gas service and meter, coordinate new gas load with Gas company (ONG).

3.9 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe size: 1/2 inches to 1-1/4 inches:
 - 1) Maximum hanger spacing: 6 ft.
 - 2) Hanger rod diameter: 3/8 inches.
 - b. Pipe size: 1-1/2 inches to 2 inches:
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 3/8 inch.
 - c. Pipe size: 2-1/2 inches to 3 inches:
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 1/2 inch.
 - 2. Plastic Piping - PVC:
 - a. All Sizes:
 - 1) Maximum hanger spacing: 4 ft.
 - 2) Hanger rod diameter: 3/8 inch.
 - 3. Cross-linked Polyethylene (PEX-a) piping:
 - a. All Sizes:
 - 1) Maximum hanger spacing: 2'-8".
 - 2) Hanger rod diameter: 3/8 inch.
 - 3) Hanger spacing per piping manufacturer's instructions.
 - b. The use of horizontal rigid metal channel supporting the tubing with hangers spaced at maximum of 6 ft. per tubing manufacturer's instructions shall be allowed with approval of local plumbing code.

END OF SECTION

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SECTION 221006

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof drains.
- B. Floor drains and floor sinks.
- C. Cleanouts.
- D. Hydrants.
- E. Trap Primers.
- F. Water hammer arrestors.
- G. Thermostatic mixing valves.
- H. Sanitary backwater valves.
- I. Thermostatic balancing valve.
- J. Water box.

1.2 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 223000 - Plumbing Equipment.
- C. Section 224000 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

- A. ASME A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers; 2003.
- B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).
- C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).
- D. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2004, and Errata 2005 (ANSI/ASSE 1019).
- E. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.4 SUBMITTALS

- A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements, for additional provisions.
 - 2. Extra Loose Keys for Outside wall hydrants: Two.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 DRAINS

- A. Manufacturers:
 - 1. Sioux Chief Manufacturing: www.siouxchief.com.
 - 2. Wade Drains: www.wadedrains.com.
 - 3. Zurn Industries, Inc.: www.zurn.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Roof Drain:
 - 1. Assembly: ASME A112.6.4. Galvanized cast iron with sump. Cast iron dome strainer integral gravel stop, membrane flange and adjustable deck clamp as required for installation.
- C. Downspout Nozzles: Bronze round with wall flange and offset bottom section.
- D. Floor Drain:
 - 1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round adjustable nickel-bronze strainer. Trap primer connection. Vandal resistant strainer screws.
 - 2. Adjustable strainer height after concrete floor is poured for strainer flush with finished floor covering.
- E. Floor Sink:
 - 1. ASME, square cast iron body with anchor flange, white acid resisting porcelain enamel interior and top, ABS anti-splash interior bottom dome strainer, medium duty square 1/2 grate.
- F. Refer to Plumbing Fixture Schedule on plans.

2.2 CLEANOUTS

- A. Manufacturers:
 - 1. Wade Drains: www.wadedrains.com.
 - 2. Zurn Industries, Inc.: www.zurn.com.
 - 3. Sioux Chief Manufacturing: www.siouxchief.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Cleanouts at Exterior Areas :
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover. Cast iron cleanout ferrule with threaded brass raised head. Access housing with adjustable anchor flange and extra heavy secured scoriated ductile iron cover with vandal resistant screws. Provide concrete pad for cleanout.
- C. Cleanouts at Interior Finished Floor Areas:
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas. Provide cover with vandal-proof screws.

- D. Cleanouts at Interior Finished Wall Areas:
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with vandal-proof screw.
- E. Refer to Plumbing Fixture Schedule on plans.

2.3 HYDRANTS

- A. Manufacturers:
 - 1. Woodford Manufacturing: www.woodfordmfg.com.
 - 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 3. Zurn Industries, Inc.: www.zurn.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Roof Hydrant:
 - 1. ASSE 1052; Freezeproof / Pollution-proof post-type, with below-roof reservoir with locking handle, 1" or 3/4" inlet, 3/4" hose thread outlet, ASSE 1052 backflow preventer outlet, 1-1/4" galvanized steel casing pipe, freeze resistant, roof mounting hardware, below roof deck drain outlet to be piped to nearest hub drain or floor sink.
- C. Wall Hydrants:
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall box with hinged door hose thread spout, removable key and integral vacuum breaker.
- D. Refer to Plumbing Fixture Schedule on plans.

2.4 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1. Wade Drains: www.wadedrains.com.
 - 2. Watts Water Technologies: www.watts.com.
 - 3. Zurn Industries, Inc.: www.zurn.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Water Hammer Arrestors:
 - 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.5 THERMOSTATIC MIXING VALVES

- A. Thermostatic Mixing Valves:
 - 1. Manufacturers:
 - a. Watts Water Technologies: www.watts.com.
 - b. Lawler Manufacturing: www.temperedwater.com.
 - c. Leonard Valve Company: www.leonardvalve.com.
 - d. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Valve: Lead free brass body, integral temperature, adjustment, check valves. Valve shall be ASSE 1070 listed.

2.6 TRAP PRIMER VALVES

- A. Manufacturers:
 - 1. Sioux Chief Manufacturing: www.siouxchief.com.
 - 2. Precision Plumbing Products (PPP) Industries: www.pppinc.com.
 - 3. Zurn: www.zurn.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

- B. Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018.
 - 1. Provide distribution unit for up to four outlets.
- C. Electric trap priming assembly: the primer will come with an electronic timer that will deliver 2 ozs of water to floor drains every 24 hours. The primer will come complete with a solenoid valve, electronic timer, ½" male inlet, an air gap fitting with a ½" female thread outlet and hard-wired electrical connection (120 volt). The primer will come with a test switch to test functionality. Provide distribution unit for up to four outlets or manifold for over 4 outlets.
- D. Refer to Plumbing Fixtures Schedule on plans. Provide as required by local codes.

2.7 SANITARY BACKWATER VALVES

- A. Manufacturers:
 - 1. Rectorseal: www.rectorseal.com.
 - 2. Oatey: www.oatey.com.
 - 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. PVC body with valve flapper, valve extension pipe with tee handle for manual operation of flapper valve, threaded collar for access riser to grade, threaded access cover.
- C. Refer to Plumbing Fixtures Schedule on plans.

2.8 REFRIGERATOR VALVE AND RECESSED BOX

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com.
 - 2. Oatey: www.oatey.com.
 - 3. Sioux chief:
 - 4. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.
- B. Description: Plastic preformed rough-in box with quarter turn brass valve, water hammer arrestor, slip in finishing cover.
- C. Refer to Plumbing Fixture Schedule on plans.

2.9 THERMOSTATIC BALANCING VALVE

- A. Manufacturers:
 - 1. ThermOmegaTech: www.circuitsolver.com.
 - 2. Caleffi North America, Inc: www.caleffi.com.
 - 3. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.
- B. Valve: thermostatically controlled balancing valve shall be self contained and fully automatic. Valve shall regulate flow of recirculated domestic hot water based on water temperature entering valve regardless of system operating pressure. When fully closed the valve shall bypass a minimum amount of hot water to maintain dynamic control of the recirculating loop. Valve shall be NSF-61 certified for use in all domestic water systems.
- C. Refer to Plumbing Fixture Schedule on plans.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms,

penthouses or rooms with excessive positive or negative pressure.

- C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rotting of drainage system.
- D. Encase exterior cleanout and backwater valve covers in concrete flush with grade.
- E. Install sanitary backwater valve per manufacturer's instructions.
- F. Install floor cleanouts at elevation to accommodate finished floor.
- G. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur.
- H. Pipe relief from backflow preventer to nearest drain.
- I. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown on plans. Provide access panels as required.
- J. Install backflow preventers in accordance with Oklahoma requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.
- K. Install trap primer assemblies in accessible location and per manufacturer's instructions. Slope piping from trap primer towards floor drain. Coordinate power outlet with electrical contractor for electric trap primer assembly.
- L. Coordinate roof hydrant installation with roofing contractor. Slope drain line from hydrant to nearest hub drain or floor sink. Install hydrant per manufacturer's recommendations.
- M. Mount wall hydrants recessed in exterior wall construction with valve plug extended beyond interior side of building insulation. Slope to drain to exterior. Install so discharge is 18" min. above finished grade. Set wall box in grout or caulk and fill exterior wall penetration with insulation.
- N. Equipment by others: Provide rough-in piping and make final and necessary connections as required by equipment supplier.
- O. Thermostatic balancing valve: Installation of valve shall be made by qualified tradesmen. Install valve in each domestic hot water return piping branch beyond last hot water device in that branch. Provide suitable line size isolation valves, unions, and strainer as recommended by manufacturer. Provide suitable access panel as required in non-accessible ceilings and walls.

3.2 OWNER TRAINING

- A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 223000

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters.
- B. Electronic Descaler.
- C. Thermal expansion tanks.
- D. Circulation pumps.

1.2 RELATED REQUIREMENTS

- A. Section 262702 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

- A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.
- B. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Provide electrical characteristics and connection requirements.
- B. Shop Drawings:
 - 1. Indicate heat exchanger dimensions, size of tappings, and performance data.
 - 2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- C. Project Record Documents: Record actual locations of components.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 CERTIFICATIONS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- B. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

- A. Refer to Bidding Requirements and Division 1 - General Requirements, for additional warranty requirements.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS-FIRED WATER HEATERS – TANKLESS TYPE

- A. Manufacturers:
 - 1. Navien Inc.: www.navien.com.
 - 2. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Type: Tankless, automatic, natural gas-fired, modulating burner with 10-1 turn down ratio, high efficiency, sealed combustion, condensing, direct vent exhaust and air intake, wall mounted. Unit shall have built-in control panel with diagnostics display. Multiple units shall be connected with communications cable from manufacturer.
- C. Performance: Refer to Water Heater Schedule on plans.
- D. Accessories: Provide:
 - 1. Temperature and Pressure Relief Valve: ASME labeled.
 - 2. Wall mounted support.
 - 3. Ball valves and unions at pipe connection points.
 - 4. Ready-Link Communications Cable
 - 5. Condensate drain neutralizer kit piped to floor sink.
 - 6. Coordinate 120 volt outlet for power supply with Electrical Contractor.
 - 7. Provide concentric vent kit.
 - 8. Ready-link wall mount piping manifold.
 - 9. Communication cable to external circulation pump.
- E. Venting: PVC, CPVC or ABS combustion air intake and flue gas outlet with DWV solvent weld fittings per manufacturer's instructions.

2.2 ELECTRONIC DESCALER

- A. Manufacturer:
 - 1. Clear Water Enviro technologies; model Scaleblaster SB-250.
 - 2. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.
- B. Electronic descaler to prevent calcium build-up in piping. Install unit on wall next to water heaters, coil wiring installed on cold water supply pipe to water heater per manufacturer's instructions. Coordinate 120 volt outlet for power supply with electrical contractor.
- C. Refer to Plumbing Schedules on plans.

2.3 THERMAL EXPANSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc.: www.amtrol.com.
 - 2. Wessel Company: www.westank.com.
 - 3. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.
- B. Construction: Welded steel, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles. NSF/ANSI 61 listed for potable water.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 40 psig.

2.4 CIRCULATION PUMPS

- A. Manufacturers:
 - 1. ITT Bell & Gossett: www.bellgossett.com.
 - 2. Grundfos Pumps Corporation: www.grundfos.us.

3. Taco Inc: www.tac-hvac.com.
 4. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.
- B. Type: Lead free bronze body design, wet rotor circulator with 175 psig maximum working pressure at operating temperature of 225°F continuous. Flanged connections with pump internals capable of being serviced without disturbing piping connections. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.
- C. Refer to Plumbing Schedules on plans.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any. Provide accessories as required for a complete operating system.
- B. Coordinate with plumbing piping and related fuel piping, gas venting, ductwork and electrical work to achieve operating system. Locate equipment and arrange plumbing piping to provide access space for servicing all components.
- C. Startup and test equipment adjusting operating and safety controls for proper operation. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.
- D. Provide accessories as required for a complete operating system.
- E. Domestic water heaters: Pipe relief valves and drains to nearest floor drain, hub drain or floor sink. Install water heater condensate neutralizer kit per manufacturer's recommendations.
- F. Mount commercial tankless water heaters on wall. Adjust and level equipment. Coordinate mounting height with all trades on site to provide required clearance to unit.
- G. Connect equipment to water and drain piping using unions or flanges and isolation valves.
- H. Adjust compression tank pre-charge to scheduled minimum operating pressure prior to connecting to system.
- I. Route water heater venting thru roof and terminate per manufacturer's instructions. Maintain proper code required clearances to openings and mechanical equipment on roof.
- J. Circulating pumps: Provide line sized isolating valve, balancing valve and thermometer on suction and line sized soft seated check valve and balancing isolating valve on discharge.
 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve

3.2 OWNER TRAINING

- A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Service sinks.
- F. Electric water coolers.

1.2 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 221006 - Plumbing Piping Specialties.
- C. Section 223000 - Plumbing Equipment.
- D. Section 262702 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

- A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2006.
- B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).
- C. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.
- D. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

1.4 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.

- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements, for additional warranty requirements.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

- A. Water Closet Manufacturers:
 - 1. American Standard Inc.: www.americanstandard.com.
 - 2. Kohler Company: www.kohler.com.
 - 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Water Closets: Vitreous china, ASME A112.19.2, elongated rim wall hung back outlet type, siphon jet flush action, china bolt caps. Flush volume 1.6 gallons. Color white. Refer to Architectural plans for mounting heights.
- C. Flush Valves: ASME A112.18.1, Exposed chrome plated, diaphragm type, complete with vacuum breaker stops and accessories. Vandal resistant stop cap. 1.6 gallon flush volume.
 - 1. Sensor-Operated Type: Sensor-Operated Type: Battery powered, solenoid operator, infrared sensor and over-ride push button.
- D. Flush Valve Manufacturers:
 - a. Sloan Valve Company: www.sloanvalve.com.
 - b. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- E. Seats:
 - 1. Manufacturers:
 - a. Bemis Manufacturing Company: www.bemismfg.com.
 - b. Kohler Company: www.kohler.com.
 - c. Comfort Seats: www.comfort-seat.com.
 - d. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
 - 2. Solid white plastic, open front, extended back, self-sustaining hinge, external check hinge with stainless steel posts, without cover.
- F. Water Closet Carriers: Wall hung
 - 1. Manufacturers:
 - a. Wade Drains: www.wadedrains.com.
 - b. Watts Water Technologies: www.watts.com.
 - c. Zurn Industries, Inc.: www.zurn.com.
 - d. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
 - 2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.
- G. Refer to Plumbing Fixture Schedule on plans.

2.2 URINALS – WALL HUNG

- A. Wall Hung Urinal Manufacturers:
 - 1. American Standard Inc.: www.americanstandard.com.
 - 2. Kohler Company: www.kohler.com.
 - 3. Sloan Valve Company: www.sloanvalve.com.
 - 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Urinals: Vitreous china, color white, ASME A112.19.2, wall hung with side shields and concealed carrier.

1. Flush Valve: Exposed, top spud
 2. Removable stainless steel strainer.
- C. Flush Valves: ASME A112.18.1, Exposed chrome plated, diaphragm type, complete with vacuum breaker stops and accessories. Vandal resistant stop cap. 0.5 gallons flush volume.
1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor, and mechanical over-ride push button.
- D. Flush Valve Manufacturers:
- a. Sloan Valve Company: www.sloanvalve.com.
 - b. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- E. Carriers:
1. Manufacturers:
 - a. Wade Drains: www.wadedrains.com.
 - b. Zurn Industries, Inc.: www.zurn.com.
 - c. Watts: www.watts.com.
 - d. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.
- F. Refer to Plumbing Fixture Schedule on plans.

2.3 LAVATORY STATION

- A. Lavatory Manufacturers:
1. Bradley Corporation: www.bradleycorp.com.
 2. Sloan Valve Company: www.sloanvalve.com.
 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. 2-station unit: stone resin based solid surface top, stainless steel frame supports and access panels, grid strainer, waste with single P-trap. Center-Shank drillings for two faucets. No soap dispenser. Thermostatic mixing valve assembly with stops and hoses. Unit meets ANSI and ADA accessibility requirements. Refer to Architectural plans for mounting heights.
1. All color options to be available for selection by Architect.
- C. Faucet Manufacturers:
1. Sloan Valve Company: www.sloanvalve.com.
 2. Bradley Corporation: www.bradleycorp.com.
 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- D. Faucet: ASME A112.18.1; infrared sensor operated, battery powered, chrome plated, pedestal with base plate, below deck thermostatic mixing valve, 1.5 GPM laminar flow, ADA compliant.
1. Provide Commercial grade quarter turn supply stops with removable handle or loose key.
- E. Refer to Plumbing Fixture Schedule on plans.

2.4 SINKS

- A. Sink Manufacturers:
1. Elkay Manufacturing: www.elkayusa.com.
 2. Advance Tabco: www.advancetabco.com.
 3. Just Manufacturing Company: www.justmfg.com.
 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Classroom Sink Package: Single compartment bowl at 6" deep, ASME A112.19.3; 18 gage thick, Type 304 stainless steel, self rimming and undercoated, with each side and back ledge drilled for trim, includes right side bubbler, left side lever handle and gooseneck faucet at back.

1. Lever handle shall be located on left side, centered on sink bowl. Do not place lever at front left corner of bowl.
 2. Bubbler with flexible mouth guard and push button.
- C. Laboratory prep sink: Single compartment bowl, ASME A112.19.3; 18 gage thick, Type 304 stainless steel, self rimming and undercoated, with back ledge drilled for trim. Faucet shall have gooseneck spout and ADA complaint lever handles.
- D. Supply Faucet Manufacturers:
1. Chicago Faucets: www.chicagofaucets.com.
 2. Elkay Manufacturing: www.elkay.com.
 3. T & S Brass: www.tsbrass.com.
 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- E. Accessories for sinks:
1. Commercial grade quarter turn supply stops with removable handle or loose key.
 2. Supply lines: rigid chrome plated or flexible stainless steel.
 3. Provide below deck thermostatic mixing valve (ASSE 1070) at location indicated on plans.
 4. Drain: 3-1/2 inch stainless steel crumb cup and offset tailpiece.
 5. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
- F. Refer to Plumbing Fixture Schedule on plans.

2.5 SERVICE SINKS

- A. Service Sink Manufacturers:
1. Fiat Products: www.fiat.ca.
 2. Florestone, Inc: www.florestone.com.
 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Bowl: 24 by 24 by 12 inch high, square type, molded stone, floor mounted, 6" drop front with stainless steel threshold and stainless steel flat strainer.
- C. Sink Faucet Manufacturers:
1. Fiat Products: www.fiat.ca.
 2. Chicago Faucets: www.chicagofaucets.com.
 3. T & S Brass: www.tsbrass.com.
 4. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- D. Trim: ASME A112.18.1 exposed chrome plated wall type supply with lever handles, adjustable spout wall brace, vacuum breaker, hose end spout, pail hook, integral screwdriver stops with covering caps and wall flanges.
1. Provide hose with wall bracket, 3-position mop bracket and stainless steel wall guards.
- E. Refer to Plumbing Fixture Schedule on plans.

2.6 ELECTRIC WATER COOLERS

- A. Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company: www.elkay.com.
 2. Halsey-Taylor: www.halseytaylor.com.
 3. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Water Cooler: Electric 120/60/1, mechanically refrigerated; wall mounted, handicapped accessible, stainless steel cabinet, vandal-resistant construction, lead free design, water filter, push button operation.
1. Dual height unit with water bottle filling station on lower unit, ADA installation.
 2. Sensor operated bottle fill station.
 3. Provide cane apron on upper unit.

- 4. Refer to Architectural plans for mounting heights.
- C. Refer to Plumbing Fixture Schedule on plans.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install plumbing fixtures in accordance with manufacturer's instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping. Cover exposed water closet bolts with bolt covers..
- B. Install each fixture with trap, easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.
- C. Provide chrome plated rigid or stainless steel flexible supplies to fixtures with commercial grade quarter-turn loose key or removable handle stops, reducers, and escutcheons.
- D. Set floor mounted water closets, floor mounted service sinks; counter mounted lavatories and sinks; lavatory and sink faucets and drains with full setting bed of flexible non-staining plumber's putty.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.
- F. Provide unions at water connections and PVC P-traps for electric water coolers.
- G. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass and incased with ADA compliant covers.
- H. Provide adjustable support bracket with pipe clamps for fastening to wall framing to secure piping stub outs at fixtures. Piping stub outs shall be type L copper.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

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

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 RELATED WORK

- A . Section 230513 - Common Motor Requirements for HVAC Equipment.
- B . Section 230593 - Testing, Adjusting, and Balancing for HVAC.
- C . Section 233300 - Air Duct Accessories.

1.2 REFERENCE

- A . Applicable provisions of Division 1 govern work under this section.

1.3 REFERENCE STANDARDS

- A . Abbreviations of standards organizations referenced in other sections are as follows:
 - 1. AABC Associated Air Balance Council.
 - 2. ADC Air Diffusion Council.
 - 3. AGA American Gas Association.
 - 4. AMCA Air Movement and Control Association.
 - 5. ANSI American National Standards Institute.
 - 6. ARI Air Conditioning and Refrigeration Institute.
 - 7. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers.
 - 8. ASME American Society of Mechanical Engineers.
 - 9. ASTM American Society for Testing and Materials.
 - 10. EPA Environmental Protection Agency.
 - 11. GAMA Gas Appliance Manufacturers Association.
 - 12. IEEE Institute of Electrical and Electronics Engineers.
 - 13. ISA Instrument Society of America.
 - 14. MCA Mechanical Contractors Association.
 - 15. MICA Midwest Insulation Contractors Association.
 - 16. NBS National Bureau of Standards.
 - 17. NEBB National Environmental Balancing Bureau.
 - 18. NEC National Electric Code.
 - 19. NEMA National Electrical Manufacturers Association.
 - 20. NFPA National Fire Protection Association.
 - 21. SMACNA Sheet Metal and Air Conditioning Contractors' National Association. Inc.
 - 22. UL Underwriters Laboratories Inc.
 - 23. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - 24. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 25. UL1479 Fire Tests of Through-Penetration Firestops.
 - 26. UL723 Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

- A . Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.5 CONTINUITY OF EXISTING SERVICES

- A . Do not interrupt or change existing services without prior written approval from the Owner Project Representative. When interruption is required, coordinate the down-time with the user agency to minimize disruption to their activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.6 PROTECTION OF FINISHED SURFACES

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.7 SLEEVES AND OPENINGS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

1.8 SEALING AND FIRESTOPPING

- A . Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.
- B . Firestopping shall be UL listed and labeled for the actual application.

1.9 SUBMITTALS

- A . Submittals must be reviewed, and approved by submitting Contractor.
- B . Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
- C . Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the Engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies. See related comments in Section 230513 - Common Motor Requirements for HVAC Equipment in Part 1 under Electrical Coordination.
- D . Include wiring diagrams of electrically powered equipment.
- E . Submit all shop drawings in PDF format with paper copies.
- F . Submit sufficient quantities of printed shop drawings to allow the following distribution:
 - 1. Operating and Maintenance Manuals 2 copies.
 - 2. Testing, Adjusting and Balancing Contractor 1 copy.
 - 3. Owner 1 copy.
 - 4. Architect/Engineer 1 copy.

1.10 OFF SITE STORAGE

- A . Prior approval by Owner and the Architect/Engineer will be needed. The Contractor shall carry insurance for full value, with Owner as beneficiary for consideration of offsite materials storage.
- B . Generally, ductwork, metal for making ductwork, duct lining, sleeves, and similar rough in material will not be accepted for offsite storage. For material that can be stored off site, no material will be accepted for offsite storage unless shop drawings for that material have been approved.

1.11 REQUEST AND CERTIFICATION FOR PAYMENT

- A . Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner Project Representative in a form prescribed below and by the General Conditions of the Contract - Scheduling and Coordination of Work, Reports, Records and Data, Payments to Contractor, a cost breakdown of the proposed values for work performed which, if approved by Owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.
- B . In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.12 CERTIFICATES AND INSPECTIONS

- A . Refer also to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer. Deliver originals of these certificates to the Division Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A . Assemble material in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
 - 1. Copies of all approved shop drawings.
 - 2. Manufacturer's wiring diagrams for electrically powered equipment.
 - 3. Records of tests performed to certify compliance with system requirements.
 - 4. Certificates of inspection by regulatory agencies.
 - 5. Parts list for manufactured equipment.
 - 6. Lubrication instructions, including list/frequency of lubrication done during construction.
 - 7. Warranties.
 - 8. Additional information as indicated in the technical specification sections.
- B . Provide a PDF file copy of all Operation and Maintenance (O&M) Manuals.

1.14 OWNER TRAINING

- A . Instruct personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than 4 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.15 RECORD DRAWINGS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 PRODUCTS

2.1 ACCESS PANELS AND DOORS

- A . Lay-in Ceilings:
 - 1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B . Plaster Walls and Ceilings:

1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A . Stencils:

1. Not less than 1 inch high letters/numbers for marking pipe and equipment.

B . Engraved Name Plates:

1. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

2.3 SEALING AND FIRESTOPPING

A . Non-Rated Penetrations:

1. Duct Penetrations:
 - a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.
 - b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 EXECUTION

3.1 BUILDING ACCESS

- A . Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.2 EQUIPMENT ACCESS

- A . Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.
- B . Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.3 COORDINATION

- A . Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi recessed heating and/or cooling terminal units installed in/on architectural surfaces.
- B . Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

- C . Cooperate with the test and balance agency in ensuring Section 230593 specification compliance. Verify system completion to the test and balance agency (clean filters, duct systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.4 IDENTIFICATION

- A . Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.
- B . Where stenciling is not appropriate for equipment identification, engraved name plates may be used.
- C . Use engraved name plates to identify control equipment.

3.5 SLEEVES

- A . Duct Sleeves:
 - 1. Duct sleeves are not required in non-rated partitions or floors.
 - 2. Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.

3.6 SEALING AND FIRESTOPPING

- A . Fire and/or Smoke Rated Penetrations:
 - 1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier. Provide a UL label at each penetration.
- B . Non-Rated Partitions:
 - 1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
 - 2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

3.7 OWNER TRAINING

- A . All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified.

END OF SECTION

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SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

- A . This section includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Quality Assurance.
 - f. Shop Drawings.
 - g. Operating and Maintenance Data.
 - h. Electrical Coordination.
 - i. Product Criteria.
 2. PART 2 – PRODUCTS.
 - a. Three Phase, Single Speed Motors.
 - b. Single Phase, Single Speed Motors.
 3. PART 3 – EXECUTION.
 - a. Installation.

1.2 RELATED WORK

- A . Division 26 - Electrical.

1.3 REFERENCE

- A . Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

- A . ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators.
B . ANSI/NEMA MG-1 Motors and Generators.
C . ANSI/NFPA 70 National Electrical Code.

1.5 QUALITY ASSURANCE

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

1.6 SHOP DRAWINGS

- A . Include with the equipment which the motor drives the following motor information: Motor manufacturer, horsepower, voltage, phase, hertz, rpm, and full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

1.7 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.8 ELECTRICAL COORDINATION

- A . All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

- B . Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the Architect/Engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See related comments in Section 230500 - Common Work Results for HVAC, under Shop Drawings.
- C . Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.
- D . Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.9 PRODUCT CRITERIA

- A . Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.
- B . Select motors for conditions in which they will be required to perform; i.e., general purpose, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.
- C . Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 PRODUCTS

2.1 THREE PHASE, SINGLE SPEED MOTORS

- A . Use NEMA rated, three phase, 60 hertz motors for all motors 1/2 HP and larger unless specifically indicated.
- B . Use NEMA general purpose, continuous duty, Design B, normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless totally enclosed fan-cooled motors are specified in the equipment sections.
- C . Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- D . All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.
- E . All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested in accordance with NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

MOTOR HP	-----Open Drip-Proof Motors-----		
	-----Nominal Motor Speed-----		
	1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	77.0
1-1/2	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7-1/2	90.2	91.0	88.5

MOTOR HP	----Totally Enclosed Fan-Cooled----		
	-----Nominal Motor Speed-----		
	1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	77.0
1-1/2	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5
7-1/2	91.0	91.7	89.5

2.2 SINGLE PHASE, SINGLE SPEED MOTORS

- A . Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.
- B . Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

PART 3 EXECUTION

3.1 INSTALLATION

- A . Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.
- B . When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.
- C . Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.
- D . Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

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SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

A . This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:

1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Quality Assurance.
 - e. Design Criteria.
 - f. Shop Drawings.
2. PART 2 – PRODUCTS.
 - a. Materials.
 - b. Type 5: Spring Hanger with Neoprene.
3. PART 3 – EXECUTION.
 - a. Installation.

1.2 RELATED WORK

A . Section 233400 - HVAC Fans.

1.3 REFERENCE

A . Applicable provisions of Division 1 govern work under this section.

1.4 QUALITY ASSURANCE

A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

1.5 DESIGN CRITERIA

A . Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure.

1.6 SHOP DRAWINGS

A . Include isolator type and materials of construction.

PART 2 PRODUCTS

2.1 MATERIALS

A . Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

2.2 TYPE 5: SPRING HANGER WITH NEOPRENE

A . Vibration hanger with a steel spring and 0.3" deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SCOPE

- A . This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Description.
 - f. Quality Assurance.
 - g. Submittals.
 2. PART 2 – PRODUCTS.
 - a. Instrumentation.
 3. PART 3 – EXECUTION.
 - a. Preliminary Procedures.
 - b. Performing Testing, Adjusting and Balancing.
 - c. Deficiencies.

1.2 RELATED WORK

- A . Section 230500 - Common Work Results for HVAC.
B . Section 230700 - HVAC Insulation.

1.3 REFERENCE

- A . Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

- A . AABC National Standards for Total System Balance, Sixth Edition, 2002.
B . ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.
C . NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.5 DESCRIPTION

- A . The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.
- B . Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.
- C . Test, adjust and balance all air systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

- D . Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.
- E . Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.6 QUALITY ASSURANCE

A . Qualifications:

1. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
2. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact Owner immediately.
3. Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity.
4. Submit Qualifications of firm and project staff to Owner upon requested.

1.7 SUBMITTALS

A . See Related Work in this section.

B . Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

C . Submission:

1. Distribute electronic copies of the Report to the Contractor, the Lead Contractor, the Owner, and the Prime Architect/Engineer.

D . Enter a RFI, with a copy of the Testing and Balancing Report Summary as an upload, indicating that the Testing and Balancing Report is posted on the Overview page and requesting review of the report.

1. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
 - a. General Information.
 - b. Summary.
 - c. Air Systems.
2. Contents: Provide the following minimum information, forms and data:
 - a. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
 - b. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
 - c. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 PRODUCTS

2.1 INSTRUMENTATION

- A . Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.
- B . All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards

PART 3 EXECUTION

3.1 PRELIMINARY PROCEDURES

- A . Review preconstruction meeting report, applicable construction bulletins, applicable change orders, and approved shop drawings of equipment, outlets/inlets and temperature controls.
- B . Check filters for cleanliness, dampers for correct positioning, equipment for proper rotation and belt tension, and temperature controls for completion.
- C . Notify Owner's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.2 PERFORMING TESTING, ADJUSTING AND BALANCING

- A . Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.
- B . Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.
- C . In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the Owner's Project Representative.
- D . Cut insulation for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.
- E . In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.
- F . Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers.
- G . Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.
- H . Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Adjust register, grille and diffuser vanes and

accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

- I . Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the Owner's Project Representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to Owner's Project Representative. Prior authorization is needed before this work is started.
- J . Final air system measurements to be within the following range of specified cfm:
 - 1. Fans 0% to +10%.
 - 2. Supply grilles, registers, diffusers 0% to +10%.
 - 3. Return/exhaust grilles, registers 0% to -10%.
- K . Contact the Temperature Control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.
- L . Permanently mark equipment settings, including damper positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.
- M . Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.
- N . Coordinate furnace and rooftop unit minimum outside air set points with the Temperature Control Contractor.

3.3 DEFICIENCIES

- A . Mechanical Contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Mechanical Contractor for correction of the deficient work. All corrective work to be done at no cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

SECTION 230700

HVAC INSULATION

PART 1 GENERAL

1.1 SCOPE

- A . This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Quality Assurance.
 - f. Description.
 - g. Definitions.
 - h. Shop Drawings.
 - i. Operation and Maintenance Data.
 - j. Environmental Requirements.
 - 2. PART 2 – PRODUCTS.
 - a. Materials.
 - b. Insulation Types.
 - c. Jackets.
 - d. Accessories.
 - 3. PART 3 – EXECUTION.
 - a. Examination.
 - b. Installation.
 - c. Duct Insulation.

1.2 RELATED WORK

- A . Section 230500 - Common Work Results for HVAC.
- B . Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE

- A . Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

- A . ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.
- B . ASTM C165 Test Method for Compressive Properties of Thermal Insulations.
- C . ASTM C177 Heat Flux and Thermal Transmission Properties.
- D . ASTM C355 Test Methods for Test for Water Vapor Transmission of Thick Materials.
- E . ASTM C518 Heat Flux and Thermal Transmission Properties.
- F . ASTM C921 Properties of Jacketing Materials for Thermal Insulation.
- G . ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation.
- H . ASTM D1000 Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.
- I . ASTM E84 Surface Burning Characteristics of Building Materials.
- J . ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems.

- K . MICA National Commercial & Industrial Insulation Standards.
- L . NFPA 225 Surface Burning Characteristics of Building Materials.
- M . UL 723 Surface Burning Characteristics of Building Materials.

1.5 QUALITY ASSURANCE

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.
- C . Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the Contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

1.6 DESCRIPTION

- A . Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
 - 1. Duct Insulation.
- B . Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner Project Representative.

1.7 DEFINITIONS

- A . Concealed: Shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.8 SHOP DRAWINGS

- A . Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.9 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.10 ENVIRONMENTAL REQUIREMENTS

- A . Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.
- B . Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 PRODUCTS

2.1 MATERIALS

- A . Manufacturers:
 - 1. Armacell: www.armacell.com.
 - 2. Certainteed: www.certainteed.com.
 - 3. Johns Manville: www.johnsmanville.com.
 - 4. Knauf: www.knaufusa.com.
 - 5. Owens-Corning: www.insulation.owens-corning.com.
 - 6. VentureTape: www.venturetape.com.

- B . Materials or accessories containing asbestos will not be accepted.

2.2 INSULATION TYPES

- A . Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.
- B . Flexible Fiberglass Insulation:
 - 1. Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.
- C . Rigid Fiberglass Insulation:
 - 1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
- D . Foil-scrim-polyethylene vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms.

2.3 JACKETS

- A . Foil Scrim All Service Jackets (FSJ):
 - 1. Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

2.4 ACCESSORIES

- A . All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
- B . Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.
- C . Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.
- D . Tack fasteners to be stainless steel ring grooved shank tacks.
- E . Staples to be clinch style.
- F . Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
- G . Finishing cement to be ASTM C449.
- H . Bedding compounds to be non-shrinking and permanently flexible.
- I . Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.
- J . Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A . Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.
- B . Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.2 INSTALLATION

- A . All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient

temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

- B . Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
- C . Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.
- D . Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.
- E . All duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.
- F . Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.
- G . Provide a complete vapor barrier for insulation on the following systems:
 - 1. Insulated Duct.
 - 2. Equipment, ductwork or piping with a surface temperature below 65 degrees F.

3.3 DUCT INSULATION

- A . General:
 - 1. Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.
 - 2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.
 - 3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
 - 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
 - 5. External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner. Provide 4" overlap of external insulation over ends of acoustically lined sections.
 - 6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

END OF SECTION

SECTION 233100

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SCOPE

- A . This section includes specifications for all duct systems used on this project. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Shop Drawings.
 - f. Design Criteria.
 - g. Delivery, Storage and Handling.
 2. PART 2 – PRODUCTS.
 - a. General.
 - b. Duct Pressure Class.
 - c. Materials.
 - d. Low Pressure Ductwork (Maximum 2 inch pressure class).
 - e. Duct Sealant.
 - f. Gaskets.
 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Ductwork Support.
 - c. Low Pressure Duct (Maximum 2 inch pressure class).
 - d. Cleaning.

1.2 RELATED WORK

- A . Section 230593 - Testing, Adjusting, and Balancing for HVAC.
B . Section 233300 - Air Duct Accessories.

1.3 REFERENCE

- A . Applicable provisions of Division 1 govern work under this Section.

1.4 REFERENCE STANDARDS

- | | |
|-----------------|--|
| A . ASTM A90 | Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles. |
| B . ASTM A623 | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. |
| C . ASTM A527 | Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality. |
| D . ASTM 924 | Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method. |
| E . ASTM C 1071 | Specification for Fibrous Glass Duct Lining Insulation. |
| F . ASTM E 84 | Test Method for Surface Burning Characteristics of Building Materials. |
| G . ASTM C 1338 | Test Method for Determining Fungal Resistance of Insulation Materials and Facings. |
| H . ASTM C 916 | Standard Specification for Adhesives for Duct Thermal Insulation |

NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.

I . UL 181 Standard for Safety for Factory Made Air Ducts and Air Connectors.

J . NAIMA Fibrous Glass Duct Liner Standard.

1.5 SHOP DRAWINGS

A . Include manufacturer's data and/or Contractor data for the following:

1. Duct sealant and gasket material.
2. Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

1.6 DESIGN CRITERIA

A . Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

B . Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.
2. HVAC Air Duct Leakage Test Manual, 1st Edition, 1985.
3. HVAC Systems - Duct Design, 4th Edition, 2006.
4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004.
5. Round Industrial Duct Construction Standards, 2nd Edition, 1999.

C . Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.7 DELIVERY, STORAGE AND HANDLING

A . Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

B . Protect Ductwork against damage.

C . Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

D . Offsite storage agreements do not relieve the contractor from using proper storage techniques.

E . Storage and protection methods must allow inspection to verify products.

PART 2 PRODUCTS

2.1 GENERAL

A . All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

B . Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.2 DUCTWORK PRESSURE CLASS

A . Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application.

2.3 MATERIALS

A . Galvanized Steel Sheet:

1. Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish for ductwork that will be painted.

2.4 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

- A . Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.
- B . Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.
- C . Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 233300. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.
- D . Where rectangular elbows are used, provide turning vanes in accordance with Section 233300.
- E . Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.
- F . Button punch snaplock construction will not be accepted on aluminum ductwork.
- G . Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer. All uninsulated exposed round duct shall be spiral type.
- H . Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.5 DUCT SEALANT

A . Manufacturer:

1. 3M 800: www.3m.com.
2. 3M 900: www.3m.com.
3. H.B. Fuller/Foster: www.hbfuller.com.
4. Lockformer Cold Sealant: www.lockformer.com.
5. Mon-Eco Industries: www.mon-ecoindustries.com.
6. United Sheet Metal: www.unitedsheetmetal.com.

B . Silicone sealants are not allowed in any type of ductwork installation.

C . Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.6 GASKETS

A . 2 inch pressure class and lower:

1. Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

PART 3 EXECUTION

3.1 INSTALLATION

- A . Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.
- B . Make allowances for beams, pipes or other obstructions in building construction and for work of other Contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.
- C . Test openings for test and balance work will be provided under Section 230593.
- D . Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.
- E . Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
- F . Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.
- G . Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.
- H . Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- I . Provide adequate access to ductwork for cleaning purposes.
- J . Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.
- K . Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.
- L . During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 DUCTWORK SUPPORT

- A . Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.
- B . Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

3.3 LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)

- A . Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.
- B . Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C . Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at Contractor's option.

3.4 CLEANING

A . Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

B . Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

END OF SECTION

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SECTION 233300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

- A . This section includes accessories used in the installation of duct systems. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Related Work.
 - b. Reference.
 - c. Reference Standards.
 - d. Shop Drawings.
 - e. Operation and Maintenance Data.
 2. PART 2 – PRODUCTS.
 - a. Manual Volume Dampers.
 - b. Turning Vanes.
 - c. Control Dampers.
 - d. Smoke Detectors.
 - e. Access Doors.
 - f. Flexible Duct.
 - g. Duct Lining.
 - h. Duct Flexible Connections.
 - i. Hoods for Intake and Exhaust.
 3. PART 3 – EXECUTION.
 - a. Manual Volume Dampers.
 - b. Turning Vanes.
 - c. Control Dampers.
 - d. Smoke Detectors.
 - e. Access Doors.
 - f. Flexible Duct.
 - g. Duct Lining.
 - h. Duct Flexible Connections.
 - i. Hoods for Intake and Exhaust.

1.2 RELATED WORK

- A . Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
B . Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE

- A . Applicable provisions of Division 1 govern work under this Section.

1.4 REFERENCE STANDARDS

- A . NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems.
B . SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995.
UL 214.
C . UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers.

1.5 SHOP DRAWINGS

- A . Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

- B . Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.
- C . Submit manufacturer's color charts where finish color is specified to be selected by the Engineer.

1.6 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

PART 2 PRODUCTS

2.1 MANUAL VOLUME DAMPERS

- A . Manufacturers:
 - 1. Ruskin: www.ruskin.com.
 - 2. Vent Products: www.ventproducts.com.
 - 3. Air Balance: www.airbalance.com.
- B . Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.
- C . Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.2 TURNING VANES

- A . Manufacturers:
 - 1. Aero Dyne: www.aero-dyne.net.
 - 2. Anemostat: www.anemostat.com.
 - 3. Hart & Cooley: www.hartandcooley.com.
- B . Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.3 CONTROL DAMPERS

- A . Control dampers are integral to the packaged rooftop units and exhaust fans. New dampers for Furnace outside air control shall be provided and installed by the Mechanical Contractor. Wiring for dampers shall be by the Mechanical Contractor.

2.4 ACCESS DOORS

- A . Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of cam sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

2.5 FLEXIBLE DUCT

- A . Manufacturers:
 - 1. Anco Products: www.ancoproductsinc.com.
 - 2. Clevaflex: www.clevaflex.com.
 - 3. Thermafex: www.thermafex.net.
 - 4. Flexmaster: www.flexmasterusa.com.
- B . Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and smoke developed rating of 50 or under in accordance with NFPA 90A.
- C . Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ± 2 inch pressure class, depending on the application.
- D . Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.
- E . Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.6 DUCT LINING

- A . Manufacturer:
 - 1. Manville: www.jm.com.
 - 2. Owens-Corning: www.owenscorning.com.
 - 3. Knauf: www.knaufusa.com.
- B . 1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.
- C . Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.
- D . Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.
- E . Install liner using adhesive conforming to ASTM C 916.

2.7 DUCT FLEXIBLE CONNECTIONS

- A . Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.
- B . Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.
- C . Use coated glass fiber fabric for all applications. Material for inside applications to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard.

2.8 HOODS FOR INTAKE AND EXHAUST

- A . Manufacturers:
 - 1. Acme: www.acmefan.com.
 - 2. Carnes: www.carnes.com.
 - 3. Cook: www.lorencook.com.
 - 4. Greenheck: www.greenheck.com.
 - 5. Louvers and Dampers: www.louvers-dampers.com.
 - 6. Penn: www.pennstateind.com.

7. Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

- B . Use low silhouette type hoods.
- C . Use louvered penthouse type hoods with drainable blade louvers.
- D . Construct hoods of aluminum.
- E . Construct hoods of galvanized steel with baked enamel finish; color to be selected by the Architect during the submittal stage.

For hoods and louvered penthouses maintain minimum 30 inches from bottom of air intake to finished roof.

- F . Provide bird screen and motor operated damper for each hood.

PART 3 EXECUTION

3.1 MANUAL VOLUME DAMPERS

- A . Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.2 TURNING VANES

- A . Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.
- B . Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.
- C . If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.3 ACCESS DOORS

- A . Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire dampers, smoke detectors, fan bearings, heating and cooling coils, filters, and control devices needing periodic maintenance.
- B . Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated.

3.4 FLEXIBLE DUCT

- A . Flexible duct may only be used for final connections of air outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.
- B . Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.
- C . Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.
- D . Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

- E . Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.
- F . Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.5 DUCT LINING

- A . Do not apply lining to the following ductwork:
 - 1. Outside air ductwork.
- B . Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally, secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

3.6 DUCT FLEXIBLE CONNECTIONS

- A . Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

3.7 HOODS FOR INTAKE AND EXHAUST

- A . Install in locations indicated on the drawings, coordinating the roof opening location with the General Contractor.

END OF SECTION

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SECTION 233713

DIFFUSERS, REGISTERS AND GRILLES

PART 1 GENERAL

1.1 SCOPE

- A. This section includes specifications for air terminal equipment. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Submittals.
 - f. Design Criteria.
 - 2. PART 2 – PRODUCTS.
 - a. Manufacturers.
 - b. Square Ceiling Diffusers - High Performance.
 - c. Eggcrate Grille.
 - 3. PART 3 – EXECUTION.
 - a. Installation.

1.2 RELATED WORK

- A. Section 230593 - Testing, Adjusting and Balancing for HVAC.
- B. Section 233100 - HVAC Ducts and Casings.
- C. Section 233300 - Air Duct Accessories.

1.3 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

- A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 - Factory-Made Air Ducts and Connectors.
- C. ARI-ADC Standard 880.

1.5 SUBMITTALS

- A. Furnish submittal information including, but not limited to, the following:
 - 1. Manufacturer's name and model number.
 - 2. Identification as referenced in the documents.
 - 3. Capacities/ratings.
 - 4. Materials of construction.
 - 5. Sound ratings.
 - 6. Dimensions.
 - 7. Finish.
 - 8. Color selection charts where applicable.
 - 9. Manufacturer's installation instructions.
 - 10. All other appropriate data.

1.6 DESIGN CRITERIA

- A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Carnes: www.carnes.com.
- B. Krueger: www.krueger-hvac.com.
- C. Titus: www.titus-hvac.com.
- D. Metal-Aire: www.metalaire.com.
- E. E.H. Price: www.price-hvac.com.
- F. Acceptable manufacturers for specific products are listed under each item.

2.2 SQUARE CEILING DIFFUSERS - HIGH PERFORMANCE

- A. Diffusers to be steel unless otherwise indicated, louvered face furnished with frame type appropriate to installation.
- B. Diffuser shall have throw characteristics of a round diffuser having a 360° horizontal blow pattern.
- C. Louver cones shall be one-piece construction with no corner joints.
- D. White, baked enamel finish or powder coat finish, unless otherwise indicated.
- E. High performance type diffuser incorporating short throws and low NC levels.
- F. Manufacturers:
 - 1. Titus; Model TMS: www.titus-hvac.com.
 - 2. Carne; Series SF: www.carnes.com.
 - 3. Price; Model SCD: www.price-hvac.com.
 - 4. Metal Aire; Series 5800: www.metalaire.com.
 - 5. Krueger; Series 1400: www.krueger-hvac.com.

2.3 EGGCRATE GRILLE

- A. Aluminum construction with frame type appropriate to installation.
- B. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.
- C. Grille sizes and finishes as shown on drawings and/or as scheduled.
- D. White, baked enamel finish or powder coat finish, unless otherwise indicated.
- E. Screw holes on surface counter sunk to accept recessed type screws.
- F. Manufacturers:
 - 1. Titus; Model 50: www.titus-hvac.com.
 - 2. Carnes; Model RAE or RAT: www.carnes.com.
 - 3. Price; Model 80: www.price-hvac.com.
 - 4. Metal Aire; Model CC: www.metalaire.com.
 - 5. Krueger; Model EGC: www.krueger-hvac.com.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.
- B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

- C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.
- D. Seal connections between ductwork drops and diffusers/grilles airtight.
- E. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

END OF SECTION

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SECTION 235400
GAS FIRED FURNACES

PART 1 GENERAL

1.1 SCOPE

- A . This section includes specifications for gas fired furnaces. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Energy Efficiency.
 - f. Submittals.
 - g. Operation and Maintenance Data.
 - h. Warranty.
 2. PART 2 – PRODUCTS.
 - a. Furnaces.
 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Furnaces.
 - c. Owner Training.

1.2 RELATED WORK

- A . Section 230513 - Common Motor Requirements for HVAC Equipment.

1.3 REFERENCE

- A . Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

- A . AGA American Gas Association.
B . ANSI Z21.64 Direct Vent Central Furnaces.
C . GAMA Gas Appliance Manufacturers Association.
D . NEC National Electrical Code.

1.5 ENERGY EFFICIENCY

- A . Provide gas furnaces that bear the ENERGY STAR label and meet the ENERGY STAR specifications for energy efficiency.

1.6 SUBMITTALS

- A . Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

1.7 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.8 WARRANTY

- A . Furnace primary and secondary heat exchangers warranted for 20 years under normal use and maintenance. Remainder of furnace components warranted for 1 year from date of start up.

PART 2 PRODUCTS

2.1 FURNACES

- A . Manufacturers:
 - 1. Carrier: www.carrier.com.
 - 2. Lennox: www.lennox.com.
 - 3. York: www.york.com.
- B . Substitutions: Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements. Direct vent, sealed combustion, condensing type AGA certified for use with natural gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 91. All ratings are to be certified by GAMA. All wiring shall comply with the National Electrical Code.
- C . 22 gauge steel casing with baked enamel finish or pre-painted galvanized steel. Insulate casing back and side panels with foil faced fiberglass insulation.
- D . Construct primary heat exchanger of aluminized steel. Construct secondary heat exchanger of stainless steel with aluminum fins or of polypropylene laminated steel. Aluminized steel multi-port in-shot burner with hot surface or electronic spark ignition, approved for vertical or sidewall venting.
- E . AGA listed gas controls including manual main shut-off valve, double automatic gas valves for redundancy and gas pressure regulator.
- F . Centrifugal type blower fan statically and dynamically balanced with multiple speed, direct drive or belt drive fan motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas venting.
- G . Provide unit with 2" thick MERV 8 minimum disposable type panel air filter and filter holding rack.
- H . Provide solid state integral control unit with all necessary controls and relays including but not limited to:
 - 1. Pressure switch for airflow of flue products through furnace and out vent system.
 - 2. Rollout switch with manual reset to prevent over temperature in burner area.
 - 3. Electronic flame sensor.
 - 4. Blower access safety interlock.
 - 5. Timed blower start after main burners ignite.
 - 6. Factory installed 24 v transformer for controls and thermostat.
 - 7. LED's to indicate status and to aid in troubleshooting.
- I . Provide unit with matching cased "A" configuration cooling coil for upflow units, and vertical flat face configuration cooling coil for horizontal units.
- J . Minimum 1/2" OD seamless copper tubing mechanically bonded to heavy ripple edged aluminum fins with thermal expansion valve, holding charge and copper tube stubs for field piping.
- K . Non-corrosive stainless steel or polymer drain pan with 3/4" NPT drain connection.
- L . 20 gauge steel Coil casing with baked enamel finish and fiberglass insulation.
- M . This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All wiring is to be in conduit in accordance with Division 26 - Electrical. All relays, transformers and controls are to be in enclosures.
- N . Provide a Honeywell RedLINK Wireless VisionPRO 8000 – TH8110R1008 thermostat with 2 occupied periods per day, automatic changeover, separate heating and cooling set points for both occupied and unoccupied modes. Provide auxiliary controls on sub-base to open minimum outside air damper during occupied mode. Substitutions will not be accepted.
- O . Provide lockable thermostat guards in public spaces.

- P . During occupied mode run the supply fan continuously, cycle the cooling or heating as required to maintain occupied space temperature cooling or heating set point. During unoccupied mode cycle the supply fan and cooling or heating as required to maintain unoccupied cooling or heating temperature set point.

PART 3 EXECUTION

3.1 INSTALLATION

- A . Install units as shown on plans and according to the manufacturer's installation instructions.
- B . Install remote thermostats where indicated on the drawings. Provide all wiring between remote thermostats and the gas fired item.

3.2 FURNACES

- A . Install on concrete housekeeping pad, steel stand or suspend unit from structure as indicated on the drawings. Pipe condensate to floor drain or as indicated on plans.
- B . Provide schedule 40 PVC, ASTM D1785 combustion air and vent piping and fittings with solvent welded joints as indicated on the drawings. Terminate as recommended by the furnace manufacturer.

3.3 OWNER TRAINING

- A . Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.

END OF SECTION

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SECTION 236213

PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSING UNITS

1.1 SCOPE

- A . This section includes specifications for air cooled condensing units for use with split system type air conditioning. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference.
 - d. Reference Standards.
 - e. Quality Assurance.
 - f. Submittals.
 - g. Operation and Maintenance Data.
 - h. Delivery, Storage and Handling.
 - i. Warranty.
 2. PART 2 – PRODUCTS.
 - a. Units up to 5 Tons.
 - b. Refrigerant Piping Sizing.
 - c. Refrigerant Piping Accessories.
 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Startup.

1.2 RELATED WORK

- A . Section 230500 - Common Work Results for HVAC.

1.3 REFERENCE

- A . Applicable provisions of Division 1 shall govern work under this section.

1.4 REFERENCE STANDARDS

- | | |
|-----------------|--|
| A . ARI 210/240 | Unitary Air Conditioning and Heat Pump Equipment. |
| B . ARI 365 | Commercial and Industrial Unitary Air Conditioning Condensing Units. |
| C . ASHRAE 15 | Safety Standard for Refrigeration Systems. |
| D . ASHRAE 90.1 | (2004 edition)Energy Standard for Buildings Except Low Rise Residential Buildings. |
| E . NEC | National Electrical Code. |
| F . ASTM B117 | Standard Practice for Operating Salt Spray (fog) Apparatus. |
| G . UL | Underwriters Laboratory. |

1.5 QUALITY ASSURANCE

- A . Unit Energy Efficiency Ratio (EER), Coefficient of Performance (COP) and Integrated Part Load Value (IPLV) shall meet the minimum applicable requirements of ASHRAE 90.1(2004 edition). Units that are labeled ENERGY STAR® will be acceptable.
- B . Rate unit performance in accordance with the latest edition of ARI Standard 365 or ARI Standard 210/240, whichever is applicable for the equipment.
- C . Construct units in accordance with ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.

- D . Factory run test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

1.6 SUBMITTALS

- A . Submit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, stages of unloading capacity achievable without hot gas bypass (and with hot gas bypass if applicable), refrigerant type and charge, component information, size and location of piping connections, electrical connections, wiring diagrams and information for all specialties and accessories.
- B . Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.
- C . At substantial completion, submit warranty certificate and copy of start-up report.

1.7 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.8 DELIVERY, STORAGE AND HANDLING

- A . Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.
- B . Ship units to jobsite fully assembled.

1.9 WARRANTY

- A . Provide a one-year parts and labor warranty on the entire unit beginning upon substantial completion of project.
- B . Provide a five-year parts warranty on the compressor(s) beginning upon substantial completion of project.

PART 2 PRODUCTS

2.1 UNITS UP TO 5 TONS

- A . Manufacturers:
 - 1. Lennox: www.lennox.com.
 - 2. Carrier: www.carrier.com.
 - 3. York: www.york.com.
- B . Provide factory assembled, outdoor mounted, air -cooled condensing unit suitable for on grade or rooftop installation. Include compressor, air cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls, motor starting components and additional features as specified herein or required for safe, automatic operation. Capacity and steps of unloading as indicated in the equipment schedule. Refrigerant is to be R-410A.
- C . CABINET:
 - 1. Construct cabinet of heavy gauge, galvanized steel coated with weather resistant paint. Provide removable access panels to facilitate full access to the compressor, fan and control components.
- D . COMPRESSOR:
 - 1. Provide hermetic reciprocating or scroll type compressor with built in motor winding temperature and current protection, liquid and suction service valves, gage ports, sight glass and liquid line filter dryer. Provide crankcase heater with reciprocating type compressors. Mount compressors on vibration isolators. Cooling shall be two-stage.

- E . CONDENSER:
 - 1. Provide condenser coils with aluminum alloy plate fins mechanically fastened to seamless copper tubing with integral subcooler. Construct coils with design working pressure suitable for the refrigerant. Louvered condenser guard shall be provided.
- F . Provide direct-drive statically and dynamically balanced propeller type fans with vertical or horizontal discharge as indicated on the drawings and guards constructed of heavy gage PVC coated wire or galvanized steel.
- G . POWER WIRING:
 - 1. Provide factory installed 24-volt control circuit with fusing; control power transformer and all associated internal wiring. Provide a single point power connection to the unit(s). Provide factory installed magnetic contactors for compressor and condenser motors.
 - 2. Electrical characteristics shall be as indicated in the equipment schedule.
- H . CONTROLS:
 - 1. Provide high/low refrigerant pressure cutouts with manual reset and anti-short cycle compressor timer.
 - 2. Provide "low ambient" controls and accessories needed so that unit is capable of operating down to ambient temperature of 25F.

2.2 REFRIGERANT PIPING SIZING

- A . The unit manufacturer shall verify the final refrigeration pipe sizing process to ensure conformance to specific unit requirements such as max lengths, refrigerant velocities, unloading considerations and proper oil return. Provide factory pre-charged line sets unless the distance between the unit and the evaporator coil is too great. In this case, provide sizing criteria and materials to the Mechanical Contractor for this purpose.

2.3 REFRIGERANT PIPING ACCESSORIES

- A . For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225 degree F.
- B . Filter Dryers: For circuits below 15 tons provide straight pattern filter dryers without replaceable core.
- C . Sight glasses: Two piece brass construction with solder end connections. Include color indicator for sensing moisture.
- D . Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, teflon diaphragm and solder end connections. Provide replaceable coil assembly.
- E . Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.
- F . Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.
- G . Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 EXECUTION

3.1 INSTALLATION

- A . Install units, piping and accessories in accordance with the manufacturer's written instructions and recommendations. Mount unit(s) on a poured concrete pad on grade or on roof mounted rails as indicated on the drawings. Units shall be level on pitched roofs.
- B . Maintain adequate service access and airflow clearances for all components as recommended by the manufacturer and as indicated on the drawings.

- C . Charge unit(s) with full oil charge and refrigerant charge based on the entire refrigeration system pipe size and length.
- D . Provide all control wiring in conduit in compliance Division 26 - Electrical.
- E . Coordinate power wiring requirements with the electrical trade.

3.2 STARTUP

- A . Adjust units for maximum operating efficiency, adjust all controls to required final settings and demonstrate that all components are functioning properly. Submit four copies of a written startup report following the initial start up. Include in the report: work done to the system, all readings taken, a statement certifying that the refrigeration system(s) are leak free and a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications.

END OF SECTION

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The electrical work included in all other Divisions is the responsibility of the Contractor performing the Division 26 work unless noted otherwise.

1.2 SCOPE

- A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Reference Standards.
 - d. Regulatory Requirements.
 - e. Quality Assurance.
 - f. Continuity of Existing Services and Systems.
 - g. Protection of Finished Surfaces.
 - h. Approved Electrical Testing Laboratories.
 - i. Sleeves and Openings.
 - j. Sealing and Firestopping.
 - k. Intent.
 - l. Omissions.
 - m. Submittals.
 - n. Project/Site Conditions.
 - o. Work Sequence and Scheduling.
 - p. Work by Other Trades.
 - q. Offsite Storage.
 - r. Request and Certificate for Payment.
 - s. Salvage Materials.
 - t. Certificates and Inspections.
 - u. Operating and Maintenance Data.
 - v. Record Drawings.
 - 2. PART 2 – PRODUCTS.
 - a. Access Panels and Doors.
 - b. Identification.
 - c. Sealing and Firestopping.
 - 3. PART 3 – EXECUTION.
 - a. Excavation and Backfill.
 - b. Concrete Work.
 - c. Cutting and Patching.
 - d. Building Access.
 - e. Equipment Access.
 - f. Coordination.
 - g. Sleeves.
 - h. Sealing and Firestopping.
 - i. Housekeeping and Clean Up.
 - j. Owner Training.

1.3 RELATED WORK

- A. Applicable provisions of Bidding requirements and Division 1 – General Requirements govern work under this Section.

1.4 REFERENCE STANDARDS

- A. Abbreviations of standards organizations referenced in this and other sections are as follows:
 - 1. ANSI American National Standards Institute.
 - 2. ASTM American Society for Testing and Materials.
 - 3. EPA Environmental Protection Agency.
 - 4. ETL Electrical Testing Laboratories, Inc.
 - 5. IEEE Institute of Electrical and Electronics Engineers.
 - 6. IES Illuminating Engineering Society.
 - 7. ISA Instrument Society of America.
 - 8. NBS National Bureau of Standards.
 - 9. NEC National Electric Code.
 - 10. NEMA National Electrical Manufacturers Association.
 - 11. NESC National Electrical Safety Code.
 - 12. NFPA National Fire Protection Association.
 - 13. UL Underwriters Laboratories Inc.

1.5 REGULATORY REQUIREMENTS

- A. All work and materials are to conform in every detail to applicable rules and requirements of the State of Oklahoma Electrical Code the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).
- B. All Division 26 work shall be done under the direction of a currently certified State of Oklahoma Certified Master Electrician.

1.6 QUALITY ASSURANCE

- A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.
- B. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply. Where two or more manufacturers are specified and no reference is made to “or equal” other manufacturers, other manufacturers will be considered for prior approval with ten day prior approval submittals.
- C. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by Owner, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.7 CONTINUITY OF EXISTING SERVICES AND SYSTEMS

- A. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner Project Representative. The Owner may require written approval. Any outage must be scheduled when the interruption causes the least interference with normal schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

- B. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible. Note that Owner operations are on a seven-day week schedule, unless otherwise specified.

1.8 PROTECTION OF FINISHED SURFACES

- A. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.9 APPROVED ELECTRICAL TESTING LABORATORIES

- A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
 1. Underwriters Laboratories Inc.
 2. Electrical Testing Laboratories, Inc.

1.10 SLEEVES AND OPENINGS

- A. Below Grade Wall Penetrations.
- B. Conduit Penetrations.

1.11 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.12 INTENT

- A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
- B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the Owner's intent (as determined by the Owner / Project Manager). Refer to the General Conditions of the Contract for further clarification.
- C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.
- D. All sizes as given are minimum except as noted.
- E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Owner's and/or Architect/Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.
- F. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

1.13 OMISSIONS

- A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Owner to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.14 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 – General Requirements.
- B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
- C. On request from the Owner or Architect/Engineer, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
- D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
- E. The submittals must be approved before fabrication is authorized.

1.15 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.
- C. Tools, materials and equipment shall be confined to areas designated by the Owner.

1.16 WORK SEQUENCE AND SCHEDULING

- A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with Owner's Construction Representatives.

1.17 WORK BY OTHER TRADES

- A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.
- B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.18 OFFSITE STORAGE

- A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which the Owner will consider on a case by case basis. Prior approval by Owner personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.19 REQUEST AND CERTIFICATE FOR PAYMENT

- A. Refer to the General Conditions of the Contract for all payment request requirements. A cost breakdown of the proposed values for work performed which may be required by the Owner and if approved by the Owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

1.20 SALVAGE MATERIALS

- A. No materials removed from this project shall be reused. All materials removed shall become the property of and shall be disposed of by the Contractor.

1.21 CERTIFICATES AND INSPECTIONS

- A. Refer to the General Conditions for Certificates and Inspections.
- B. This Contractor is responsible for coordination of Owner electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this Contractor and the Electrical Inspector having jurisdiction.

1.22 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. In addition to the general content specified under applicable sections in Bidding Requirements and Division 1 - General Requirements supply the following additional documentation:
 - 1. Manufacturer's wiring diagrams for electrically powered equipment.

1.23 RECORD DRAWINGS

- A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.
- B. The Owner or Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.
- C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- D. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner prior to final payment.

PART 2 PRODUCTS

2.1 ACCESS PANELS AND DOORS

- A. Lay-in Ceilings:
 - 1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.
- B. Concealed Spline Ceilings:
 - 1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under other divisions.
- C. Metal Pan Ceilings:
 - 1. Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.
- D. Plaster Walls and Ceilings:
 - 1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

- A. See Electrical Section 260553 – Identification for Electrical Systems.

2.3 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Rated Penetrations:
 - 1. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.
- B. Manufacturers:
 - 1. 3M: www.3m.com.
 - 2. STI/SpecSeal: www.stifirestop.com.
 - 3. Tremco: www.tremcosealants.com.
 - 4. Hilti: www.hilti.com.
- C. All firestopping systems shall be by the same manufacturer.
- D. Submittals:
 - 1. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
 - 2. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
- E. Product:
 - 1. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
- F. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
- G. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
- H. Non-Rated Penetrations:
 - 1. Conduit Penetrations Through Below Grade Walls:
 - a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
 - 2. Conduit and Cable Tray Penetrations:
 - a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with Division 31 - Trenching. Blasting will not be allowed without written permission of the Owner.

3.2 CONCRETE WORK

- A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.3 CUTTING AND PATCHING

- 1. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.

3.4 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.5 EQUIPMENT ACCESS

- A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.6 COORDINATION

- A. The Contractor shall cooperate with other trades and Owner's personnel in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
- B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
- C. Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.
- D. Cooperate with the testing consultant in ensuring specification Section 260504 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing Contractor can perform its work.

3.7 SLEEVES

- A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.
- B. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.
- C. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.8 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Penetrations:

1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
- B. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.
- C. Non-Rated Surfaces:
1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
 2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
 3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
 4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.9 HOUSEKEEPING AND CLEAN UP

- A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 260504

CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this Contractor for this project. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 2. PART 2 – PRODUCTS.
 - a. Not Used.
 3. PART 3 – EXECUTION.
 - a. General Inspection and Cleaning of all Equipment.
 - b. Grounding Systems.
 - c. Mechanical and Electrical Interlock System.
 - d. Cables.
 - e. Panelboards.
 - f. Light Fixtures.
 - g. Occupancy Sensors.
 - h. Battery Pack Emergency Lighting.

1.2 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this Section.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

- A. Inspect for physical damage and abnormal mechanical and electrical conditions.
- B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the Engineer and Owner. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
- C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.
- D. Verify proper auxiliary device operation and indicators.
- E. Check tightness of accessible bolted electrical joints. Use torque wrench method.
- F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
- G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
- H. Clean All Equipment:
 1. Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, horizontal and vertical busducts, MCC's, fire alarm panels, comm/data, security panel, etc.
 2. Loosen attached particles and vacuum them away.
 3. Wipe all insulators with a clean, dry, lint free rag.
 4. Clean insulator grooves.

5. Re-vacuum inside surfaces as directed by the Owner's Construction Representative or Inspector.
- I. Inspect equipment anchorage.
- J. Inspect equipment and bus alignment.
- K. Check all heater elements for operation and control.
- L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.2 GROUNDING SYSTEMS

- A. Inspect the ground system for adequate termination at all devices.

3.3 MECHANICAL AND ELECTRICAL INTERLOCK SYSTEM

- A. Physically test each system to ensure proper function, operation and sequencing.
- B. Closure attempt shall be made on locked open devices.
- C. Opening attempt shall be made on locked closed devices.
- D. Key exchange shall be made with devices operated in off normal positions.

3.4 CABLES

- A. Visual and Mechanical Inspections:
 1. Inspect exposed sections for physical damage.
 2. Verify cable is supplied and connected in accordance with single line diagram.
 3. Inspect for shield grounding, cable support and termination.
 4. If cables are terminated through window type C.T.'s make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.
 5. Inspect for visual jacket and insulation condition.
 6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii -- 12 times the diameter for tape shielded cables.
 7. Inspect for proper fireproofing in common cable areas.
 8. There shall be NO tests performed on existing cable without specific direction from the Consulting Engineer.
- B. Electrical Tests -- Below 600 Volts:
 1. All secondary cables from the substation transformers to the secondary switchboards shall be subjected to insulation tests using a 500 vdc megger.
 2. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.
 3. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.
 4. Check for proper grounding resistance at all services and at transformers. Resistance shall be 2 ohms maximum.
 - a. Above 600 volts:
 - 1) Above 600 volt testing will be performed under a separate contract.

3.5 PANELBOARDS

- A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.6 LIGHT FIXTURES

- A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.7 OCCUPANCY SENSORS

- A. Confirm operation of the sensor per the manufacturers spec.

3.8 BATTERY PACK EMERGENCY LIGHTING

- A. Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

END OF SECTION

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SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. References.
 - d. Submittals.
 - e. Project Conditions.
 - 2. PART 2 – PRODUCTS.
 - a. General.
 - b. Building Wire.
 - c. Underground Wire for Exterior Work.
 - d. Wiring Connectors.
 - 3. PART 3 – EXECUTION.
 - a. General Wiring Methods.
 - b. Wiring Installation In Raceways.
 - c. Wiring Connections and Terminations.
 - d. Field Quality Control.
 - e. Wire Color.
 - f. Branch Circuits.
 - g. Emergency Circuits.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.
- B. Section 260533 – Raceway and Boxes for Electrical Systems.
- C. Section 260553 – Identification for Electrical Systems.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Refer to applicable sections of Bidding Requirements and Division 1 - General Requirements.
- B. Submit product data: Provide for each cable assembly type.
- C. Submit factory test reports: Indicate procedures and values obtained.
- D. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.
- E. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.

- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.1 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.
- C.

2.2 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.

2.3 UNDERGROUND WIRE FOR EXTERIOR WORK

- A. Description: Stranded single or multiple conductor insulated wire.
- B. Insulation: Type XHHW-2 or USE.
- C. This wiring shall be used in all underground applications, except when run in a concrete-encased ductbank.

2.4 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.
- E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps. Connector shall be irreversible type meeting IEEE Standard 837-2002, UL Listed.

PART 3 EXECUTION

3.1 GENERAL WIRING METHODS

- A. All wire and cable shall be installed in conduit.
- B. Do not use wire smaller than 12 AWG for power and lighting circuits.
- C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).
- D. Make conductor lengths for parallel conductors equal.
- E. Splice only in junction or outlet boxes.

- F. No conductor less than 10 AWG shall be installed in exterior underground conduit.
- G. Identify ALL low voltage, 600v and lower, wire per section 260553.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.
- E. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

3.3 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
- C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
- D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed.
 - 1. Additional testing as follows shall be performed if aluminum conductors are used:
 - a. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.
 - b. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.
 - c. Test procedures shall meet NETA guidelines.
 - d. Test results and report shall be provided to the engineer.
 - e. Contractor shall correct all deficiencies reported in the test report.

3.5 WIRE COLOR

- A. General:
 - 1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
 - 2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
 - 3. In existing facilities, use existing color scheme.

4. In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
 5. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.
- B. Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.
 - C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.
 - D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.
 - E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, Contractor shall provide green with yellow tracer.

3.6 BRANCH CIRCUITS

- A. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

3.7 EMERGENCY CIRCUITS

- A. All emergency system wiring (level 1 and level 2) shall be installed in separate raceways after their associated transfer switches. The wiring shall be separate from each other and from all normal system wiring.

END OF SECTION

SECTION 260523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes furnishing and installing required remote control and signal cabling. Included are the following topics:
 - 1. PART 1 - GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. References.
 - d. Submittals.
 - e. Project Conditions.
 - 2. PART 2 - PRODUCTS.
 - a. General.
 - b. Remote Control and Signal Cable.
 - c. Wiring Connectors.
 - 3. PART 3 - EXECUTION.
 - a. General Wiring Methods.
 - b. Wiring Installation In Raceways.
 - c. Free-Air Cable Installation.
 - d. Wiring Connections and Terminations.
 - e. Field Quality Control.

1.2 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this Section.
- B. Section 260533 - Raceway and Boxes for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements, for submittal procedures.
- B. Submit product data: Provide for each cable assembly type.
- C. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.1 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.
- C. Insulation shall have a 600 volt rating.
- D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
 - 1. All conductors terminated with crimp type devices must be stranded.
 - 2. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 REMOTE CONTROL AND SIGNAL CABLE

- A. Refer to Section 283100 for requirements for cable to be used on fire alarm systems.
- B. Refer to Drawings for requirements for cable to be used on communication systems.
- C. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
 - 1. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, shielded, and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
 - 2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.3 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 EXECUTION

3.1 GENERAL WIRING METHODS

- A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.
- B. Control cables for controlling HVAC and lighting equipment connected to emergency power shall be routed in raceway.
- C. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.
- D. Splice only in junction boxes.
- E. Identify wire per section 260553.
- F. Neatly train and lace wiring inside boxes, and equipment.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.

3.3 FREE-AIR CABLE INSTALLATION

- A. When permitted in exposed ceiling areas, 'Free-Air' wiring runs shall avoid areas of high traffic (i.e. aisle way), shall be run as close as possible to outlining walls and shall be a minimum of ten (10) feet above finished floor.
- B. Cabling shall be neatly run at right angles and be kept clear of other trades work.
- C. Cabling shall be supported at a maximum of 4-foot intervals utilizing 'bridal-type' mounting rings anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Mounting rings shall be designed to maintain cables bend to larger than the minimum bed radius (typically 4 x cable diameter).
- D. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical conduit. Additionally, cabling shall not be laid directly on the ceiling grid.
- E. To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances for 'Free-Air' cabling installations shall be adhered to:
 - 1. Twelve (12) inches from power lines of less than 5kV.
 - 2. Thirty-nine (39) inches from power lines of 5kV or greater.
 - 3. Eighteen (18) inches from lighting fixtures.
 - 4. Thirty-nine (39) inches from transformers and motors.
- F. A coil of 2 feet in each cable shall be placed in the ceiling at each 'free-air' wired device. These coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
- G. All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.
- H. Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
- I. All exposed vertical cable extensions to devices located below the finished ceiling shall be in conduit.
- J. Provide protection for exposed cables where subject to damage.
- K. Use suitable cable fittings and connectors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
- C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- D. Thoroughly clean wires before installing lugs and connectors.

- E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 260504.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:
 - 1. PART 1 - GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. References.
 - d. Performance Requirements.
 - e. Submittals.
 - f. Project Record Documents.
 - g. Regulatory Requirements.
 - 2. PART 2 - PRODUCTS.
 - a. Rod Electrode.
 - b. Mechanical Connectors.
 - c. Compression Connectors.
 - d. Exothermic Connections.
 - e. Wire.
 - f. Bus.
 - 3. PART 3 - EXECUTION.
 - a. Examination.
 - b. General.
 - c. Less Than 600 Volt System Grounding.
 - d. Field Quality Control.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this Section.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 2 ohms maximum at building service entrance.
- B. Testing of grounding system resistance is to be witnessed by the Engineer / Owner Representative. Provide test report of grounding system resistance in final O&M manuals.

1.5 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Product Data: Provide data for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- D. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of grounding electrodes.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch (19 mm) minimum.
- C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.2 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength; high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.
- B. Split bolt connector types are NOT allowed. Exception: The use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.3 COMPRESSION CONNECTORS

- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.4 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 - 1. Cadweld: www.Cadweld.com.

2.5 WIRE

- A. Material: Stranded copper (aluminum not permitted).
- B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.
- C. Foundation Electrodes: As shown on drawings.
- D. Primary Manhole, Main Switchgear room and Vault Bonding: No. 4/0 minimum.
- E. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

2.6 BUS

- A. Material: Copper (aluminum not permitted).
- B. Size: 1/4" X 2" minimum.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before permanent building service is energized.
- E. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

3.3 LESS THAN 600 VOLT SYSTEM GROUNDING

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Use effectively grounded metal frame of the building.
- B. Provide code sized copper grounding electrode conductor from secondary switchboard ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.
- C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- D. Install ground grid under access floors where indicated. Construct grid of #4 AWG bare copper wire installed on 72 inch centers both ways. Bond each access floor support pedestal to grid.
- E. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to under floor ground grid. Use #4 AWG bare copper conductor.
- F. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.
- G. Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.
- H. Telecommunications and Audio Visual systems shall be installed with an isolated grounding system which has only one ground point. That ground point is to be the common grounding electrode system at the electrical service entrance for the building. Contractor is to provide an isolated grounding conductor from the electrical service entrance of the building to each Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room. Use a minimum No. 2/0 AWG copper conductor, or as indicated on the plans, for the telecommunications service grounding conductor. Leave 10 feet slack grounding conductor at each Telecommunications Room. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).
- I. Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

3.4 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Quality Assurance.
 - 2. PART 2 – PRODUCTS.
 - a. Material.
 - 3. PART 3 – EXECUTION.
 - a. Installation.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.

1.3 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Product Data: Provide data for support channel.

1.4 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.
- B. Hardware: Corrosion resistant.
- C. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and 1/4" for single conduits 1" and smaller.
- D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.

- C. **Powder-actuated fasteners and plastic wall anchors are not permitted.**
- D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
- F. Do not drill structural steel members unless approved by Owner.
- G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch concrete pads.
- I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall (7/8" Uni-strut or 3/4" painted, fire-retardant plywood is acceptable).
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes. Included are the following topics:
 - 1. PART 1 - GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - 2. PART 2 - PRODUCTS.
 - a. Rigid Metal Conduit and Fittings.
 - b. PVC Coated Rigid Metal Conduit.
 - c. Intermediate Metal Conduit (IMC) and Fittings.
 - d. Electrical Metallic Tubing (EMT) and Fittings.
 - e. Flexible Metal Conduit and Fittings.
 - f. Liquidtight Flexible Metal Conduit and Fittings.
 - g. Rigid Nonmetallic Conduit and Fittings
 - h. Conduit Supports.
 - i. Auxiliary Gutters (Wireways).
 - j. Outlet Boxes.
 - k. Floor Boxes.
 - l. Pull and Junction Boxes.
 - m. General.
 - 3. PART 3 - EXECUTION.
 - a. Conduit Sizing, Arrangement and Support.
 - b. Conduit Installation.
 - c. Conduit Installation Schedule.
 - d. Coordination of Box Locations.
 - e. Outlet Box Installation.
 - f. Floor Box Installation.
 - g. Pull and Junction Box Installation.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262726 - Wiring Devices.
- D. Section 262702 - Equipment Wiring Systems.
- E. Section 283100 - Fire System.
- F. Division 27, for Communications Cable and Equipment.

1.3 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Surface Raceway System - submit product data and catalog sheets for all components.
- C. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.2 PVC COATED RIGID METAL CONDUIT

- A. PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.
- B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches whichever is greater.

2.3 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.4 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, galvanized tubing.
- B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.
- C. Conduit Bodies: All steel threaded conduit bodies.

2.5 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: Steel, galvanized, spiral strip.
- B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 265113).

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: Flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.7 RIGID NONMETALLIC CONDUIT AND FITTINGS

- A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90 °C conductors.
- B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.8 CONDUIT SUPPORTS

- A. See Section 260529.

2.9 AUXILIARY GUTTERS (WIREWAYS)

- A. Description: Oil-tight and dust-tight type wireway without knockouts.
- B. Size: as required.
- C. Cover: Screw applied
- D. Connector: screw applied cover.

- E. Fittings: Lay-in type with removable top, bottom, and side; captive screws. Finish: Rust inhibiting primer coat with gray enamel finish.

2.10 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: Galvanized steel, with stamped knockouts.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Concrete Ceiling Boxes: Concrete type.
- D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.11 FLOOR BOXES

- A. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Full adjustable.

2.12 PULL AND JUNCTION BOXES

- A. Pull boxes and junction boxes shall be minimum 4 inch square by 2-1/8 inches deep for use with 1 inch conduit and smaller. On conduit systems using 1-1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square.
- B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1-1/4 inch and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.
- C. Sheet Metal Boxes: Code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
- D. Sheet Metal Boxes Larger than 12 inches in any dimension shall have a hinged cover or a chain installed between box and cover.
- E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.
- G. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.
- H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
- I. Wireways shall not be used in lieu of junction boxes.

2.13 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. No cast metal or split-gland type fittings permitted.
- C. Mogul-type condulets larger than 2 inch not permitted except as approved or detailed.
- D. All conduit covers must be fastened to the conduit body with screws and be of the same manufacturer.
- E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.
- F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4 inch and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.
- B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch minimum except all homerun conduits shall be 3/4 inch, or as specified elsewhere. Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.
- C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
- D. Arrange conduit to maintain headroom and present a neat appearance.
- E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- F. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- J. Support and fasten metal conduit at a maximum of 8 feet on center.
- K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
- L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
- M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- N. For indoor conduits, no continuous conduit run shall exceed 100 feet without a junction box.
- O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square; de-burr cut ends.
- B. Conduit shall not be fastened to the corrugated metal roof deck.
- C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.

- E. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 260526 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
- F. Install no more than the equivalent of three 90 degree bends between boxes.
- G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
- H. Conduit shall be bent according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
- I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
- K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
- L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- N. Route conduit through roof openings for piping and ductwork where possible.
- O. Conduit is not permitted in any slab topping of two inches or less.
- P. Ground and bond conduit under provisions of Section 260526.
- Q. Maximum Size Conduit in Slabs Above Grade: 3/4 inch. Do not route conduits to cross each other in slabs above grade.
- R. PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor.
- S. Identify conduit under provisions of Section 260553.
- T. All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, whether or not the conduit is concrete encased.
- U. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturers recommendations.

3.3 CONDUIT INSTALLATION SCHEDULE

- A. Conduit other than that specified below for specific applications shall not be used.
- B. Underground Installations within Five Feet of Foundation Wall: Rigid steel conduit.
- C. Underground Installations More than Five Feet from Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.
- D. Under Slab on Grade Installations: Schedule 40 PVC conduit.
- E. Exposed Outdoor Locations: Rigid steel conduit.

- F. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit.
- G. Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit.
- H. Wet Interior Locations: Rigid steel conduit, PVC coated rigid steel conduit.
- I. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- J. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- K. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot; maximum length shall be three feet. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- L. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8 inch minimum diameter and six foot maximum length. Conduit length shall allow movement of fixture for maintenance purposes.
- M. Medium Voltage Applications (Interior Locations): Rigid steel conduit.

3.4 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
- D. Boxes shall not be fastened to the metal roof deck.
- E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
- F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
- G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch by 24 inch access doors.
- I. Locate and install to maintain headroom and to present a neat appearance.
- J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.5 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.
- B. Power:
 - 1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

- C. Low Voltage:
 - 1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4-11/16 inch square, 2-1/8 inch deep. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
- D. Provide knockout closures for unused openings.
- E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.
- F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.
- G. Install boxes in walls without damaging wall insulation.
- H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes. Devices mounted above a countertop shall be oriented horizontally.
- I. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.
- J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.
- N. Surface wall outlets shall be 4 inch square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.6 FLOOR BOX INSTALLATION

- A. Set boxes level and flush with finish flooring material.

3.7 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- B. Support pull and junction boxes independent of conduit.

END OF SECTION

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SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE

A . The work under this section includes the products and execution requirements relating to labeling of power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie & riser) cables, terminating equipment and labeling of inner duct (fiber optic). Included are the following topics:

1. PART 1 - GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
2. PART 2 - PRODUCTS.
 - a. Materials.
3. PART 3 - EXECUTION.
 - a. General.
 - b. Junction and Pullbox Identification.
 - c. Power and Control Wire Identification.
 - d. Wiring Device Identification.
 - e. Nameplate Engraving.
 - f. Panelboard Directories.

1.2 RELATED WORK

- A . Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.
- B . Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- C . Section 260523 - Control-Voltage Electrical Power Cables.
- D . Division 27, for Communications Cable and Equipment.

1.3 SUBMITTALS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Include schedule for nameplates and stenciling.
- C . Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8-1/2" x 11" sheets annotated, explaining their purposed use.

PART 2 PRODUCTS

2.1 MATERIALS

- A . Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: Back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

- B . Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.
- C . Nameplates: Engraved three layer laminated plastic, black letters on a white background. Emergency system (level 1 and level 2) shall use white letters on red background.
- D . Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.
- E . Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16 inch and smaller junction boxes, fire alarm and control devices.

PART 3 EXECUTION

3.1 GENERAL

- A . Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.
- B . All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.
- C . Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.
- D . Install all labels firmly as recommended by the label manufacturer.
- E . Labels shall be installed plumb and neatly on all equipment.
- F . Install nameplates parallel to equipment lines.
- G . Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.
- H . Embossed tape will not be permitted for any application.

3.2 JUNCTION AND PULLBOX IDENTIFICATION

- A . The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power – 480Y/277V	Brown
Secondary Power – 208Y/120V, 240/120V	White
Emergency Power – 480Y/277V	Brown/Red
Emergency Power – 208Y/120V	White/Red
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow
- B . Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.
- C . Telecommunication Rooms identifiers shall be unique in each building.
- D . Telecommunications Outlets are to be labeled 1) on the cover of the assembly and 2) on each cable terminated at that location.

- E . All new outlet faceplates shall incorporate recessed label holders and shall be fitted with clear plastic covers. Where no such label holders are present on existing to remain outlets, the faceplate labels shall be protected with a clear over-laminate.
- F . Labels shall be White background with Black lettering. Lettering size shall be as large as practicable (up to 16-point) to fit properly on the outlet label. No lettering shall be smaller than 12-point.
- G . Copper Data and Fiber Optic Patch Panels shall be labeled identifying Outlet ID. Modular Jacks and/or Fiber Couplers shall be positioned in sequence of Outlet ID. Fiber Panels shall also be labeled with the fiber number. Fibers shall be sequenced in order per the manufacturer's color code.
- H . Each Station Cable shall be labeled within 4-inches of the cable end at the Data Patch Panel, 110 blocks, and Information Outlet.

3.3 POWER AND CONTROL WIRE IDENTIFICATION

- A . Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
- B . All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.4 WIRING DEVICE IDENTIFICATION

- A . Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells and time clocks shall be identified with circuit numbers and source. In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated labels, or neatly hand-written permanent marker.

3.5 NAMEPLATE ENGRAVING

- A . Provide nameplates of minimum letter height as scheduled below.
- B . Panelboards, Switchboards and Motor Control Centers: 1 inch; identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.
- C . Equipment Enclosures: 1 inch; identify equipment designation.
- D . Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch; identify circuit and load served, including location.
- E . Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch; identify source and load served.
- F . Transformers: 1 inch; identify equipment designation. 1/2 inch; identify primary and secondary voltages, primary source, and secondary load and location.
- G . Junction boxes: 1 inch; identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.6 PANELBOARD DIRECTORIES

- A . Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION

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APP-5 Sample Work Permit Form.

APP-6 Copy of Warning Labels, including study date.

- E. The above sections shall include the following items in detail:
1. Obtain available fault current from the local utility company.
 2. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.
 3. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.
 4. Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.
 5. Arc flash values for two normal cases to define the highest values (low short circuit and high short circuit).
 6. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.
 7. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define the system data and are easy to interpret.
 8. Recommendations to reduce the arc flash incident energy in all areas that require class 2 and higher PPE.
 9. Prioritized report summarizing all recommendations from this study. This shall include observed NEC code violations and their corrective action.
 10. The Contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24" x 36" (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical room.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 SHORT CIRCUIT AND COORDINATION STUDY

- A. The short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.
- B. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

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SECTION 262416

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

- A . The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Operation and Maintenance Data.
 - e. Spare Parts.
 2. PART 2 – PRODUCTS.
 - a. Main and Distribution Panelboards.
 - b. Branch Circuit Panelboards.
 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Field Quality Control.

1.2 RELATED WORK

- A . Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements for Submittal procedure.
- B . Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.4 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.5 SPARE PARTS

- A . Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A . Square D: www.squared.com.
- B . Siemens: www.siemens.com.
- C . General Electric: www.geindustrial.com.
- D . Cutler Hammer: www.cutlerhammer.com.

2.2 MAIN AND DISTRIBUTION PANELBOARDS

- A . Panelboards: Circuit breaker type.
- B . Enclosure: NEMA Type 1.Type 3R. Minimum cabinet size: 5-3/4 inches deep; 20 inches wide, with 5 inch minimum gutter space top and bottom. Constructed of galvanized code gauge steel.

- C . Provide cabinet front with hinged door with flush lock. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- D . Provide metal directory holders with clear plastic covers.
- E . Provide panelboards with copper bus (phase buses, bus fingers, etc., ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.
- F . Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.
- G . Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H . Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

2.3 BRANCH CIRCUIT PANELBOARDS

- A . Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.
- B . Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches deep; 20 inches (508 mm) wide with 5 inch minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.
- C . Provide surface cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- D . Provide metal directory holders with clear plastic covers.
- E . Provide panelboards with copper bus (phase buses, bus fingers, etc., ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.
- F . Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.
- G . Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H . Do not use tandem circuit breakers.
- I . Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A . See Section 260529 for support requirements.
- B . Install panelboards plumb with wall finishes.
- C . Height: 6 feet to top.
- D . Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

- E . Provide filler plates for unused spaces in panelboards.
- F . See Section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G . Stub three (3) empty 3/4 inch conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

3.2 FIELD QUALITY CONTROL

- A . If aluminum conductors size #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the Contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.
- B . Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION

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SECTION 262702

EQUIPMENT WIRING SYSTEMS

PART 1 GENERAL

1.1 SCOPE

- A . The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:
 - 1. HVAC motors, VFDs, and panels.
 - 2. Plumbing motors, VFDs, and panels.
- B . Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Coordination.
 - 2. PART 2 – PRODUCTS.
 - a. Cords and Caps.
 - b. Other Products.
 - 3. PART 3 – EXECUTION.
 - a. Inspection.
 - b. Preparation.
 - c. Installation.
 - d. HVAC and Plumbing Connections.
 - e. Equipment Connection Schedule.

1.2 RELATED WORK

- A . Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.
 - 1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems.

1.3 SUBMITTALS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Product Data: Provide data for cord and wiring devices.

1.4 COORDINATION

- A . Coordinate all equipment requirements with the various Contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

- A . Straight-blade Attachment Plug: NEMA WD 1.
- B . Locking-blade Attachment Plug: NEMA WD 5.
- C . Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D . Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

- E . Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.2 OTHER PRODUCTS

- A . Refer to related sections for other product requirements.

PART 3 EXECUTION

3.1 INSPECTION

- A . Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

- A . Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

- A . Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B . Make conduit connections to equipment using flexible PVC-coated metal conduit.
- C . Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- D . Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E . Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- F . Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
- G . Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.4 HVAC AND PLUMBING CONNECTIONS

- A . Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
- B . VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.
- C . Provide 120 volts to each temperature control panel. Coordinate requirements with HVAC/DDC Contractors.
- D . Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.
- E . Each motor terminal box shall be connected with a minimum 12 inch, maximum 36 inch piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- F . Check for proper rotation of each motor.

3.5 EQUIPMENT CONNECTION SCHEDULE

A . As indicated on the drawings.

END OF SECTION

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SECTION 262726

WIRING DEVICES

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through service fittings, access floor boxes, photo cells and time clocks. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Operation and Maintenance Data.
 - 2. PART 2 – PRODUCTS.
 - a. Manufacturers.
 - b. Wall Switches.
 - c. Receptacles.
 - d. Occupancy Sensors.
 - e. Wall Dimmers.
 - f. Device Plates and Box Covers.
 - g. Poke-Through Fittings.
 - 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Field Quality Control.
 - c. Occupancy Sensors.
 - d. Adjusting.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.

1.3 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.
- C. For occupancy sensor shop drawings, the manufacturer's actual layout of occupancy sensors and the wiring diagrams shall be provided.

1.4 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under applicable sections in Bidding Requirements and Division 1 - General Requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Cooper: www.cooperwiringdevices.com.
- B. Hubbell: www.hubbell-wiring.com.
- C. Pass and Seymour: www.passandseymour.com.
- D. Leviton: www.leviton.com.

2.2 WALL SWITCHES

- A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.
- B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.
 - 1. Handle: Made of nylon or high impact resistant material.
 - 2. Color: Gray.

2.3 RECEPTACLES

- A. Convenience and Straight-blade Receptacles: NEMA Type 5-20R, nylon or high impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362, Hubbell model HBL5362, Pass & Seymour model 5362A, or Cooper model AH5362.
- B. Generally, all receptacles shall be duplex convenience type unless otherwise noted.
- C. All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.
- D. GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 7899, Hubbell model GF20, Pass & Seymour model 2095, Cooper model VGF20 or approved equal.
- E. All devices shall be Gray in color. All receptacles on emergency circuits shall have a red face.
- F. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.
- G. Locking-Blade Receptacles: As indicated on drawings.
- H. Specific-use Receptacle Configuration: As indicated on drawings.

2.4 OCCUPANCY SENSORS

- A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.
- B. Wall Mounted (Wall Switch Type):
 - 1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
 - 2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz.
 - 3. Sensitivity shall be user adjustable or self-adjusting type.
 - 4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
 - 5. The off switch shall have manual override for positive off and automatic on.
 - 6. The test LED shall indicate motion.
 - 7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
 - 8. The unit shall have a five year warranty.

C. Ceiling Mounted:

1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.
7. The unit shall have a five year warranty.
8. See drawings for actual type of sensor.

2.5 WALL DIMMERS

- A. Wall Dimmers: Linear slide semiconductor type.
- B. Rating: 600 Watts minimum, larger size to accommodate load shown on Contract Drawings.

2.6 DEVICE PLATES AND BOX COVERS

- A. Decorative Cover Plate: 302/304 smooth stainless steel.
- B. Weatherproof Cover Plate: Gasketed metal with hinged device covers.
- C. Surface Cover Plate: Raised galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install wall switches 46 inches above floor to the center of device, OFF position down.
- B. Install wall dimmers 46 inches above floor to the center of device; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.
- C. Install convenience receptacles 24 inches above floor, 2" above backsplash, grounding pole on bottom.
- D. Install box for information outlet 24 inches above finished floor. Install box for telephone jack for wall telephone 48 above finished floor.
- E. Install specific-use receptacles at heights shown on Contract Drawings.
- F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.
- J. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

3.2 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch and sensor with circuit energized and verify proper operation.

- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.
- F. Owner personnel reserve the right to be present at all tests.

3.3 OCCUPANCY SENSORS

- A. Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.
- B. Provide a minimum of 4 feet of coiled cable for ceiling-mounted sensors.
- C. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.
- D. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.
- E. For lights on emergency power without a remote transfer device, route the emergency circuit through a separate relay controlled by the occupancy sensor(s) in the respective area. For lights on emergency power with a remote transfer device, the emergency power does not get routed through the occupancy sensor relay, but the normal power does get routed through the occupancy sensor relay.

3.4 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

END OF SECTION

SECTION 262728

DISCONNECT SWITCHES

PART 1 GENERAL

1.1 SCOPE

- A . The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Operation and Maintenance Data.
 2. PART 2 – PRODUCTS.
 - a. Manufacturers.
 - b. Disconnect Switches.
 - c. Fuses.
 3. PART 3 – EXECUTION.
 - a. Installation.

1.2 RELATED WORK

- A . Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.

1.3 SUBMITTALS

- A . Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B . Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.4 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified under applicable sections in Bidding Requirements and Division 1 - General Requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A . Square D: www.squared.com.
- B . Siemens: www.siemens.com.
- C . General Electric: www.geindustrial.com.
- D . Cutler Hammer: www.cutlerhammer.com.

2.2 DISCONNECT SWITCHES

- A . Fusible Switch Assemblies (use only when overcurrent protection is required): NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R cartridge type fuses.
- B . Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C . Enclosure: NEMA Type 1 for interior installations and Type 3R for exterior installations.

D . Provide manufacturer's equipment ground kit in all disconnect switches.

2.3 FUSES

A . Fuses 600 Amperes and Less: Dual element, time delay, 600 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.

B . Fuses 601 Amperes and Larger: Time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C . **Provide three (3) spares of each size and type fuse. Provide enclosure for spare fuse.**

PART 3 EXECUTION

3.1 INSTALLATION

A . Install disconnect switches where indicated on Drawings.

B . Provide identification as specified in Section 260553.

END OF SECTION

SECTION 262730

CONTACTORS

PART 1 GENERAL

1.1 SCOPE

- A . The work under this section includes general purpose contactors and lighting contactors. Included are the following topics:
1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. References.
 - d. Submittals.
 - e. Project Record Documents.
 - f. Operation and Maintenance Data.
 - g. Regulatory Requirements.
 2. PART 2 – PRODUCTS.
 - a. General Purpose Contactors.
 - b. Accessories.
 3. PART 3 – EXECUTION.
 - a. Installation.
 - b.

1.2 RELATED WORK

- A . Applicable provisions of Division 1 govern work under this Section.

1.3 REFERENCES

- A . ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
B . NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
C . ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A . Product Data: Include dimensions, size, voltage ratings, current ratings, enclosure type and NEMA sizes.

1.5 PROJECT RECORD DOCUMENTS

- A . Accurately record actual locations of each contactor and indicate circuits controlled.

1.6 OPERATION AND MAINTENANCE DATA

- A . All operations and maintenance data shall comply with the submission and content requirements specified.

1.7 REGULATORY REQUIREMENTS

- A . Furnish products listed and classified by Underwriters Laboratories Inc., or ETL as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS

- A . Description: NEMA ICS 2, AC general purpose magnetic contactor.
B . Coil Voltage: 120 volts, 60 Hertz.
C . Poles: Three.

- D . Size: As scheduled.
- E . Enclosure: ANSI/NEMA ICS 6, Type 1.
- F . Accessories: As scheduled.
- G . Pushbuttons and Selector Switches: NEMA ICS 2, heavy duty type.
- H . Indicating Lights: NEMA ICS 2, LED push-to-test type.
- I . Auxiliary Contacts: NEMA ICS 2, Class A600.

PART 3 EXECUTION

3.1 INSTALLATION

- A . Install in accordance with manufacturer's instructions.
- B . The installation must be accessible. The preferred location shall be in the electrical or the mechanical rooms or as shown on the drawings.

END OF SECTION

SECTION 265113

INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:
 - 1. PART 1 – GENERAL.
 - a. Scope.
 - b. Related Work.
 - c. Submittals.
 - d. Operation and Maintenance Data.
 - e. Extra Material.
 - 2. PART 2 – PRODUCTS.
 - a. Manufacturers.
 - b. Interior Luminaires and Accessories.
 - c. LED Luminaires.
 - 3. PART 3 – EXECUTION.
 - a. Installation.
 - b. Adjusting and Cleaning.
 - c. Interface with Other Products.
 - d. Field Quality Control.
 - e. All Fixture Connections Including Master-Satellite.

1.2 RELATED WORK

- A. Applicable provisions of Bidding Requirements and Division 1 - General Requirements govern work under this section.

1.3 SUBMITTALS

- A. Refer to applicable sections in Bidding Requirements and Division 1 - General Requirements.
- B. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.
- C. For each luminaire type, submit luminaire information in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

LUMINAIRE		BALLAST	LAMP	ANSI INPUT WATTS
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

1.4 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under applicable sections in Bidding Requirements and Division 1 - General Requirements.

1.5 EXTRA MATERIAL

- A. Provide ten (10) percent of each lamp type, but not less than one (1) of each type.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. As specified on Light Fixture Schedule on drawings.

2.2 INTERIOR LUMINAIRES AND ACCESSORIES

- A. See the Lighting Fixture Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.
- B. Provide fluorescent fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.3 LED LUMINAIRES

- A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
 - 1. Minimum Light Output.
 - 2. Zonal Lumen Requirements.
 - 3. Minimum Luminaire Efficacy.
 - 4. Minimum CRI.
 - 5. L70 Lumen Maintenance.
 - 6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
 - 7. Additional requirements:
 - a. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
 - b. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
 - c. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
 - d. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
 - e. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 - f. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
 - g. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
 - h. Driver shall have a rated life of 50,000 hours, minimum.
 - i. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
 - j. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
 - k. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
 - l. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
 - m. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
 - n. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.

- o. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 - p. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
 - q. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
 - r. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
 - s. All luminaires shall be provided with knockouts for conduit connections.
 - t. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
 - u. Provide all of the following data on submittals:
 - 1) Delivered lumens.
 - 2) Input watts.
 - 3) Efficacy.
 - 4) Color rendering index.
8. LED Luminaires used for Emergency Egress Lighting:
- a. The failure of one LED shall not affect the operation of the remaining LEDs.
9. Emergency LED Luminaire Compatibility with Inverters:
- a. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.
10. Dimming:
- a. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
 - b. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

PART 3

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- D. Locate ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.
- G. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips. Provide independent support for all fixtures over 50 lbs.

- H. Install recessed luminaires to permit removal from below.
- I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- J. Install code required hardware to secure recessed grid-supported luminaires in place.
- K. Install wall mounted luminaires and exit signs at height as scheduled.
- L. Install accessories furnished with each luminaire.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.
- O. Install specified lamps in each luminaire and exit sign.
- P. HID Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between ballast and structure. Provide safety chain between reflector and ballast.
- Q. All lamps shall be delivered to the job in sealed cartons and protected from dirt and dust during storage on the project. Lamps shall be taken directly from the cartons and installed in the fixture with special care so that they do not become dusty and are not soiled in the operation.
- R. Lamps installed in fixtures using dimming ballasts shall be burned in at 100% rated output by the Contractor for a minimum of 100 hours as recommended by the ballast manufacturer.
- S. All new lamps shall be operational at the Substantial Completion of the project.

3.2 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Aim and adjust luminaires as indicated on Drawings or as directed by the Architect/Engineer.
- C. Touch up luminaire finish at completion of work.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Interface with air handling accessories furnished and installed under Division 23.

3.4 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.5 ALL FIXTURE CONNECTIONS INCLUDING MASTER-SATELLITE

- A. Direct box or conduit connections for surface and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be minimum 3/8" minimum diameter and six foot maximum length. Flexible whip between master and slave fixtures may be supported off of the ceiling grid wires. Conduit length shall allow movement of the fixture for maintenance purposes. Minimum wire size shall be #18 AWG for single fixture or master-slave fixture.
- B. The flexible connectors shall be all steel, galvanized, clamp type with locknut or snap-in connector including those used on the master-slave unit.

END OF SECTION

SECTION 283100

FIRE SYSTEM

REFER TO SPECIFICATIONS ON ELECTRICAL SYSTEMS DRAWINGS

END OF SECTION

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