PROJECT MANUAL

TECHNICAL SPECIFICATIONS

AGRICULTURAL SCIENCE CENTER EXTENSIONS
Including Alcalde, Artesia, Clayton, Farmington, and Tucumcari

April 16, 2020
DRAFT 99%
NOT FOR CONSTRUCTION
NEW MEXICO STATE UNIVERSITY
AGRICULTURAL SCIENCE CENTERS

PROJECT MANUAL
INCLUDING TECHNICAL SPECIFICATIONS
FOR GENERAL CONSTRUCTION

OF

Agricultural Science Centers Extensions
Including Alcalde, Artesia, Clayton, Farmington, and Tucumcari

FOR

NEW MEXICO STATE UNIVERSITY

APRIL 16, 2020
ARCHITECT

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## SECTION 00 0115
### LIST OF DRAWINGS SHEETS

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- **AS-102**: ENLARGED SITE PLAN
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SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Project Summary
   2. Contractor’s Duties.
   3. Description of Alterations Work.
   4. Work Sequence.
   5. Work by Others.
   6. Owner Occupancy.
   7. Contractor use of site.
   8. Contractor’s Personal Jobsite Restrictions.
   9. Employee Background Checks.
   10. Definitions.
   11. Abbreviations.

B. Related documents and sections:
   1. Document 00 7200 - General Conditions of the Contract
      a. Article 2: Basic responsibilities and rights of Owner.
      b. Article 3: Basic responsibilities of Contractor.

1.02 PROJECT

A. Project Name: AGRICULTURAL SCIENCE CENTER – INCLUDING ALCALDE, ARTESIA, CLAYTON, FARMINGTON, and TUCUMCARI

B. Owner’s Name: NEW MEXICO STATE UNIVERSITY

C. Architect’s Name: VIGIL & ASSOCIATES ARCHITECTURAL GROUP

D. Project Summary:

BID LOT NO.1
   Tucumcari: NMSU PROJECT NO. 3748
   Address: 6502 Quay Road Am. 5, Tucumcari, NM 88401
   1. BASE BID: Connect site to city water system, installation of water meter, run new domestic water lines to existing buildings on site.
   2. ADD-ALT: New Irrigation Lines, frost free valves and boxes

BID LOT NO.2
   Clayton: NMSU PROJECT NO. 3699
   Address: 15 NMSU Lane, Clayton, NM 88415
1. **BASE BID:** Boiler Replacement at the Feed Mill Bldg.
2. **ADD-ALT 1:** Restroom Renovation (Main Office)
3. **ADD-ALT 2:** New Flooring (Main Office)

**BID LOT NO.3**

**Farmington:** NMSU PROJECT NO. 3743  
**Address:** 300 Road 4063, Farmington, NM 87401

1. **BASE BID:** Demolition of the existing greenhouse and new addition of an 1800 SF pre-manufactured greenhouse on site.
2. **ADD-ALT 1:** Heated planting tables & benches

**BID LOT NO.4**

**Alcalde:** NMSU PROJECT NO. 3737  
**Address:** 371 County Rd. 40, Alcalde, NM 87511

1. **BASE BID:** Main office building repairs including headers, re-stucco, exterior finishes to include first floor window replacement and header replacement, (includes replacement of interior plaster and exterior stucco at modified areas).
2. **ADD-ALT:** Exterior Stucco System Re-finish throughout the entire bldg.

**BID LOT NO.5**

**Artesia:** NMSU PROJECT NO. 3738  
**Address:** 67 E. Four Dinkus Rd, Artesia, NM 88210

1. **BASE BID:** Foundation stabilization at perimeter of building, to include helical piers and sidewalk around perimeter of building. Exterior resurfacing, patching, prime & painting of entire building. New metal roof replacement system, gutters, downspouts, and site drainage components at entire building.
2. **ADD- ALT:** 2 inches of poly Iso below the new Metal Roof

**1.03 CONTRACT DESCRIPTION**

A. Contract Type: A single prime contract based on a Stipulated Price as described in construction contract agreement.

**1.04 CONTRACTOR’S DUTIES**

A. Except as noted, provide and pay for all labor, materials, and equipment.

1. Pay required sales, gross receipts, and other taxes. Owner will pay Contractor applicable New Mexico gross receipts tax including local option tax and any increase in tax becoming effective after Contract date. Tax is to be excluded from bid prices but included as separate amount on Applications for Payment.

C. Secure and pay for permits (including plan checking fees), fees, and licenses necessary for execution of Work as applicable at time of receipt of bids or as otherwise required in other sections of the Specifications.

D. Give required notices.

E. Comply with codes, ordinances, regulations, and other legal requirements of public authorities which bear on performance of Work.

F. Request required inspections from public authorities, correct any noted deficiencies, and obtain
certifications of satisfactory inspection. Deliver certificates to Owner in accordance with Section 1 7800 – Closeout Submittals.

1.05 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings and specified in Section 02 4100.

B. Scope of alterations work is shown on drawings.

1.06 WORK SEQUENCE

A. Construct Work in phases during the construction period as coordinated with Owner and Architect.

B. Coordinate construction schedule and operations with Owner and Architect.

C. Refer to stages of Work on Sheet G003.

1.07 WORK BY OTHERS

A. Owner will award separate construction contracts for purchase and installation of:

B. Owner will remove and retain possession of the following items prior to start of Work:

C. Owner’s responsibilities:
   1. Schedule and assist Contractor in coordination of work by Owner’s own forces and separate contractors.
   2. Schedule delivery of Owner supplied products.
   3. Obtain and provide to Contractor shop drawings, product data, and installation instructions for Owner supplied products.
   4. Arrange and pay for delivery of Owner supplied products to site.
   5. Submit claims for transportation damage and replace damaged, defective, or deficient items.

D. Contractor’s responsibilities:
   1. Participate in coordination of work with other installers, including Owner’s own forces and separate contractors.
   2. Inform Owner of required delivery dates for Owner supplied products and installation dates for work by others.
   3. Review shop drawings, product data, and installation instructions; coordinate installation with other work; and provide blocking and other preparation required for Owner supplied products.
   4. Unload Owner supplied products required to be installed by Contractor at site and inspect for completeness and damage. Assemble, finish and install products as indicated by Contract Documents.
   5. Repair or replace items damaged after receipt.
1.08 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the construction period.
B. Owner intends to occupy the Project upon Substantial Completion.
C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
D. Schedule the Work to accommodate Owner occupancy.

1.09 CONTRACTOR USE OF SITE

A. Existing building and site will be occupied during construction. Cooperate with Owner to minimize conflict and to facilitate Owner's operations during regular and after-hours use.
B. Construction Operations: Limited to areas noted on Drawings and as coordinated with Owner and Architect.
C. Contractor will have restricted use of site to allow Owner occupancy, Owner to conduct normal operations, and installations by others.
   1. Access to site by trucks, equipment, and automobiles. Limited to route and entrances designated in Section 01 5000 – Temporary Facilities and Controls. Schedule construction traffic and material deliveries to site during time periods coordinated in advance with Owner.
   2. On site construction vehicle and equipment traffic shall be limited to pathways, areas, and time periods approved in advance by Owner to ensure safe site conditions. Special care shall be taken during change of class periods, student arrival/departure times and around playgrounds, bus zones and established student pathways. The Contractor shall strictly maintain close communication with designated school representative(s) on matter of on-site construction traffic scheduling and promptly inform them in advance of any significant changes to related pre-authorized arrangements. Do not proceed with altered arrangements prior to designated school representative(s) approval.
   3. Existing student and staff toilet rooms are off-limits to Contractor unless they are not available for use by the school due to the approved schedule of work.
   4. Parking: Contractor and work force may use designated portions of existing parking lots. Do not interfere with Owner’s parking requirements.
   5. Unless otherwise agreed to in advance by Owner, construction shall be performed only during these time periods:
      a. Normal weekday work hours.
      b. Time periods established by Owner and Architect.
   6. Construction activities shall be limited to areas of actual construction. Unless otherwise agreed to in advance by Owner, restrict workmen from entering adjacent restricted areas.
D. Existing building spaces may not be used for storage.
E. Contractor shall make arrangements with Owner to secure any keys necessary for access to existing building and site areas so that the work can be performed. The Contractor assumes sole responsibility for the security and use of school keys obtained from the Owner and shall not
reproduce them nor lend them out during the progress of work.

F. Do not allow dust and debris to blow onto adjacent restricted areas.

G. Provide 72 hours notice to Owner for any work that may interrupt or otherwise impact the facility’s normal operation including noisy dust or odor producing activities.

H. Emergency exits shall be maintained during construction in a manner satisfactory to the Architect, Owner, and local officials having jurisdiction over emergency procedures and fire safety at the school. Notify Architect and Owner of any proposed modifications to emergency exits in advance of making changes due to construction.

I. Utility outages and shutdowns:
   1. Maximum allowable duration: 4 hours or as approved in advance by Owner.
   2. Coordinate all utility shutdowns which affect the operation of the school and neighbors with the Architect, Owner, and any entity having jurisdiction over or ownership of impacted public or private utility infrastructure.
   3. Schedule outages during off hours to facilitate Owner’s operations.
   4. Submit written requires for outage to Architect 72 hours before anticipated outage. Outage must be approved in writing by Design Professional.

J. Owner reserves right to place and install equipment and furnishings in completed areas of building prior to Substantial Completion, provided such occupancy does not interfere with construction. Placing of equipment and furnishings does not constitute Substantial Completion of any portion of the Work. An inspection by Contractor, Owner and Architect shall be made prior to such limited occupancy solely for the purpose of establishing the condition of finishes and other items that might be damaged or obscured by placement and installation of Owner’s items.

K. Existing natural vegetation at the site shall be retained to the extent possible. Limit movement and storage of equipment and materials to minimize damage to natural vegetation and terrain.

1.10 CONTRACTOR’S PERSONNEL JOBSITE RESTRICTIONS

A. Contractor shall enforce the following requirements on his entire workforce throughout the progress of the Work:
   1. All personnel on site, directly or indirectly in the employ of Contractor, are restricted from any interaction with any Owner, Owner’s staff, students, or other members of the public while on, or adjacent to Owner’s property except through jobsite meetings conducted by the Design Professional and the Owner or as otherwise determined by the Owner.
   2. Contractor’s personnel shall remain in their designated work areas. Communications with any non-project related persons on or near the site shall be through Project Superintendent.
   3. No firearms or other types of weapons, of any sort are allowed on site. If member of the Contractor’s workforce is found to be in possession of a firearm, of any kind, they will be directed to leave immediately and will not be allowed to return. This includes firearms found in company or private vehicles, tool boxes, or brought on site in any other manner;
   4. Smoking is prohibited on any occupied school campus. Smoking shall be limited to designated areas on a new, or un-occupied, site, if allowed in advance by Owner.
   5. There shall be no use, possession, sale, and distribution of alcohol, drugs, or other controlled substances on its premises. The Contractor shall also prohibit the presence of an individual with such substances in their body from the workplace.
6. Any employee who is found in violation of requirements of these restrictions, or of any others within the Contract Documents, or who refuses to permit inspection shall be barred from the Project site at the discretion of the Owner in accordance with Subparagraph 13.8.4.1 of the General Conditions.

7. Comply with Owner’s procedures for individual visual identification of Contractor’s workforce on school site and in occupied areas. If identification badges are required make sure that they are worn at all times on site during the work.

1.11 DEFINITIONS

A. Refer to Document 00 7000 – General Conditions, Article 1.1 for definitions of terms used within Contract Documents.

B. Additional terms used within Specifications but not defined by Document 00 7000 – General Conditions shall have the following definitions:

1. Products: Materials, manufactured items, components, fixtures, machinery, equipment, or systems forming the Work but not including machinery, equipment, and other aids used for preparing, fabricating, conveying, and installing the work.

2. Supply: Furnish, deliver, and unload and Project site. Same meaning as furnish.

3. Furnish: Supply, deliver, and unload at Project site. Same meaning as supply.

4. Install: Operations and Project site to incorporate products into the Work such as unpacking, anchoring, erecting, applying, placing, curing, finishing, and preparing for use.

5. Provide: To supply or furnish a product and to also install it.

6. Execution: Operations at Project site including preparatory actions, installing, and post-installation adjusting, testing, cleaning, and demonstrating.

1.12 ABBREVIATIONS

1. Abbreviations used within the Specifications are defined as follows. For abbreviations not listed, contact Architect for definitions.

   ANSI – American National Standards Institute
   CF – Cubic feet.
   CFM – Cubic feet per minute.
   F – Fahrenheit.
   LF – Linear feet.
   LB – Pound.
   MPH – Miles per hour.
   SF – Square feet.
   SY – Square yards.
   PSI – Pounds per square inch.
   PSF – Pounds per square foot.
   RPM – Revolutions per minute.
   UL – Underwriters Laboratory.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION
SECTION 01 1500
GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 GEOTECHNICAL STUDY

A. ALCALDE:
A geotechnical study for this project has been prepared by GEO-TEST, New Mexico. Dated March 10, 2020. This study is provided following this sheet for additional information. Neither the Owner(s) or the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for soil preparation prior to the placement of footing, building slabs, concrete sidewalks, mowing strips, site flatwork, and retaining and or non-retaining walls addressed in the Geotechnical Study shall be followed. Should the Contractor question the recommendations of the study or require additional testing, the Contractor is then encouraged to perform additional testing at the expense of the Contractor.

B. ARTESIA
A geotechnical study for this project has been prepared by GEO-TEST, New Mexico. Dated April 10, 2020. This study is provided following this sheet for additional information. Neither the Owner(s) or the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for soil preparation prior to the placement of footing, building slabs, concrete sidewalks, mowing strips, site flatwork, and retaining and or non-retaining walls addressed in the Geotechnical Study shall be followed. Should the Contractor question the recommendations of the study or require additional testing, the Contractor is then encouraged to perform additional testing at the expense of the Contractor.

C. FARMINGTON
A geotechnical study for this project has been prepared by GEO-TEST, New Mexico. Dated March 18, 2020. This study is provided following this sheet for additional information. Neither the Owner(s) or the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for soil preparation prior to the placement of footing, building slabs, concrete sidewalks, mowing strips, site flatwork, and retaining and or non-retaining walls addressed in the Geotechnical Study shall be followed. Should the Contractor question the recommendations of the study or require additional testing, the Contractor is then encouraged to perform additional testing at the expense of the Contractor.

END OF SECTION

(GEOTECHNICAL REPORT TO FOLLOW)
GEOTECHNICAL ENGINEERING SERVICES REPORT
JOB NO. 1-91012
NEW MEXICO STATE AGRICULTURAL SCIENCE CENTER LEACH FIELD ALCALDE, NEW MEXICO

PREPARED FOR:
NEW MEXICO STATE UNIVERSITY
PROJECT DEVELOPMENT & ENGINEERING
March 10, 2020
Job No. 1-00202

New Mexico State University
Project Development & Engineering
1530 Wells Street
P.O. Box 30001, MSC 3545
Las Cruces, New Mexico 88003

ATTN: Gary Martinez, Project Manager

RE: Geotechnical Engineering Services Report
New Mexico State Agricultural Science Center
Leach Field
Alcalde, New Mexico

Dear Mr. Martinez:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation and laboratory testing.

It has been a pleasure to serve you on this project. If you should have any questions, please contact our Albuquerque office.

Respectfully submitted: Reviewed by:

GEO-TEST, INC.

Timothy Matson, Staff Engineer

Robert D Booth, P.E.
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INTRODUCTION

This report presents the results of geotechnical engineering services performed by this firm at the NMSU Agricultural Science Center located in Alcalde, New Mexico.

The objectives of this investigation were to:

1) Provide data and percolation rates for the subsurface soils underlying selected areas of the site.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples and preparation of this report.

FIELD EXPLORATION

A total of three exploratory borings were drilled, 2 to approximately 5 feet below existing grade and 1 to about 10 feet below existing site grade. The location for the borings were provided by the client and are shown on the attached Boring Location Map, Figure 1. During the test drilling, the soils encountered in the borings were continuously examined, visually classified, and logged. The boring logs are presented in a following section of this report. Drilling was accomplished with a truck mounted drill rig using 5.5-inch diameter continuous flight hollow stem auger. Bulk samples of auger cuttings were collected at various elevations in some of the borings and percolation tests were performed in the shallower borings (P-1 & P-2).

SUBSURFACE SOIL CONDITIONS

The subsurface soils underlying the site are made up of a surface layer consisting primarily of interbedded silty sand, silty-clayey sand. These soils ranged from non-plastic to low plasticity and extend to about 5 feet below existing site grade. Below the surface layer, sandy clays were encountered and extended to full depth explored. These soils ranged from low to medium in plasticity.

No free groundwater was encountered in the borings and soil moisture contents were generally moderate in the upper 5.0 feet becoming moderate to high below 5 feet. Although free groundwater was not encountered, very high moisture contents were encountered at 10 feet below existing site grade.

LABORATORY TESTING

Selected samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents were determined to evaluate the various soil deposits with depth. The results of these tests are presented on the boring logs.
Sieve analysis and Atterberg limits tests were performed on selected samples to aid in soil classification. The soils were classified using both the United States Department of Agriculture (USDA) system, as shown on the Soil Texture Chart, Figure 2, below in Table 1, and the Unified Soil Classification System (USCS) which are presented in the Summary of Laboratory Results and on the individual test reports presented in a following section of this report.

Table 1: Soil Strata & Corresponding Application Rates

<table>
<thead>
<tr>
<th>Strata</th>
<th>Depth (ft)</th>
<th>USDA Classification</th>
<th>Soil Type</th>
<th>Application Rate (ft²/gallon/day)</th>
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</thead>
<tbody>
<tr>
<td>Silty Sand</td>
<td>0-5</td>
<td>Sandy Loam</td>
<td>II</td>
<td>2.00</td>
</tr>
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</tr>
<tr>
<td>Sandy Clay</td>
<td>5-10</td>
<td></td>
<td>II</td>
<td>2.00</td>
</tr>
</tbody>
</table>

**PERCOLATION TESTING**

The percolation tests were performed at depths ranging from about 4 to 5 feet below existing site grade and had an average percolation rate of 20.0 minutes per inch.

**CLOSURE**

This report has been prepared for the sole use of New Mexico State University Project Development & Engineering, and not for use by any third parties without consent.

We make no other warranty, either expressed or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.
<table>
<thead>
<tr>
<th>DEPTH (Ft)</th>
<th>LOG</th>
<th>SAMPLE INTERVAL</th>
<th>TYPE</th>
<th>N. BLOWS/FT</th>
<th>MOISTURE %</th>
<th>DRY DENSITY (pcf)</th>
<th>USC</th>
<th>DESCRIPTION</th>
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<td>AC</td>
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<td>35</td>
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<td></td>
<td>STOPPED AUGER AT 10'</td>
</tr>
</tbody>
</table>

**LEGEND**

- SS - Split Spoon
- AC - Auger Cuttings
- UD/SL - Undisturbed Sleeve
- ST - Shelby Tube
- AMSL - Above Mean Sea Level
- CS - Continuous Sampler
- UD - Undisturbed

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
**LOG OF TEST BORINGS**

**NO: P-1**

**DESCRIPTION**

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**STOPPED AUGER AT 5’**

**Project:** NMSU Agricultural Science Center-Leach Field  
**Date:** 02/28/2020  
**Elevation:**  
**Project No:** 1-00202  
**Type:** 5.5” OD HSA

---

**LEGEND**

- SS - Split Spoon  
- AC - Auger Cuttings  
- UD/SL - Undisturbed Sleeve  
- AMSL - Above Mean Sea Level  
- CS - Continuous Sampler  
- UD - Undisturbed  
- ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
**LOG OF TEST BORINGS**

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<th>USC</th>
<th>DESCRIPTION</th>
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<td>AC</td>
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**LEGEND**

- **SS** - Split Spoon
- **AC** - Auger Cuttings
- **UD/SL** - Undisturbed Sleeve
- **ST** - Shelby Tube
- **AMSL** - Above Mean Sea Level
- **CS** - Continuous Sampler
- **UD** - Undisturbed

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
### SUMMARY OF LABORATORY RESULTS

**PERCENT PASSING**

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</table>

**LL = LIQUID LIMIT**  
**PI = PLASTICITY INDEX**  
**NP = NON PLASTIC or NO VALUE**
Figure 2

SOIL TEXTURE CHART

NMSU Agricultural Science Center Percolation Tests
Alcalde, New Mexico
Job No. 1-00202
GEOTECHNICAL ENGINEERING SERVICES
JOB NO. 1-00214
NMSU AGRICULTURAL SCIENCE CENTER
DISTRESS EVALUATION
ARTESIA, NEW MEXICO

PREPARED FOR:
NEW MEXICO STATE UNIVERSITY
PROJECT DEVELOPMENT & ENGINEERING
April 10, 2020
Job No. 1-00214

New Mexico State University
Project Development & Engineering
1530 Wells Street
P.O. Box 30001, MSC 3545
Las Cruces, New Mexico 88003

ATTN: Gary Martinez, Project Manager

RE: Geotechnical Engineering Services Report
NMSU Agricultural Science Center
Distress Evaluation
Artesia, New Mexico

Dear Mr. Martinez:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation, laboratory testing, discussions of our findings pertaining to the movement and damage that has occurred, and suggested remedial actions to prevent, or at least minimize, future movements.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

Respectfully submitted: Reviewed by:

GEO-TEST, INC.
Timothy Matson, Staff Engineer

cc: Addressee
# Table of Contents

- **INTRODUCTION** ............................................................... 1
- **EXISTING CONDITIONS** .................................................. 1
- **FIELD EXPLORATION** ..................................................... 1
- **LABORATORY TESTING** .................................................. 2
- **SUBSURFACE SOIL CONDITIONS** ................................. 2
- **CONCLUSIONS AND RECOMMENDATIONS** ..................... 2
- **CLOSURE** ................................................................. 3
- **BORING LOCATION MAP** ............................................... 5
- **BORING LOGS** ............................................................... 6
- **SUMMARY OF LABORATORY RESULTS** ......................... 7
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INTRODUCTION

This report presents results of the geotechnical engineering distress evaluation performed by this firm for the existing damage and movement at a maintenance shop building at the NMSU Agricultural Science Center in Artesia, New Mexico.

The objectives of this investigation were to:

1) Evaluate the nature and engineering properties of the subsurface soils underlying the building.

2) Provide our opinions and evaluations relative to the cause, or causes, of the existing distress which has occurred and provide a discussion of potential remedial actions.

The services included subsurface exploration, selective soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

EXISTING CONDITIONS

The distress is manifested by cracking in the CMU walls around the structure. The majority of the damage is located in the northwest and northeast corners of the structure. The area around the building is flat with very poor drainage away from the building. Moreover, the majority of the roof has no rain gutters and downspouts to collect roof runoff and direct the water away from the building. Based on conversations with on-site staff, the distress/cracks have been there for many years. During our site visit we observed ponding water near the northwest corner and along the west wall. A leaky evaporative cooling unit near the northwest corner and a leaking hose on the west wall was observed during our site visit. It is also understood that a sink is located inside the building along the west wall, which discharges into a small underground sump outside the west wall. A waterline also runs along the west wall and turns along the north wall to a valve. It is unknown where the waterline leads to after the valve. It is unknown if the sump or waterline have ever leaked.

FIELD EXPLORATION

One exploratory boring was drilled to a depth of about 25½ feet below existing site grades. A total of 2 or 3 borings were proposed, however, due to accessibility, overhead power lines and unknown subsurface utility locations,
only 1 boring was performed. The location of the boring was performed about 6½ feet south and 12 feet west of the northwest corner of the building and is shown on the attached Boring Location Map, Figure 1. During the test drilling, the soils encountered in the boring were continuously examined, visually classified, and logged. The boring log is presented in a following section of this report. Drilling was accomplished with a truck mounted drill rig using 6.5-inch diameter continuous flight hollow stem auger. Subsurface materials were sampled at five-foot intervals or less utilizing an open tube split barrel sampler and a brass ring-lined sampler driven by a standard penetration test hammer.

LABORATORY TESTING

Selected samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents were determined to evaluate the various soil deposits both with depth and laterally. The results of these tests are shown on the boring logs.

Sieve analysis and Atterberg limits tests were performed to aid in soil classification. In addition, a consolidation/expansion test and two FHA swell tests were performed on a select sample to evaluate the volume change characteristics upon moisture increases. Results of the laboratory tests are presented in the Summary of Laboratory Results included in a subsequent section of this report.

SUBSURFACE SOIL CONDITIONS

As indicated by the exploratory borings, the soils underlying the site consist of low to medium plasticity clays which extend to full depth explored. These soils were generally soft to moderately firm throughout the extent of the boring.

No free groundwater was encountered, and soil moisture contents were generally moderate in the upper 15 feet and high below 15 feet.

CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that the distress and movement of the structure is probably a direct result of soil moisture increases. These soil moisture increases have weakened and increased the compressibility of the soils supporting the structure creating settlement and the observed cracking. The soil moisture increases are believed to be a direct result of natural precipitation combined with poor drainage away from the structure as well as and leaking appliances as described above.

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Based on the above, the following remedial measures are recommended for consideration:

1. Install rain gutters and downspouts on the roof that discharge storm water away from the structure.

2. Construct a 5-foot wide concrete sidewalk around the entire perimeter of the structure and slope the sidewalk to drain away from the structure.

3. Grade the area around the perimeter of the entire structure to slope away from the structure for a distance of at least 10 feet.

After the above remedial measures have been implemented, the structure should be carefully observed and monitored for a period of at least 6 months to determine if the structure has stabilized. Monitoring should consist of the installation of crack gages across the cracks in selected areas to monitor movement on a monthly basis. Once it has been determined that the movement has stopped, cosmetic repairs to the damage can be performed. If the observations and monitoring indicate that movement is continuing, additional investigation may be necessary.

**CLOSURE**

Our conclusions, recommendations and opinions presented herein are:

1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

This report has been prepared for the sole use of New Mexico State University Project Development & Engineering, specifically to evaluate the cause, or causes, of the present distress to the maintenance shop located at the NMSU Agricultural Science Center in Artesia, New Mexico, and not for the use by any third parties.

We make no other warranty, either express or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and
subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

All soil samples will be discarded 30 days after the date of this report, unless we receive a specific request to retain the samples for a longer period of time.
## LOG OF TEST BORINGS

**NO: 1**

During Drilling: none

### GROUNDWATER DEPTH

After 24 Hours:

### DEPTH (Ft) | LOG | SAMPLE INTERVAL | TYPE | N. BLOWS/FT | MOISTURE | DRY DENSITY (pcf) | USC | DESCRIPTION
--- | --- | --- | --- | --- | --- | --- | --- | ---
5 | | | UD | 4-6 | 10 | 15 | 111 | CLAY with SAND, low to medium plasticity, soft to moderately firm, dark brown to brown
10 | | | UD | 5-6-8 | 14 | 15 | 107 | CLAY, low to medium plasticity, moderately firm to firm, moist, brown
15 | | | UD | 4-7-8 | 15 | 15 | | *soft, very moist below 19 feet
20 | | | UD | 3-2-4 | 6 | 14 | | STOPPED AUGER AT 24’
25 | | | UD | 5-4-4 | 8 | 15 | | STOPPED SAMPLER AT 25.5’
30 | | | | | | | |

### LEGEND

- **SS** - Split Spoon
- **UD** - Undisturbed
- **UD/SL** - Undisturbed Sleeve
- **AC** - Auger Cuttings
- **ST** - Shelby Tube
- **CS** - Continuous Sampler
- **N. BLOWS/FT**
- **MOISTURE**
- **DRY DENSITY (pcf)**
- **USC**
- **A.M.S.L.** - Above Mean Sea Level
- **ELEVATION**

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
# SUMMARY OF LABORATORY RESULTS

**PROJECT:** NMSU Agricultural Science Center-Distress Evaluation  
**LOCATION:** Artesia, New Mexico  
**NUMBER:** 1-00214  

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**LL = LIQUID LIMIT**  
**PI = PLASTICITY INDEX**  
**NP = NON PLASTIC or NO VALUE**
Grain Size Distribution

**Specimen Identification**

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<td>9.5</td>
<td></td>
<td></td>
<td>1.0</td>
<td>9.1</td>
<td></td>
<td>89.9</td>
</tr>
</tbody>
</table>

**GEO-TEST**

Project: NMSU Agricultural Science Center-Distress Evaluation
Location: Artesia, New Mexico
Number: 1-00214
CONSOLIDATION TEST RESULTS
NMSU AGRICULTURE SCIENCE CENTER
DISTRESS EVALUATION
ARTESIA, NEW MEXICO
BORING NO.1 AT 3'

INITIAL MOISTURE CONTENT = 15.8%
INITIAL DRY DENSITY = 110.9 PCF

SAMPLE INUNDATED AT 0.144 KSF
Soil Volume Change Worksheet

FHA Swell Test

Project: NMSU Artesia Distress Evaluation
Project #: 1-00214

Sample Location: Boring 1 @ 0-5
Sample Description: Clay with Sand
Soil Moisture: In-Situ

Initial Wet Weight with Ring: 374.1 grams

<table>
<thead>
<tr>
<th>Initial Moisture</th>
<th>Final Moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Weight: 216.1 grams</td>
<td></td>
</tr>
<tr>
<td>Dry Weight: 188.8 grams</td>
<td></td>
</tr>
<tr>
<td>Wet Weight: #DIV/0!</td>
<td></td>
</tr>
<tr>
<td>Dry Weight: #DIV/0!</td>
<td></td>
</tr>
</tbody>
</table>

Initial Wet Density: 132.7 pcf
Initial Dry Density: 115.9 pcf

<table>
<thead>
<tr>
<th>Elapse Time</th>
<th>Read Time</th>
<th>Dial Reading</th>
<th>Swell Index</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
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<td>Start</td>
<td>14:30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30 minutes</td>
<td>15:00</td>
<td>1</td>
<td>150</td>
<td>0</td>
</tr>
<tr>
<td>1 hour</td>
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<tr>
<td>2 hours</td>
<td>17:00</td>
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<td>300</td>
<td>0.2</td>
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Potential Volume Change Category

<table>
<thead>
<tr>
<th>0-2</th>
<th>Non-Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4</td>
<td>Marginal</td>
</tr>
<tr>
<td>4-6</td>
<td>Critical</td>
</tr>
<tr>
<td>6+</td>
<td>Very Critical</td>
</tr>
</tbody>
</table>
### Soil Volume Change Worksheet

**FHA Swell Test**

**Project:** NMSU Artesia Distress Evaluation  
**Project #:** 1-00214  
**Sample Location:** Boring 1 @ 0-5  
**Sample Description:** Clay with Sand  
**Soil Moisture:** Air-Dried

| Initial Wet Weight with Ring: | 341 grams |

<table>
<thead>
<tr>
<th></th>
<th><strong>Initial Moisture</strong></th>
<th></th>
<th><strong>Final Moisture</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wet Weight:</td>
<td>112.1 grams</td>
<td>Wet Weight:</td>
</tr>
<tr>
<td></td>
<td>Dry Weight:</td>
<td>110.7 grams</td>
<td>Dry Weight:</td>
</tr>
</tbody>
</table>

| Initial Wet Density: | 98.7 pcf | Intitial Moisture: | 1% |
| Initial Dry Density: | 97.5 pcf | Final Moisture:    | #DIV/0! |

<table>
<thead>
<tr>
<th>Elapse Time</th>
<th>Read Time</th>
<th>Dial Reading</th>
<th>Swell Index</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
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<td>0</td>
</tr>
<tr>
<td>30 minutes</td>
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<td>2 hours</td>
<td>12:00</td>
<td>7</td>
<td>1075</td>
<td>1.2</td>
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</table>

**Potential Volume Change Category**

<table>
<thead>
<tr>
<th>X</th>
<th>0-2</th>
<th>Non-Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-4</td>
<td>Marginal</td>
</tr>
<tr>
<td></td>
<td>4-6</td>
<td>Critical</td>
</tr>
<tr>
<td></td>
<td>6+</td>
<td>Very Critical</td>
</tr>
</tbody>
</table>
GEOTECHNICAL ENGINEERING SERVICES REPORT
NO. 1-00204

NEW MEXICO STATE UNIVERSITY
AGRICULTURAL SCIENCE CENTER

GREENHOUSE REPLACEMENT
FARMINGTON, NEW MEXICO

PREPARED FOR:
NEW MEXICO STATE UNIVERSITY
FACILITIES AND SERVICES DEPARTMENT
March 18, 2020
Job No. 1-00204

New Mexico State University
Facilities and Services Dept.
1530 Wells Street
Las Cruces, NM 88003

ATTN: Gary Martinez

RE: Geotechnical Engineering Services Report
NMSU Agricultural Science Center
Greenhouse Replacement
Farmington, New Mexico

Dear Mr. Martinez:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation, laboratory testing, and recommendations for foundation design as well as criteria pertaining to excavation, backfill and general site grading.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

Respectfully submitted:
GEO-TEST, INC.

Reviewed by:

Patrick R. Whorton, E.I.
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INTRODUCTION

This report presents the results of our geotechnical engineering services investigation performed by this firm for the proposed new Greenhouse to be constructed for the NMSU Agricultural Science Center in Farmington, New Mexico.

The objectives of this investigation were to:

1) Evaluate the nature and engineering properties of the subsurface soils underlying the site.

2) Provide recommendations for foundation and slab on grade design as well as site grading criteria.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

PROPOSED CONSTRUCTION

It is understood that the project will include the installation of a new approximately 1,800 square foot single-story pre-engineered greenhouse shell supported by a continuous perimeter footing. The shell columns will attach to the footing or stem wall via steel base plates with a downward load of 2.5 kips at each plate location. The new greenhouse will have a permeable gravel floor and no floor slab although an entry vestibule has been proposed which would have a floor slab.

The existing greenhouse on the site will be demolished and completely removed from the site as part of this project. The new greenhouse will be constructed within the approximate footprint of the old greenhouse but shifted approximately 30 feet to the south so that the new greenhouse will be independent of the existing building north of the greenhouse site.

Should structural loads or other project details vary significantly from those outlined above, this firm should be notified for review and possible revision of the recommendations contained herein.

FIELD EXPLORATION

Two (2) exploratory borings were drilled at the site to a depth of 15 feet below existing grades. Locations of the borings are shown on the attached Boring Location Map, Figure 1. The soils encountered in the borings were continuously examined, visually classified and logged during the drilling operation. The boring logs are presented in a following section of this report. Drilling was accomplished using a truck mounted drill rig equipped with 5.5-inch diameter continuous flight hollow stem auger. Subsurface soils were
sampled at five foot intervals or less utilizing an open tube split barrel sampler driven by a standard penetration test hammer.

LABORATORY TESTING

Selected samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents were determined to evaluate the various soil deposits with depth. The results of these tests are shown on the boring logs.

Sieve analysis and Atterberg limits tests were performed to aid in soil classification. The results of these tests are presented in the Summary of Laboratory Results and on the individual test reports presented in a following section of this report.

SURFACE CONDITIONS

The Agricultural Science Center is located southwest of Farmington within the Navajo Agricultural Products Industry (NAPI) area. The existing greenhouse to be replaced is located adjacent to the southside of the existing office building on site. This greenhouse will be demolished and the proposed new greenhouse constructed in the same location. The overall site within the vicinity of the greenhouse is relatively flat and developed for agricultural/educational purposes.

SUBSURFACE SOIL CONDITIONS

As indicated by the exploratory borings, the subsurface profile consists of very loose to medium dense non-plastic silty sand which extended to the full depth explored.

No free groundwater was encountered in the borings. Soil moisture contents were generally low throughout the full depth of the borings.

CONCLUSIONS AND RECOMMENDATIONS

The near surface soils underlying the site were found to have a very loose to loose relative density. These soils have the potential to create excessive settlements of shallow foundations, even with the use of low bearing pressures in footing design. As such, these soils are not considered suitable in their present condition to provide reliable support of shallow footings. However, with the site preparation and very careful moisture protection, as recommended in a following section of this report, the proposed structure may be supported on a continuous spread-type footing bearing directly on properly compacted structural fill.
The site preparation would involve overexcavation of the existing soils throughout the building area to such an extent as to provide for at least 12 inches of properly compacted, non-expansive structural fill below foundations and any slabs on grade, or to such an extent as to remove all man-made fills or debris associated with the old greenhouse, whichever is the greater depth of overexcavation. This may be accomplished by either overexcavation from existing site grades, raising the site with structural fill or a combination of both. The limits of the overexcavation should also extend laterally from the footing perimeters a distance equal to the depth of fill beneath their bases. The exposed native soils at the base of the excavation should be densified prior to placement of structural fill. Detailed recommendations for foundation design and the required site grading are presented in the following sections of this report.

Post-construction moisture increases in the supporting soils could cause some differential foundation movements. Therefore, moisture protection is considered a critical design consideration and should be reflected in overall site grading and drainage details as recommended in the Moisture Protection section of this report.

FOUNDATIONS

Shallow spread-type footings bearing directly on a minimum thickness of 12 inches of properly compacted structural fill are recommended for the support of the structure. An allowable bearing pressure of 1,500 pounds per square foot is recommended for footing design. This bearing pressure applies to full dead load plus realistic live loads and can be safely increased by one-third for totals loads including wind and seismic forces.

Footings should be established a minimum of 2.0 feet below lowest adjacent finished grade. The minimum recommended width of continuous footings is 18 inches.

Total settlements of foundations designed and constructed as recommended herein are estimated not to exceed ½ inch for the soil moisture contents encountered during this investigation or moisture contents introduced during construction. Differential movements should be less than 75 percent of total movements. Significant post-construction moisture increases in the supporting soils could create additional movements and could cause excessive movements at least in some areas of the site. Accordingly, the moisture protection provisions as recommended in a following section of this report are considered critical for the satisfactory performance of the structure.
LATERAL FOUNDATION LOADS

Resistance to lateral forces will be provided by soil friction between the base of floor slabs and footings and the soil and by passive earth resistance against the sides of the footings and stem walls. A coefficient of friction of 0.40 should be used for computing the lateral resistance between bases of footings and slabs and the soil. With backfill placed as recommended in the site grading section of this report, a passive soil resistance equivalent to a fluid weighing 375 pounds per cubic foot should be used for analysis.

SLABS ON GRADE

Concrete slabs on grade should be founded on a minimum of 12 inches of properly compacted, non-expansive structural fill and constructed in conformance with the methods outlined in ACI 302.1R-04.

Adequate support for lightly loaded slab-on-grade floors will be provided by the structural fill when compacted as recommended in the Site Grading section of this report. Thus, the use of granular base for structural support of lightly loaded slabs is not considered necessary. However, should it be desired as a working surface, or to increase the modulus of subgrade reaction, a course of granular base can be placed beneath concrete floor slabs.

Where granular base is used beneath the slabs, it should have a plasticity index of no greater than 3 and meet the following grading requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Inch</td>
<td>100</td>
</tr>
<tr>
<td>¾ Inch</td>
<td>70-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>35-85</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

The granular base should be compacted to at least 95 percent of maximum dry density as determined in accordance with ASTM D1557.

Any heavily loaded slabs on the project bearing on structural fill should be designed using a modulus of subgrade reaction of 200 pounds per square inch per inch of deflection. If a 6 inch thickness of granular base is placed and compacted beneath the slabs, the modulus of subgrade reaction can be increased to 300 pounds per square inch per inch of deflection.

The granular base may act as a capillary barrier but will not totally eliminate the rise of moisture to the slabs. If floor coverings are proposed which are highly sensitive to moisture, or highly moisture sensitive equipment will be installed within the buildings, a synthetic vapor barrier should be installed to prevent moisture intrusion through the slab. A minimum of 4 inches of granular
base as recommended above should be placed between the vapor barrier and the slab. Barriers should be overlapped a minimum of 6 inches at joints, should be carefully fitted around service openings and should conform with ACI 302.1R-04 specifications.

**EXCAVATIONS**

Excavated slopes for foundation and utility construction should be designed and constructed in accordance with 29 CFR 1926, Subpart P, and any applicable state or local regulations. Excavated temporary and permanent slopes should not exceed 1.5 to 1 (horizontal to vertical). Excavation of the surficial soils can be readily accomplished using normal earthmoving equipment.

**SITE GRADING**

The following general guidelines should be included in the project construction specifications to provide a basis for quality control during site grading. It is recommended that all structural fill and backfill be placed and compacted under engineering observation and in accordance with the following:

1) The existing site soils throughout the site should be overexcavated to such an extent as to provide for at least 12 inches of properly compacted structural fill beneath all footings and floor slabs or to such an extent as to remove all man-made fills or construction debris, whichever is the greater depth of overexcavation. The overexcavation limits should extend laterally beyond the footing perimeters equal to the depth of fill beneath their bases. The soils exposed at the base of the overexcavation should be densified before placement of structural fill.

2) After the required overexcavation, the exposed cut surface should be densified. Densification of the exposed native soils should consist of scarifying to a depth of 8 inches, moisture conditioning to the optimum moisture content or above to as deep as practicable and compacting the subgrade to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557.

3) The results of this investigation indicate that the overexcavated surficial silty sands will be suitable for use as structural fill, however some blending may be required to meet the specifications below. Any imported soils to be used as structural fill should also meet the specifications below.

4) All structural fill and backfill should be free of vegetation and debris and contain no rocks larger than 3 inches. Gradation of the structural fill, as determined in accordance with ASTM D-422, should be as follows:
5) The plasticity index of the structural fill should be no greater than 15 when tested in accordance with ASTM D-4318.

6) Structural fill and general backfill consisting of soils approved by the geotechnical engineer, shall be placed in 8 inch loose lifts and compacted with approved compaction equipment. Loose lifts should be reduced to 4 inches if hand held compaction equipment is used. All compaction of fill or backfill shall be accomplished to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D-1557. The moisture content of the structural fill during compaction should be within 2 percent of the optimum moisture content.

7) Tests for degree of compaction should be determined by the ASTM D-1556 method or ASTM D-6938. Observation and field tests should be carried on during fill and backfill placement by the geotechnical engineer to assist the contractor in obtaining the required degree of compaction. If less than 95 percent is indicated, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

**MOISTURE PROTECTION**

Precautions should be taken during and after construction to minimize moisture increase of foundation soils. Accumulations of excessive moisture could weaken or cause other changes in the soils supporting the foundation. This can cause differential movement of the foundations and could result in cosmetic or structural damage to the structure.

Positive drainage should be established away from the exterior perimeter of the structure. A typical adequate slope is 6 inches in the first 5 feet with positive drainage being provided from those points to streets, pavement or natural water courses. If necessary to provide positive drainage, the building area should be raised above adjacent grades with structural fill.

Roof runoff should be collected by gutters and downspouts or roof canales and discharged to splash blocks which carry water rapidly away from the structure's foundation. Should lot size or other factors impede positive drainage away from the structure to less than 5 feet from foundations, a non-perforated drain system should be installed to carry water to a minimum of five feet away from foundations or to streets or natural water courses.
Utility backfill should be well compacted and should meet the specifications outlined in the Site Grading section of this report. Special care should be taken during installation of the subfloor sewer and water lines to reduce the possibility of future subsurface saturation.

Irrigation within 10 feet of foundations is discouraged or at the very least should be carefully controlled. Proper landscaping and drainage maintenance are required to preclude accumulation of excessive moisture in the soils below the structure and throughout the site. This should include but is not limited to routine maintenance checks of irrigation system to ensure no leakage and proper functionality and that irrigation is adjusted and maintained seasonally so that over watering does not occur. Native drought resistant plants are recommended for use in landscaping. Landscape features should not impede positive drainage away from foundations as recommended above.

Drainage control ponds or any other drainage/landscaping feature which allows for surface waters to infiltrate the subsurface soils should not be placed within 20 feet of building foundations.

It is understood that the proposed greenhouse will have a permeable gravel floor which will allow for irrigation water within the greenhouse to infiltrate the subsurface soils. As the subsurface soils are generally loose non-cohesive sands, any infiltrated water will percolate relatively quickly through the soils and should not have an adverse effect on the greenhouse foundations. However, these loose sands are also susceptible to excessive settlement given significant increases in moisture content. Therefore, care should be taken to prevent excessive watering or flooding within the greenhouse interior as these actions will likely result in excessive foundation settlement and potential damage to the greenhouse structure.

The foregoing recommendations should only be considered minimum requirements for overall site development. It is recommended that a civil/drainage engineer be consulted for more detailed grading and drainage recommendations.

**FOUNDATION REVIEW AND INSPECTION**

This report has been prepared to aid in the evaluation of this site and to assist in the design of this project. It is recommended that the geotechnical engineer be provided the opportunity to review the final design drawings and specifications in order to determine whether the recommendations in this report are applicable to the final design. Review of the final design drawings and specifications should be noted in writing by the geotechnical engineer.

In order to permit correlation between the conditions encountered during construction and to confirm recommendations presented herein, it is recommended that the geotechnical engineer be retained to perform continuous observations and testing during the earthwork portion of this...
project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted and foundation elements penetrate the recommended soils.

**CLOSURE**

Our conclusions, recommendations and opinions presented herein are:

1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation will be provided during construction.

5) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

This report has been prepared for the sole use of New Mexico State University specifically to aid in the design of the proposed new Greenhouse to be located at the Agricultural Science Center campus in Farmington, New Mexico, and not for use by any third parties without consent.

We make no other warranty, either expressed or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.
SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
ST - Shelby Tube

AQL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
**LOG OF TEST BORINGS**

**GROUNDWATER DEPTH**

**NO: 2**

**During Drilling:** none
**After 24 Hours:**

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>LOG SAMPLE INTERVAL</th>
<th>TYPE</th>
<th>N. BLOWS/FT</th>
<th>MOISTURE %</th>
<th>DRY DENSITY (pcf)</th>
<th>USC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>5</td>
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<td>SS</td>
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<td>4</td>
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<td></td>
<td>SM</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>SS</td>
<td>3-4-6</td>
<td>10</td>
<td>6</td>
<td></td>
<td>SILTY SAND, non-plastic, very loose to medium dense, dry to moist, brown to light brown</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SS</td>
<td>5-8-9</td>
<td>17</td>
<td>12</td>
<td></td>
<td>Stopped Auger @ 14 feet, Stopped Sampler @ 15.5 feet</td>
</tr>
</tbody>
</table>

**LEGEND**

- SS - Split Spoon
- AC - Auger Cuttings
- UD/SL - Undisturbed Sleeve
- SM - Silty Sand
- AMSL - Above Mean Sea Level
- CS - Continuous Sampler
- UD - Undisturbed
- ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
### SUMMARY OF LABORATORY RESULTS

<table>
<thead>
<tr>
<th>TEST HOLE</th>
<th>DEPTH (FEET)</th>
<th>UNIFIED CLASS</th>
<th>(%) MOIST</th>
<th>LL</th>
<th>PI</th>
<th>NO 200</th>
<th>NO 100</th>
<th>NO 40</th>
<th>NO 10</th>
<th>NO 4</th>
<th>3/8&quot;</th>
<th>1/2&quot;</th>
<th>3/4&quot;</th>
<th>1&quot;</th>
<th>1 1/2&quot;</th>
<th>2&quot;</th>
<th>4&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
<td>SM</td>
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<td>21</td>
<td>NP</td>
<td>40</td>
<td>73</td>
<td>90</td>
<td>98</td>
<td>99</td>
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</tr>
<tr>
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<tr>
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<td>SM</td>
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<td>NP</td>
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**SIEVE ANALYSIS PERCENT PASSING**

**LL = LIQUID LIMIT**

**PI = PLASTICITY INDEX**

**NP = NON PLASTIC or NO VALUE**

Project: NMSU Agricultural Science Center Greenhouse

Location: Farmington, New Mexico

Number: 1-00204
SECTION 01 2100
ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Cash allowances: Descriptions and procedures for cash allowances covering the following: MODIFICATION/CONTINGENCY ALLOWANCE

B. Related documents and sections:

1. Document 00 4113 – Bid Form: Cash amount(s) of Allowances
2. Document 00 7200 – General Conditions of the Contract, Article 3, Paragraph 3.8 – Allowances.
4. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.02 CASH ALLOWANCES

A. Costs included in cash allowances:

1. Cost of product or service to Contractor or subcontractor less applicable trade discounts.
2. Delivery to site or location designated by Design Professional.

1.03 CASH ALLOWANCE SCHEDULE

A. Cash allowance schedule is as listed in Document 00 4113 – BID FORM:

1.04 MODIFICATION/CONTINGENCY ALLOWANCE

A. Include in Contract Sum a Modification/Contingency Allowance as scheduled herein to be used for Owner's purposes related to modifications in the design and construction of the project as directed by Owner through written instruction issued by the Architect.

B. Upon request form the Architect, Contractor shall submit proposal similar to that required for change order showing all itemized costs. Items considered for deduction from the Modification/Contingency Allowance shall include costs for products, delivery, installation, labor, and equipment rental. Overhead, profit, bond, and general conditions for Modification/Contingency Allowance items are not part of the Allowance, but instead are to be included in Contract Sum. Contractor shall not proceed with Modification/Contingency Allowance work until authorized by Owner and Architect. Total cost of modifications shall not exceed Modification/Contingency Allowance.
C. At closeout of Contract, funds remaining in Modification/Contingency Allowance will be credited to Owner.

1.04 ALLOWANCES SCHEDULE

A. Bid Lot #1: Modification/Contingency Allowance: Include the stipulated sum/price of $50,000.00 for use upon Owner's instructions. This allowance shall be included in Bid Lot No. 1 Base Bid.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION
SECTION 01 2300

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Description of alternates.
   B. Procedures for pricing alternates.
   C. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS
   A. IB 1-35 - Instructions to Bidders: Instructions for preparation of pricing for Alternates, List of Alternates in Bid Form, and Incorporating monetary value of accepted Alternates.

1.03 ACCEPTANCE OF ALTERNATES
   A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
   B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.
   C. Work not specifically identified in the following Additive Alternates descriptions shall be included in the Base Bid.

1.04 SCHEDULE OF ALTERNATES

BID LOT NO. 1
   TUCUMCARI: NMSU PROJECT NO. 3748
   ADDRESS: 6502 QUAY ROAD AM. 5, TUCUMCARI, NM 88401
   1. ADD-ALT: NEW IRRIGATION LINES, FROST FREE VALVES AND BOXES
      Consists of new irrigation lines, frost free valves, and boxes.

BID LOT NO. 2
   CLAYTON: NMSU PROJECT NO. 3699
   ADDRESS: 15 NMSU LANE, CLAYTON, NM 88415
   1. ADD-ALT 1: RESTROOM RENOVATION (MAIN OFFICE)
      Consists of renovation of public restrooms for ADA compliance.
   2. ADD-ALT 2: NEW FLOORING (MAIN OFFICE)
      Consists of abatement of flooring and new flooring throughout the building.

BID LOT NO. 3
   FARMINGTON: NMSU PROJECT NO. 3743
   ADDRESS: 300 ROAD 4063, FARMINGTON, NM 87401
   1. Alternate No.1: HEATED PLANTING TABLES & BENCHES
      Consists of new heated planting tables and benched form manufacture.

BID LOT NO. 4
   ALCALDE: NMSU PROJECT NO. 3737
   ADDRESS: 371 COUNTY RD. 40, ALCALDE, NM 87511
1. ** Alternate No.1: Exterior Stucco System Re-Finish Throughout the Entire Bldg.  
   Consists of new stucco system throughout the entire building on both first and second floor.

**BID LOT NO.5**

**ARTESIA:** NMSU PROJECT NO. 3738  
**ADDRESS:** 67 E. FOUR DINKUS RD, ARTESIA, NM 88210

1. ** Alternate No.1: 2 Inches of Poly ISO Below the New Metal Roof  
   Consists of a 2-inch poly-iso under new metal roof system.

**1.05 PROCEDURES**

A. Consider all work that must be accomplished for complete incorporation of alternates including modifications to Base Bid items.

B. Include in lump sum prices for alternates all costs of labor, materials, equipment, permits, fees, insurance, bonds, overhead, and profit.

C. Where work is shown in Additive Alternates that represent an "upgrade" to the base Bid, include additional costs only (separate from costs already included in Base Bid) for the "upgrade" in the designated Additive Alternate.

D. Immediately after award of the Contract, advise all necessary personnel and suppliers as to which Alternates have been selected by Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the work caused by Owner's selection or rejection of alternates.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION**
SECTION 01 3100
PROJECT MANAGEMENT & COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Project coordination.
B. Field engineering.
C. Preconstruction meeting.
D. Site mobilization meeting.
E. Progress meetings.
F. Construction progress schedule.
G. Progress photographs.
H. Coordination drawings.

1.02 RELATED REQUIREMENTS
   1. Document GC 1-94 – General Conditions for Construction Contract
   2. Document IB 1-35 – Instructions to Proposers
   3. Document SGC 1-2 – Supplementary General Conditions
B. Section 01 1000 - Summary
C. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
D. Section 01 3300 Submittal Procedures: Shop drawing and product submittal requirements.
E. Section 01 7000 - Execution Requirements: Additional coordination requirements.
F. Section 01 7700 - Closeout Procedures: Additional coordination requirements.
G. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION
A. Cooperate with the Owner in allocation of mobilization areas of site; for field offices and sheds, for general access, traffic, and parking facilities.
B. During construction, coordinate use of site and facilities with Owner and Occupants.
C. Comply with Architect’s procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
D. Scheduling: Coordinate scheduling, submittals, and work of various specification sections to ensure efficient and orderly sequence of installation of interdependent construction elements. Ensure that work of one specification section is not installed in such a manner as to limit, preclude, or restrict work of another section.
E. Coordinate completion and cleanup of work of separate specification sections in preparation for final inspection specified in Section 01 7000 - Execution and Closeout Procedures.
F. After acceptance of Work, coordinate access to facility for required maintenance, monitoring, adjusting, and correcting deficiencies to manner to minimize disruption of Owner’s activities.

G. Make the following types of submittals to Architect:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.

1.04 FIELD ENGINEERING

A. Existing control datum for field engineering as indicated on Drawings.

B. Locate or establish survey control and reference points prior to starting site construction. Protect points during construction and record locations with horizontal and vertical data on Project Record Documents in accordance with Section 01 7800 - Closeout Submittals.

C. Prior to start of construction, verify location of control points and layout information on Drawings relative to property, setback, and easement lines.

D. Provide competent field engineering services. Establish elevations, lines, and levels utilizing recognized engineering survey practices. Periodically verify layouts.

E. Promptly replace dislocated control and reference points based on original survey control.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Verify utility requirements and characteristics of equipment are compatible with facility utilities. Coordinate work of various specification sections having interdependent requirements for installing, connecting to, and placing in service such equipment.

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Contractor will administer Pre-Construction Meeting to be held on site.

C. Attendance Required:
   1. Owner.
   3. Contractor.
   5. Officials.
7. Suppliers.

D. Agenda:
   1. Notice to Proceed.
   2. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   3. Designation of personnel representing the parties to Contract, Owner, and Architect.
   4. Channels of communication.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Presentation and discussion of site mobilization plan specified in Section 01 5000 - Temporary Facilities and Controls.
   8. Construction facilities, storage, controls, and temporary utilities.
   10. Security, safety, first aid, and housekeeping procedures.
   11. Permits.
   12. Procedures for maintaining project record documents.
   13. Testing procedures / requirements.
   14. Public relations.
   15. Other pertinent items.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. Architect will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's Superintendent.
   5. Major Subcontractors.
   6. Officials.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements and occupancy prior to completion.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Contractor will schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, and distribute notice of meeting five (5) days in advance of meeting.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
  10. Coordination of projected progress.
  11. Maintenance of quality and work standards.
  12. Effect of proposed changes on progress schedule and coordination.
  13. Review proposed change orders and effect on schedule.
  14. Review project record documents.
  15. Review of RFI's and status of RFI's.
  16. Other business relating to Work.

E. Contractor will record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

F. Pre-Installation Conferences:
   1. When required by an individual specification section, Contractor will convene a pre-installation conference at site.
   2. Require attendance of entities directly concerned with item of work.
   3. Notify Architect five (5) days in advance of meeting.
   4. Prepare agenda and preside at conference. Record minutes, and distribute copies within three (3) days to participants and Architect.
   5. At meeting, review conditions of installation, preparation and installation procedures, and coordination with related work.

3.04 CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216

3.05 PROGRESS PHOTOGRAPHS
A. Contractor will submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Enclosure of building, upon completion.
   6. Final completion, minimum of ten (10) photos.

E. Take photographs as evidence of existing project conditions as follows:
   1. Interior views: Three (3).
   2. Exterior views: Three (3).

F. Views:
   1. Provide non-aerial photographs from four cardinal views at each specified time, until Date of Substantial Completion.
   2. Consult with Architect for instructions on views required.
   3. Provide factual presentation.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
   5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
   4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.06 COORDINATION DRAWINGS

A. Provide information required by Architect for preparation of coordination drawings.

B. Provide where coordination is critical for installation of components fabricated off site and where space is limited and maximum utilization of space is required.

C. Show relationship and integration of components and construction entities, required installation sequence, dimensions, and tolerances.

END OF SECTION
SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Preliminary schedule.
B. Construction progress schedule, bar chart type.

1.02 REFERENCES
A. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America; 2004.

1.03 SUBMITTALS
A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Submit updated schedule with each Application for Payment.
E. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
F. Submit under transmittal letter form specified in Section 01 3000.

1.04 QUALITY ASSURANCE
A. Coordinate Construction Progress Schedule with testing services required in the contract.

1.05 SCHEDULE FORMAT
A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.
C. Sheet Size: Multiples of 8-1/2 x 11 inches.
D. Scale and Spacing: To allow for notations and revisions.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PRELIMINARY SCHEDULE
A. Prepare preliminary schedule in the form of a horizontal bar chart.
3.02 CONTENT
   A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
   B. Identify each item by specification section number.
   C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
   D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
   E. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS
   A. Include a separate bar for each major portion of Work or operation.
   B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE
   A. Participate in joint review and evaluation of schedule with Architect at each submittal.
   B. Evaluate project status to determine work behind schedule and work ahead of schedule.
   C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE
   A. Maintain schedules to record actual start and finish dates of completed activities.
   B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
   C. Annotate diagrams to graphically depict current status of Work.
   D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
   E. Indicate changes required to maintain Date of Substantial Completion.
   F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE
   A. Distribute copies of updated schedules to Contractor’s project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.
   B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes submittal procedures for:
   1. Shop drawings.
   2. Product data.
   3. Samples.
   4. Manufacturer's instructions.
   5. Design data and calculations.
   6. Manufacturer's certificates.
   7. Reports for testing, inspecting, and demonstrating.
   8. HVAC & controls construction checklists
   9. Equipment inventory and roofing data collection forms.

B. Related documents and sections:
   1. Document 00 7200 - General Conditions Paragraph 3.12: Contractor's responsibilities regarding submittals.
   2. Section 01 3100 - Project Management and Coordination: Submittal of Progress Schedule and coordination drawings.
   3. Section 01 4000 - Quality Requirements: Manufacturers' field services and reports.
   4. Section 01 6300 - Product Substitution Procedures: Submittal of substitution requests.
   5. Section 01 7800 - Closeout Submittals: Submittal of project record drawings, operation and maintenance manuals, warranties, certifications of inspection, extra materials, and other closeout submittals.
   6. Section 01 7801 – Equipment Inventory and Roofing Data Collection: Collection and submittal of data required by Owner for equipment and roof system(s) installed under the Contract.
   7. Refer to individual specification sections for unique submittal requirements related to a specific product, system, or procedure.

1.02 HVAC & CONTROLS CONSTRUCTION CHECKLISTS

Not Used

A. Reports shall include:
   1. Completion of all required checklist items.
   2. Names of persons performing activity.

1.03 EQUIPMENT INVENTORY AND ROOFING DATA COLLECTION FORMS
A. Submission:
   1. Submit completed forms for all categories of equipment and roofing installed under the Contract, and as required in Section 01 7801 – Equipment Inventory and Roofing Data Collection.
   2. Submit forms prior to Substantial Completion and as required by Section 01 7801.

PART 2 - PRODUCTS
   Not used.

PART 3 - EXECUTION

3.01 SUBMITTALS FOR REVIEW
   A. When the following are specified in individual sections, submit them for review:
      1. Product data.
      2. Shop drawings.
      3. Samples for selection.
      4. Samples for verification.

   B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

   C. Samples will be reviewed only for aesthetic, color, or finish selection. Note: Product substitutions may be rejected based on aesthetic, color or finish of the material if it does not meet the intent of the design.

   D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - CLOSEOUT SUBMITTALS.

3.02 SUBMITTALS FOR INFORMATION
   A. When the following are specified in individual sections, submit them for information:
      1. Design data.
      2. Certificates.
      3. Test reports.
      4. Inspection reports.
      5. Manufacturer's instructions.
      6. Manufacturer's field reports.
      7. Other types indicated.

   B. Submit for Architect's knowledge as contract administrator or for Owner.

3.03 SUBMITTALS FOR PROJECT CLOSEOUT
   A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

**3.04 NUMBER OF COPIES OF SUBMITTALS AND FORMATTING**

A. All documents shall be submitted electronically through the FTP site (or E-Builder), unless directed otherwise by Architect.

B. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches. Submit electronic copies in PDF format.
   2. Larger Sheets, Not Larger Than 30 x 42 inches: Submit electronic copies in PDF format.
   3. Review will be returned electronically.

C. Documents for Information: Submit electronically plus one (1) hard copy.

D. Documents for Project Closeout: Provide an electronic version on USB flash drive or CD-R of submittal originally reviewed and the final, revised and approved submittals.

E. Samples: Submit the number specified in individual specification sections; two of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

**3.05 SAMPLES**

A. Submit the number specified in individual specification sections; two (2) of which will be retained by Architect.
   1. For color samples, after review, produce duplicates. All color samples shall be actual materials or accurate color representations of the materials.
   2. Label each sample with identification related to Submittal Transmittal Form.
   3. Product samples will not be returned to Contractor unless specifically so stated.
   4. Submit samples at least thirty (30) days prior to the date the contractor needs approval for ordering or incorporation into the Work.
   5. Colors and Patterns: Unless a color and pattern is specified for the product, submit two sets of accurate color and pattern charts, and samples illustrating the manufacturer's full range for selection by the Architect. All color samples must be submitted before a color schedule can be generated allowing any color to be assigned to any product for ordering.
      a. When a color/pattern has been specified in the construction documents, any substitution may be rejected by the architect solely based on the color/pattern. All substitutions must be approved by the architect.
   6. Type: Submit samples to illustrate functional and aesthetic characteristics of the products, with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating color, textures and patterns for the Architect's selection if selection has not been previously scheduled.
   7. Reviewed product samples may be used in the work with approval by the Architect.

**3.06 SUBSTITUTION PROCEDURES**
A. The Instructions to Bidders in the front end of project manual specifies time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Architect will consider requests for substitutions prior to bidding per the Instructions to Bidders and within 30 days after date established in Notice to proceed.
   1. Only requests submitted on “01 6301 – Prior Approval Substitution Request Form” will be considered.

C. Substitutions may be considered after bidding (unless noted otherwise) when:
   1. A product becomes unavailable through no fault of the Contractor.
   2. There will be a delay in schedule without a substitution through no fault of the Contractor.
   3. At sole discretion of the Architect/Owner.
   4. Only requests submitted on “01 6302 – Contractor Substitution Request Form” will be considered.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:
   1. Submit two copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit separate request for each substitution with Form 01 6301 or 01 6302 - Substitution Request Form. Only requests submitted on this form will be accepted.
   3. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer. Include in the request:
      a. Complete data substantiating compliance of proposed substitution with Contract Documents.
      b. For products:
         (1.) Product identification, including manufacturer's name and address.
         (2.) Manufacturer's literature containing product description, performance and test data, and reference standards with the sections pertaining to the product to be substituted highlighted or marked.
         (3.) Samples as required.
      c. For construction methods: Detailed description of proposed method, and drawings illustrating methods, if a change is needed from the original methods listed in the Construction Documents.
      d. Itemized comparison of proposed substitution with product specified.
      e. Data relating to changes in construction schedule.
f. Give cost data comparing proposed substitution with specified product.

3.07 SUBMITTAL PROCEDURES

A. Schedule submittals to expedite work. Unless otherwise noted, submittals shall be submitted within 45 days of the date of the Owner – Contractor Agreement.

B. Transmit each submittal with a separate Submittal Transmittal Form. The form follows this section in Section 01 3301 - Submittal Transmittal Form.

C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

E. Apply Contractor’s stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Return non-conforming submittals to preparer for revision rather than submitting to Architect.

F. Sign Submittal Transmittal Form and deliver submittals electronically to Architect plus one hard copy to business address

G. Schedule submittals to expedite the Project, and coordinate submission of related items.

H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

I. Provide separate submittals for each specification section requiring submittals. Include all material requested for that section. Provide folders or binders for material.

J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

K. Do not fabricate products or begin work which requires submittals until return of submittal with the Architect’s acceptance.

L. Coordinate submission of related items. Group submittals of related products or a system in a single transmission.

M. Mark or show dimensions and values in the same units as specified.

N. Provide space for Contractor and Architect review stamps.

O. When revised for resubmission, identify all changes made since previous submission.

P. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

Q. Submittals not requested or not approved in advance by the Contractor will not be recognized or processed.

3.07 PRODUCT DATA

A. Submission: Submit electronically or the number of hard copies which Contractor requires plus
two (2) originals to be retained by Architect.

B. Form:
   1. Provide all critical information such as references standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances.
   2. Submit only data which are pertinent. Highlight and mark each copy of manufacturer’s standard printed data to identify products, models, option, and other data pertinent to project.

3.08 MANUFACTURER’S INSTRUCTIONS

A. Submission: Submit electronically or the number of hard copies which Contractor requires plus two (2) to be retained by Architect.

B. Form:
   1. Manufacturers’ printed instructions for activities such as delivery, storage, assembly, installation, wiring, start-up, adjusting, finishing, and maintaining.
   2. Indicate pertinent portions and identify conflicts between manufacturers’ instructions and Contract Documents.

3.09 DESIGN DATA AND CALCULATIONS

A. Submission: Submit electronically or the number of hard copies which Contractor requires plus two (2) to be retained by Architect.

B. Form:
   1. Provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State assumptions and define parameters. Give general formulas and references. Provide sketches as required to illustrate design method and application.
   2. Arrange calculations and data in a logical manner with suitable text to explain procedure.
   3. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

3.10 MANUFACTURERS’ CERTIFICATES

A. Submission: Submit electronically or the number of hard copies which Contractor requires plus two (2) to be retained by Architect.

B. Form:
   1. Certificates shall indicate that products conform to or exceed specified requirements. Submit supporting reference data, affidavits, and certifications as required.
   2. Certificates may be based on recent or previous test results if acceptable to Architect.

3.17 REPORTS

A. Submission:
   1. Submit electronically or the number of hard copies which Contractor requires plus two (2) to be retained by Architect.
2. Submit reports within fifteen (15) days after completion of activity.

B. Form:
   1. Present complete information in a clear concise manner.
   2. Typed or computer printed on 8-1/2 by 11 inch white paper.
   3. Bind with titled cover in folder, plastic binder, or three ring binder as appropriate for quantity of material.

C. Reports shall include:
   1. Time, location, conditions, and duration of activity.
      a. Names of persons performing and witnessing activity.
      b. Equipment used.
      c. Description of activity, data recorded, and results.
      d. Deficiencies found, corrective measures, and results of retesting.
      e. Other pertinent data.

END OF SECTION
Date: _________________________

Project: AGRICULTURAL SCIENCE CENTER EXTENSIONS INCLUDING ALCALDE, ARTESIA, CLAYTON, FARMINGTON, AND TUCUMCARI

Project Numbers.  3737, 3738, 3699, 3743, 3748

Owner: NEW MEXICO STATE UNIVERSITY

Contractor: _______________________________________________

Submittal Number: ___________________   Number of Copies Submitted: __________

(Include transmittal number - referenced specification section - submission number; i.e. "24-013300-01" Or "24-013300-02" if re-submittal)

Resubmittal: ☐Yes ☐ No

Submittal Title/Item: ___________________________________________________________________________

Referenced Specification Section: ___________________        __________________________________________

Name of Subcontractor and/or Supplier: ____________________________________________________________

Comments:
___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

Samples Included: ☐Yes ☐ No

Color Selection Required: ☐Yes ☐ No

The undersigned, as Contractor for the above project, submits the following and certifies that submittal has been reviewed and conforms to requirements of the Contract Documents.

Reviewed and Submitted By: ___________________________________

Signature: ____________________________________________________

Note: Submittal review corrections and comments by Architect do not relieve Contractor from compliance with Contract Documents. Review is only for general conformance with design concept and general compliance with information given in Contract Documents. Contractor is responsible for verifying dimensions, selecting fabrication processes and techniques of construction, coordination with other trades, and performing work in safe and satisfactory manner.

FOR ARCHITECT USE:

Date Received by Architect: ____________________________
NEW MEXICO STATE UNIVERSITY                                      AG SCIENCE CENTER EXTENSIONS

Distributed To:

☐ Owner   ☐ Civil   ☐ Landscape   ☐ Structural   ☐ Mechanical   ☐ Electrical

Other: _____________________________________________________
SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Installation quality control.
   2. Reference standards.
   4. Field samples.
   5. Inspection and testing laboratory services.
   6. Manufacturer's field services and reports.

B. Related requirements:
   1. Document 00 7200 - General Conditions:
      a. Paragraph 3.3: Contractor's supervision and construction procedures.
      b. Subparagraph 2.2.4: Owner's responsibilities for testing and inspections.
      c. Article 12: Contractor's responsibility for uncovering and correction of work.
      d. Paragraph 13.5: Requirements for tests and inspections.
   2. Section 01 3100 – Project Management and Coordination: Requirements for coordination with Owner's separate contractors.
   3. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.02 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference.
otherwise in any reference document.

G. When specifications require conformance to a reference standard, applicable standard shall be the edition current at date of receiving bids.

H. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants

I. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

J. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry

K. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing


1.03 INSPECTION AND TESTING LABORATORY SERVICES

A. Unless required otherwise in the Contract, Owner shall appoint, employ, and pay for services of an independent firm to perform routine inspections and compliance for:

B. Testing firm shall perform inspections, tests, and other services specified in individual specification sections and as required.

END OF SECTION
SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Site mobilization plan.
   2. Temporary services: Electrical, lighting, heating, ventilating, water, telephone, and facsimile.
   3. Fencing, barriers, and other temporary controls.
   4. Temporary erosion and sediment controls including NPDES-SWPPP requirements.
   5. Construction facilities: Temporary buildings, sanitary facilities, access, and parking.
   6. Protection of Work and existing facilities.
   7. Project sign.

B. Related documents and sections:
   1. Document 00 7200 - General Conditions:
      b. Paragraph 3.15: Contractor's responsibility for cleaning.
      c. Article 10: Safety precautions and programs.
   2. Section 01 3100: Project Management and Coordination
   3. Section 01 7000 - Execution Requirements: Progress cleaning.

1.02 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers.


1.03 SITE MOBILIZATION PLAN

A. Coordinate locations for temporary facilities with Design Professional and Owner.

B. Based upon information indicated on Drawings, prepare site mobilization plan in accordance with requirements for site logistics plan in Subparagraph 3.13.14 in Document 00 7200 General Conditions.

C. Present 3 copies of plan at Pre-Construction Conference in accordance with Section 01 3100 - Project Management and Coordination.

D. Prior to mobilization, revise and resubmit to Design Professional site mobilization plan incorporating final revisions made at Pre-Construction Conference and approved by Design Professional and Owner.
1.04 TEMPORARY ELECTRICITY

A. Provide for temporary electricity used during construction. Provide service disconnect and overcurrent protection. Provide temporary feeder as required.

B. Connect to existing power source at site. Do not disrupt Owner's need for continuous service. Provide service disconnect and overcurrent protection. Provide temporary feeder as required. Contractor will pay cost of electricity used. Exercise measures to conserve power.

C. Provide power outlets for construction operations with branch wiring, distribution boxes, and flexible power cords as required.

D. Permanent convenience receptacles may be utilized during construction.

1.05 TEMPORARY LIGHTING

A. Provide lighting for construction operations in accordance with Paragraph 3.13 in the General Conditions. Lighting levels shall be appropriate for type and difficulty of work. Use these minimums as guidelines:

B. After dark, provide security lighting for interior and exterior work and storage areas.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtailed, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction. Document existing lighting system conditions at start of Work and submit report to Design Professional for approval before Work begins. Re-lamp, replace, or repair existing fixtures at end of job to return lighting to conditions documented prior to commencement of Work.

1.06 TEMPORARY HEATING AND VENTILATING

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

B. Provide temporary fan units to maintain clean air for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in interior areas where construction is in progress.

1.07 TEMPORARY WATER SERVICE

A. Provide, maintain, and pay for suitable quality water service required for construction operations.

B. Connect to existing water source at site for construction operations.

C. Assume responsibility for temporary connections and water lines. Upon completion, remove temporary facilities.

1.08 COMMUNICATIONS
A. Provide, maintain, and pay for telephone service to field office. School telephones will not be available to Contractor’s workforce unless for an emergency.

B. Provide, maintain, and pay for facsimile service to field office.

1.09 FENCING

A. Provide temporary fencing around new building and materials storage site. Completely separate construction from existing facilities, student pathways and related exterior areas.

B. Type: Panelized 6 foot high commercial grade chain link fence. Equip with vehicular and pedestrian gates with locks.

1.10 BARRIERS AND PROTECTION

A. Security: Provide to protect Work and existing facilities from unauthorized entry, vandalism, and theft. Coordinate with Owner’s security program and personnel.

B. Barriers: Provide to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from construction operations.

C. Barricades and covered walkways: As required by Design Professional, Owner and governing authorities for safe public access to existing buildings.

D. Enclosures: Provide temporary, insulated, weather tight closures of exterior openings to provide acceptable working conditions, protect Work, and prevent unauthorized entry. Fit with lockable doors.

E. Interior Enclosures- Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

F. Temporary partitions: Provide to separate work areas from existing building at point of connection and completed Work. Prevent penetration of dust and moisture into existing and completed portions of building.

G. Emergency exits shall be maintained during construction. Provide separate barriers as appropriate.

H. Protect existing detection devices such as smoke detectors and sensors from construction dust.

I. Protect existing trees and plants designated to remain. Replace damaged plant material.

J. Hand-water existing trees, plants and grass as necessary to maintain them viable in the event that existing irrigation system is made temporarily inoperable due to the Work. Replace dead plant material as required in the event of failure to comply with this provision.

1.11 PROTECTION OF EXISTING AND INSTALLED WORK

A. Protect installed Work. Control activity in immediate work area.

B. Provide temporary and removable protection for installed products.

C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, and movement of heavy objects with durable sheet materials.

D. Prohibit traffic and storage on roof surfaces and landscaped areas.
1.12 TEMPORARY FIRE PROTECTION

A. Install and maintain temporary fire protection components. Establish and follow procedures to protect against fire losses. Comply with NFPA 241.

B. Fire extinguishers: Provide hand carried, portable, UL rated fire extinguishers of type and size recommended by NFPA 10 for building exposure conditions. Place in accessible, convenient locations in clear view with a minimum of one extinguisher per floor.

C. Access: Maintain unobstructed access to fire hydrants, water supply, fire extinguishers, stairways, and access routes for fighting fires.

D. Heating devices: Exercise care and monitor use of temporary heaters to minimize fire risk.

E. Store combustible materials in fire-safe containers.

F. Volatile products: Do not store paints, varnishes, paint removers, solvents, adhesives, cleaning rags, and other volatile products in building. Take precautionary measures to prevent fire hazards and spontaneous combustion.

G. Cutting and welding: Approve in advance use of open flame cutting, welding, and soldering equipment. Ensure that safe conditions exist before granting approval.

1.13 TEMPORARY EROSION AND SEDIMENT CONTROLS

A. Prevent temporary collection of sediment on sidewalks, parking lots, streets and driveways. Clean such surfaces promptly if such conditions exist due to the Work.

B. National Pollution Discharge Elimination System (NPDES) permit and procedures for preparing a Storm Water Pollution Prevention Plan (SWPPP).

1. Contractor shall determine whether Project requires an EPA NPDES storm water discharge permit in conformance with all regulations governing the disturbance of construction site areas.

2. If storm water discharge permit is required, then both Contractor and Owner shall be designated as separate permittees and the Contractor shall do the following:
   a. Prepare a Storm Water Pollution Prevention Plan (SWPPP) document as necessary to ensure compliance with any and all NPDES construction storm water permitting plan requirements.
   b. Prepare and submit all EPA documentation and forms required of Contractor for permit.
   c. Assist Owner with preparation and submittal of all EPA documentation and forms specifically required of Owner for permit. Provide all required project-related information to Owner as necessary.
   d. At Final Completion of Project, Contractor shall complete and submit documentation to EPA as required and to Design Professional as part of Project Closeout documentation package. See Section 01 78 00 of Specifications.

3. If a storm water discharge permit is not required, then the Contractor shall submit to the Design Professional and Owner prior to mobilization a signed statement containing specific written justification why such permit is not required on the Project.

4. The Contractor shall manage the discharge of storm water from the site in accordance with NPDES permit and the provisions of the SWPPP. The Contractor shall be responsible for installing and maintaining any necessary storm water control measures.
in accordance with control device manufacturer’s recommendations and the provisions of the SWPPP. The Contractor shall monitor the suitability of the designated control measures and management practices to achieve the storm water quality provisions of the NPDES permit, and shall make any necessary changes to the controls and practices in order to meet the permit requirements. The Contractor shall be responsible for updating the SWPPP and maintaining all records related to the SWPPP. A copy of the approved SWPPP shall be kept on the jobsite at all times. Contractor shall be liable for all fines and construction delays resulting from any governmental agency enforcement action due to failure by the Contractor to satisfy the above requirements.

5. Contractor is responsible for payment of all applicable fees and permits related to SWPPP approval process and for full cost of control measures for the Project.

1.14 ACCESS

A. Refer to Drawings for location of acceptable access routes and site entrances. Protect existing curbs and walks traversed by construction vehicles from damage.

B. Identify access to Contractor's work and office area with appropriate signs so that delivery personnel and others may contact Contractor. School office shall not be used as destination for Contractor’s deliveries.

C. Prevent unauthorized personnel from accessing school building or site through Contractor's work area.

1.15 FIELD FACILITIES

A. Provide and maintain a weathertight, fully equipped field office. Provide work station for use of Design Professional during field inspections.

B. Provide space for project meetings with table and chairs to accommodate at least 6 persons.

C. Provide and maintain storage sheds and other facilities as required.

D. Arrange for parking for work force in manner approved by Owner. Do not limit Owner's requirements for parking.

1.16 TEMPORARY SANITARY FACILITIES

A. Provide and maintain daily in clean and sanitary condition required sanitary facilities for workforce. Provide at time of project mobilization.

B. New and existing toilet facilities shall not be used by work force.

1.17 DRINKING WATER

A. Provide independent source of drinking water for workforce. School drinking fountains shall not be routinely available for Contractor’s use.

1.18 PROJECT SIGNS

A. Project Construction Sign.
   1. Furnish project sign and erect on site at location designated by Design Professional.
   2. Construction: 3/4 inch exterior plywood bolted to 4 by 4 inches treated wood posts.
3. Sign shall be prepared by professional sign painter using either painted exhibit lettering or die cut adhesive applied letters.

4. Design, style and proportional sizes of lettering, color, and text shall be as shown following this section.

5. Allow no other signs to be displayed without approval of Design Professional or as required by Owner.

1.19 BULLETIN BOARD

A. Furnish and maintain bulletin board adjacent to field office. Display the following throughout construction period:
   1. State wage rates.
   2. Safety requirements.
   3. Official notices and announcements.

1.20 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 – PRODUCTS
Not used

PART 3 - EXECUTION
Not used.

END OF SECTION

(PROJECT SIGN DRAWING TO FOLLOW)
FOR NAME NAME NAME
SECRETARY / TREASURER MEMBER MEMBER
VICE-PRESIDENT MEMBER
PRESIDENT

8'-0" 4'-0"

SUPERINTENDENT

BOARD OF EDUCATION
NAME NAME NAME
NAME NAME NAME
NAME NAME NAME

THANK YOU TO THE TAXPAYERS OF NEW MEXICO FOR MAKING THIS PROJECT POSSIBLE

CONTRACTOR LOGO
VIGIL & ASSOCIATES LOGO 4 COLORS

PROJECT SIGN
SCALE: 1"=1'-0"

NOTES:
1. SIGN TO HAVE WHITE BACKGROUND WITH BLACK TEXT.
2. CONFIRM TEXT WITH OWNER PRIOR TO FABRICATION.

THE NEW MEXICO STATE UNIVERSITY CONSTRUCTION DEPARTMENT

NEW MEXICO STATE UNIVERSITY PROJECT

PROJECT TITLE
HERE

COLOR BORDER LINE
1 1/2" THICK
(TYP @ BOTTOM)

HELVETICA BOLD TEXT
2 1/2" HEIGHT

HELVETICA TEXT
1" HEIGHT

HELVETICA BOLD TEXT
2" HEIGHT

HELVETICA TEXT
1" HEIGHT

SEAL OF NMSU;
10' SQUARE

VIGIL & ASSOCIATES
ARCHITECTURAL GROUP, PC
www.va-architects.com
SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 – GENERAL

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

1.02 SUMMARY
A. Section includes administrative and procedural requirements for selection of products for use
in project; product delivery, storage, and handling; manufacturers’ standard warranties on
products; special warranties; and comparable products.
B. Related Requirements:
   1. Section 01 2300 “Alternates” for products selected under an alternate.
   2. Section 01 6300 “Substitution Procedures” for requests for substitutions.
   3. Section 01 4200 “Reference” for applicable industry standards for products specified.

1.03 DEFINITIONS
A. Products: items obtained for incorporating into the work, weather purchased for project or
taken from previously purchased stock. The term “product” includes the terms “material”,
“equipment”, “system”, and terms similar intent.
   1. Named Products: Items identified by manufacturer’s product name, including make or
   model number or other designation shown or listed in manufacturer's published
   product literature, which is current as of date of the Contract Document.
   2. New Products: Items that have not previously been incorporated into another project
   or facility. Products salvaged or recycled from other projects are not considered new
   products.
   3. Comparable Product: Product that is demonstrated and approved through submittal
   process to have the indicated qualities related to type, function, dimension, in-service
   performance, physical properties, appearance, and other characteristics that equal or
   exceed those of specified product.
B. Basis-of-Design Product Specification: A specification in which a specific manufacturer’s
product is named and accompanied by the words “basis-of-design product”, including make
or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other
characteristics for purposes of evaluating comparable products of additional manufacturers
named in the specification.

1.04 ACTION SUBMITTALS
A. Comparable Product Requests: Submit request for consideration of each comparable
product. Identify product or fabrication or installation method to be replaced. Include
Specification Section Number and Title and Drawing Number and Titles.
   1. Include data to indicate compliance with the requirements specified in “Comparable
   Products” Article.
   2. Architect’s Action: If necessary, Architect will request additional information or
documentation for evaluation within one week of receipt of a comparable product
request within fifteen (15) days of receipt of request, or seven (7) days of receipt
of additional information or documentation, whichever is later.

END OF SECTION
SECTION 01 6300

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for product options and substitution procedures.

B. Related documents and sections:
   1. Section 00 7200 General Conditions: Paragraph 3.4 – Labor and Materials

1.02 SUBSTITUTIONS

A. During bidding, Design Professional will consider written requests from qualified offerors, subcontractors, and manufacturers for substitutions.
   1. Submit separate request for each substitution with Form 01 6301 - Prior Approval Substitution Request Form. Copy of form follows this Section.
   2. Submit substitution request in accordance with procedures and time limitations stated in Document 00 2113 - Instructions to Bidders.
   3. Substitutions approved during bidding will be listed in Addenda.

B. After Contract award:
   1. After signing of Agreement Between Owner and Contractor, Design Professional will consider written requests for substitutions in accordance with Subparagraph 3.4.2 of the General Conditions.
   2. Submit separate request for each substitution with Form 01 6302 - Contractor Substitution Request Form. Copy of form follows this Section. Provide data documenting need for substitution and substantiating compliance of proposed product with Contract Documents. Include proposed changes to contract amount and time if substitution is accepted.

C. Substitutions may be considered after Contract award when:
   1. A product becomes unavailable through no fault of the Contractor.
   2. There will be a delay in schedule without a substitution through no fault of the Contractor.
   3. At sole discretion of the Architect/Owner.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request including justification as per paragraph C. above, or when acceptance will require revision to the Contract Documents.

E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

F. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.

G. Substitution Submittal Procedure:

1. Submit two copies of request for substitution for consideration. Limit each request to one proposed substitution. Any catalogs or brochures shall be highlighted to indicate the item desired for substitution.
   a. Prior Approval Requests made during bidding and are less than 20 pages may be emailed. Larger documents must be delivered as hard copies.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Architect will notify Contractor in writing of decision to accept or reject request.

PART 2 – PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION - FORMS FOLLOW
CONTRACTOR SUBSTITUTION REQUEST FORM

The undersigned, as Contractor for the above Project, requests that the following product be accepted for use in the Project:

PRODUCT: ________________________________________________________________
MODEL NO.: ______________________________________________________________
MANUFACTURER: __________________________________________________________
ADDRESS: _________________________________________________________________

The above product would be used in lieu of:

PRODUCT: ________________________________________________________________
specified in
SECTION: __________________________________________________________________
PARAGRAPH: __________________________________________________________________
Reason for substitution request: __________________________________________________________________

Attached are the following circled items:

1. Product description including specifications, performance and test data, and applicable reference standards.
2. Drawings.
3. Photographs.
4. Samples.
5. Tabulated comparison with specified product.
6. For items requiring color selections, full range of manufacturer's color samples.
7. Documentation of reason for request.
8. Cost data for comparing proposed substitution with specified product.
9. Other: __________________________________________________________________

The undersigned certifies that the following statements are correct. Explanations for all items which are not true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product. TRUE FALSE
2. Same warranty will be provided for substitution as for specified product. **TRUE** **FALSE**

3. **No** aspect of Project will require re-design. **TRUE** **FALSE**

4. Use of substitution will **not** adversely affect:
   a. Dimensions shown on Drawings. **TRUE** **FALSE**
   b. Construction schedule and date of completion. **TRUE** **FALSE**
   c. Work of other trades. **TRUE** **FALSE**

5. Maintenance service and replacement parts for proposed substitution will be readily available in New Mexico area. **TRUE** **FALSE**

6. Proposed substitution does **not** contain asbestos in any form. **TRUE** **FALSE**

7. All changes to Contract Sum related to use of proposed substitution are included in price listed below. Contractor waives claims for additional costs related to acceptance of substitution which may subsequently become apparent. **TRUE** **FALSE**

8. Costs of modifying project design caused by use of proposed substitution which subsequently become apparent will be paid for by Contractor. **TRUE** **FALSE**

If substitution request is accepted:

Contract Sum will be [decreased] [increased] by $ _____________________________

Contract Time will be [decreased] [increased] by ______________________________

calendar days.

Submitted By:

CONTRACTOR: ____________________________________________________________

ADDRESS: ________________________________________________________________

TELEPHONE NUMBER: ______________________________________________________

NAME OF PERSON SUBMITTING REQUEST: ________________________________

TITLE: ___________________________________________________________________

DATE: ___________________________________________________________________
SECTION 01 6310

SUBSTITUTION REQUEST FORM

The undersigned requests that the following product be accepted for use in the Project.

Product: __________________________________________ Model No.: ______________

Manufacturer: __________________________________________

Address: __________________________________________

The above product would be used in lieu of:

______________________________________________________________________________

Specified in: Section: ______________ Paragraph: _____________

Reason for substitution request:

____________________________________________________________________________________

Attached are the following items:

☐ Product description including specifications, performance and test data, and applicable reference standards

☐ Drawings

☐ Photographs

☐ Samples

☐ Tabulated comparison with specified product

☐ For items requiring color selections, full range of manufacturer’s color samples

☐ Documentation of reason for request.

☐ Other: __________________________________________

The undersigned certifies that the following statements are correct. Explanations for all items which are not true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product, including EPISD requirements as applicable. ☐ True ☐ False

2. Same warranty will be provided for substitution as for specified product. ☐ True ☐ False
3. **No** aspect of Project will require re-design.  

4. Use of substitution will **not** adversely affect:
   a. Dimensions shown on Drawings.  
      - [ ] True  [ ] False
   b. Construction schedule and date of completion.  
      - [ ] True  [ ] False
   c. Work of other trades.  
      - [ ] True  [ ] False

5. Maintenance service and replacement parts for proposed substitution will be readily available in the New Mexico area.  

6. Proposed substitution does **not** contain asbestos in any form.  

7. **NOTE:** Any additional costs for modifying project design, which subsequently becomes apparent caused by use of proposed substitution, will be paid for by Contractor.

Submitted By:

Company: ____________________________________________________________

Address: ____________________________________________________________

Telephone Number: ______________________

Name: ______________________________

Signature: ________________________________  Date: ______________
SECTION 01 7000
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Basic requirements for examination, preparation and installation.
   2. Requirements and limitations for cutting and patching incidental to work, including excavation and backfilling, and as required making several parts fit together.
   3. Progress cleaning.

B. Related documents and sections:
   1. General Conditions:
      a. Paragraph 3.13: Contractor's responsibilities regarding use of the site.
      b. Paragraph 3.14: Contractor's responsibilities regarding cutting and patching operations.
      c. Article 12: Uncovering and correction of work.
   2. Section 01 5000 - Temporary Facilities and Controls: Temporary barriers and enclosures.
   3. Section 01 7700 - Closeout Procedures: Final cleaning.
   4. Section 02 4100 - Demolition: Minor demolition required to accommodate new construction and renovation.

1.02 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Effect on work of Owner or separate Contractor.
f. Written permission of affected separate Contractor.
g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

I. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to work:
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed submittals.

B. Store Record Documents separate from documents used for construction. Label "Project Record Documents".

C. Record information concurrent with construction progress. Use erasable colored pencil. Date all entries. Call attention to entry by circling area affected.

D. Specifications: Legibly mark and record in each section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

E. Contract Drawings and shop drawings: Legibly mark each item to record actual construction including:
   1. Actual items of equipment and system components installed.
   2. Actual locations of components and routing of piping and raceways.
   3. Measured horizontal and vertical locations of underground water, sewer, irrigation, electrical, and other utilities and appurtenances, referenced to permanent surface improvements.
   4. Measured locations of piping, raceways, and other items concealed in construction, referenced to visible and accessible features.
   5. Field changes of dimension and detail.
   6. Details not on original Contract Drawings.
   7. Accurately record actual locations of capped and active utilities.
F. Documents will be reviewed by Architect at each submittal of Application for Payment to ensure that entries are current.

G. Submit documents to Architect prior to or in conjunction with submission of Notice of Substantial Completion.

1.02 LOCATION OF UNDERGROUND UTILITIES

A. The Contractor shall arrange for all spotting of lines by utility companies in advance of any excavation work.

B. The Contractor shall arrange for spotting of lines by Owner’s forces in advance of any excavation work on the school site. Procedures for arranging for line spots and obtaining clearance prior to excavation shall be strictly adhered to.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Patching and replacement materials: Those used for original installation.

B. Product substitutions: For any proposed change in patching materials, submit request for substitution in accordance with Section 01 6300 - Product Substitution Procedures.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK
A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement. Where manufacturers' instructions conflict with specifications, notify Architect. Do not proceed until clarification is received.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

F. Remove excess materials such as adhesive, grout, mortar, and sealants, from finished surfaces in a manner which does not stain, corrode, disfigure, or otherwise damage finished surface.

G. Replace deformed, scratched, cracked, broken, or otherwise damaged products as result of installation.

H. Follow Indoor Air Quality Management Plan as required by Division 1 Section "Sustainable Design Requirements."

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.
9. Uncover in order to install improperly sequenced work.
10. Execute patching to complement adjacent work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Size openings to exactly fit penetrating item plus allowance for sealant. Form edges of hole even and smooth.

H. Drill penetrations through concrete for conduit and piping.

I. Drill round hole and saw cut rectangular openings in concrete masonry units. Where block is broken or chipped in process, remove complete face of exposed block and replace with partial block.

J. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

K. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400 - Firestopping, to full thickness of the penetrated element.

L. Patching:
   1. Restore work with new products meeting requirements of Contract Documents.
   2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   3. Match color, texture, and appearance.
   4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 ASPHALT PAVEMENT [IF APPLICABLE]

A. Where existing or new pavement is damaged from construction operations, cut to install new underground utilities and where existing items are removed from paved areas:
   1. Cut pavement with saw or other means to provide neat, straight joints.
   2. Where existing pavement is damaged by removals, remove additional pavement to allow clean cuts.
   3. Backfill and sufficiently compact removal area prior to placement of pavement.
4. Place pavement to match existing materials and thicknesses.
   B. Immediately after placement, protect new pavement from mechanical damage.

3.08 ROOF PENETRATIONS

A. New roofing:
   1. Coordinate, locate and schedule roof penetrations prior to installation of new roof system.
   2. Coordinate roof penetrations such that installation does not void roof warranty.

B. Existing roofing: Prior to penetrating, cutting, and patching existing roofing, verify with Owner if roof is under warranty. If warranted, employ roof contractor certified by manufacturer of roof system, make required inspections and notifications, and perform cutting and patching as required to ensure warranty is not violated. Protect building interior during operations and return roof to weathertight condition after the work is performed.

3.09 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.10 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: General procedures for starting, monitoring, and adjusting items of equipment and complete systems.

B. Related sections:
   1. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

PART 2- PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 STARTING OF SYSTEMS

A. Submit written Construction Checklists in accordance with Section 01 3300 - Submittal Procedures that equipment and systems have been properly installed and are functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Substantial Completion Procedures.
   2. Final Completion Procedures
   3. Systems Start-Up
   4. Demonstration and Instruction.
   5. Adjusting.
   6. Final cleaning.
   7. Closeout procedures.
   8. Maintenance.
   9. Inspection held immediately prior to end of one year correction period.

B. Related documents and sections:
   1. Document 00 7200 - General Conditions of the Contract,
      a. Paragraph 9.8: Substantial Completion.
      c. Paragraph 9.10: Closeout Requirements
      d. Paragraph 9.11: Final completion and final payment.
      e. Subparagraph 12.2.2.1: One year correction period for Contractor to correct defective work.
   2. Section 01 7000 - Execution Requirements: Progress cleaning.
   3. Section 01 7500 – Starting and Adjusting: Starting and adjusting items of equipment and complete systems.
   4. Section 01 7800 - Closeout Submittals: Submittal of project record documents, operation and maintenance manuals, warranties, certificates of inspection, extra materials, and keys.
   5. Section 01 7900 – Demonstration and Training: Demonstrations and training for Owner’s personnel.

1.02 SUBSTANTIAL COMPLETION PROCEDURES

A. Prior to or in conjunction with submission of Contractor’s request for Substantial Completion, submit the items specified in Section 01 7800 - Closeout Procedures:

B. Comply with Document 00 7200 - General Conditions of the Contract, Paragraph 9.8 for issuance of Certificate of Substantial Completion.

1.03 FINAL COMPLETION PROCEDURES
A. Follow procedures as outlined in Article 9 of the General Conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
D. Verify that wiring and support components for equipment are complete and tested.
E. Execute start-up under supervision of applicable Contractor personnel and manufacturer’s representative in accordance with manufacturers’ instructions.
F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
D. See Section 01 7900 - Demonstration and Training.

3.03 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.04 FINAL CLEANING

A. Execute final cleaning prior to final inspection by methods and with materials and equipment suitable for commercial/institutional building maintenance. See Paragraph 3.13 – General Conditions.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the
surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.05 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Substantial Completion.

D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

F. Notify Architect when work is considered finally complete.

G. Complete items of work determined by Architect's final inspection.

3.06 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Furnish service and maintenance of components indicated in specification sections during the warranty period.

D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION
SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes procedures for preparing and submitting closeout submittals:

1. Project Record Documents.
2. Operation and maintenance manuals and data.
3. Warranties.
4. Insurance information.
5. Certificates of inspection and compliance.
7. Extra materials.

B. Related documents and sections:

1. Document 00 7200 - General Conditions of the Contract:
   a. Paragraph 3.5: Contractor's warranty that Work is of good quality and free from defects and conforms to Contract Documents.
   b. Subparagraph 9.9.1: Commencement of warranties and correction period.
   c. Subparagraph 9.10.1: Closeout requirements
   d. Paragraph 9.11: Affidavits and Certificates required before Final Payment
   e. Subparagraph 12.2.2.1: One year correction period for Contractor to correct defective work.

2. Section 01 3300 - Submittal Procedures: Submittal of shop drawings, product data, samples, installation instruction, reports and other submittals during construction prior to closeout.

3 Section 01 7500 – Starting and Adjusting: Starting and adjusting items of equipment and complete systems.

4 Section 01 7700 – Closeout Procedures: Requirements for achieving Substantial Completion and Final Completion.

5 Section 01 7801 – Equipment Inventory and Roofing Data Collection: Requirements for completing equipment inventory and roofing data submittals.

1.02 OPERATION AND MAINTENANCE DATA
A. Provide operation and maintenance data for:
   1. Mechanical equipment, systems, and controls specified in Divisions 21, 22, and 23.
   2. Electrical equipment, systems, and controls specified in Division 26.
   3. Other equipment and systems for which operation and maintenance data is requested in individual specification sections.

B. Provide written sequence of operations for each automated building system, including those related to the following:
   2. Life safety system(s).
   3. Electrical system(s).
   3. Mechanical system(s).
   4. Other automated building systems and components.

C. Submission:
   1. Submit data to Design Professional in one or more binders.
   2. Submit for review one draft copy 30 days prior to need date or as otherwise specified. This copy will be returned after review with Design Professional's comments. Revise content as required.
   3. Once approved, submit copies of final operation and maintenance manuals as follows:
      a. Two (2) hard copies and two (2) electronic disk(s) of entire manual to District.
      b. One (1) electronic disk of entire manual to Architect.
   4. All manuals shall be submitted prior to or in conjunction with Contractor's request for Substantial Completion and prior to demonstration and training session.

D. Contents:
   1. Appropriate design criteria.
   2. Equipment parts list.
   3. Equipment inventory data (on Owner-provided electronic forms) and parts lists.
   4. Roofing data (on Owner-provided electronic forms).
   5. Operating instructions.
   7. Shop drawings and product data.
   8. Written sequence of operations for each automated building system including those related to the following:
a. Life safety system(s).
b. Electrical system(s).
c. Mechanical system(s).

9. Testing, balancing, and other field quality reports.


11. Directory listings

12. Other material and information as indicated in individual specification sections and as necessary for operation and maintenance by Owner's personnel.

E. Form:

1. Hard copies of manuals shall be 8-1/2 x 11 inch text pages bound in three ring expansion binders with a hard durable plastic cover. All documents to be originals unless otherwise noted.

2. Prepare binder covers with printed subject title of manual, title of project, date, and volume number when multiple binders are required. Printing shall be on face and spine.

3. Internally subdivide the binder contents with divider sheets with typed tab titles under reinforced plastic tabs. Place dividers at beginning of each chapter, part, section, and appendix.

4. Provide a table of contents for each volume.

5. Provide directory listing as appropriate with names addresses, and telephone numbers of Design Professional, Contractor, subcontractors, equipment suppliers, and nearest service representatives. Provide emergency 24-hour service contact information for all subcontractors, service contractors and principal vendors.

6. Provide electronic data disk(s) with each manual including all data required to be submitted electronically. Include hard copy with each manual.

1.03 WARRANTIES

A. Provide duplicate notarized copies of special and extended warranties as required by individual specifications sections.

B. Submit warranties to Design Professional prior to or in conjunction with submission of Notice of Substantial Completion.

C. Execute and assemble warranties from subcontractors, suppliers, and manufacturers.

D. Provide a separate binder containing all the warranties. Provide Table of Contents and assemble in three ring binder with a hard durable plastic cover. Internally subdivide the binder contents with permanent page dividers, with tab titling clearly typed under reinforced laminated plastic tabs.

E. All warranties shall be the dated from the date of Substantial Completion.
F. For items of work delayed beyond date of Substantial Completion, provide updated warranty submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.04 CERTIFICATES OF INSPECTION AND COMPLIANCE

A. For inspections throughout the construction period required by regulatory agencies, obtain and maintain certificates issued to show compliance.

B. Assemble certificates and any formal written evidence of regulatory compliance in three ring binder with table of contents and submit to Design Professional prior to or in conjunction with submission of Notice of Substantial Completion.

C. Certificate of Occupancy: Prior to Substantial Completion, obtain from authorities having jurisdiction Certificate of Occupancy. Submit with Notice for Substantial Completion.

1.05 INSURANCE INFORMATION

A. Submit prior to or in conjunction with submission of Contractor’s request for Substantial Completion information regarding insurance including change over requirements and insurance extensions.

1.06 MAINTENANCE TOOLS

A. Provide any hardware and software tools (including software keys) that are proprietary to the mechanical systems and that may be necessary for service during their lifecycle.

B. Tools shall be as provided or recommended by manufacturers of installed equipment and systems. Types and sizes shall be as specifically required for installed products.

C. Tools shall be available and their use demonstrated during training sessions specified in Section 01 7500 - Starting, Adjusting, and Demonstrating.

D. Prior to, or concurrent with Contractor’s request for Substantial Completion, deliver maintenance tools to Owner’s representative. Prepare inventory of tools provided and obtain receipt from Owner’s representative.

1.07 EXTRA MATERIALS

A. Provide spare parts and maintenance materials in quantities specified in individual sections.

B. Extra materials shall be produced by the same manufacturer of and compatible with the installed products.

C. Prior to or concurrent with submission of Notice of Substantial Completion deliver extra materials in unopened containers to Owner’s representative at designated storage area at project site and place in location as directed. Obtain receipt from Owner’s representative.

D. During one year correction period:

1. Extra materials may be used by Contractor to replace expendable and normally worn parts.
2. Extra materials used by Contractor for replacement of defective products shall be replaced at no additional cost to Owner.

1.08 KEYS

A. Prior to or in conjunction with submission of Contractor’s request for Substantial Completion, provide Owner with all keys for:

3. Door hardware locks after re-keying in accordance with Section 08 7100 - Door Hardware.

4. Access doors and panels.

5. Electrical panel boards and other equipment.

E. Provide a minimum of two keys for each lock.

F. Clearly label each key as to function and location of lock.

G. Obtain receipt from Owner’s representative.

E. Prior to, or in conjunction with Final Completion, return all keys lent out by Owner to Contractor for access to existing spaces, gates, etc. for the Work. Obtain receipt from Owner.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION
SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes: Training of Owner's designated personnel in operation and maintenance of equipment and systems.

B. Related sections:
   1. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

1.02 SUBMITTALS
A. Provide in accordance with Section 01 3300 - Submittal Procedures:
   1. List of names, resumes, and qualifications of personnel conducting training sessions.
   2. Preliminary schedule listing times, dates, and outline showing organization and proposed contents of training sessions for approval by Design Professional and Owner.
   3. Copies of training manuals and other materials to be used in training sessions for approval by Design Professional and Owner.
   4. Provide Owner additional copy of audio visual material on the same media used in training sessions.
   5. Three (3) copies of training manuals for future use in training by Owner and three (3) digital copies of training manuals.
   6. Submit report within 1 week after completion of training that sessions have been satisfactorily completed. Give times, dates, list of persons trained, and summary of instructions.

1.03 QUALITY ASSURANCE
A. Personnel conducting demonstration and training sessions shall be knowledgeable of installation, operation, sequence of operations, and maintenance of specific project equipment and systems. Where appropriate manufacturer's representatives shall conduct training.

PART 2 - PRODUCTS

2.01 TRAINING MATERIALS
A. Training manuals: Loose leaf notebook format with agenda and objectives of each lesson.
   1. Manuals shall describe function, operation, sequence of operations, and maintenance of various items of equipment and be suitable for personnel with high school education.
   2. Manuals shall be suitable for future training of Owner personnel by Owner staff.
3. Manuals shall be useful reference for staff maintaining facility.

B. Visual aids: Provide charts, handouts, overhead projector slides, electronic presentations, and other visual aids required to make effective presentation and facilitate training.

1. Equipment needed for showing visual training aids shall be provided by Contractor.

2. Visual aids shall be suitable for use by Owner's staff to train additional personnel in the future.

PART 3 - EXECUTION

3.01 SCHEDULING

A. Schedule demonstration and training sessions after equipment and systems have been completely installed, startup completed, and adjustments made. Single demonstration and training session shall be conducted of all items prior to substantial completion. Schedule with Design Professional to accommodate Owner's representatives.

3.02 DEMONSTRATION AND TRAINING

A. Provide demonstration and training session to emphasize operation, sequence of operations, use, and maintenance of installed items and systems:

1. Mechanical systems specified in Divisions 21, 22 and 23.

2. Electrical systems specified in Division 26.

3. Other items and systems as designated by Design Professional or requested by Owner.

B. Conduct at project site using actual installed equipment and systems.

C. Owner shall be responsible for designating and notifying personnel to attend and ensuring attendance at scheduled sessions.

D. Have copies of operation and maintenance manuals specified in Section 01 7800 - Closeout Submittals available. Use as training aids. Include training on each of written sequence of operations contained in the Operations & Maintenance Manual.

E. Provide two (2) video recordings of demonstration and training sessions to the Owner with the O&M Manuals. Owner shall have right to record or video tape demonstration and training sessions.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Construction Drawings and general provisions of the contract, including general and supplementary conditions, and Division 1 specification sections, apply to this section.

B. Basis of Design/Design Intent documents.


D. Current standards required by the State of Texas.

1.02 RELATED SECTIONS

A. Division 1 - Special Procedures

B. Division 23 – Mechanical Specifications.

C. Division 26 – Electrical Specifications.

1.03 SUMMARY

A. The Commissioning Authority shall be contracted directly to the Owner. The process of commissioning as defined here-in goes well beyond typical HVAC system start-up both in detail of testing and in detail of documentation. The director of the commissioning process is the Commissioning Authority (CxA).

B. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent, basis of design, construction documents and Owner’s system operational needs. This is achieved by beginning in the design phase, documenting design intent/basis of design and continuing through construction, building acceptance and the warranty period with actual verification of performance. The commissioning process shall coordinate what have traditionally been separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and Owner training.

C. The Commissioning Authority shall provide all forms for deficiency & issues logs, prefunction checklists, functional performance procedures and test forms. The contractor shall be required to complete this paperwork as required by the CxA.

D. The building and systems shall be commissioned to the requirements of Section 408 of the 2015 International Energy Code with amendments as adopted by the City of El Paso.

1.04 DEFINITIONS:

A. Definition of Terms:

1. Adjustment: To change the speed, flow, position, signal, or level of any piece of mechanical equipment.
2. **Basis of Design (BoD) Document**: A document, prepared by Architect of Record, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

3. **Calibration**: To check or adjust the graduations of a quantitative measuring instrument against a known standard.

4. **Datalogging** - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

5. **Deficiency** - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not comply with the design intent).

6. **Design Intent** - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

7. **Facility Control System (FCS)**: Other common acronyms are DDC (Direct Digital Controls), BAS (Building Automation System), BMS (Building Management System) or FMS (Facility Management System). This is the system providing automation functions for control of the HVAC and mechanical systems as well as alarming, monitoring, trending and interface/integration to related building systems such as fire alarm, security, card access, electrical switchgear, and stand-alone controls for major equipment such as chillers.

8. **Functional Performance Testing (FPT)**: This portion of the Commissioning Process involves dynamic tests that ensure that all mechanical systems function in accordance with design intent. The tests are dynamic and on-line and test the systems through all possible modes of operation.

9. **Installation Verification**: This initial portion of the Commissioning Process includes observations and punch-lists recorded and performed by the Engineer to ensure that all equipment is installed in accordance with the Specifications and Drawings. The Commissioning Authority shall overview this process.

10. **Minor Adjustment**: To add, subtract, or change various parameters included in the operation logic of a mechanical system or systems in order to improve or optimize operational performance. This refers only to the specified performance logic. Difficulties encountered in accomplishing a minor adjustment shall not be used to define a minor versus a major adjustment.

11. **Major Adjustment**: To fully change the specified operation logic of a mechanical system or systems. This refers only to the specified performance logic. Difficulties encountered in accomplishing a minor adjustment shall not be used to define a minor versus a major adjustment.

12. **OPR**: A written document, prepared by Owner’s Representative, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

13. **Pre-functional checklists (PFC)**: This portion of the Commissioning Process involves primarily the test and balance and startup personnel to ensure that individual pieces of equipment are capable of performing in accordance with the Specifications, Drawings, and manufacturers’ requirements. This is documented with a pre-functional checklist provided and completed by the contractor. The Commissioning Authority shall overview this testing.
14. **Statistical Sampling**: Functionally testing a statistically representative quantity (i.e. 15%) of identical or near identical pieces of equipment. Subject to 3% failure threshold whereby if there are greater than 3% testing failures of randomly chosen equipment, the testing shall be noted as failed and the Contractor shall re-verify the startup of 100% of the equipment. An additional identical statistically representative quantity of equipment shall again be tested which shall include a retest of 25% of the failed equipment and 75% randomly chosen untested equipment. This shall be repeated until the testing is noted as passing. Any proposed statistical sampling shall be identified in the construction phase commissioning plan and approved by the CxA.

15. **System Component or System Element**: A single piece of mechanical equipment such as a pump, fan, chiller, boiler, coil, etc. that when combined together through piping or ductwork will comprise a "System".

16. **System**: A combination of system components that allow the manufacture or distribution of conditioned air or water from one location to another.

17. **Tuning**: To adjust for maximum performance.

### 1.05 COMMISSIONING TEAM

A. Coordination and management: The Commissioning Authority Firm (CxA) shall provide overall coordination and management of the commissioning program as specified herein.

B. The commissioning process will require cooperation of the Contractor, subcontractors, vendors, Architectural Engineering firm, Commissioning Authority and Owner.

C. The commissioning team shall be comprised of the following:
   1. Contractor: Project manager and MEP coordinator.
   2. Subcontractors: As required by the prime contractor.
   3. Manufacturers’ factory engineers: As specified elsewhere.
   4. Commissioning Authority
   5. Construction Management Engineer
   6. Owner Construction Observers
   7. Architectural/Engineering Representatives

### 1.06 COMMISSIONING RESPONSIBILITIES

A. Commissioning Authority Firm (CxA): The CxA Responsibilities include, but are not limited to:

1. General Tasks:
   a. Coordinate, schedule and manage the commissioning activities.
   b. Assist the Contractor to coordinate all Sub Contractor commissioning activities.
   c. Obtain, assemble and submit commissioning documentation.
   d. Attend periodic on-site commissioning activities

2. Commissioning Documentation Development Tasks:
   a. Develop the commissioning plan and schedule.
   b. Develop detailed pre-functional check lists (see attachment sample)
   c. Develop detailed functional performance test procedures (see attachment sample).
   d. Coordinate locations of test ports required for Commissioning on P&ID’s, shop drawings and during installation.
   e. Conduct and coordinate the installation verification inspections with the Engineer, AE, CME and Owner Construction Observers.
f. Prepare and submit the Commissioning Reports.

3. Pre-Functional Testing Tasks:
   a. Assist and witness the start-up activities and pre-functional testing.
   b. Monitor the performance of the Test, Adjust and Balance contractor.

4. Functional Performance Testing Tasks:
   a. Direct the functional performance testing. Provide testing of all systems to provide complete confidence in the systems. The tests will include the interaction between individual components, sub-systems and complete building systems under both normal and emergency power conditions.
   b. Ensure that necessary test instrumentation is available during functional performance testing and instruments meet quality and calibration requirements and are in good working order.
   c. Enforce system compliance and recommend modifications to the system design that will correct or enhance the system performance.
   d. Coordinate witnessing of the tests.
   e. Track commissioning deficiencies until correction and retesting are successfully completed. Assist the Commissioning Team in determining the cause of failure.

B. Owner:

1. Construction and Acceptance Phase:
   a. Facilitate the coordination of the commissioning work by the CA, and, with the GC and CA, ensure that commissioning activities are being scheduled into the master schedule.
   b. Review and approve the final Commissioning Plan—Construction Phase.
   c. Attend a commissioning scoping meeting and other commissioning team meetings.
   d. Perform the normal review of Contractor submittals.
   e. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
   f. When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.
   g. Review commissioning progress and deficiency reports.
   h. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
   i. Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.
   j. Assist the GC in coordinating the training of owner personnel.

C. Architect / Engineering Firm (A/E)

1. Design & Construction Period:
   a. Attend the commissioning scope meeting and selected commissioning team meetings.
   b. Participate and coordinate resolution of system deficiencies (which are related to possible design deficiencies) identified during commissioning, according to the contract documents.
   c. Provide any design narrative and sequences documentation requested by the CxA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
d. Participate in the resolution of potential design concerns as discovered during the commissioning process.

2. Warranty Period: Participate and coordinate the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

D. Mechanical and Electrical Designers/Engineers (of the A/E)

1. Construction and Acceptance Phase
   a. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
   b. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
   c. Attend commissioning scoping meetings and other selected commissioning team meetings.
   d. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
   e. Review the prefunctional checklists for major pieces of equipment for sufficiency prior to their use.
   f. The Design Engineer shall be responsible for the observations and checklists for the Installation Verification.
   g. Additional calculation and investigation of design adjustments needs by the Engineers as defined by the Commissioning Authority.
   h. Review the functional test procedure forms for major pieces of equipment for sufficiency prior to their use.
   i. Witness testing of selected pieces of equipment and systems:

2. Warranty Period: Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

E. General Contractor (GC)

1. Design & Construction Period:
   a. Facilitate the coordination of the commissioning work by the CxA, and ensure that commissioning activities are being scheduled into the project's master CPM schedule.
   b. Include the cost of the contractor's involvement and support of the commissioning process throughout the project in the total contract price.
   c. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
   d. Ensure that all Subcontractors execute their commissioning responsibilities according to the Contract Documents and commissioning plan and schedule.
   e. A representative shall attend a commissioning scope meeting scheduled by the CxA and other necessary meetings scheduled by the CxA to facilitate the Cx process.
   f. Coordinate the activities of all contractor, subcontractor and vendor personnel, required to complete training of Owner personnel in accordance with the requirements of the Specifications and the Training Agenda.
g. Prepare and submit the O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

2. Warranty Period
   a. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
   b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

F. Subcontractors

3. Construction Period:
   a. Cooperate with the CxA to complete commissioning activities.
   b. Include the cost of the contractor’s involvement and support of the commissioning process throughout the project in the total contract price.
   c. The Contractor shall be responsible for the Pre-functional Testing, a start-up procedure performed prior to balancing as defined in Part 2 of this specification.
   d. The Contractor shall be responsible for providing any technical personnel required for physical operation, testing, and simulation of control sequences for each piece of controlled equipment as required by the Commissioning Authority during the Functional Performance Testing. This shall include chiller service personnel, boiler service personnel, the temperature control engineering and technical startup crew, mechanical contracting service personnel for miscellaneous mechanical equipment, and balancing contractor personnel. To the extent possible, these personnel will be scheduled.
   e. Additional calibration and adjustment of the mechanical equipment included in each mechanical system for proper operation under actual operation as defined by the Commissioning Authority.
   f. Additional testing, calibration, adjustment, tuning, and minor adjustments to the temperature controls system sequences for proper operation under actual operation as defined by the Commissioning Authority.
   g. Additional testing, calibration and adjustment of the mechanical water and air flows of each mechanical system for proper operation under actual operation as defined by the Commissioning Authority.
   h. Review final construction phase commissioning plan procedures for equipment installed, training and functional testing required under the particular subcontract.
   i. Provide training services as specified

4. Warranty Period
   a. Provide seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
   b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

G. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents.
4. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.

5. Provide information requested by CA regarding equipment sequence of operation and testing procedures.

6. Review test procedures for equipment installed by factory representatives.

1.07 SUBMITTALS

A. Commissioning Plan – Construction Phase: Within 60 calendar days of issue of construction phase bid documents, submit a preliminary construction phase commissioning plan to identify how commissioning activities will be integrated into general construction and trade activities. The plan is the key means for the CxA to inform all parties as to how each system functions, independently and with respect to other systems. The plan shall be updated regularly and redistributed to the commissioning team for review and comment. The intent of this plan is to evoke questions, expose issues, and resolve them with input from the entire commissioning team early in construction. The commissioning plan shall identify how commissioning responsibilities are distributed. Include the following sections:

1. Executive Summary: Provide a description of the Commissioning Manual

2. Commissioning Team: Provide a listing of all commissioning team members including the names, addresses, and office/fax/cell phones number or the owner, commissioning authority, architect, mechanical engineer, electrical engineer, general contractor, mechanical contractor, electrical contractor, controls contractor, fire alarm system contractor and test & balance contractor.

3. System Overview: Provide a listing of design weather data, design parameters and all mechanical and electrical systems equipment data.

4. Overview of Testing Program Procedures: Provide a detailed description of the testing plan and procedures that will be implemented during the commissioning process.

5. Record Document - Sequences of Operation: Provide a detailed sequence of operation that is utilized for testing purposes. The final commissioning report shall describe any modifications to the engineer specified sequences of operation.

6. Pre-Functional Testing Checklists: Provide prefunctional testing checklist forms to the contracting team for each individual piece of mechanical equipment. The forms shall describe all events required to fully start-up a piece of equipment.

7. Functional Testing Procedures & Data Forms: Provide complete and detailed functional performance testing procedures required to fully test the entire system including the following:
   a. Each procedure shall have a unique alphanumeric designator consisting of the applicable functional performance test procedure designator followed by a dash digit suffix to distinguish multiple repetitions of the same procedure.
   b. The same procedure may be applied to multiple identical pieces of equipment or systems.
   c. The testing for a "System" may be grouped into a single large test or broken down into multiple individual tests that are designed to be executed independently from each other as the construction phasing permits, but in combination will completely test all modes of operation and functionality.
   d. Identify instrumentation required for each test and who will provide it.
   e. State the Testing Objective: This shall include, for example, the design criteria, design intent/basis of design, code requirements, specifics of the equipment to be provided, sequences of operation, specification section, operating priorities,
protocols, etc. Some of these items will be provided to the CxA with the construction package and may be copied or referenced.

de. Identify the initial values for all setpoints and inputs, positions of adjustable devices, valves, dampers, and switches.

g. For each Testing Objective, provide sufficient step-by-step testing events with corresponding expected results such that a clear “pass/fail” result can be documented. FPT procedures shall be written to allow a test to be repeated under identical conditions with repeatable results.

h. Include space to record: Description of the procedure; whether the form is for a retest of a failed procedure; identification and location of the equipment being tested; identification of instrumentation used by serial number; observed conditions at each step of the procedure; acceptable results as specified elsewhere; date of the test; names of technicians performing the procedure; name and signature of the CxA

8. Provide samples of commissioning forms including:

a. Deficiencies and Issues Log: Provide a sample functional performance test deficiency report form. Include space to record: Associated functional performance test data form number; date of test; name of person reporting the deficiency; description of the observations associated with the failure of the test; cause of the failure, if apparent at the time of the test; date and description of corrective action taken; name and signature of person taking corrective action; and schedule for retest.

b. Daily Log: Provide a blank log as an example.

c. Meeting Minutes: Provide a blank log as an example.

9. Commissioning schedule: Submit within 30 calendar days after the Commissioning scoping meeting with the Contracting Team.

1.08 SCHEDULE

A. Commissioning schedule: Integrate functional performance testing and commissioning requirements into the master construction schedule. Commissioning scheduling is the responsibility of the Contractor.

1. Prior to the beginning of start-up or functional performance testing activities, update the schedule of commissioning activities monthly.

2. Two weeks prior to the beginning of start-up or functional performance testing activities, provide a detailed two-week look-ahead schedule. Thereafter, update the two-week look-ahead schedule weekly for the duration of commissioning for that construction phase. The two-week look-ahead schedule shall identify the date, time, beginning location, contractor personnel required, and anticipated duration for each startup or test activity.

B. Commissioning of systems shall proceed per the criteria established in the specific sections that follow, with activities to be performed on a timely basis. Commissioning of systems may proceed prior to final completion of systems. The CxA must be available to respond promptly to avoid delay to the CPM schedule.

C. Problems observed shall be addressed immediately, in terms of notification to responsible parties and actions to correct deficiencies.

1.09 COMMISSIONING MEETINGS

A. Scoping Meeting: Early in the construction process, a commissioning scoping meeting involving all members of the commissioning team shall be held at a time and place designated by the Owner. The purpose of the meeting will be to familiarize all parties with the
requirements of the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

B. Progress Meetings:
   1. Prior to the beginning of start-up or functional performance testing activities, the CxA will hold commissioning meetings at least monthly. These meetings may be held concurrently with the general construction meetings.
   2. Beginning two weeks prior to the commencement of start-up or functional performance testing activities, whichever is earlier, the CxA will hold commissioning meetings at least weekly. Thereafter, and for the duration of commissioning for that construction phase, commissioning meetings will continue to be held at least weekly. These meetings may be held concurrently with the general construction meetings.

C. The CxA may require additional meetings if the commissioning process appears to be behind schedule or if there are coordination problems.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. The Division contractor for the equipment tested provides all standard or proprietary testing equipment required to perform startup and initial checkout and required functional performance testing. For example, the mechanical contractor is ultimately responsible for all standard or proprietary testing equipment for the Facility Controls System (FCS), except for equipment specific to and used by TAB in their commissioning responsibilities. The Division contractor provides two-way radios.

B. Include special or proprietary equipment, tools, software and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents in the base bid price to the Contractor and left on site, except for stand-alone data logging equipment used by the CxA.

C. The CxA will provide any data logging equipment and software required to test equipment outside of that available through the FCS.

D. Provide all testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Documents. If not otherwise noted, the following minimum requirements apply:
   1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F.
   2. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

E. Calibrate all equipment according to the manufacturer’s recommended intervals and when dropped or damaged. Affix calibration tags or have certificates readily available.

2.01 COMMISSIONING REPORTS

A. Documentation - General:
   1. The Commissioning Authority shall record and maintain detailed testing data. The data record shall be comprehensive and concise.
2. All data must be recorded as soon as possible during the course of the testing.
3. All documentation shall have the date, time, and names of persons participating in the inspection and testing.
4. All test instruments shall be documented for valid calibration.
5. The recording work sheets, inspection check lists, and performance testing plans must all be approved by the Engineer and Commissioning Authority prior to the start of Functional Performance Testing.

B. Daily Commissioning Report Logs:
1. The Commissioning Authority shall provide daily report logs to be included in the final report.
2. The daily logs shall record the commissioning Authority personnel and event summaries of meetings, conversations, tests, failures, solutions, procedures and successes.

C. Installation verification audit: Prior to start-up, the Engineer shall maintain a report of installation verification audit activities. Identify equipment and components verified, deficiencies noted, corrective action taken, and the dates and initials of the persons making the entries.

D. Test, adjust and balance (TAB) progress reports: After TAB activities have begun, the TAB shall submit weekly TAB progress reports to the CxA. Identify:
1. Systems or subsystems for which preliminary balancing is complete.
2. Systems or subsystems for which final balancing is complete.
3. Status of deficiencies and balancing problems encountered, including corrective actions taken.
4. Updated schedule of remaining TAB activities.

E. Deficiencies and Issues Report: At the end of each day, in which functional performance tests are conducted, the CxA shall maintain a deficiencies and Issues (D&I) log for tests for which acceptable results were not achieved during the day.
1. Identify tests for which acceptable results were not obtained by test number and description, and equipment identification and location. Briefly describe observations about the performance that was associated with failure to achieve acceptable results. Identify the cause of failure if such is apparent.
2. When corrections have been completed, the CxA shall update the functional performance test deficiency report forms. Identify corrective action taken and the dates and initials of the persons making the entries.
3. Identify the schedule for re-testing.

F. Final Commissioning Report: The CxA shall prepare and submit a final report with the closeout package. The binding format shall be 8 ½ x 11 bound documents with 11 x 17 fold out. This report shall contain:
1. The report shall verify performance of HVAC equipment and systems.
2. Document any field modifications to the testing process and why these modifications were made.
3. The organization of the final commissioning report shall be as follows:
   a. Executive Summary of each mechanical system and problems encountered and resolved.
b. System Overview summarizing the system design.
c. Commissioning Plan
d. Post Commissioned Controls Sequences and Points Lists.
e. Prefunctional Testing Checklists
f. Functional Testing Procedures and Results
g. Deficiencies and Issues Logs
h. Daily report logs.
i. Appendix of letters, meeting minutes, memos and notes occurring during the commissioning process.

G. Hardcopy and Electronic Versions:
   1. The Commissioning Plan provided prior to the on-site commissioning and the Final Commissioning Report provided at the conclusion shall be provided in hard copy (2 copies) and electronic on CD (6 copies).
   2. The Commissioning Plan CD shall include files developed in the most current MS Word format.
   3. The Final Commissioning Report CD shall contain scanned copies of all documentation developed and gathered during the Commissioning Process in Acrobat PDF format.

PART 3 - EXECUTION

3.01 COMMISSIONING PROCEDURE

A. Sequence of testing: Commissioning shall proceed from lower to higher levels of complexity. For each discrete subsystem or system, testing at the lower level shall be completed prior to starting the next higher level of tests. In general, the order of testing from lowest to highest is:
   1. Static tests (such as duct leakage tests).
   2. Component functional performance tests (of motors, actuators, sensors, etc.) and start-up.
   5. Intersystem functional performance tests.

B. Re-testing: The Contractor shall repeat, at no additional cost to Owner, the complete functional test procedure for each test for which acceptable results are not achieved. Repeat tests until acceptable results are achieved. The CxA shall track commissioning deficiencies until correction. Within each system, the CxA shall provide one re-commissioning for any deficiencies. For systems with large quantities of identical equipment, a statistical re-commissioning strategy shall be applied to retest 20% of the deficiencies. The tested systems will not be witnessed by the Owner until acceptable results are achieved, documented, reviewed and accepted. Additional testing beyond a single failure may be subject to back-charges by the CxA.

C. Correction of deficiencies:
   2. Corrections during functional performance tests are generally prohibited to avoid consuming the time of personnel waiting for the test, but not involved in making the correction. Exceptions will be allowed if the cause of the failure is obvious and corrective action can be completed in less than five minutes. If corrections are made under this
exception, the failure shall be noted on the functional performance test data form. A new functional performance test data form, marked "retest", shall be initiated after the correction has been made. The entire functional performance test procedure shall be repeated.

D. Delegated witnesses: Witnesses may be designated by the Owner or A/E to observe the commissioning process. Witnesses shall provide no labor or materials in the commissioning process. The only function of the witnesses shall be to observe and comment on the progress and results of commissioning.

3.02 SYSTEMS TO BE COMMISSIONED

   1. Indoor units.
   2. Outdoor Air Cooled Condensing Units.
   3. Miscellaneous piping components.

B. Packaged Rooftop DX Natural Gas Heat Units.

C. Ventilation Systems
   1. Energy Recovery Fresh Air Units.
   2. Computer room air conditioning units (CRAC)
   3. Exhaust and Supply Systems:
      a. General & Toilet.
      c. Energy Recovery Fresh Air Units.

D. Facility Control System (Building Automation)

E. Plumbing Systems:
   1. Domestic H/C Water

F. Electrical Systems:
   1. Normal Power as it relates to the mechanical systems
   2. Lighting Control Systems
   3. Emergency Power

3.03 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Assist the Contractor in reviewing the O&M manuals prepared by other divisions of the work related to commissioning for compliance with the requirements of Division 1.
   1. Incorporate the standard technical literature into a systems-specific document: concise, to the point, and above all, tailored specifically to this facility.
   2. Obtain the equipment manufacturer’s standard technical literature relevant to the operation and maintenance of the provided equipment. The literature shall be specifically oriented to the equipment provided, indicating all operation and maintenance procedures, parts lists, assembly/disassembly diagrams, and related information. Wiring diagrams must be complete and specific to the equipment provided.
B. Have all of these materials available for the training sessions.

3.04 INSTALLATION VERIFICATION

A. During construction, assist the Contractor and coordinate the AE's observation the work of the Contractor and subcontractors to ensure that all installations are being made in accordance with the intent of the contract documents.

B. Before system start-up begins, coordinate and attend a final installation verification audit with the AE. The audit shall include, but not be limited to, a check of:
   1. Piping specialties including balance, control, and isolation valves.
   2. Ductwork specialty items including turning devices; balance, fire, smoke, and control dampers; and access doors.
   3. Control sensor types and locations.
   4. Identification of piping, valves, starters, gauges, thermometers, etc.
   5. Documentation of pre-start-up tests performed, including manufacturers' factory tests.
   6. Accessibility to equipment in 1-3 above.

C. If any work is found to be incomplete, inaccessible, incorrect, or non-functional, make note of deficiencies and correct the deficiencies before system start-up work proceeds.

3.05 SYSTEM START-UP

A. Assist the Contractor in the development a start-up plan and deficiency list. Commence with system start-up after approval has been given to the start-up plan and the pre-functional checklists have been signed off by the Contractor and subcontractors. The CxA and/or delegated representative shall witness system start-up and list all system and equipment deficiencies noted during start-up. The Contractor shall take corrective action on all system deficiencies noted and demonstrate suitable system operation to the CxA.

B. Prepare start-up deficiency list forms to report deficiencies discovered in conjunction with system start-up. Start-up deficiency forms shall indicate the system being started up; the location and identification of the deficient equipment/material; date of observation; initials of the observer; observed deficiency; date of correction; initials of person making the correction; and corrective action taken.

C. Issue start-up deficiency report forms to the Contractor for corrective action. The Contractor shall advise the CxA when all start-up deficiency list items have been corrected.

3.06 TEST, ADJUST, AND BALANCE (TAB)

A. Assist the Contractor in the coordination the air and hydronic balancing. Advise the TAB firm when systems are complete and ready for balancing. Start TAB as early as possible following systems start-ups and component functional performance tests, in order to be essentially complete prior to system functional performance tests. Coordinate TAB activities with other construction schedule activities.

B. Verify the accuracy of the TAB work prior to commencing any FPT activities that may be adversely affected by improper balancing.
C. Spot check 10% of the TAB measured flows for all air and water flows. This may be accomplished by physically measuring those flows independently of the TAB or witnessing the TAB contractors measurement of the required quantity.

3.07 FUNCTIONAL PERFORMANCE TEST PROCEDURES

A. The CxA shall develop as a part of the construction phase commissioning plan submittal, the functional performance test (FPT) commissioning procedures and documentation to be used. Personnel experienced in the technical aspects of each system to be commissioned shall be enlarged if necessary to augment the expertise of the CxA.

   1. Include functional performance test procedures and functional performance test data sheets for each system based upon actual system configuration. Emphasis shall be placed on testing procedures that will conclusively determine actual system performance and compliance with the design.

   2. The test procedures shall fully describe system configuration and steps required for each test, appropriately documented so that another party can repeat the tests with virtually identical results.

B. The FPT procedures must confirm the performance of systems to the extent of the design intent/basis of design and applicable code under which the project was permitted. When a system is accepted, the Owner and A/E must be assured that the system is complete, works as intended, is correctly documented, and that the designated Owner staff is trained in the operation and maintenance of the system.

C. The majority of mechanical equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met. This could include adequate oil pressure, proof-of-flow, non-freezing conditions, maximum head pressure, etc. Functional performance test procedures shall demonstrate the actual performance of safety shutoffs in real or closely simulated conditions of failure.

D. Systems may include safety devices and components that control a variety of equipment operating as a system. Interlocks may be hard-wired or installed via software. Functional performance test procedures shall demonstrate these interlocks.

E. The CxA shall inform appropriate subcontractors and vendors before commissioning is started as to what the test and expected results will be. Whereas some test results and interpretations may not become evident until the actual tests are performed, all participants should have a reasonable understanding of the requirements. The commissioning plan must address the requirements and be distributed to all participants involved with that particular system.

3.08 REVIEW SOFTWARE DOCUMENTATION

A. The CxA shall review vendor/contractor/Owner-provided detailed FCS software documentation. This includes obtaining FCS program documentation, a review of the programming approach, interface with other systems (such as lighting, fire alarm, security, clock, emergency generator monitoring, sump pumps, and utility metering), and a review of the specific software routines as applied to this project. Discrepancies in programming approaches shall be resolved to provide Owner with the most appropriate, simple, and straightforward approach to software routines.

3.09 TRAINING

A. Assist the Contractor in the preparation and submission a training plan for approval. The training plan shall include for each training session:

   1. Dates, start and finish times, and locations.
2. Outline of the information to be presented.
4. List of texts and other materials required to support training.

B. Obtain assistance from appropriate subcontractors and vendors to provide training for the delegated Owner operations staff as specified for commissioned systems.

C. Equipment vendors provide training on the specifics of each system and philosophy, troubleshooting, maintenance recommendations and repair techniques as specified in the relevant sections of this specification.

D. Installation subcontractors provide training on peculiarities specific to this project and job-specific experience as specified in the relevant sections of this specification.

3.10 EXCLUSIONS

A. The Commissioning Authority shall not be responsible for construction means, methods, job safety, or any management function related to commissioning on the job site.

B. The Contractor shall provide all technician services requiring tools or the use of tools to test, adjust, or otherwise bring equipment into a full operational state.

C. The CxA shall not be responsible for any Civil or Structural testing required.

D. The Commissioning Authority shall not be responsible for comfort balance Test and Balance contractor tasks or Electrical Acceptance Testing contractor tasks.

END OF SECTION
Division Two
EXISTING CONDITIONS
SECTION 02 2626
EXISTING ASBESTOS ASSESSMENT DATA

PART 1 - GENERAL

1.01 ASBESTOS ABETMENT STUDY(S)

This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' reference and are intended to be used as a guide for the awarded GC for all required hazardous material abatement within each building. They are made available for the Bidders' reference and information but are not a warranty of existing conditions. These Documents and its attachments are considered part of the Contract Documents. Neither the Owner(s) nor the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for hazardous material removal shall be followed. If the Bidding or Proposing Contractor is not satisfied with the report or requires any supplemental information, the Bidder is welcome to coordinate their own asbestos survey on the facility at their own expense within the proposed base bid. No additional time or days will be given to the awarded Contractor.

A. ALCALDE:
An asbestos abatement study for this project has been prepared by AnE Consulting Inc., El Paso, Texas. Dated October 08, 2015. This study is provided following this sheet for additional information. Neither the Owner(s) nor the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for asbestos addressed in the Asbestos Abatement Study shall be followed. Should the Contractor question the recommendations of the study or require additional testing, the Contractor is then encouraged to perform additional testing at the expense of the Contractor.

B. CLAYTON:
An asbestos abatement study for this project has been prepared by AnE Consulting Inc., El Paso, Texas. Dated January 14, 2020. This study is provided following this sheet for additional information. Neither the Owner(s) nor the Architect will guarantee or attest to the accuracy of information contained in the study. However, all recommendations for asbestos addressed in the Asbestos Abatement Study shall be followed. Should the Contractor question the recommendations of the study or require additional testing, the Contractor is then encouraged to perform additional testing at the expense of the Contractor.

1.02 Environmental Review Report(s) for bidding Project(s), are referenced below and are included in this project manual following this section:

C. An asbestos abatement study for this project has been prepared by AnE Consulting Inc., El Paso, TX. Dated above for specific project location. This study is provided following this sheet for additional information.

1.03 Related Requirements:

1. Division 02 Section “Selective Demolition”.
2. Asbestos abatement removal requirements as noted in the Drawings.
END OF SECTION

(ASBESTOS ABATEMENT REPORT TO FOLLOW)
Asbestos Survey at
Sustainable Agriculture Science Center at Alcalde
371 County Road 40
Alcalde, N.M. 87511

Prepared for:
New Mexico State University
P. O. Box 30001, MSC 3545
Las Cruces, New Mexico 88003

Prepared by:

CONSULTING, INC.
912 Texas Ave. Suite C
El Paso, Texas 79901

Nicolas Rodriguez, Asbestos Inspector
TDSHS#60-0932, Expires 01/20/2016

Date of Inspection
October 08, 2015
October 15, 2015

New Mexico State University
Attn: Jose Loera
P.O. Box 30001, MSC 3545
Las Cruces, NM 88003

Re: Asbestos Survey
Sustainable Agriculture Science Center at Alcalde
371 County Road 40
Alcalde, New Mexico 87511

Dear Mr. Loera:

On October 8, 2015, AnE Consulting, Inc., conducted a asbestos survey of the Main building structure at the above-referenced location. The survey report is attached.

We appreciate the opportunity to be of service to you. Please contact us with questions or comments, or if we may be of further assistance.

Sincerely,

AnE Consulting, Inc.

Asbestos Consulting Agency
TDSHS License #10-0441, Expires 02/01/2017

Nicolas Rodriguez
Asbestos Building Inspector
TDSHS License #60-0932, Expires 01/20/2016

Enclosures: Asbestos Survey Report
Figures 1-2
Laboratory reports with chain of custody documentation
Texas asbestos licenses
Purpose

The structure is an academic building structure located at 371 County Road 40, Alcaldes, New Mexico. Mr. Jose Loera, with New Mexico State University, requested that AnE Consulting, Inc. (AnE) conduct a survey for asbestos-containing materials (ACMs) associated with the academic building structure. This survey is intended for the identification and locations of Asbestos Containing Materials and may be utilized for future renovation and demolition projects. The areas sampled were under direction of NMSU.

Subject Property Overview

The two story structure was built in 1920. The subject areas sampled consists of offices with a basement. The exterior and interior walls and ceilings consist of plaster and the furnace walls consist of drywall. Wood and linoleum flooring materials were observed.

Inspection

Field activities were conducted on October 8, 2015, by Mr. Nick Rodriguez, with AnE Consulting Inc., Mr. Rodriguez, is licensed by the Texas Department of State Health Services (TDSHS) as an Asbestos Building Inspector (license number 60-0932).

The survey was performed in general accordance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) issued by the U.S. Environmental Protection Agency (40 CFR 61, Subpart M – National Emission Standard for Asbestos), the Asbestos Hazard Emergency Response Act (AHERA, 40 CFR 763), and the Asbestos School Hazard Abatement Reauthorization Act of 1990 (ASHARA, 40 CFR 763, Appendix C to Subpart E). These regulations generally require that, prior to any construction, renovation, or demolition, the area(s) where the work is to be performed shall be inspected by a properly trained and licensed or certified individual for the presence of ACMs that potentially may be disturbed during the work.

AnE employed a sampling strategy which involved identifying homogeneous materials throughout the proposed areas of work, and collecting bulk samples of the suspect materials for laboratory analysis for asbestos content. The term “homogeneous,” as defined by in AHERA, means any material having the same color and texture, and having been installed in the same general time period.

The building contained ten (10) homogeneous areas that were identified during the course of this survey from which twenty-six (26) bulk samples were collected. Accessible areas of the building were visually inspected; exploratory demolition inside wall or ceiling cavities and other inaccessible areas was not performed as part of this limited survey. The identified homogeneous materials are summarized in Table 1 that follows.
Table 1 – Summary of Homogenous Materials

<table>
<thead>
<tr>
<th>Suspect ACM</th>
<th>Location(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Walls Plaster</td>
<td>Entrance, Patio &amp; Second Floor Patio</td>
</tr>
<tr>
<td>Exterior Door Caulking</td>
<td>Entrance &amp; Door</td>
</tr>
<tr>
<td>Floor Joint Caulking</td>
<td>Yard (First Floor)</td>
</tr>
<tr>
<td>Window Glazing</td>
<td>West and South First Floor Windows &amp; North Second Floor Window</td>
</tr>
<tr>
<td>Linoleum Floor Tile</td>
<td>West First Floor Restroom &amp; East Second Floor Restroom</td>
</tr>
<tr>
<td>Walls Drywall</td>
<td>West and East (First furnace closet floor)</td>
</tr>
<tr>
<td>Cabinet Caulking</td>
<td>First Floor West Restroom</td>
</tr>
<tr>
<td>Duct Tape</td>
<td>East First Floor Restroom</td>
</tr>
<tr>
<td>Interior Walls Plaster</td>
<td>Computer Rooms &amp; Entrance</td>
</tr>
<tr>
<td>Roofing Paper</td>
<td>Second Floor Roof</td>
</tr>
</tbody>
</table>

The homogeneous materials were then assessed in terms of friability, condition, and quantity. The term “friable” means a material that when dry can be reduced to a powder using hand pressure (25 TAC § 295.32 (45)). Prior to sampling, each suspect asbestos material was properly wetted, and then each bulk sample was carefully extracted and placed in its own self-sealing container. Each container was wiped, sealed, and labeled with a unique sample number. Appropriate chain of custody paperwork was completed listing each sample collected.

**Laboratory Analysis**

All samples were shipped under standard chain of custody protocols to Micro Analytical Services, Inc. (MAS) in Houston Texas. This facility is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis, and licensed by the TDSHS as an asbestos laboratory (license number 30-0341).

The bulk samples were analyzed by Polarized Light Microscopy (PLM) coupled with Dispersion Staining in accordance with EPA Method 600/M4-82-020. The laboratory report with chain of custody documentation is attached to this report.
An ACM is defined as any material or product that contains greater than one percent (1%) asbestos (25 TAC § 295.32 (15). Based on the laboratory data, two (2) of the ten (10) identified homogenous materials was found to contain asbestos greater than one percent by PLM.

Table 2 – Summary of Asbestos-Containing Materials

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Asbestos Content By PLM</th>
<th>Condition / Friability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall plaster Sample # AB-01</td>
<td>2% Chrysotile</td>
<td>Good / Non-Friable</td>
</tr>
<tr>
<td>Roofing mastic Sample # AB-26</td>
<td>10% Chrysotile</td>
<td>Good / Non-Friable</td>
</tr>
</tbody>
</table>

Summary of Findings
The following is a summary of findings based on the field activities conducted and laboratory analyses performed.

- Asbestos-containing (ACM) materials were identified.
- Asbestos-containing wall plaster was identified in the exterior of the building. The material was observed to be in good condition and considered non-friable.
- Roofing mastic was identified in the exterior of the building. The material was observed to be in good condition and considered non-friable.

Recommendations
Based on the findings, AnE recommends the following:

- If the planned renovation or demolition will disturb the identified ACM, then the materials must be abated by a licensed abatement contractor in accordance with applicable Federal, State, and Local Rules and Regulations.
- A mandatory 10-day notification must be submitted in accordance with NESHAP for the planned abatement of the asbestos-containing materials. Written notification must be postmarked at least 10 working days prior to the start of the abatement. Responsibility for proper notification is that of the building owner, which may be delegated to the asbestos consultant or abatement contractor by the owner.
• If during the renovation or demolition project other suspect asbestos-containing materials are encountered, then the work must be stopped and the suspect asbestos-containing material(s) should be tested for asbestos content.

**Qualifications and Limitations**

The discussions, findings, and recommendations contained herein are based upon data collected on the day of our investigation, the laboratory analysis of the samples collected, and typical practices accepted by the asbestos consulting profession. The scope of our work was limited to the subject areas and services stated in this report. Those building materials not inspected shall be assumed to contain asbestos unless laboratory analysis indicates otherwise.

Exterior of Building
Exterior wall plaster
and
door caulking

Floor Joint Caulking
Window Glazing

Linoleum
Furnace wall drywall

Air Duct Tape
Interior Wall Plaster

Roofing Materials
PLM BULK ASBESTOS ANALYSIS REPORT

CLIENT: AnE Consulting, Inc.

PROJECT: Alcalde Bldg. NMSU

MAS JOB NO.: 12066-00

REPORT DATE: October 13, 2015

IDENTIFICATION: Asbestos, Bulk Sample Analysis, Quantitation by Visual Area Estimation

TEST METHOD: Polarized Light Microscopy with Dispersion Staining
EPA Test Method 600/M4-82-020; (40CFR Part 763 Appendix E to Subpart E) &
EPA 600/R-93/116

STATEMENT OF LABORATORY ACCREDITATION

These samples were analyzed at Micro Analytical Services, Inc. in the Asbestos Laboratory at 11301 Richmond Ave. Suite K100B, Houston, Texas, 77082. The Laboratory holds accreditation from the National Institute of Standards and Technology under the National Voluntary Laboratory Accreditation Program (NVLAP). This laboratory is also licensed and authorized to perform as an Asbestos Laboratory in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/M4-82-020(40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116 or the U.S. Environmental Protection Agency method, under AHERA, for the analysis of asbestos in building materials by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Specific questions concerning bulk sample results shall be directed to the Asbestos Bulk Laboratory at Micro Analytical Services, Inc.

Analyst: Tony T. Dang

Approved Signatory:
**Polarized Light Microscopy Analysis**

AnE Consulting, Inc.  
912 Texas Ave. Suite B  
El Paso, Texas 79901  
MAS Project #: 12066-00  
Date Received: 10/12/2015  
Date Analyzed: 10/13/2015

**Project Name:** Alcalde Building - NMSU

<table>
<thead>
<tr>
<th>Field ID/ Lab ID</th>
<th>Layer #</th>
<th>Sample Description</th>
<th>Asbestos Detected? (Yes/No)</th>
<th>Asbestos Constituents (%)</th>
<th>Non-Asbestos Constituents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB-01 MAS356484</td>
<td>1</td>
<td>Light green fibrous plaster with beige paint</td>
<td>Yes</td>
<td>2% Chrysotile</td>
<td>78% Aggregate</td>
</tr>
<tr>
<td>AB-02 MAS356485</td>
<td>0</td>
<td>Sample not analyzed, first positive reached</td>
<td>No</td>
<td></td>
<td>20% Other</td>
</tr>
<tr>
<td>AB-03 MAS356486</td>
<td>0</td>
<td>Sample not analyzed, first positive reached</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB-04 MAS356487</td>
<td>1</td>
<td>Opaque non-fibrous caulking with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-05 MAS356488</td>
<td>1</td>
<td>Opaque non-fibrous caulking with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-06 MAS356489</td>
<td>1</td>
<td>Opaque non-fibrous caulking with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-07 MAS356490</td>
<td>1</td>
<td>Light green non-fibrous caulking</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-08 MAS356491</td>
<td>1</td>
<td>Light green non-fibrous caulking</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-09 MAS356492</td>
<td>1</td>
<td>Light green non-fibrous caulking</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-10 MAS356493</td>
<td>1</td>
<td>Beige non-fibrous glaze with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-11 MAS356494</td>
<td>1</td>
<td>Beige non-fibrous glaze with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-12 MAS356495</td>
<td>1</td>
<td>Beige non-fibrous glaze with dark brown paint</td>
<td>No</td>
<td></td>
<td>100% Other</td>
</tr>
<tr>
<td>AB-13 MAS356496</td>
<td>1</td>
<td>Beige fibrous linoleum</td>
<td>No</td>
<td></td>
<td>10% fibrous Glass</td>
</tr>
</tbody>
</table>

Samples have been analyzed by the EPA Interim Method 600/M4-82-020(40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116. The test results herein relate only to the sample submitted and analyzed. This report may only be reproduced in full with the approval of the Bulk Asbestos Laboratory of Micro Analytical Services (MAS). MAS is not responsible for any errors resulting from improper or incorrect sampling or shipping procedures. These samples will be retained for a period of 30 days. Accreditation by NVLAP in no way constitutes or implies product certification, approval, or endorsement by NIST. Some materials, especially floor tiles, contain asbestos fibers too thin to be detected by this method.

NVLAP Lab Code: 2005658  
TDSHS License: 30-0341

**Analyzed by:** Tony Dang  
**Approved NVLAP Signatory:** Tony Dang

Page 1 of 3
### Polarized Light Microscopy Analysis

**Project Name:** Alcalde Building - NMSU

<table>
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<th>Asbestos Constituents (%)</th>
<th>Non-Asbestos Constituents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB-13 MAS356496</td>
<td>2</td>
<td>Beige non-fibrous mastic</td>
<td>No</td>
<td>100% Mastic</td>
<td></td>
</tr>
<tr>
<td>AB-14 MAS356497</td>
<td>1</td>
<td>Beige fibrous linoleum</td>
<td>No</td>
<td>10% fibrous Glass</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10% Synthetic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60% Vinyl</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20% Other</td>
<td></td>
</tr>
<tr>
<td>AB-14 MAS356497</td>
<td>2</td>
<td>Beige non-fibrous mastic</td>
<td>No</td>
<td>100% Mastic</td>
<td></td>
</tr>
<tr>
<td>AB-15 MAS356498</td>
<td>1</td>
<td>Beige fibrous linoleum</td>
<td>No</td>
<td>10% fibrous Glass</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10% Synthetic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60% Vinyl</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20% Other</td>
<td></td>
</tr>
<tr>
<td>AB-15 MAS356498</td>
<td>2</td>
<td>Beige non-fibrous mastic</td>
<td>No</td>
<td>100% Mastic</td>
<td></td>
</tr>
<tr>
<td>AB-16 MAS356499</td>
<td>1</td>
<td>White non-fibrous texture</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with beige paint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB-16 MAS356499</td>
<td>2</td>
<td>White non-fibrous joint</td>
<td>No</td>
<td>70% Cellulose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>compound with beige paper</td>
<td></td>
<td>30% Other</td>
<td></td>
</tr>
<tr>
<td>AB-16 MAS356499</td>
<td>3</td>
<td>White fibrous gypsum with</td>
<td>No</td>
<td>70% Cellulose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>brown paper</td>
<td></td>
<td>30% Gypsum</td>
<td></td>
</tr>
<tr>
<td>AB-17 MAS356500</td>
<td>1</td>
<td>Beige non-fibrous plaster</td>
<td>No</td>
<td>40% Perlite</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with beige paint</td>
<td></td>
<td>60% Other</td>
<td></td>
</tr>
<tr>
<td>AB-18 MAS356501</td>
<td>1</td>
<td>White non-fibrous texture</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with white paint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB-18 MAS356501</td>
<td>2</td>
<td>White non-fibrous joint</td>
<td>No</td>
<td>70% Cellulose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>compound with beige paper</td>
<td></td>
<td>30% Other</td>
<td></td>
</tr>
<tr>
<td>AB-18 MAS356501</td>
<td>3</td>
<td>White fibrous gypsum with</td>
<td>No</td>
<td>70% Cellulose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>brown paper</td>
<td></td>
<td>30% Gypsum</td>
<td></td>
</tr>
</tbody>
</table>

Samples have been analyzed by the EPA Interim Method 600/M4-82-020(40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116. The test results herein relate only to the sample submitted and analyzed. This report may only be reproduced in full with the approval of the Bulk Asbestos Laboratory of Micro Analytical Services (MAS). The above percentages are visual estimates of area percent. MAS is not responsible for any errors resulting from improper or incorrect sampling or shipping procedures. These samples will be retained for a period of 50 days. Accreditation by NVLAP in no way constitutes or implies product certification, approval, or endorsement by NIST. Some materials, especially floor tiles, contain asbestos fibers too thin to be detected by this method.

NVLAP Lab Code: 2000618  TDSHS License: 30-0341

**Analysed by:** Tony Dang

**Approved NVLAP Signatory:** Tony Dang
### Polarized Light Microscopy Analysis

**Project Name:** Alcalde Building - NMSU

<table>
<thead>
<tr>
<th>Field ID/ Lab ID</th>
<th>Layer #</th>
<th>Sample Description</th>
<th>Asbestos Detected? (Yes/No)</th>
<th>Asbestos Constituents (%)</th>
<th>Non-Asbestos Constituents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB-19 MAS356502</td>
<td>1</td>
<td>Beige non-fibrous caulking</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td>AB-20 MAS356503</td>
<td>1</td>
<td>Beige non-fibrous paint</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td>AB-20 MAS356503</td>
<td>2</td>
<td>Silver non-fibrous wrap</td>
<td>No</td>
<td>100% Foil</td>
<td></td>
</tr>
<tr>
<td>AB-21 MAS356504</td>
<td>1</td>
<td>Beige non-fibrous paint</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td>AB-21 MAS356504</td>
<td>2</td>
<td>Silver non-fibrous wrap</td>
<td>No</td>
<td>100% Foil</td>
<td></td>
</tr>
<tr>
<td>AB-22 MAS356505</td>
<td>1</td>
<td>Beige non-fibrous paint</td>
<td>No</td>
<td>100% Other</td>
<td></td>
</tr>
<tr>
<td>AB-22 MAS356505</td>
<td>2</td>
<td>Silver non-fibrous wrap</td>
<td>No</td>
<td>100% Foil</td>
<td></td>
</tr>
<tr>
<td>AB-23 MAS356506</td>
<td>1</td>
<td>Beige non-fibrous plaster with beige paint</td>
<td>No</td>
<td>40% Perlite</td>
<td>60% Other</td>
</tr>
<tr>
<td>AB-24 MAS356507</td>
<td>1</td>
<td>Beige non-fibrous plaster with beige paint</td>
<td>No</td>
<td>30% Perlite</td>
<td>50% Aggregate 20% Other</td>
</tr>
<tr>
<td>AB-25 MAS356508</td>
<td>1</td>
<td>Beige non-fibrous plaster with beige paint</td>
<td>No</td>
<td>40% Perlite 60% Other</td>
<td></td>
</tr>
<tr>
<td>AB-26 MAS356509</td>
<td>1</td>
<td>Black fibrous roofing mastic with white paint</td>
<td>Yes</td>
<td>10% Chrysotile</td>
<td>80% Mastic 10% Other</td>
</tr>
<tr>
<td>AB-26 MAS356509</td>
<td>2</td>
<td>Black fibrous roofing material with pebbles</td>
<td>No</td>
<td>10% fibrous Glass 30% Aggregate 60% Binder</td>
<td></td>
</tr>
</tbody>
</table>

Samples have been analyzed by the EPA Interim Method 600/M4-82-020(40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116. The test results herein relate only to the sample submitted and analyzed. This report may only be reproduced in full with the approval of the Bulk Asbestos Laboratory of Micro Analytical Services (MAS). The above percentages are visual estimates of area percent. MAS is not responsible for any errors resulting from improper or incorrect sampling or shipping procedures. These samples will be retained for a period of 30 days. Accreditation by NVLAP in no way constitutes or implies product certification, approval, or endorsement by NIST. Some materials, especially floor tiles, contain asbestos fibers too thin to be detected by this method.

**NVLAP Lab Code:** 2000618  **TDSHS License:** 30-0341

**Analyzed by:** Tony Dang

**Approved NVLAP Signatory:** Tony Dang

Page 3 of 3
# Asbestos Bulk Sample Chain of Custody

**Company:** AnE Consulting, Inc.  
**Address:** 912 Texas Ave, Ste C  
**Contact:** Bill to: Nick Rodriguez  
**City:** El Paso  
**State/Zip:** Texas 79902  
**Phone:** (915) 532-3788  
**Fax:** (915) 532-3789  
**Project Name:** AM# Building  
**Date Collected:** 10/08/15  
**MAS Project #:** 15016.4

Turn around time (circle): Emergency 1-day 2-day 3-day 4-day 5-day

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Lab ID</th>
<th>Sample Description</th>
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<tr>
<td>MB-20</td>
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Relinquished by:  
Date: 10/08/15  
Time:  

Received by:  
Date: 10/13/15  
Time: 10:00am  

Relinquished by:  
Date:  
Time:  

Received by:  
Date:  
Time:  

Page 2 of 2
### Asbestos Bulk Sample Chain of Custody

**Company:** AnE Consulting, Inc.  
**Address:** 912 Texas Ave. Ste. C  
**City:** El Paso  
**State/Zip:** Texas 79902  
**Phone:** (915) 532-3788  
**Fax:** (915) 532-3789  
**Email:** aneconsulting@att.net  

**Project Name:** MISU  
**Project #:**  
**PO #:**  
**Date Collected:** 10/08/15  
**MAS Project #:** 12066

**Turn around time (circle):** Emergency (1-day) 2-day 3-day 4-day 5-day

<table>
<thead>
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<th>Field ID</th>
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<th>Sample Description</th>
<th>Sample Location</th>
<th>Comments</th>
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<tr>
<td>A2</td>
<td>C1</td>
<td>EXT. WALL PLASTER</td>
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<td>B6</td>
<td>35105D2</td>
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**Relinquished by:**  
**Date:** 10/08/15  
**Time:**  

**Received by:**  
**Date:** 10/13/15  
**Time:** 12:00pm
TEXAS DEPARTMENT OF STATE HEALTH SERVICES

ANE CONSULTING INC
is certified to perform as a

Asbestos Consultant Agency
in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

DAVID LAKEY, M.D.
COMMISSIONER OF HEALTH

License Number: 100441
Control Number: 96762
Expiration Date: 2/1/2017
(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE
TEXAS DEPARTMENT OF STATE HEALTH SERVICES

MICRO ANALYTICAL SERVICES INC

is certified to perform as a

Asbestos Laboratory
PCM, PLM

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

DAVID LAKEY, M.D.
COMMISSIONER OF HEALTH

License Number: 300341
Control Number: 95930

Expiration Date: 1/25/2016
(Void After Expiration Date)

VOID IF ALTERED    NON-TRANSFERABLE
Texas Department of State Health Services
Asbestos Inspector

NICOLAS RODRIGUEZ
License No. 600932
Control No. 97903
Expiration Date: 1/20/2016
Limited Asbestos Survey at 15 NMSU Lane
Clayton Livestock Research Center
Clayton, New Mexico 88415

Prepared for:
New Mexico State University
1780 E. University Ave
Las Cruces, NM 88003

Prepared by:
ANE Consulting Inc
1325 Arizona Ave.
El Paso, Texas 79902

Jose A. Moriel, Asbestos Building Inspector
TDSHS #60-3220, Expires 03/05/2021

Date of Inspection
January 14, 2020
January 24, 2020

New Mexico State University
Attn: Mr. Gary Martinez
1780 E. University Ave
Las Cruces, NM. 88003

RE: Limited Asbestos Survey at
15 NMSU Lane
Clayton Livestock Research Center
Clayton, New Mexico 88415

Dear Mr. Martinez,


We appreciate the opportunity to be of service to New Mexico State University. Please contact us with questions or comments, or if we may be of further assistance.

Sincerely,
AnE Consulting, Inc.
Asbestos Consulting Agency
TDSHS License #10-0441, expires 02/01/2021

Jose A. Morel
Asbestos Building Inspector
TDSHS #66-3220, Expires 03/05/2021

Enclosures: Asbestos Survey Report
Figures 1-3
Laboratory reports with chain of custody documentation
Texas asbestos licenses
**Purpose**
The structure is located at 15 NMSU Lane, Clayton, New Mexico. Mr. Gary Martinez, of New Mexico State University, requested that AnE Consulting, Inc. (AnE) conduct a limited survey for asbestos-containing materials (ACMs). This survey is intended for the identification and locations of Asbestos Containing Materials and may be utilized for future renovation and demolition projects.

**Subject Property Overview**
It is unknown when the structure was built. The areas inspected consist of flooring materials and insulation. The buildings were occupied at the time of the survey.

**Inspection**
Field activities were conducted on January 14, 2020, by Mr. Jose A. Moriel, licensed by the Texas Department of State Health Services (TDSHS) as an Asbestos Building Inspector (license number 60-3220) with AnE Consulting Inc.

The survey was performed in general accordance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) issued by the U.S. Environmental Protection Agency (40 CFR 61, Subpart M – National Emission Standard for Asbestos), the Asbestos Hazard Emergency Response Act (AHERA, 40 CFR 763), and the Asbestos School Hazard Abatement Reauthorization Act of 1990 (ASHARA, 40 CFR 763, Appendix C to Subpart E). These regulations generally require that, prior to any construction, renovation, or demolition, the area(s) where the work is to be performed shall be inspected by a properly trained and licensed or certified individual for the presence of ACMs that potentially may be disturbed during the work.

AnE employed a sampling strategy which involved identifying homogeneous materials throughout the proposed areas of work, and collecting bulk samples of the suspect materials for laboratory analysis for asbestos content. The term “homogeneous,” as defined by in AHERA, means any material having the same color and texture, and having been installed in the same general time period.

The structure contained eight (8) homogeneous materials that were identified during the course of this survey, from which fourteen (14) bulk samples were collected. Accessible areas of the unit were visually inspected. Destructive sampling was not conducted for this survey. These identified homogenous materials are summarized in Table 1 that follows.
Table 1 – Summary of Homogenous Materials

<table>
<thead>
<tr>
<th>Suspect ACM</th>
<th>Location(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” x 12” Beige Vinyl Floor Tile with Yellow Mastic</td>
<td>Office and Labs Building</td>
</tr>
<tr>
<td>Beige Floor Carpet with Yellow Mastic</td>
<td>Office and Labs Building</td>
</tr>
<tr>
<td>Brown Cove Base with Clear Mastic</td>
<td>Office and Labs Building</td>
</tr>
<tr>
<td>White Pipe TSI</td>
<td>Feedlot Mechanical Room</td>
</tr>
<tr>
<td>Grey Pipe Fitting TSI</td>
<td>Feedlot Mechanical Room</td>
</tr>
<tr>
<td>White Tank Insulation</td>
<td>Feedlot Mechanical Room</td>
</tr>
<tr>
<td>Yellow Tank Brick</td>
<td>Feedlot Mechanical Room</td>
</tr>
<tr>
<td>Grey Tank Brick Mortar</td>
<td>Feedlot Mechanical Room</td>
</tr>
</tbody>
</table>

The homogeneous material was then assessed in terms of friability, condition, and quantity. The term “friable” means a material that when dry can be reduced to a powder using hand pressure (25 TAC § 295.32 (45)). Prior to sampling, each suspect asbestos material was properly wetted, and then each bulk sample was carefully extracted and placed in its own self-sealing container. Each container was wiped, sealed, and labeled with a unique sample number. Appropriate chain of custody paperwork was completed listing each sample collected.

**Laboratory Analysis**

All samples were shipped under standard chain of custody protocols to MOLDLAB Ltd. in Carrollton, Texas. This facility is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis, and licensed by the TDSHS as an asbestos laboratory (license number 300431).

The bulk samples were analyzed by Polarized Light Microscopy (PLM) coupled with Dispersion Staining in accordance with EPA Method 600/M4-82-020. The laboratory report with chain of custody documentation is attached to this report.

An ACM is defined as any material or product that contains greater than one percent (1%) asbestos (25 TAC § 295.32 (15). Based on the laboratory data, one (1) identified homogenous material was found to contain asbestos greater than one percent.
Table 2 – Summary of Asbestos-Containing Materials

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Asbestos Content</th>
<th>Condition / Friability</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” x 12” Beige Vinyl Floor Tile with Yellow Mastic</td>
<td>2% Chrysotile</td>
<td>Fair/Non-Friable</td>
</tr>
</tbody>
</table>

Summary of Findings
The following is a summary of findings based on the field activities conducted and laboratory analyses performed.

- Asbestos-containing vinyl floor tile was identified throughout the building. The material was observed to be in fair condition and considered non-friable. The estimated quantity for this material is 3,750 sq. ft.

Recommendations
Based on the findings, AnE recommends the following:

- If the planned renovation or demolition activities will disturb the identified ACM, then the materials must be abated by a licensed/accredited abatement contractor in accordance with applicable Federal, State, and Local Rules and Regulations.

- A mandatory 10-day notification must be submitted in accordance with NESHAP for the planned abatement of the asbestos-containing materials. Written notification must be postmarked at least 10 working days prior to the start of the abatement. Responsibility for proper notification is that of the building owner, which may be delegated to the asbestos abatement contractor or consultant by the owner.

- If during the renovation or demolition project other suspect asbestos-containing materials are encountered, then the work must be stopped and the suspect asbestos-containing material(s) should be tested for asbestos content.

Qualifications and Limitations
- The discussions, findings, and recommendations contained herein are based upon data collected on the day of our investigation, the laboratory analysis of the samples collected, and typical practices accepted by the asbestos consulting profession. The scope of our work was limited to the subject areas and services stated in this report. Those building materials not inspected shall be assumed to contain asbestos unless laboratory analysis indicates otherwise.
FIGURE 1
This test report contains the following sections: Cover and Report.

<table>
<thead>
<tr>
<th>Sample Identifier*</th>
<th>Location</th>
<th>Layer Type</th>
<th>Characteristics</th>
<th>Asbestos</th>
<th>Non-Asbestos</th>
<th>Comments</th>
<th>Point Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-01-1-a</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Floor Tile</td>
<td>Homog., Beige, Fib.</td>
<td>2% Chrysotile</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>98%</td>
</tr>
<tr>
<td>15-01-1-b</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Mastic</td>
<td>Homog., Fib.</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>15-02-1-a</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Floor Tile</td>
<td>Homog., Beige, Fib.</td>
<td>2% Chrysotile</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>98%</td>
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<tr>
<td>15-02-1-b</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Mastic</td>
<td>Homog., Yellow, Fib.</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>15-03-1-a</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Floor Tile</td>
<td>Homog., Beige, Fib.</td>
<td>2% Chrysotile</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>98%</td>
</tr>
<tr>
<td>15-03-1-b</td>
<td>12&quot;x12&quot; Beige Vinyl Floor Tile w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Mastic</td>
<td>Homog., Yellow, Fib.</td>
<td>NAD</td>
<td>&lt;1% Cellulose</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>15-04-1-a</td>
<td>Beige Floor Carpet w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Carpet</td>
<td>Homog., Beige, Fib.</td>
<td>NAD</td>
<td>98% Synthetic</td>
<td>2%</td>
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</tr>
<tr>
<td>15-04-1-b</td>
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<td>Mastic</td>
<td>Homog., Yellow, Non-Fib.</td>
<td>NAD</td>
<td>100%</td>
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<tr>
<td>15-05-1-a</td>
<td>Beige Floor Carpet w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Carpet</td>
<td>Homog., Beige, Fib.</td>
<td>NAD</td>
<td>98% Synthetic</td>
<td>2%</td>
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<tr>
<td>15-05-1-b</td>
<td>Beige Floor Carpet w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Mastic</td>
<td>Homog., Yellow, Non-Fib.</td>
<td>NAD</td>
<td>100%</td>
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<td>15-06-1-a</td>
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<td>Carpet</td>
<td>Homog., Beige, Fib.</td>
<td>NAD</td>
<td>98% Synthetic</td>
<td>2%</td>
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<tr>
<td>15-06-1-b</td>
<td>Beige Floor Carpet w/ Yellow Mastic Office &amp; Labs Bldg.</td>
<td>Mastic</td>
<td>Homog., Yellow, Non-Fib.</td>
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<td>100%</td>
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<td>15-07-1-a</td>
<td>Brown Cove Base w/ Clear Mastic Office &amp; Labs Bldg.</td>
<td>Covebase</td>
<td>Homog., Brown, Non-Fib.</td>
<td>NAD</td>
<td>100%</td>
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<td>Brown Cove Base w/ Clear Mastic Office &amp; Labs Bldg.</td>
<td>Covebase</td>
<td>Homog., Brown, Non-Fib.</td>
<td>NAD</td>
<td>100%</td>
<td></td>
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<tr>
<td>15-08-1-b</td>
<td>Brown Cove Base w/ Clear Mastic Office &amp; Labs Bldg.</td>
<td>Clear Mastic</td>
<td>NAD</td>
<td>Not Analyzed: Insuff. Sample</td>
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<td>15-09-1-a</td>
<td>Brown Cove Base w/ Clear Mastic Office &amp; Labs Bldg.</td>
<td>Covebase</td>
<td>Homog., Brown, Non-Fib.</td>
<td>NAD</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-09-1-b</td>
<td>Brown Cove Base w/ Clear Mastic Office &amp; Labs Bldg.</td>
<td>Clear Mastic</td>
<td>NAD</td>
<td>Not Analyzed: Insuff. Sample</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>15-10-1-a</td>
<td>White Pipe TSI Feedlot Mechanical Room</td>
<td>TSI</td>
<td>Homog., Multi, Fib.</td>
<td>NAD</td>
<td>85% Mineral Wool</td>
<td>5% Cellulose</td>
<td>10%</td>
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<tr>
<td>15-11-1-a</td>
<td>Gray Pipe Fitting TSI Feedlot Mechanical Room</td>
<td>TSI</td>
<td>Homog., Grey, Fib.</td>
<td>NAD</td>
<td>10% Mineral Wool</td>
<td>90%</td>
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<td>White Tank Insulation Feedlot Mechanical Room</td>
<td>Insulation</td>
<td>Homog., White, Non-Fib.</td>
<td>NAD</td>
<td>95% Mineral Wool</td>
<td>5%</td>
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</table>

Tech Notes:

Submitted By: Nicolas Rodriguez | via: Lone Star Over Night | Submittal Date: 1/16/2020 | Sample Date: 1/14/2020 | Report Date: 1/17/2020 | Lab Job No.: 20-1280 | Analyst: Luis Bustillos
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<th>Layer Type</th>
<th>Characteristics</th>
<th>Asbestos</th>
<th>Non-Asbestos</th>
<th>Comments</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-13-1-a</td>
<td>Yellow Tank Brick FeedLot</td>
<td>Brick</td>
<td>Homog., Beige, Non-Fib.</td>
<td>NAD</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>15-13-1-b</td>
<td>Mechanical Room</td>
<td></td>
<td></td>
<td>NAD</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>15-14-1-a</td>
<td>Gray Tank Brick Mortar</td>
<td>Mortar</td>
<td>Homog., Off-White, Non-Fib.</td>
<td>NAD</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>
Texas Department of State Health Services

ANE CONSULTING INC

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100441
Expiration Date: 02/01/2021

Control Number: 97179

John Hellestedt, M.D.,
Commissioner of Health

(Void After Expiration Date)
TEXAS DEPARTMENT OF STATE HEALTH SERVICES

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PCM, PLM

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JOHN HELLERSTEDT, M.D.
COMMISSIONER OF HEALTH

License Number: 300431
Control Number: 96225

Expiration Date: 9/3/2019
(Void After Expiration Date)

VOID IF ALTERED    NON-TRANSFERABLE
SECTION 02 4100

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition.
B. Selective demolition of built site elements.
C. Abandonment and removal of existing utilities and utility structures.

1.02 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove building as designated on drawings.
B. Remove paving and curbs as required to accomplish new work or as shown on drawings.
C. Remove fences and gates.
D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Division 01.
B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   2. Provide, erect, and maintain temporary barriers and security devices.
   3. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   4. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.
D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's,
E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
3.03 EXISTING UTILITIES
A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
B. Protect existing utilities to remain from damage.
C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS
A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.
C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities, but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 01 1000 for other limitations on outages and required notifications.
   4. Verify that abandoned services serve only abandoned facilities before removal.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.
B. Remove from site all materials not to be reused on site.
C. Transport waste materials off Owner's property and legally dispose of them.
D. Leave site in clean condition, ready for subsequent work.
E. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

02 4100
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes removal and disposal of asbestos-containing materials by full enclosure, glove bag, or entire structures methods as applicable. Demolition and debris removal of all asbestos containing materials identified by provisions of this Section, or shown on drawings, or identified at the site, shall be executed under the provisions of this Section, and other applicable sections of these specifications.

B. Extent of asbestos removal work is as follows:

1. Surveyed and listed in "Schedule of Items Containing Asbestos" as specified in related section 003126 Existing Hazards Materials, and as indicated on the drawings. Proceed with Work of this Section simultaneously, and in coordination with, remaining Work of the Project.

1.02 RELATED SECTIONS

A. Work of this Section that is affected by alternates is described in Division 01 Section "Alternates."

B. Demolition and removal of items not containing asbestos as a component is included in Division 02 Section "Selective Demolition."

1.03 DEFINITIONS

A. Asbestos Abatement Firm: Firm engaged to perform actual removal and disposal work, either as Contractor or subcontractor.

B. Asbestos Containing Material: The term "asbestos containing material" is abbreviated ACM.

C. Owner's Consultant: Firm engaged by Owner to identify and measure asbestos containing materials, or to inspect demolition operations, including monitoring of air quality.

D. NMED: New Mexico Environment Department


1.04 SUBMITTALS

A. Initial Submittals: Submit the following documents to Owner's Representative and Architect at least 10 days prior the State Application and the pre-abatement meeting:

1. Copy of Certification: Asbestos Contractors must comply with the remediation and 40-hour contractor supervisor training requirements of the Asbestos NESHAP, 40 CFR 61 Subpart M. Asbestos contractors are required to have a GB-98 general contractor's license and a GS29 special contractor's license from the Construction Industries Division, phone number (505) 476-4700. Contractors are required to provide task training to workers, normally at least 8 hours, and to provide workers compensation insurance.
Contractor’s license requirements do not apply to work at federal facilities (military bases and research laboratories).

2. Qualified Contractors for asbestos remediation in NM shall fully complete the New Mexico electronic submittal NESHAP form, available on the New Mexico Environment Department web site at [https://www.env.nm.gov/air-quality/asbestos-2/](https://www.env.nm.gov/air-quality/asbestos-2/) Submit in PDF format as required.

3. The New Mexico Environment Department administers the federal asbestos air quality National Emission Standard for Hazardous Air Pollutants (NESHAP) 40 CFR 61 Subpart M. In particular, 10-business day notification, contractor and worker training and remediation procedures must be met and are subject to inspection.

4. Requirements for Demolition in New Mexico: A Notice of Intent on the asbestos NESHAP form is required 10 business days in advance of the scheduled start date of demolition of any commercial or industrial building or residence larger than four units. The notice must include certification that the building is free of asbestos and an explanation of how that determination was made.

5. Requirements for asbestos remediation in schools in New Mexico: Asbestos in schools is regulated directly by the U.S. EPA Region VI, Dallas Texas. The asbestos coordinator is Mark Berry, phone number (214) 665-3183

B. Waste Disposition Submittals: As required by State regulations, submit signed waste shipment record stating that asbestos waste has been properly disposed. Submit the following:

1. Receipts (trip tickets) from approved landfill.

2. Asbestos Waste Shipment Record: As follows:
   a. Prior to removing asbestos-containing material from the project site, provide Owner's Representative or Owner's consultant with a completed waste shipment record fully complying with Section 61.150 of the NESHAP standard, and 49 CFR Part 172.200 of the U.S. Department of Transportation, and including all required information.
   b. Ensure that the landfill operator provides a signed copy of the waste shipment record to NMED within the required days of the date that asbestos-containing material is removed from the project site. If waste is not transported directly from the project site to the landfill, the waste shipment record shall reflect each transfer.
   c. The Owner will not make final payment prior to receipt of signed waste shipment record.

3. In New Mexico, the following landfills are approved to accept asbestos waste:
   - Clovis Regional Solid Waste Facility (575) 769-7852
   - Corralitos LF (Las Cruces) (575) 528-3800
   - Keers Asbestos LF (Mountainair) (505) 847-2917
   - Lea Land Inc. Industrial Solid Waste (575) 887-4048
   - Northeastern New Mexico Regional LF (575) 668-2000
   - Otero/Greentree Regional LF (Otero County) (575) 439-4355
   - Vaughn Landfill (505) 384-4270

The New Mexico Solid Waste Bureau, phone (505) 827-0197, regulates transportation
and disposal of asbestos waste in New Mexico. Call to determine if disposal restrictions apply to your waste.

1.05 QUALITY ASSURANCE

A. Pre-Abatement Meeting: Approximately 2 weeks prior to scheduled start of the abatement project, the Owner's Representative will hold pre-abatement meeting with the individuals indicated below:

1. Contractor's representative.
2. Asbestos Abatement Firm's representative.
3. NMED representative (If required).
4. Owner's consultant.
5. Owner's Representative.
6. Owner's building maintenance personnel.

B. The meeting agenda will include:
   1. Review of the scope of work.
   2. Removal methods to be used.
   5. Review of Contractor's initial submittals.
   6. A walk-through survey of the site, if appropriate.

C. For small projects, the meeting may be suspended at the discretion of the Owner's Representative. If the meeting is suspended, deliver required initial submittals to the Owner's Representative's office 2 weeks prior to the start of work.

D. Safety: Regarding the Work of this Contract, the safety of the Contractor's (or Sub- Contractor) employees, the Owner's employees, the Design Professional's Team and the public is the sole responsibility of the Contractor.

PART 1 – GENERAL

2.01 PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 GENERAL:

A. Secure entire work area to prevent entry of unprotected/Unauthorized persons.

B. Cover, isolate, and seal work area walls and floors completely; including fixed equipment, doors, windows, skylights, lighting fixtures, duct openings, and all other openings into work area. Use polyethylene sheeting and seal edges with polyethylene adhesive tape.

C. Build triple barriers of plastic sheeting at all entrances and exits to the work area so that the area is always closed off by one barrier when workers enter or exit.

D. Establish emergency and fire exits from the work area as part of the written emergency action plan.

E. Locate at the project site the log sheet sign in for all persons entering work area from the beginning to the completion of the final clearance of the abatement project.
F. **NOTE:** Contractor is responsible for verifying quantities and location of asbestos materials. Contractor is responsible for the complete asbestos removal of the identified hazard and is completely responsible for following all National, State & local laws governing asbestos removal and/or remediation. Certifications of the abatement shall be presented to the Owner and Architect.

**END OF SECTION**
Division Five

METALS
SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes the following:
1. Steel pipe and tube railings.
B. Related Sections include the following:
1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
2. Division 09 Section "Gypsum Board Assemblies" for metal backing for anchoring railings.

1.03 PERFORMANCE REQUIREMENTS
A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
1. Steel: 72 percent of minimum yield strength.
B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction and 50 lbf/ ft. applied horizontally and concurrently with 100 lbf/ ft. applied vertically downward.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Pickets or Guards:
   a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft.
   b. Uniform load of 25 lbf/sq. ft. applied horizontally.
   c. Infill load and other loads need not be assumed to act concurrently.
C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS
A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
2. Grout, anchoring cement, and paint products.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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 dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.02 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

### 2.03 FASTENERS

A. General: Provide the following:


B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide tamper-resistant, flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

### 2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), if applied on-site and inside the waterproofing membrane.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

1. Use product with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), if applied on-site and inside the waterproofing membrane.


E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.
   a. POROK or equivalent.

### 2.05 FABRICATION
A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:
   1. As detailed.
   2. By bending or by inserting prefabricated elbow fittings.

K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.06 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.07 STEEL AND IRON FINISHES

A. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Interior Railings (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning.”

C. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel,” for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps & ramps for sloping members do not exceed 1/4 inch in 12 ft.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 “Fabrication” Article whether welding is performed in the shop or in the field.

3.04 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.05 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated (if indicated) wood backing between studs. Coordinate with stud installation to locate backing members.

3.06 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Repairs performed inside the weatherproofing membrane of the building must be done with products meeting VOC requirements listed in Section 01 8113 – Sustainable Design Requirements.

3.07 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION
SECTION 06 1000
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted curbs.
B. Roofing nailers.
C. Preservative treated wood materials.
D. Miscellaneous framing and sheathing.
E. Communications and electrical room mounting boards.
F. Concealed wood blocking, nailers, and supports.
G. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
B. Section 07 4113 – Metal Roof Panels
C. 07 5420 – 80 Mil TPO Fully adhered Roofing Systems
D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

D. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; Current edition.
E. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood Protection Association; Current edition.
G. PS 1 - Structural Plywood; Current edition.
H. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); Current edition.
I. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; Current edition.

1.04 SUBMITTALS
A. See Section 010010 - Special Conditions- for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING
A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER
A. Grading Agency: Western Wood Products Association (WWPA).
B. Sizes: Nominal sizes as indicated on drawings, S4S.
C. Moisture Content: S-dry or MC19.
D. Stud Framing (2 by 2 through 2 by 6):
   2. Grade: No. 2.
E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS
A. Exterior Wall Sheathing: Exterior Grade, Fire-treated Plywood, PS 1, Grade C-C Plugged or better.
B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
C. Other Applications:
   1. Plywood Concealed from View but Located Within Exterior Enclosure: PS 1, C-C Plugged
or better, Exterior grade.
2. Plywood Exposed to View but Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES
A. Fasteners and Anchors:
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.
B. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.
C. Sill Flashing: As specified in Section 07 6200 - Sheet Metal Flashing & Trim.

2.05 FACTORY WOOD TREATMENT
A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
B. Fire Retardant Treatment:
1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D 2898.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat all exterior rough carpentry items.
   c. Do not use treated wood in direct contact with the ground.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated.
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber in contact with roofing, flashing, or waterproofing.
   c. Treat lumber in contact with masonry or concrete.
   d. Treat lumber less than 18 inches above grade.
2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

3. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

PART 3 - EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Specifically, provide the following non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Smart boards, white boards, marker boards and bulletin boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

06 1000
SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fabricated Cabinet Units.
B. Solid Surface Countertops.
C. Cabinet hardware.
D. Factory finishing.
E. Miscellaneous finish carpentry items.
F. Preparation for installing utilities.
G. Miscellaneous hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements,
B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
C. Section 09 2116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; current edition
D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; (ANSI/BHMA A156.9) current edition
E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004 (ANSI/HPVA HP-1).
F. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.
G. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene a pre-installation meeting not less than one week before starting work of this section; require attendance by all affected installers.
1.05 SUBMITTALS
A. See Section 01 3300 - for submittal procedures.
B. Shop Drawings: Indicate materials, layout, dimensions, component profiles and elevations, assembly methods, cutouts, joint details, fastening methods, accessory listings, and hardware location, to a minimum scale of 1-1/2 inch to 1 foot (1:8). Include a schedule of finishes.
C. Product Data: Provide data for materials and hardware accessories.
D. Samples: Submit actual samples of architectural cabinet construction, illustrating proposed cabinet and shelf unit substrate and finish. Samples are not to be part of constructed work.
   1. Plastic laminate: as selected by Architect, minimum 12 inches square
   2. Hardware: Actual sample items of proposed pulls, shelf standards, locksets, and hinges demonstrating hardware design, quality, and finish
   3. Countertop: Submit actual samples of proposed items, demonstrating, quality, color, texture, pattern, and finish. Sample in 3 inches square for with seam filler color samples.

1.06 QUALITY ASSURANCE
A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
C. All wood parts and hardware shall be structurally sound and free from defects in material and workmanship under normal use and service for a period of three (3) years. All lock parts are warranted for a period of one (1) year.

1.07 FIELD CONDITIONS
A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 - PRODUCTS
2.01 LUMBER MATERIALS
A. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.
B. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.
C. Provide materials having fire and smoke properties as required by applicable code.

2.02 PANEL MATERIALS
A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.
B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
C. Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of wood plies
from listed species unless otherwise indicated, thickness as indicated or as required by application.

D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S).

2.03 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica; www.formica.com
   2. Nevamar Decorative Surfaces: www.nevamar.com
   4. Substitutions:  See Section 01 6000 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL):  NEMA LD 3, types as recommended for specific applications.

C. Laminate Cladding for Exposed Surfaces (including open shelving and interior side of all casework doors) for wood-finish laminates: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces:  Grade HGS.
   4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
   5. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.
   6. Color: As selected by Architect from manufacturer’s full range.

D. Materials for semi-exposed surfaces:
   1. 8-9 mil white Melamine.
      a. Edges of Melamine shelves in wood-finish casework: 8-9 melamine.
      b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.


2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness, matching laminate in color, pattern, and finish.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic or painted metal grommets for cut-outs, in color to match adjacent surface.
   1. Provide grommet cut-outs for all desktop areas and where there is a receptacle below or inside casework.

2.05 COUNTERTOPS

A. General:
   1. Back and End Splashes: size as indicated on drawings in same material, same thickness
as countertop; for field attachment.
2. Drill holes in countertops for plumbing fittings in shop.

B. **Solid Surface Countertops**: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E 84.
      b. NSF approved for food contact.
      c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d. Color and Pattern: Refer to Drawings, Color & Material Schedule.
      e. Approved Manufacturers:
         1) Avonite Surfaces: [www.avonitesurfaces.com](http://www.avonitesurfaces.com/)
         2) Dupont: [www.corian.com](http://www.corian.com/)
         3) Formica Corporation: [www.formica.com](http://www.formica.com/)
         4) Living Stone Surfaces: [www.livingstonesurfaces.com](http://www.livingstonesurfaces.com/)
         5) Wilsonart International, Inc: [www.wilsonart.com](http://www.wilsonart.com)
         6) Substitutions: See Section 01 6000 – Product Requirements.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; 3/8” roundover edge.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

D. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers ("U" shaped wire pull, aluminum with satin finish, 100 mm centers).
   3. Substitutions: See Section 01 6000 - Product Requirements.

E. Pulls for casework adjacent to video display.
   1. Door and drawer pulls for casework adjacent to video display shall be semi-flush injection molded ABS plastic with round safety corners and surfaces eliminating the possibility of garments and equipment from getting caught.
   3. Substitutions for the above products shall be submitted for approval prior to bidding in accordance with the requirements of Section 00101, Instruction to Bidders.

F. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.
G. Catches: Magnetic.

H. Drawer Slides:
   1. Type: Extension types as required; full extension for file drawers; partial extension of
drawer depth minus 5 inches for other applications.
   2. Static Load Capacity: As required by drawer size to fit specific application.
   4. Stops: Integral type.

I. Hinges: European style concealed self-closing type, 175 degree opening suitable for overlap
cabinet doors BHMA No. A 156.9, B01602, steel with satin finish.
   1. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.

J. Locks and Keying:
   1. Locks: Provide locks at all cabinet doors and drawers; keyed cylinder, steel with chrome
   finish.
      a. Door Locks: BHMA A156.11, E07121 (includes sliding doors)
      b. Drawer Locks: BHMA A156.11, E07041
   2. Keying:
      a. Coordinate final keying with Owner prior to fabrication.
      b. Keys: Provide a minimum of (2) two keys for each lock, clearly label each key as to
         function and location of lock.
      c. Master Keys: Provide (5) five copies; master key to fit all locks, clearly label each key
         as to function and location of lock.

2.07 SHOP TREATMENT OF WOOD MATERIALS
   A. Provide UL approved identification on fire retardant treated material.
   B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.08 FABRICATION
   A. Interior Woodwork Grade: Unless otherwise indicated, provide custom-grade interior woodwork
      complying with referenced quality standard.
      1. All casework is custom grade except casework with wood grain laminate or wood veneer
         faces.
   B. Fabricate all casework, lockers and accessories square, rigid and without warp. All exposed and
      semi-exposed joints shall be aligned and true. Fabricate corners, endpanels, and fillers as
      required by installation.
   C. Cabinet Style: Flush overlay.
   D. Cabinet Doors and Drawer Fronts: Flush style.
   E. Drawer Construction Technique: Dovetail joints.
   F. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit
      passage through building openings.
   G. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than
      one piece for any single length. Adjustable shelving shall be finished on all four edges.
   H. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for
      cutting. Provide matching trim for scribing and site cutting.
I. Minimum thickness:
   1. Door and drawer fronts, cabinet sides, shelves: 3/4 inch.
   2. Drawer sides and backs: 1/2 inch.
   3. Cabinet backs and drawer bottoms: 1/4 inch.

J. Plastic Laminate: 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.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.

K. Provide dust panels of 1/4 inch plywood or tempered hardboard above compartments and drawers, unless directly under tops.

L. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

M. Provide welded steel angle brackets for wall support of toilet vanities and for work surfaces fabricated in accordance with Section 05 5000 - Metal Fabrications.

N. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.09 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. Finish work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1500.

E. All other custom fabricated architectural woodwork: Plastic laminate factory applied to all exposed surfaces of cabinets when doors and drawers are closed including countertops. Interiors of cabinets and drawers are to be prefinished with white melamine.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
3.03 ADJUSTING
   A. Adjust installed work. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING
   A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

   END OF SECTION
Division Seven

THERMAL & MOISTURE
SECTION 07 2100
THERMAL INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Batt insulation at cavity wall and at ceilings where shown on drawings; board insulation
B. Rigid board insulation at exterior building wall/envelope, perimeter foundation wall, and underside of floor slabs; and for roofing system.
C. Foamed-In-Place insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof, and to fill concrete masonry units where shown on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Supporting construction for batt insulation.
B. Section 06 1000 - Rough Carpentry
C. Section 07 5432 – Adhered TPO Thermoplastic Membrane Roofing
D. Section 07 8400 - Firestopping.
E. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation.
F. Section 09 2240 – Portland Cement Plaster over Continuous Insulation

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
C. Manufacturer’s Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
D. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 - PRODUCTS

2.01 APPLICATIONS
A. Insulation Under Concrete Slabs: Extruded polystyrene board (R-5 minimum for 1”).
B. Insulation at Perimeter of Foundation: Extruded polystyrene board (R-10 minimum for 2”).
C. Insulation at exterior wall/envelope: Rigid Foam Polyisocyanurate Board. (R-13 minimum for 2”). See Section 09 2400 - Portland Cement Stucco over Continuous Insulation
D. Insulation at Low Sloped Roof: See Section 07 5432 – Adhered TPO Thermoplastic Membrane Roofing.
E. Insulation at Exposed Structures: Batt insulation with fabric and support straps.
F. Sound Attenuation Batt: Unfaced, at locations indicated on drawings.
G. Foamed-In-Place Insulation in filling perimeter window & door shim spaces and crevices in exterior wall and roof, and to fill concrete masonry units where shown on the drawings.

2.02 BATT INSULATION MATERIALS
A. Batt Insulation: ASTM C 665; preformed batt glass fiber; friction fit, conforming to the following:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E 136, except for facing, if any.
   5. Thermal Resistance: R value as indicated on drawings.
   6. Thickness: As required for specified thermal resistance.
   7. Facing: Aluminum foil, flame spread 25 rated; one side.
   8. Thickness: 3-1/2 inches at exterior wall and interior partitions as indicated on drawings. 6 inches at exterior walls and interior partitions as indicated on drawings. Verify thickness in sound partitions as required to achieve or exceed STC ratings as indicated on drawings.
   9. For use as sound attenuation: Unfaced batt, 3-1/2” thick, at locations indicated on drawings. Product: CertainTeed “NoiseReducer” or equal approved by architect.
   10. Facing (for use in exterior structural stud walls, exposed and located above ceiling level as indicated on drawings): Aluminum foil, flame spread 25 rated; one side, with taped seams at exterior stud walls for continuous vapor barrier. For exposed areas (at ceiling) as indicated on drawings: black matte (charcoal in color) polypropylene faced insulation facing on front side (or exposed side), kraft paper on the back side.
   11. Manufacturers:
   12. Substitutions: See Section 01 6300 - Product Substitutions

2.03 RIGID BOARD INSULATION MATERIALS
A. Extruded Polystyrene Board Insulation: ASTM C 578; Type IV at foundation with the following characteristics:
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   4. Board Thickness: As shown on drawings
   6. Water Absorption: 3 percent by volume, maximum, when tested in accordance with ASTM D 2842.
7. Board Density: 1.6 lb/cu ft.
9. Thermal Conductivity (k factor) at 25 degrees F: 0.28 (0.48).
10. Manufacturers:
    a. Dow Chemical Co.; www.dow.com
    b. Owens Corning Corp.; www.owenscorning.com
11. Substitutions: See Section 01 6300

B. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289; Type I; Class 1, non-reinforced foam core; at exterior walls/envelope as indicated on drawings.
   1. Compressive Strength: 25.0, when tested in accordance with ASTM D1621.
   2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
   3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   4. Thermal Resistance: R-13 for 2” board. Refer to drawings for thickness needed.
   5. Water Vapor Permeance: 0.03 perms or less, when tested in accordance with ASTM E 96.
   6. Water Absorption: 0.05 % or less by volume, when tested in accordance with ASTM C 209.
   7. Manufacturers:
      b. Dow Chemical Company.
      c. Rmax, Inc.
      d. Substitutions: See Section 01 6300 – Product Substitutions.

2.04 FOAMED-IN-PLACE INSULATION

A. Polyurethane Spray Insulation: Basis-of-design: Bayer Baysystems; BaySeal PP; 1.9 lb density, close-cell modified polyurethane; conforming to the following:
   1. Other Manufacturers:
      a. CertainTeed
      b. BASF The Chemical Company; A resin Technology Division
      d. Substitutions: See Section 01 6300 – Product Requirements
   2. Thermal Resistance (R-Value/inch): ASTM C518; initial 7.1 / aged 6.9 hr/sq ft/degree F/ BTU. In.
   3. Air Permeance: ASTM E283; 0.00 +/- 0.001 l/m²/second.
   4. Water Vapor Transmission: ASTM E96; 0.4 Perms @ 2”.
   5. Sound Transmission Class (STC): ASTM E90; STC 43
   6. Noise Reduction Coefficient (NRC): ASTM C-423; NRC-0.2
   7. Corrosion: No significant corrosion when in contact with steel under 85 percent relative humidity.
   8. Bacterial or Fungal Growth: No growth; no material deterioration.
   10. Fuel Contribution: ASTM E84; 0.
   11. Core Density: ASTM D-1622; 1.9 – 2.2 lbs/ft3
   12. Closed Cell Content: ASTM D-2856; >92%

2.05 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 - EXECUTION

3.01 EXAMINATION
3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER
A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints.
   2. Extend sheet full height of joint.
B. Apply adhesive to back of boards: Three continuous beads per board length. Full bed 1/8 inch thick.
C. Install boards horizontally on foundation perimeter as shown on drawings.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.
D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS
A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
B. Apply Type A adhesive to back of boards: Three continuous beads per board length. Full bed 1/8 inch thick.
C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.
D. Extend boards over expansion joints, unbonded to wall on one side of joint.
E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS
A. Place insulation under slabs on grade after base for slab has been compacted.
B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BATT INSTALLATION
A. Install insulation and vapor retarder in accordance with manufacturer’s instructions.
B. Install in exterior wall without gaps or voids where shown on drawings. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
F. Mechanically fasten batts in place for STC rated partitions as required.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

I. Tape seal tears or cuts in vapor retarder.

J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 2500
WEATHER BARRIERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air-tight or vapor retardant.

B. Air Barriers: Materials to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

B. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

C. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, vapor retarders, or water-resistive barriers.

B. Air Barrier: Air-tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

C. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture-resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS


1.05 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during
and after installation.

PART 2 – PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistant Barrier: Provide on outside surface of sheathing of exterior walls under exterior cladding and where indicated in other sections.
   1. Use non-woven, spunbonded polyolefin sheet equal to Tyvek Commercial Wrap as manufactured by DuPont Building Innovations unless otherwise indicated.
   2. For stud framed exterior walls, scheduled to receive stucco or mortar bed for manufactured stone veneer, use two separate layers; first layer of Tyvek StuccoWrap as manufactured by DuPont Building Innovations and second intervening layer of Grade D, 60-minute building paper.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER NOR VAPOR RETARDER)

A. Building Paper: Asphalt-saturated kraft building paper complying with requirements of ICC-ES AC38 Grade D, location between lath and weather barrier.
   1. Water Resistance: 60 minutes, minimum, when tested in accordance with ASTM D 779.

2.03 SEALANTS

A. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

2.04 ADHESIVES

A. Use adhesives recommended and compatible with weather barrier manufacturer.

2.05 ACCESSORIES

B. Seam Tape, Fasteners, and Flashings: As provided by material manufacturer.
C. Thinners and Cleaners: As recommended by material manufacturer.
D. Attachment Battens: Galvanized steel bars, with anchors of same material, as recommended by material manufacturer (where required).

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer’s instructions.
C. Coordinate installation of self-adhering, waterproofing membrane underlayment with weather barrier manufacturer.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions.
B. Self-Adhesive Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; use surface conditioner as required
C. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

D. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

E. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. Install water-resistive barrier over jamb flashings.
   5. Install air barrier and vapor retarder UNDER jamb flashings.
   6. Install head flashings under weather barrier.
   7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

F. Openings and Penetrations in Exterior Weather Barriers:
   1. Install self-adhesive flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with self-adhesive flashing at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using self-adhesive flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install self-adhesive flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form self-adhesive flashing around penetrating item and seal to weather barrier surface.

G. Parapet Caps:
   1. Install self-adhered, self-sealing flashings over parapet walls overlapping weather barrier and roofing membrane in accordance with manufacturer's instructions

3.04 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION
SECTION 07 2726
LIQUID APPLIED WATER AND AIR MEMBRANE

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Liquid applied water resistive barriers and air membrane.

1.02 RELATED SECTIONS
A. Section 03 3000 - Cast-in-Place Concrete
B. Section 04 2200 - Unit Masonry
C. Section 07 2413 –EFIS Repair and Re-Finish
D. Section 07 2726 – Liquid Applied Water & Air Membrane
E. Section 07 6200 - Sheet Metal Flashing and Trim
F. Section 07 9005 - Joint Protection
G. Section 09 2116 - Gypsum Board Assemblies

1.03 REFERENCES
A. ASTM B117 - Test Method for Salt Spray (Fog) Testing
B. ASTM C1135 - Test Method for Determining Tensile Adhesion Properties of Structural Sealants
C. ASTM D522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
D. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity
E. ASTM D4541 - Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
F. ASTM E72 - Test Methods of Conducting Strength Tests of Panels for Building Construction
G. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
H. ASTM E96 - Test Method for Water Vapor Transmission of Materials
I. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
J. ASTM E331 - Test Method for Water Penetration by Uniform Static Air Pressure Difference
O. ASTM G155 and G153 - Accelerated Weathering for Exposure of Nonmetallic Materials

1.04 DESCRIPTION SPRAY & ROLLER APPLIED BARRIERS
A. 100% acrylic based water-proof membrane and air barrier. Designed for use as water resistive barrier and air barrier behind EIFS, Stucco and other claddings. This product is
installed over glass mat gypsum sheathing, cement board sheathing, CDX plywood, OSB, concrete or CMU.

B. Functional Criteria:

1. General:
   a. Flashing: Flashing shall be continuous and watertight. Flashing shall be designed and installed to prevent water infiltration behind the continuous insulation and over all sheathing, CMU, or Concrete Substrates. Refer to Division 07 Flashing Section for specified flashing materials.
   b. The configuration of the water resistive barrier, drainage plane and flashing, must allow for the egress of incidental moisture.

2. Performance Requirements
   a. System to meet the performance and testing requirements of the International Code Council Acceptance Criteria AC 212 and ASTM E2570.

<table>
<thead>
<tr>
<th>Liquid Membrane</th>
<th>Method</th>
<th>ICC and ASTM E2570 Criteria</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated Weathering</td>
<td>AC 212</td>
<td>25 Cycles followed by Hydrostatic Pressure Test: No water penetration on the plane of the exterior facing side of the substrate.</td>
<td>Pass: no water penetration</td>
</tr>
<tr>
<td>Air Infiltration</td>
<td>ASTM E2178</td>
<td>Calculated flow Rate at 75 Pa (1.57 lb/ft², 0.3 in H₂O) = 0.02 L/m²·s (&lt;0.004 cfm/ft²)</td>
<td>&lt;0.0001 L/m²·s (0.00001 cfm/ft²) at 75 Pa (1.57 lb/ft², 0.3 in H₂O)</td>
</tr>
<tr>
<td>Air Leakage</td>
<td>ASTM E283</td>
<td>No Criteria</td>
<td>&lt;0.004 cfm/ft²</td>
</tr>
<tr>
<td>Freeze-Thaw Resistance</td>
<td>ASTM E 2485</td>
<td>10 Cycles</td>
<td>Pass – No Deleterious Effects</td>
</tr>
<tr>
<td>Hydrostatic Pressure Test</td>
<td>AATCC 127 (Water Column)</td>
<td>Resist 21.6 in (55 cm) water for 5 hours before and after aging</td>
<td>Pass: no water penetration</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D412</td>
<td>No Criteria</td>
<td>360%</td>
</tr>
<tr>
<td>Flexibility</td>
<td>ASTM D522</td>
<td>No Criteria</td>
<td>No Cracking at 1/8” (3 mm)</td>
</tr>
<tr>
<td>Nail Seal ability, Head of Water</td>
<td>ASTM D1970</td>
<td>No Criteria</td>
<td>Pass 5 inches of water</td>
</tr>
<tr>
<td>Racking</td>
<td>ASTM E72</td>
<td>Deflection at 1/8 in (3.2 mm)</td>
<td>Pass -No cracking at field, joints or flashing connection</td>
</tr>
<tr>
<td>Restrained Environmental</td>
<td>ICC ES AC 212 / ASTM E2570</td>
<td>5 Cycles of wetting and drying</td>
<td>Pass -No cracking at field, joints or flashing connection</td>
</tr>
<tr>
<td>Structural Loading</td>
<td>ASTM E1233 Procedure A</td>
<td>10 Cycles @ 80% design load</td>
<td>Pass -No cracking at field, joints or flashing connection</td>
</tr>
<tr>
<td>Surface Burning Characteristics</td>
<td>ASTM E84</td>
<td>ICC and ASTM E2568 Flame Spread &lt;25 Smoke Developed &lt;450</td>
<td>Flame Spread =0 Smoke Developed =0</td>
</tr>
<tr>
<td>Tensile Bond Strength</td>
<td>ASTM E 2134/ ASTM C 297</td>
<td>Minimum 15 psi (104 kPa)</td>
<td>Pass all listed substrates and flashing materials</td>
</tr>
</tbody>
</table>
### LIQUID APPLIED WATER AND AIR MEMBRANE

**NEW MEXICO STATE UNIVERSITY AG SCIENCE CENTER EXTENSIONS**

<table>
<thead>
<tr>
<th><strong>Water Resistance</strong></th>
<th><strong>ASTM D 2247</strong></th>
<th><strong>14 Days</strong></th>
<th><strong>Pass – No Deleterious Effects.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Penetration</strong></td>
<td><strong>ASTM E331</strong></td>
<td><strong>2.86 psf (137 Pa) for 15 minutes</strong></td>
<td><strong>Pass 25.4 psf (1216 Pa) for 165 minutes</strong></td>
</tr>
<tr>
<td><strong>Water Penetration</strong></td>
<td><strong>ASTM E331</strong></td>
<td>Tested after Structural Loading, Racking and Restrained Environmental Cycling at 2.86 psf (137 Pa) for 15 minutes</td>
<td>No Water Penetration</td>
</tr>
<tr>
<td><strong>Water vapor transmission</strong></td>
<td><strong>ASTM E96 Procedure B</strong></td>
<td>Vapor Permeable</td>
<td>7 perms</td>
</tr>
<tr>
<td><strong>Weathering</strong></td>
<td><strong>ICC ES AC 212 / ASTM E2570</strong></td>
<td>210 hours of UV Exposure, 25 cycles of accelerated weathering, 21.6 in (549 mm) water column for 5 hours</td>
<td>Pass</td>
</tr>
<tr>
<td><strong>Wind Driven Rain</strong></td>
<td><strong>F.S. TT-C-555B</strong></td>
<td>No Criteria</td>
<td>Pass</td>
</tr>
<tr>
<td><strong>VOC</strong></td>
<td><strong>EPA Reference Test Method 24</strong></td>
<td><strong>US EPA, South Coast AQMD and Greenseal Standard</strong></td>
<td><strong>10 g/L</strong></td>
</tr>
<tr>
<td><strong>Regional Harvest</strong></td>
<td></td>
<td><strong>LEED MRc 5.1</strong></td>
<td><strong>100% at all facilities</strong></td>
</tr>
</tbody>
</table>

#### 1.05 SUBMITTALS

A. General: Submit Samples, Evaluation Reports and Certificates in accordance with Division 01 General Requirements Submittal Section.

#### 1.06 QUALITY ASSURANCE

A. Qualifications:
   1. All materials shall be manufactured or sold by Water Resistive Barrier manufacturer or purchased from manufacturer or its authorized distributor.
   2. Applicator: Shall possess a current certificate of education for application of the product, and shall be experienced and competent in installation of plaster-like materials.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original packaging with manufacturer's identification.

B. Storage: Store materials in a cool, dry location, out of sunlight, protected from weather and other harmful environment, and at a temperature above 40°F and below 110°F in accordance with manufacturer's instructions.

#### 1.08 PROJECT / SITE CONDITIONS

A. Installation Ambient Air Temperature: Minimum of 40 °F and rising, and remain so for 24 hours thereafter.

B. Substrate Temperature: Do not materials to substrates whose temperature are below 40 °F or contain frost or ice.

C. Inclement Weather: Do not apply materials during inclement weather, unless appropriate protection is employed.

D. Materials shall not be applied if ambient temperature exceeds 120°F or falls below 40 °F within 24 hours of application. Protect base coat from uneven and excessive evaporation
during hot, dry weather.
E. Prior to installation, the wall shall be inspected for surface contamination, or other defects that may adversely affect the performance of the materials and shall be free of residual moisture.

1.09 COORDINATION AND SCHEDULING:
A. Coordination installation with other construction operations.

1.10 WARRANTY
A. Warranty: Upon request, at completion of installation, provide Standard Limited Warranty.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Manufacturer: Basis of Design; Weatherseal by Parex USA, Inc.
B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS
A. Water-Resistive Barrier Coating: Spray or roll-on, non-cementitious, 100% acrylic trowelable air/weather barrier.
   1. Sheathing Tape: Non-woven synthetic fiber tape to reinforce water-resistive barrier at sheathing board joints, into rough openings and other terminations into dissimilar materials; 4" minimum widths.
   2. Flashing Membrane: Self-sealing, Polyester faced, rubberized asphalt membrane, minimum 30 mils thick.

2.03 RELATED MATERIALS AND ACCESSORIES
A. Substrate Materials:
   2. Cement Fiber Sheathing conforming to ASTM C1186
   3. Gypsum Sheathing: Minimum 1/2" thick, core-treated, weather-resistant, exterior gypsum sheathing complying with ASTM C79.
   4. Plywood: Minimum 7/16" thick exterior grade or PS 1, Exposure 1, minimum 7/16" thick, C veneer facing out, panels gapped 1/8 " at all edges.
   5. Oriented Strand Board (OSB): 7/16" - 1/2" Wall-16 or Wall-24, approved by the APA, TECO, or PSI/PTL. Stamped as Exposure 1 or Exterior Sheathing with a PS2 or PRP-108 rating.
   6. Concrete Masonry Units (CMU): Non-painted (uncoated).
   7. Concrete (poured or pre-cast).
B. Flashing: Refer to Division 07 Flashing Section for flashing materials.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Verify project site conditions under provisions of Section 01 0000.
B. Compliance: Comply with manufacturer’s instructions for installation.
C. Substrate Examination: Examine prior to liquid applied installation as follows:
1. Substrate shall be of a type approved by manufacturer. Plywood and OSB substrates shall be gapped 1/8 in at all edges. Plywood and OSB substrates cut edges (non-factory edges) must be sealed with liquid water-resistive coating and sheathing tape.

2. Substrate shall be examined for soundness, and other harmful conditions.

3. Substrate shall be free of dust, dirt, laitance, efflorescence, and other harmful contaminants.

4. Substrate construction in accordance with substrate material manufacturer's specifications and applicable building codes.

5. Maximum deflection of the substrate shall be determine by the requirements of the exterior cladding.

D. Flashing: Flashing should be installed prior to the barrier application and incorporated with the flashing to create positive drainage.

E. Advise Contractor of discrepancies preventing installation of the barrier. Do not proceed with the work until unsatisfactory conditions are corrected.

3.02 PREPARATION
A. Protection: Protect surrounding material surfaces and areas during installation of system.
B. Clean surfaces thoroughly prior to installation.
C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 MIXING
A. Mix products in accordance with manufacturer's instructions.

3.04 APPLICATION
A. General: Installation shall conform to this specification written instructions.
   1. Flash all rough openings with liquid membrane and embed with sheathing tape or polyester backed peel and stick flashing membrane.
   2. Treat all sheathing joints with liquid water-resistant barrier sheathing tape.
   3. Apply liquid water-resistant barrier to the surface of the substrate (Minimum 2 coats on plywood, OSB, concrete and masonry).
   4. Ensure that the liquid barrier laps onto all tracks and flashing to allow for any water to be drained into the tracks/flashing.

3.05 CLEAN-UP
A. Removal: Remove and legally dispose of component debris material from job site.
B. Clean surfaces and work area of foreign materials resulting from installations.

3.06 PROTECTION
C. Provide protection of installed materials from water infiltration into or behind them.
D. Provide protection of installed stucco from dust, dirt, precipitation, and freezing during installation.
E. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry.
F. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the Project Designer/Owner.

END OF SECTION
SECTION 07 4113
STANDING SEAM METAL ROOF SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions, general project requirements and Division 01 Specification Sections, apply to
      this Section.
   B. Documents specifically related to this section include:
      1. Section 01 3100 - Project Management and Coordination: Coordination of
         roofing work; roofing sequence inclusion in Project Schedule.
      2. Section 01 4000 - Quality Requirements: Reports; Contractor’s
         responsibilities.
      4. Section 06 1053 - Misc Rough Carpentry; for wood nailers, wood sheathing,
         curbs, and fasteners.
      5. Section 07 2100 - Thermal Insulation; for insulation at curbs.
      6. Section 07 6200 - Sheet Metal Flashing & Trim; for roof related sheet metal.
      7. Section 07 7200 - Roof Accessories; for manufactured curbs, hatches, and
         roof equipment stands.

1.02 SCOPE OF WORK
   A. Furnish and install a weather and watertight architectural standing seam sheet metal roof
      complete, in-place, per the Contract Documents.
   B. The latest Manufacturer specifications and installation techniques are to be followed.
      When the Contract Documents and Manufacturer’s requirements are in variance with each
      other, the most stringent requirements of the two shall typically apply at no additional cost
      to Owner or resulting change in Contract.

1.03 CODE COMPLIANCE
   A. The completed roof system shall meet the following requirements:
      1. External Fire Rating: UL Class A external fire rating.
   B. The completed roof system shall meet the design wind load pressures calculated in
      accordance with the applicable building code.
      1. All roofing shall be attached to the building in accordance with ASCE 7 wind
         uplift roof attachment requirements and current code.
   C. Perimeter and corner areas shall be calculated based upon the applicable building code
      requirements.

1.04 QUALIFICATIONS
   A. Manufacturer Qualifications
      1. The Manufacturer of the roofing system shall have not less than five (5) years
of experience in the production of the specified system.

B. Installer Qualifications

1. The installer of the roofing shall have been engaged in the business of installing the specified roofing system for not less than five (5) years and shall be certified by the roofing system Manufacturer in the layout and application of this system. The installer shall have successfully installed the specified system as follows:
   a. At least once, and
   b. At least five (5) years prior to Bid on this Project.

2. The crew shall be composed of experienced and skilled workers in this work.

1.05 QUALITY ASSURANCE

A. Standards: Comply with latest edition of standards specified in this section and as referenced below:
   2. Roofing Manufacturer’s current published specifications, application instructions, and technical bulletins.

B. Qualifications of Installers: Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this section. In acceptance or rejection of the work, the Owner will make no allowance for lack of skill on the part of the workers.

C. Roofing Inspections: Make all required notifications and secure all required inspections by the Manufacturer of the approved materials to facilitate issuance of the specified roof warranty. See paragraphs 1.08 and 3.01 for other portions of this section related to Contractor’s coordination with Owner and Architect.

E. U.L. Listing: Provide materials bearing Underwriters Laboratories (U.L.) marking on bundle, package, or container, indicating that materials have been produced under U.L.’s classification and follow-up service.

F. The Roofing Contractor shall not subcontract the installation of the roof system covered under this specification to an individual or a firm that is not a full-time employee of the Roofing Contractor’s company.

1.06 REFERENCES

A. References: Materials used in this section shall be listed in the latest edition of the following:

1.07 SUBMITTALS

A. General: Comply with the provisions of the General Conditions of the Contract and
Division 01 specification sections. Submittal schedule shall allow ample time for processing and approval prior to Pre-Roofing Coordination Meeting and start of roof system installation work.

B. Product Data:
   1. Most recent copy of Manufacturer’s literature applicable to products and specifications to be used.
   2. Complete material list of all items proposed to be furnished and installed under this section.
   3. Letter from Manufacturer stating that the roofing contractor is approved for installation of the specified roofing system.
   4. Manufacturer’s recommended methods of installation.
      a. When approved by the Design Professional, the Manufacturer’s recommended methods of installation, unless superseded by more stringent requirements in the Contract Documents, will become the basis for inspecting, and acceptance or rejection of the actual installation procedures used in this Work.

C. Detail showing the proposed temporary water cutoff detail.

D. Fire Resistance Information: Provide documentation that roofing system, insulation, and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure over deck specified herein.

E. Wind Uplift Information: Provide documentation that mechanically fastened roofing system, and component materials suitable for the structural deck, and that have been tested as a complete system for application and slopes indicated. Provide information on fastening for uplift resistance to meet the applicable Building Code.

F. Sheet metal and flashing shop drawings as required by Section 07 6200.

1.08 QUALITY ASSURANCE BY ROOF SYSTEM MANUFACTURER

A. During each visit, the Manufacturer’s technical representative shall check all work installed since the last visit, mark all defects for repair, and provide a written site visitation report listing any deficient work requiring correction by the Contractor. All reports and other correspondence associated with the site visit shall be provided to the Contractor, Owner’s Representative, and Design Professional within three (3) business days of the visit.

B. The Manufacturer’s technical representative shall coordinate all site visits with the Contractor, Owner’s Representative, and Design Professional a minimum of three (3) business days in advance.

C. After the roof installation is Substantially Complete, the Manufacturer shall inspect the work and inform (by written report) the Design Professional, Owner’s Representative, Contractor, and the Installer of defective/incomplete work to be remedied. Those areas indicated shall be corrected to the full satisfaction of the Design Professional, Owner, and Manufacturer. The Manufacturer shall submit written acceptance of the project to the Design Professional prior to Final Completion for issuance of the weathertightness warranty.

1.09 DELIVERY, STORAGE AND HANDLING
A. Deliver materials to job site in their original unopened containers. Package labels shall indicate material name, production date, and/or product code. Slit Manufacturer-supplied plastic & cover with weatherproof tarps that are securely anchored so as to resist blow off.

B. Store materials in dry, raised, protected areas in an upright position. Control temperature of storage areas in accordance with Manufacturer’s instructions. Protect materials from exposed to the elements. Do not exceed allowable live load of storage area.

C. Use all necessary means to protect the materials in this section before, during, and after installation, and to protect the work and materials of all other trades.

D. In the event of damage to roofing and related work or building components, immediately make all necessary repairs and replacements subject to the approval of and at no additional cost to the Owner.

E. Wet, damaged, or defective materials which are intended for incorporation into the new roofing system shall be marked to indicate rejection, and removed from the site the same day as discovered.

1.10 SCHEDULING

A. Work is to be performed on a daily basis with each section completed before progressing to the next day’s work, unless specifically directed otherwise by the Design Professional.

B. Substantial Completion of roofing work will be defined as the contractually required and weathertight installation of all specified roof preparation, insulation, field membrane, flashings, counterflashings, sheet metal, fasteners and caulking.

C. All flashings shall be installed concurrently with the roofing membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Design Professional. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, seams and or night seals, the affected area shall be removed and replaced at the Contractor’s expense.

D. Once roofing is started, the roofing application must be Substantially Complete within the time period required by the Contract. All punch list items must be complete prior to Final Completion.

1.11 WARRANTY

A. The Roofing Contractor shall warrant all materials and workmanship for a period of two (2) years from the date of acceptance of the completed work by the Owner. The Roofing Contractor shall make good any defects in materials or workmanship that may develop during the two-year period by repairing or replacing such defects at his own expense without cost to the Owner. Roofing Contractor shall use the form entitled “Roofing Contractor’s Warranty” provided in this section.

B. The Contractor shall make all necessary notices for warranty purpose to the primary roofing Manufacturer, to secure timely inspections and issuance of the warranty.

C. Upon Final Completion and prior to final payment, Contractor shall pay all required fees, secure all required inspections, and complete all items necessary to secure and deliver to the Design Professional the following items:
   1. Copies of all Manufacturer’s punch lists and documentation of completion.
2. Primary Roofing Manufacturer’s 20-year no dollar limit (NDL) labor and material, 55 mph, total systems warranty on the form provided in this section. The total system warranty shall include the following:
   a. Roof panels
   b. Roof trim
   c. Roof insulation
   d. Roof system fasteners, termination bars, clips, and other miscellaneous accessories supplied by the roofing Manufacturer.

D. Primary Roofing Manufacturer’s Warranty shall cover design and attachment per building code required design wind uplift.

E. Primary Roofing Manufacturer’s warranty shall cover defects in materials and workmanship and shall become effective at the completion of the work. This warranty shall not include any buy-out clauses and shall not be prorated.

F. All warranties shall contain written provision(s) stating that they will be fully transferable at any time during the specified warranty period.

G. Submit all items to the Design Professional within ten days of receipt from the Manufacturer or within ten days of the final inspection.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials used on this project shall be compatible with each other.

B. No product shall contain any asbestos or asbestos-related products.

2.02 ACCEPTABLE MANUFACTURERS

A. Standing Seam Metal Roof Manufacturer Basis-Of-Design: Una-Clad UC-4 By Firestone; www.unaclad.com
   1. Substitutions: See Section 01 6300 - Product Requirements.

B. Metal Roof Underlayment:
   1. Firestone Building Products; (Clad-Gard SA Metal Underlayment)
   2. GCP Applied Technologies, Inc; (Grace Ultra) www.gcpat.com, Toll Free: 866-333-3726
   3. Owens Corning (WeatherLock - High Temperature Underlayment); www.owenscorning.com
   4. Substitutions: See Section 01 6300 - Product Requirements.

2.03 MATERIALS

A. Hot-Rolled Structural Shapes: ASTM A 36 or A 529.

B. Tubing or Pipe: ASTM A 500, Grade B; ASTM A 501; or ASTM A 53.

C. Members Fabricated from Plate or Bar Stock: 50,000 psi minimum yield strength; ASTM A 529, A 570, A 572, or A 607.
D. Members Fabricated by Cold Forming: ASTM A 607 or A 570, Grade 50.

E. Galvanized Steel Sheet: ASTM A 653/ A 653M with G90 coating; "Class" to suit building Manufacturer's standards.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Secondary Framing: Purlins, eaves struts, and end wall beams, minimum 16-gauge roll formed sections. Shop painted or G-90 galvanized.

B. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.

C. Galvanized Prime: After phosphoric acid pretreatment, prime galvanized members with zinc oxide primer (FS TT-P641).

2.05 THERMAL INSULATION (ALTERNATE 1)

A. Polyisocyanurate Foam Roof Insulation

1. Insulation shall be a closed-cell, polyisocyanurate foam core with factory-laminated facers conforming to ASTM specification C 1289-01, Type II, Class 1. Foam core shall have a rated flame spread of 75 or less according to ASTM E 84. Insulation shall have minimum compressive strength of 20 psi (Grade 2) according to ASTM C 1289-01. Insulation shall be supplied in 4’ x 8’ boards.

2.06 UNDERLAYMENT

A. Underlayment shall be a cold-applied self-adhering membrane composed of reinforcement mat and modified butyl adhesive with an embossed slip resistant traction film and an opaque release film on the bottom surface. Underlayment shall be designed and recommended for use with metal roofing in high temperature for extended periods such as the desert southwest, a heat resistance of 300 degrees F. Underlayment shall be a minimum of 30 mil thick.

2.07 BEARING PLATES

A. Minimum 4” x 4” x 20 gauge galvanized steel plates specifically designed for the attachment of the metal roof system.

2.08 ROOFING

A. General: Provide roofing roll formed to profile indicated and specified. Provide flashings, closures, fillers, metal expansion joints, ridge covers, roof panel mounting clips, gable and eave trim, gutters, and other sheet metal accessories factory formed and finished. Material and finish shall be as specified.

1. Allowances for Thermal Expansion: Metal roof system shall be designed, fabricated, and installed to allow relative movement between roof panels and attachment points, gables and ridges, due to thermal expansion and contraction, without causing damage to the system or permanent deformation to any of the system components. Roof panel end laps shall allow panels to expand and contract without damage to end lap seams. Roof panel end laps must be staggered to insure a continuous unbroken panel through each seam.
B. Roof Panels: 24-gauge x 2'0" maximum width, roll formed, Galvalume (aluminum-zinc alloy coated steel) sheet coated on both sides with a layer of aluminum-zinc alloy by continuous hot dip method (approximately 55% aluminum, 45% zinc). Triple spot minimum 0.55 oz. per square foot as determined by ASTM A 792. Length of panels shall be maximum possible to minimize end laps. Panels shall have two major corrugations nominally 2" high seam, 18 o.c..

1. Roof Panel Side Laps: Panels shall be designed to provide full double lock (180°) seam side laps when installed. Partial double lock seams, lapped seams, or friction fit seams will not be acceptable. Factory-applied sealant shall be provided in female portion of seam.

C. Prefinished Panels: Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating and seal with a chromic acid rinse. Apply to exterior surfaces of pretreated steel a 90% fluoropolymer coating (Kynar 500/Hylar 5000) system supplied to provide a total dry film thickness of .09 mils minimum. Color will be as selected by Design Professional and shown on the finish schedule.

D. Standing Seam Roof Panel Mounting Clip: Galvanized steel clip with stainless steel sliding clip tab. Galvanized clip shall be prepunched or predrilled for mounting to roof purlins. Sliding clip tab shall be designed to lock into and become an integral part of roof panel double lock seam. Provisions shall be incorporated into mounting clip assembly to keep sliding clip tab centered on mounting clip during installation of roof panels.

E. Sheet Panel Fasteners: Manufacturer's standard system of self-tapping screws, bolts, and nuts; self-locking rivets; self-locking bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Self-drilling fasteners are not acceptable.

1. Provide metal-backed neoprene/EPDM washers under heads of fasteners bearing on weather side of panels.

2. Use stainless steel fasteners for exterior application and galvanized or admium-plated fasteners for interior application. Lock rivets where required shall be aluminum or stainless steel.

3. Locate and space fasteners for true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.

4. All exposed fasteners shall be color matched to match the panels.

F. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing, cut or premolded to match corrugation configuration of roofing and siding sheets. Provide where indicated and necessary to ensure weathertight construction.

G. Sealing Tape: 99% solids, pressure sensitive grey polyisobutylene compound tape with release paper backing. Not less than 1/2" wide and 1/8" thick, nonsag, nontoxic, nonstaining, and permanently elastic.

H. Joint Sealant: One part elastomeric; polyurethane or polysulfide as recommended by building Manufacturer. Color to match roof panels.

I. Manufactured Pipe Boot: Pipe flashing boot shall be one-piece construction of EPDM with flexible metal reinforcing ring bonded to flange on base of boot. Size of boot shall be appropriate for size of penetrations where the operating temperature of the penetration is between -25° F to 250° F.

J. Equipment Mounting Curb: Shall be sized to fit equipment, welded watertight construction
that is integral with panel, with water diverter or cricket on up-slope side of curb. Curb shall be designed to support load of equipment. Provide structural support for curb to transfer load to building’s structural system. Profile of curb panel shall match that of specified metal panel roof system. Finish of curb shall match roof panels. Curb shall be manufactured by panel Manufacturer or supplier approved by panel Manufacturer.

2.09 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work in this section shall be as selected by the Contractor, approved by the Manufacturer, and subject to the approval of the Owner.

B. Wood Nailer – Division 06

PART 3 - EXECUTION

3.01 INSPECTION

A. The Contractor shall be responsible for verifying existence of suitable substrate to accept the roofing system.

B. Installer of roofing system shall examine substrate and conditions under which roofing work is to be performed and shall notify the Design Professional and Owner’s Representative immediately of unsatisfactory conditions. Do not proceed with roofing work until unsatisfactory conditions have been corrected in a manner acceptable to Design Professional, installer and Manufacturer.

C. Pre-roofing coordination meeting: Before roofing work may begin, the Design Professional shall conduct a pre-roofing coordination meeting with mandatory attendance required for the Owner’s Representative, primary roofing Manufacturer’s technical representative, General Contractor, the Roofing Contractor, roofing foreman, and all other subcontractors who have any components of their work on or penetrating the roof. The participants shall:

1. As much as is possible by visual inspection and by the cutting of core samples, inspect surfaces and site conditions required to be ready to receive work. Contractor shall verify acceptability of substrate for application of new roofing system before commencement of installation.

2. Examine roof openings, curbs, pipes, sleeves, ducts, and vents through roof, cant strips, wood nailing strips and reglets in place. Observe if curbs and penetrations have been laid out and installed with adequate vertical and horizontal clearance as required by the Manufacturer to provide the specified warranty.

3. Observe if the condition of surface to receive roof insulation is firm, clean, smooth, and dry.

4. Review the Contractor’s schedule for roofing work so that all parties can coordinate essential tasks within the time restraints and as required by the roofing production rates of the contract.

5. Review the responsibilities of all parties in regard to communication and coordination during the roofing portion of the Work.

6. Review status of all submittals necessary to be approved prior to the start of the roofing work.

7. Review plans for roofing equipment and materials staging and roofing schedule in coordination with school schedule and traffic patterns.
3.02 DESCRIPTION

A. Installation – General
   1. Perform all related work specified elsewhere necessary for the installation of the specified panel system.
   2. Ensure that fasteners do not penetrate conduit or other miscellaneous items located on the underside of the roof deck.
   3. Do not apply roofing materials when water in any form (i.e. rain, dew, ice, frost, snow, etc.) is present.
   4. Do not apply roofing during inclement weather or when ambient conditions will not allow proper application. Consult Manufacturer’s technical specifications on cold weather application.
   5. Phased roofing system installation shall not be permitted.

3.03 WOOD NAILER INSTALLATION

A. Nailers are to be installed as per detail drawings.
B. Discard units of material with defects that might impair quality of work and units that are too small to use in fabricating work with minimum joints or optimum joint arrangement.
C. Set nailers to required levels and lines with members plumb and true.
D. Top of perimeter nailers shall be uniformly flush with the top of insulation.
E. Nailers shall be installed with 1/4" gap between ends of adjoining pieces.
F. Nailers shall be fastened in accordance with the following schedule:
   1. Fasteners in 6" or wider (nominal) lumber shall be installed in two (2) rows, staggered one-third of nailer width. Listed spacings indicate distance between fasteners in adjacent rows.
   2. Two (2) fasteners shall be installed within 3" of each nailer end.
   3. Corner fastener spacing shall extend 8’ maximum from all outside building corners.
   4. Where two or more nailers are installed, each nailer shall be fastened independently.
   5. Over all deck types, the bottom nailer shall be fastened using the specified fasteners and 5/8” diameter washers. Countersink washers and fasteners level with top of wood using spade bit or similar method. Fasten subsequent nailers, where specified, using the specified screws without washers.

6. Nailer Attachment Schedule (unless noted otherwise on the drawings)

<table>
<thead>
<tr>
<th>Attachment Substrate</th>
<th>Perimeter Fastener Spacing (maximum)</th>
<th>Corner Fastener Spacing (maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Concrete</td>
<td>12” o.c.</td>
<td>6” o.c.</td>
</tr>
<tr>
<td>CMU (fastener into solid material)</td>
<td>12” o.c.</td>
<td>6” o.c.</td>
</tr>
</tbody>
</table>
### 3.04 ERECTION

A. Purlins and Girts: Provide rake or gable purlins with tight fitting closure channels and fascia. Secure purlins to structural framing.

B. Framed Openings: Provide shapes of proper design and size to reinforce opening and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

### 3.05 INSULATION INSTALLATION

A. Install only as much insulation as can be covered with roofing membrane and completed before the end of the day’s work or before the onset of inclement weather.

B. Neatly fit insulation to all penetrations, projections, and nailers. Insulation should be loosely fitted, with gaps greater than 1/4” being filled with acceptable insulation.

C. Where overall insulation thickness is 2 inches or greater, install required thickness in two layers with joints of second layer staggered from joints of first layer a minimum of 12 inches each direction.

D. Areas of damage or broken corners shall be cut out and replaced with pieces 12”x 12” minimum.

E. Fastener spacings shall be as required to meet the design wind up-lift resistance defined within this section, but no less than two fasteners per each piece of insulation.

### 3.06 UNDERLAMENT INSTALLATION

A. Install underlayment in accordance with the Manufacturer’s recommendation for a 20 year.

### 3.07 ROOFING

A. General: Arrange and nest panel side lap joints so that prevailing winds blow over, not into lapped joints. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage. Samples submitted will be used as basis for evaluating quality of work performed.

B. Provide weather seal under ridge cap; flash and seal roof panels at eaves and rake with EPDM or other closures to exclude weather.

C. Roof Sheets: Secure roof panels to structural s by means of a sliding clip fastened through a bearing plate into the structure and securely locked into panel seam. Sliding clip shall be centered in mounting clip.

1. Panel seams shall be full double lock field formed using Manufacturer's standard forming machine. Cracking or splitting of metal or cracking, peeling, blistering or other damage to panel coating is not acceptable. Panels shall be securely fastened to
eaves structural and sealed watertight.

2. Panel end splices shall consist of notched roof panels fastened together and sealed weathertight. End splices shall be staggered across field of roof so that in no event end lap seams occur together in adjacent panels. End lap seams shall be tight and flat. Fish mouth between fasteners is not acceptable.

D. Sheet Metal Accessories: Install gutters, roof curbs, ventilators, louvers, and other sheet metal accessories in accordance with Manufacturer's recommendations for positive anchorage to building and weathertight mounting.

E. Dissimilar Materials: Where aluminum surfaces come in contact with ferrous metal or other incompatible materials, keep aluminum surfaces from direct contact by application to the other materials as follows:
   1. One coat of zinc chromate primer, FS TT-P-645, followed by two coats of aluminum paint, SSPC-Paint 101.
   2. In lieu of two coats of aluminum paint, apply one coat of high build bituminous paint, SSPC-Paint 12, applied to a thickness of 1/16" over zinc chromate primer.
   3. Backpaint aluminum surface where impractical to paint other surface.

3.08 Temporary Water Cutoffs

A. Temporary water cutoffs are to be constructed at the end of each working day to protect the insulation, roofing, building, and building interior from damage due to wind, snow, and rain.

B. Temporary water cutoffs are to be detailed by the Contractor and approved by the Manufacturer and the Design Professional.

C. All temporary water cutoffs shall be removed at the commencement of work the next working day.

3.09 Field Quality Control

A. Water Test
   1. After completion of the roof and prior to the installation of the cap sheet, a water test, shall be coordinated with the Owner and conducted by the Contractor in the presence of Design Professional and Owner's Representative. The water test shall include the following procedures:
      a. At the direction of the Design Professional, apply simulated rain over all roof areas for at least 15 minutes per area, or as otherwise directed.
      b. In addition to the simulated rain, direct water to all walls, windows, units, penetrations, etc. that occur adjacent to, or within each roof area, using a continuous, unforced hose stream.
      c. Plug all roof drains and scuppers in each drainage area and allow each drain/scupper sump to be filled to a depth of 3-4 inches. Allow to stand for a minimum of 2 hours.
      d. Perform any necessary corrections to defects noted (including the ensuring of positive drainage around all curbs, roof openings and crickets to roof drains or scuppers) during or after the water test procedures. Perform additional testing as necessary to further define sources of any noted leakage.
      e. Contractor shall provide and/or arrange for necessary equipment, supplies,
water, etc. as needed to perform these tests. Provide a water truck with an appropriate hose, if necessary.

3.10 PROTECTION

A. Protect building surfaces, rooftop mounted equipment, piping, conduit, etc., against damage from roofing work. Where traffic must continue over finished roof membrane, protect surfaces.

3.11 CLEANUP

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this Section, consult Manufacturer of surfaces for cleaning advice and conform to their instructions.

C. Remove excess materials, trash, debris, equipment, and parts from the work.

D. Repair or replace defaced or disfigured finishes caused by work of this section.

END OF SECTION

(Roofing Contractor’s Warranty follows)
Trade: ________________________________________________

Manufacturer and System: ________________________________

Installed: Contractor: ____________________________________

Contract Number and Date: _______________________________

Project and Location: ____________________________________

Area of Roof Installation: _________________________________

Date of Acceptance (Effective Warranty Date): ________________

1. Contractor warrants to Owner that the roofing system identified above have been installed in accordance with the specifications of the contract referenced above, and the specifications of the Manufacturers of all materials used in performance of the work.

2. Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner’s acceptance of the installation, will make good any deficiencies that develop as a direct result of workmanship defects, by repairing or replacing such defects. All corrective work shall utilize materials and installation procedures in strict accordance with the specifications. The Contractor will respond within 24 hours and repair within 5 business days, any leaks or defects in the roofing assembly.

3. Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner’s acceptance of the installation, will maintain all sheet metal flashing in a watertight condition without cost to the Owner.

4. Contractor’s liability hereunder shall be limited to the repair or necessary replacement of any defective component of the work without cost to Owner and shall not include incidental or consequential damages.

CONTRACTOR

By: _______________________________ (Officer)

Title: ________________________________

Company: ____________________________

Date Executed: ________________________
WARRANTY

1. The Manufacturer warrants to the Client named above, that, subject to the provisions of this document, the Manufacturer will, within 3 business days, at its own expense, make or cause to be made all repairs necessary to maintain the roofing system in a watertight condition during the warranty period stated above which commences on the date of Substantial Completion. System warranty includes:
   A. Roof underlayment and adhesion
   B. Roof panel system
   C. Roof flashings (except metal or components not furnished by the Manufacturer as part of its advertised system)
   D. Roof insulation
   E. Roof insulation attachment / adhesion
   F. Roof system fasteners, termination bars, and other miscellaneous accessories supplied by the roofing Manufacturer
   G. Roof related sheet metal (edge metal, copings, counterflashing) supplied by the Manufacturer.
   H. Metal component strip-in-plies.
   I. Roof system attachment / adhesion to the building code defined design wind speed.

2. OWNER'S RESPONSIBILITY: The Owner will notify the Manufacturer if repairs covered by the Warranty are required. The notice will be by, Telephone, Fax, E-mail, or Mail, to the Manufacturer's office listed above within 30 days of discovery of leaks or other defects in the roofing system. The Owner will provide the Manufacturer free access to the building during regular business hours over the life of the Warranty. The Owner acknowledges that the Manufacturer has provided its Roofing Maintenance Manual, including instructions necessary for the Owner to inspect and maintain the roofing system during the warranty period.

3. EXCLUSIONS: The following are excluded from this Warranty:
   A. Roof maintenance for corrections of conditions other than leaks.
   B. Damage to any part of the building (other than the roofing system) or to its contents (consequential damages).
C. Damage resulting from repairs made to the roofing system without the Manufacturer's prior authorization.

D. Damage resulting from any one of the following:

1. Settlement, expansion, contraction, cracking, warping, deflection or movement of roof deck, walls, coping structural members or building foundation.

2. Natural disasters (i.e., windstorm (in excess of wind speed defined in 1. I. above), hail, flood, hurricane, cyclone, lighting, tornado or earthquake).

3. Changes in building usage; new installations on, through or adjacent to the roofing system made after the effective date of this Warranty, unless the Manufacturer has given prior written approval of such changes in building usage or new installations.

4. Accidents, vandalism or other uncontrollable events.

5. Lack of positive drainage (standing water) for asphalt built-up systems.

6. Chemical attacks on the membrane from sources unknown or not present at time of roofing installation.

7. Falling objects, misuse or abuse of the roofing system, traffic, recreational activities or storage of material on the roofing system.

8. Infiltration or condensation of moisture in, through or around walls, copings, building structure or underlying or surrounding areas.

9. Movement or deterioration of metal components adjacent to the roof (except where such components are a part of the Manufacturer's advertised roofing system).

10. Failure of materials supplied by others (except where such materials are a part of the specified roofing system certified by the Manufacturer prior to bidding the roofing work).

11. Tests or test cuts not authorized by the Manufacturer.

12. Failure of the Owner to provide maintenance in accord with the Roofing Maintenance Manual.

13. Failure of the Owner to notify the Manufacturer of leaks or other defects within 30 days of discovery.

4. The Parties agree that any controversy or claims relating to this Warranty shall be first submitted to mediation under the Construction Industry Arbitration and Mediation Rules of the American Arbitration Association (Regular Track Procedures) or to such other mediation arrangement as the parties mutually agree. Participation in mediation as set forth above shall be a condition precedent to institution of any legal, equitable or arbitration proceedings regarding a controversy or claim relation to this warranty.

5. This is the sole roof system Manufacturer's 20-year warranty, any implied warranty of merchantability and fitness for a particular purpose are excluded.

In Witness Whereof: Manufacturer and Owner have caused this Warranty to be duly executed on the dates below.

MANUFACTURER:

_____________________________________            _____________________________________

BY:  __________________________________  BY:  __________________________________

TITLE: ________________________________ TITLE: ________________________________

DATE: ________________________________ DATE: ________________________________
SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Documents specifically related to this section include:

1. Section 01 3100 – Project Management and Coordination: Coordination of roofing work with Owner; roofing sequence inclusion in Project Schedule.

2. Section 01 4100 – Quality Requirements: Contractor’s responsibilities.

1.02 SCOPE OF WORK

A. Furnish and install roof related sheet metal work per the drawings and specifications, include all clips, sealant, fasteners, and joining to make weather and watertight.

1.03 CODE COMPLIANCE

A. The installed copings and edge metal shall comply with ANSI/SPRI ES-1 Standards and shall meet the local design wind pressures as per building code.

1.04 QUALIFICATIONS

A. Installer Qualifications

1. The installer of the roofing shall have been engaged in the business of installing the specified roofing system for not less than five (5) years and shall be certified by the roofing system Manufacturer in the layout and application of this system. The installer shall have successfully installed the specified system as follows:
   a. At least once, and;
   b. At least five (5) years prior to Bid on this Project.

2. The crew shall be composed of experienced and skilled workers in this work.

1.05 QUALITY ASSURANCE

A. Standards: Comply with latest edition of standards specified in this section and as referenced below:

1. ANSI/SPRI ES-1.


4. Published installation instructions from Manufacturers of selected products.


B. Qualifications of Installers: Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this section.

C. In acceptance or rejection of the work of this section, the Owner will make no allowance for lack of skill on the part of the workers.

1.06 SUBMITTALS

A. General: Comply with the provisions of the General Conditions of the Contract and Division 01 specification sections. Submittal schedule shall allow ample time for processing and approval prior to Pre-Roofing Coordination Meeting and start of roof system installation work.

B. Drawings of all shop and pre-Manufactured components to show type and gauge of metal used. Gauges of sheet metal specified in this section are minimums.

C. Submit product information or material list noting fasteners, sealants, sealant primers, sealant tapes, and other required accessories.

D. Submit color chart or physical samples for selection of prefinished metal color by the Design Professional.

E. Submit color chart or physical samples for selection of sealant color by the Design Professional.

F. Submit copies of all required warranties.

1.07 DELIVERY, STORAGE AND HANDLING

A. Use all means to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades. Roof surfaces shall be protected from damage at all times.

B. Deliver only new materials to the job site. Materials to be stored in such a manner as to be protected from rain, snow, or inclement weather. When storing materials on the roof, do not overstress the deck.

C. In the event of damage, immediately make all repairs and replacements to the approval of the Owner and at no additional cost to the Owner.

D. Follow the Manufacturer’s recommendations for storage of temperature sensitive materials.

E. Securely store and protect materials designated for removal and re-installation as part of the re-roofing work.

1.08 SCHEDULING
A. Work is to be performed on a daily basis with each section completed before progressing to the next day’s work, unless specifically directed otherwise by the Design Professional.

B. Substantial Completion of sheet metal flashing and trim work will be defined as the contractually required and weathertight installation of all specified roof preparation, insulation, field membrane, flashings, counterflashings, sheet metal, fasteners and caulking.

C. All new sheet metal work shall be closely coordinated with the installation of the new roofing membrane.

D. Sheet metal shall be installed directly after roofing work such that roofing terminations shall not be left unprotected by metal.

E. Once roofing is started, the roofing application must be Substantially Complete within the time period required by the Contract. All punch list items must be complete prior to Final Completion.

1.09 WARRANTY

A. The Roofing Contractor shall warrant all materials and workmanship for a period of two years from the date of acceptance of the completed work by the Owner. The Roofing Contractor shall make good any defects in materials or workmanship that may develop during the two-year period by repairing or replacing such defects at his own expense without cost to the Owner. Roofing Contractor shall use the form entitled “Sheet Metal Contractor’s Warranty” provided in this section.

B. 20-year warranty for Kynar 500/Hylar 5000 metal finish.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials used on this project shall be compatible with the existing conditions and with each other.

B. No product shall contain any asbestos or asbestos-related products.

2.02 MATERIALS

A. Sheet metal components, metal types, finishes, gauges/thicknesses, joint types, and ANSI/SPRI ES-1 compliance data are specified in the detail drawings.

B. Where sheet metal is required and no material or gauge is indicated on the drawings, provide the highest quality and gauge commensurate with the referenced standards.

C. Contractor shall use gauges or thicknesses listed in the schedule or as prescribed in the referenced standards for specific girths, whichever is greater.

D. Continuous clip shall be fabricated with material one gauge heavier than connecting component.

2.03 MATERIAL SPECIFICATIONS

A. Galvanized Steel
1. Galvanized steel shall be G-90 material.

2. Specifications References

B. Stainless Steel

1. Specification References

2. Finish shall be selected by the Design Professional.

C. Kynar Prefinished Steel

1. Approved Products
   a. PAC-CLAD by Peterson Aluminum Corporation
   b. TUFFCLAD by Clad-Tex Metals
   c. Color Klad by Vincent Metals
   d. UNA-CLAD by Firestone Building Products
   e. Approved equal

2. Color shall be selected by the Design Professional from the Manufacturer’s standard colors.

2.04 CARBON STEEL FASTENERS

A. All fasteners shall be carbon steel with corrosion-resistant coating, unless otherwise noted. Fasteners shall show no more than 15% red rust corrosion after 30 cycles of Kesternich testing.

B. Masonry / Concrete Fasteners

1. Fasteners shall be threaded or expansion type as required by site conditions.

2. Threaded fasteners shall be corrosion-resistant with hex washer head.

3. Expansion fasteners shall be zinc-alloy jacketed with stainless steel drive pin and mushroom head (nylon or plastic anchors are not approved).

4. Corrosion-resistant, watertight, EPDM sealing washer shall be supplied for either threaded or expansion type fasteners.

5. Fasteners shall be approved by FM Global.

6. Approved Products
   a. Tapcon Hex Washer Head with Blue Climaseal or White UltraShield Coating by ITW Buildex
   b. Tapper with Perma-Seal Coating by Powers Fasteners, Inc.
   c. Metal Hit Anchor by Hilti
d. Zamac Hammer-Screw with Carbon Steel Drive Screw by Powers Fasteners, Inc.
e. Masonry Anchor by OMG
f. Approved equal

7. Fasteners to be nominal ¼” thickness minimum and of sufficient length to penetrate the masonry/concrete 1”.

C. Steel / Wood Fasteners

1. Corrosion-resistant, self-drilling, self-tapping screw with hex washer head for exposed fastening.

2. Corrosion-resistant, watertight, EPDM sealing washer for exposed fastening.

3. Approved Products – Steel Fasteners
   a. Tek Screw with Climaseal Coating by ITW Buildex
   b. Dekfast Zac Anchor with Sentri XP Coating by SFS intec, Inc.
   c. Owner approved equal

4. Approved Products – Wood Fasteners
   a. TruGrip GT with Climaseal Coating by ITW Buildex
   b. Dekfast Zac Anchor with Sentri XP Coating by SFS intec, Inc.
   c. Owner approved equal

5. Fasteners to be nominal ¼” thickness minimum and of sufficient length to penetrate the steel ½” or into wood minimum 1”.

6. 1¼” x 11-gauge, galvanized, ring shank roofing nails shall be used for concealed fastening into wood.

2.05 STAINLESS STEEL FASTENERS

A. All fasteners shall be Type 304 or Series 400 stainless steel, or zinc alloy in composition.

B. Masonry / Concrete Fasteners

1. Fasteners shall be threaded or expansion type as required by site conditions.

2. Threaded fasteners shall be corrosion-resistant with hex washer head.

3. Expansion fasteners shall be zinc alloy with stainless steel nail and mushroom head (nylon or plastic anchors are not approved).

4. Stainless steel, watertight, EPDM sealing washer shall be supplied for either threaded or expansion type fasteners.

5. Fasteners shall be approved by FM Global.

6. Fasteners to be nominal ¼” thickness minimum and of sufficient length to penetrate the masonry/concrete 1”.

7. Approved Products
   a. Scots Tapcon Hex Washer Head with Silver Climaseal Coating by ITW Buildex
   b. Metal Hit Anchor by Hilti
C. Steel / Wood Fasteners


2. Stainless steel, watertight, EPDM sealing washer for exposed fastening.

3. Approved Products – Steel Fasteners
   a. 12 - 14 Scots Tek Screw with Climaseal Coating by ITW Buildex
   b. Owner approved equal

4. Approved Products – Wood Fasteners
   a. 17 - 14 Scots Tek Screw with Climaseal Coating by ITW Buildex
   b. Owner approved equal

5. Fasteners to be of sufficient length to penetrate the steel ½” or into wood minimum 1”.

6. 1¼” x 11-gauge, stainless steel, ring shank, roofing nails shall be used for concealed fastening into wood.

2.06 OTHER MATERIALS

A. Membrane Closure / Cover

1. Sheet waterproofing underlayment at parapets, expansion joints, etc., shall be 36-mil (minimum) single-ply material and associated seaming materials. Sheet waterproofing material shall be compatible and approved by the primary roofing membrane Manufacturer.

B. Sealants and Related Accessories

1. General: Except as specifically otherwise directed by the Owner’s Representative, use only the type of sealants described in this section.
   a. Silyl-Termination Polyether (Hybrid) Sealant
      1) Approved Products: Sonolastic 150 VLM by BASF Building Systems or Approved Equal

2. Cleaner
   a. Industrial solvent recommended by the sealant Manufacturer, such as Isopropyl Alcohol, Naphtha, Mineral Spirits, Xylol, Toluene, MEK, or Manufacturer-supplied cleaner.

3. Primer
   a. General: Use only those primers that are specifically recommended for this installation by the caulking Manufacturer.
   b. Primer shall be one of the following:
      1) Primer 733 BASF Building Systems
      2) Approved Equal

4. Backer Rod
   a. General: Use only those backup materials that are specifically recommended for this installation by the sealant Manufacturer and
that are non-absorbent, non-staining, and non-gassing when punctured. Backup materials must be 1½ times the width of the joint.

b. Backer rod shall be one of the following:
1) Soft Backer-Rod by BASF Building Systems
2) Approved Equal

5. High Temperature Resistant Sealant
a. Trade Mate® Hi-Temp Silicone Sealant by Dow Corning Corporation
b. Approved equal

C. Sealant Tape
1. Permanently elastic isobutylene triopolymer tape or isobutylene isoprene copolymer tape that will bond to galvanized steel; aluminum; siliconized polyester, and polyvinyl fluoride painted metals; as well as wood, concrete, etc., 1/8” x 1” nominal cross section, meeting Federal Specification TT-C 1796A, Type II, Class B, with minimum 20 psi adhesive tensile strength according to ASTM C 907, with a service temperature range of -60° F to 212° F.
   a. Approved Products
      1) Sika Lastomer – 95 Gray by Sika Corp.
      2) Sika Lastomer – 93 Black by Sika Corp.
      3) Sika Lastomer – 65 White by Sika Corp.

2.07 GUTTERS AND DOWNSPOUTS

A. Gutters: SMACNA Architectural Sheet Metal Manual, Material gauge and profile shall be as indicated on the Drawings. Each gutter joint will be cleaned, primed and covered with either a 6” wide strip of uncured EPDM glued in place in accordance with manufacturer’s recommendations with the edges sealed with recommended seam caulk, or a 6” wide strip of weather resistant Eternabond.

B. Downspouts: Rectangular profile - See Drawings for details. Material finish shall match metal roof panels and be fabricated from 22 gauge metal, or as indicated on the drawings.

C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 5 years in accordance with SMACNA Architectural Sheet Metal Manual. If gutters and downspouts are fabricated using prefinished or galvanized steel, shop primed and painted carbon steel brackets and straps shall be used (color to match gutters and downspouts), and be fabricated from 22 gauge metal; or as indicated on the drawings.
   1. If gutters and downspouts are fabricated using mill finished aluminum or stainless steel, stainless steel brackets and straps shall be used.
   2. The finish shall be Kynar 500/Hylar 5000 metal finish, color selected by Architect.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA requirements.
   2. Gutter Supports shall be as indicated on the Drawings.
   3. Downspout Supports: Brackets. Where referenced on the drawings, 1/8” x 1” gutter brackets and downspout straps shall be provided.

E. Splash Blocks: Provide Concrete splash blocks. Locate at the bottom of downspouts where downspouts drain onto lower roofs.
F. Downspout Boots: Steel.
   1. At grade level and accessible to public: Eight foot high 16 gage primed steel. Wrap with metal with same finish as downspouts.
   2. Inaccessible to public: Two foot high 16 gage primed steel. Wrap with metal with same finish as downspouts.

G. Seal metal joints.

H. Solder: ASTM B 32, flux type and alloy composition as required for use with metals to be soldered.

I. Rivets
   1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and stainless steel for stainless steel and aluminum alloy, galvanized steel or stainless steel for galvanized steel.
   2. Not less than 1/8” diameter.

3.04 SOFFIT PANEL FABRICATION

A. Panel type: Soffit Seam Panels with V-Grooves, Prefinished.

B. Panel Material and Fabrication
   2. Thickness: 0.032 inch min
   3. Form panels in longest practical lengths, true to shape, accurate in size, square, and free from distribution or manufacturing defects.
   4. Panel Depth: 1/2 inch min
   5. Panel Width: 12 inch min
   6. Fabricate panels with an interlocking leg (male/female interlocking joint design).

C. Accessories
   1. Fasteners: Concealed, non-corrosive, 5/8 inch self-tapping sheet metal screws for securing to metal substrate.

D. Finishes
   1. Kynar 500®/Hylar 5000® high performance fluorocarbon resinous coatings, minimum 3 coats.
   2. Color: As selected by Architect from manufacturer’s standard color chart.
   3. Provide factory applied strippable plastic film for protection during fabrication and installation.

E. Model: “Flexloc” by MBCI or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION
A. Examine the areas and conditions under which work of this section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 FABRICATION

A. Sheet metal shall be formed accurately to sheet shapes as indicated on the drawings and in conformance with details on the approved shop drawings. Contractor shall be responsible for all dimensions.

B. Counterflashing shall be furnished where indicated on drawings. Form flashing sections not less than 8’0” in length, unless otherwise approved prior to fabrication and installation. Counterflashing shall overlap base flashing a minimum of 3”.

C. Coping caps and edge metal shall be furnished where indicated on drawings. Form coping and edge metal in sections not less than 8’0” in length, unless otherwise approved prior to fabrication and installation.

D. Where loose lock lap joints are specified on the drawings, adjacent sections of metal shall overlap a minimum of 3”.

E. Where joint covers are specified on the drawings, they shall be slightly larger than the primary component to ensure a proper fit. Edges of joint covers shall be tipped toward primary component to form a compression seal.

F. Miter all inside and outside corner joints in coping caps, edge metal, and expansion joints. Joints adjacent to inside and outside corners shall be placed exactly 24” each direction from the corner, unless otherwise approved prior to fabrication and installation.

G. Break counterflashing, coping cap, or edge metal sections where they cross building expansion joints, if applicable.

H. Horizontal flanges of edge metal, soil pipe leads, pitch pans, lower flanges, pipe jacks, etc., shall be 4” minimum with rounded corners.

I. All exposed edges of cut sheet metal shall be folded back on concealed surfaces.

J. Form, fabricate, and install all sheet metal so as to adequately provide for expansion and contraction in the finished work.

K. Where a continuous clip is specified on the drawings, the primary component shall be continuously crimped along the bottom edge of the clip.

L. Fabricate radial coping/edge metal in uniform length sections using radial components with finished edges.

### 3.03 DISSIMILAR METALS

A. Dissimilar materials in contact, which are subject to electrolysis, shall be protected against such action prior to installation. Protective materials shall not be visible after installation. Protect metals using coatings recommended by Manufacturer, or separated using felt or EPDM membrane.
3.04 WEATHERPROOFING

A. Finish all sheet metal watertight and weathertight where so required.

B. Where lap seams do not have a joint cover, lap 3” minimum according to pitch.

C. Make all lap seams in the direction of the water flow.

D. Where roof membrane is not already carried over top of parapet wall, expansion joint blocking, etc., the top of each is to be covered with sheet waterproofing membrane (or the flashing membrane material if the roof system is a single-ply). Unless otherwise shown on the drawings, the membrane is to be fastened only on sides as required to hold it in place and make the wall or curb watertight until sheet metal cover can be installed over it. All laps in the membrane material shall be seamed watertight per the Manufacturer’s published installation instructions.

3.05 JOINTS

A. Join parts with rivets or sheet metal screws where necessary for strength or stiffness.

B. Provide suitable watertight expansion joints for all sheet metal as required for proper installation in accordance with the schedule of roof related sheet metal and detail drawings.

C. Sealant application shall be neatly and thoroughly performed for a watertight seal. Sealant shall be installed within all loose lock joints under joint cover plates, and in other locations shown on the drawings. All exposed caulking joints shall be dry tooled to the profile shown on the detail drawings. If required, Contractor shall build custom tools on job site to provide the specified profile(s).

D. Surfaces to receive sealant shall be thoroughly cleaned as recommended by the sealant Manufacturer. All bitumen coating materials, roof cement, adhesive residue, rust, old caulking and/or other contaminants shall be removed down to the substrate to which sealant bonding is intended.

E. All surfaces to receive sealant shall be primed initially with the sealant Manufacturer’s recommended primer.

F. Provide solder/weld joints where noted on the drawings.

3.06 FASTENING

A. Only stainless steel fasteners shall be used to fasten aluminum components, where specified.

B. Only stainless steel fasteners shall be used to fasten copper components, where specified.

C. Secure metal as per detail drawings. Do not in any case install exposed fasteners on a horizontal plane, unless specifically shown on a particular detail drawing.

D. All clips and cleats are to be fastened 6” o.c., unless otherwise noted on the drawings.
E. On the roof facing side, copings are to be fastened 12" o.c. with EPDM washered fasteners, unless noted otherwise on the drawings.

F. Do not fasten adjacent coping, counterflashing, or edge metal sections together at laps or at joint covers, so as to limit expansion/contraction ability. Fasten through center of joint cover through butt joint gap between primary component sections.

G. Embedded metal flanges are to be fastened 3" o.c., staggered.

H. The specified spacings for all fasteners in perimeter metal work shall be reduced by a factor of two in the corner zones of each roof section. Corner zones shall be as calculated based upon the applicable version of ASCE-7.

I. For concealed fastening into wood, use annular ring shank roofing nails.

J. For fastening into concrete, use masonry/concrete anchors with EPDM washers. Use only metal anchors. Plastic anchors shall not be used.

K. For exposed fastening into wood, use screws with EPDM washers. Deformed shank nails shall not be used.

L. Ensure that fasteners are not overdriven such that EPDM washer damage results. Remove and replace all such damaged fasteners, using oversized fasteners.

3.07 PROTECTION

A. Roof surfaces and flashing shall be adequately protected to prevent damage during the installation of metal work. The Contractor shall repair, at no cost to the Owner, any materials damaged.

3.08 CLEANUP

A. Debris from sheet metal work shall be frequently removed from building site as it accumulates.

B. Leave job site absolutely clean at completion of work, and properly dispose of all construction debris such as metal trimmings, fasteners, rivet nails, caulk tube ends, etc.
SHEET METAL CONTRACTOR'S WARRANTY

Trade: ________________________________

Contractor: ________________________________

Contract Number and Date: ________________________________

Project and Location: ________________________________

Area of Roof Installation: ________________________________

Date of Acceptance (Effective Warranty Date): ________________________________

1. Contractor warrants to Owner that the roof related sheet metal have been installed in accordance with the specifications of the contract referenced above, and the specifications of the Manufacturers of all materials used in performance of the work.

2. Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner’s acceptance of the installation, will make good any deficiencies that develop as a direct result of workmanship defects, by repairing or replacing such defects. All corrective work shall utilize materials and installation procedures in strict accordance with the specifications. The Contractor will respond within 24 hours and repair within 5 business days, any leaks or defects in the roofing assembly.

3. Contractor warrants to Owner that Contractor for a period of two (2) years commencing with the date of Owner’s acceptance of the installation, will maintain all sheet metal flashing in a watertight condition without cost to the Owner.

4. Contractor’s liability hereunder shall be limited to the repair or necessary replacement of any defective component of the work without cost to Owner and shall not include incidental or consequential damages.

CONTRACTOR

By: ________________________________

(Officer) ________________________________

Title: ________________________________

Company: ________________________________

Date Executed: ________________________________

End of Section
SECTION 07 6500

FLEXIBLE FLASHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes flexible rubberized asphalt adhesive based self-sealing flashing tape.

B. Related Sections:
   1. Section 06 1053 - Miscellaneous Rough Carpentry
   2. Section 07 6200 - Sheet Metal Flashing and Trim

1.02 REFERENCES

A. American Society for Testing and Materials
   1. ASTM E96 – Test Methods for Water Vapor Transmission of Materials
   2. ASTM D570 – Test Method for Water Absorption of Plastics
   3. ASTM E2112 – Standard Practice for Installation of Exterior Windows, Doors, and Skylights

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of flashing, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Details of termination points and assemblies, including fixed points.
   2. Details of opening conditions, including heads, jambs, and sills as applicable.
   3. Details of special conditions.
   4. Details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish required.

D. Qualification Data: For qualified fabricator.

E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
F. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical corner at sill, jamb and head of openings approximately 4 feet long, including seams, attachments and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Pre-Installation Conference: Conduct conference at Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from rain and physical damage. Do not be double stack pallets on the job site. Provide cover on top and all sides, allowing for adequate ventilation. Store this product in its original, unopened packaging at ambient temperatures between 40 - 90 degrees F under dry conditions and away from exposure to direct sunlight. Store all products in a dry area away from high heat, flames or sparks. Store only as much material at point of use as is required for each day's work.

B. Allow a minimum of 24 hours for drying before installing the flashing, air and surface temperature of 25 degrees F and above.

1.06 WARRANTY

A. Standard Product Warranty:
   1. Submit manufacturer's warranty that flashing and accessories are free of defects at time of delivery, and are manufactured to meet manufacturer's published physical properties and material specifications.
   2. Warranty Period: Five years from date of completion of the flashing installation.
   3. Installer to warrant that flashing and accessories have been installed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

B. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Carlisle Coatings & Waterproofing Inc
2. Henry Company
3. Metal-Fab Manufacturing, LLC
4. Owens Corning

2.02 MATERIALS

A. Polyethylene Sheet: (for use at heads and jambs of window and door openings) Self-sealing, fully adhered composite flexible flashing; 25-mil thick cold applied polyethylene sheet complying with ASTM D 4397.
   1. Composition: 3 mil high density, cross-laminated polyethylene film coated on one side with a 22 mil layer of rubberized asphalt adhesive.
   2. Thickness: 25 mil (0.64 mm) ASTM D3767, Method A
   3. Dimensions: Provide widths as required by manufacturer for full coverage at window and door openings; 4”, 6”, 9”, 12” or 18” and flashing lengths as recommend by manufacturer.
   4. Tensile Strength: ASTM D412, Die C Modified – Min. 985 kPa (143 psi)
   5. Low temperature flexibility: ASTM D1970 Unaffected at -45°F (-43°C)
   6. Elongation: ultimate failure of rubberized asphalt, per ASTM D412 200% minimum
   7. Cracked cycling 100 cycles per ASTM C836 Unaffected at -25°F (-32°C)

B. Polyethylene Sheet: (for use at window sills including skylights) Self-sealing, fully adhered high temperature composite flexible flashing; 30-mil thick cold applied polyethylene sheet complying with ASTM D 4397.
   1. Composition: Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of butyl rubber adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.
   2. Dimensions: Provide widths as required by manufacturer for full coverage at window and door openings and flashing lengths as recommend by manufacturer.
   3. Tensile strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).
   4. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
   5. Elongation, Membrane: 250% ASTM D412 (Die C modified).
   6. Adhesion to Plywood: 3.0 lbs/in width (525 N/m) ASTM D903.
   7. Permeance (max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.
   8. Service Temperature: 300 degrees F (148.8 degrees C) per ASTM D1204

2.03 MISCELLANEOUS MATERIALS

A. General: All adhesives, sealants, coatings, and waterproofing materials applied on-site shall meet the requirements of Division 1 Section “Sustainable Design Requirements”.

B. Primer: as recommended by manufacturer.

C. Sealer compatible with flashing and as approved by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Apply primer if flashing does not adhere to substrate and as recommended by manufacturer. Allow primer to dry prior to the application of the flashing, minimum of 1 hour.

B. Install polyethylene sheet in shingle fashion to shed water, with lapped and taped joints of not less than 3 inches.

C. Do not use flashing to bridge gap larger than ¼ inch.

3.03 PROTECTION

A. Protect finish work from other construction trades.

B. Clean off excess sealants.

C. Replace flashing that has been damaged that has a wrinkle repair by finish touchup or similar minor repair procedures.

END OF SECTION
SECTION 07 8400

FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

B. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

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

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.

2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

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

C. Installer Qualifications: Company specializing in performing the work of this section and:

1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:

2. With minimum 3 years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.
PART 2 - PRODUCTS

2.01 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and T Rating Equal to F Rating and that meets all other specified requirements.

2.02 MATERIALS

A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Red.
   3. Manufacturers:
      b. 3M Fire Protection Products: www.3m.com/firestop.
      e. Substitutions: See Section 01 6300 - Product Substitution Procedures.

B. Foam Firestopping: Single component silicone foam compound; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Red.
   3. Manufacturers:
      a. 3M Fire Protection Products: www.3m.com/firestop.
      d. Substitutions: See Section 01 6300 - Product Substitution Procedures.

C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Red.
   3. Manufacturers:
      c. Substitutions: See Section 01 6300 - Product Substitution Procedures.

D. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      e. Substitutions: See Section 01 6300 - Product Substitution Procedures.

E. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION
A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

### 3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

### 3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

### 3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION
SECTION 07 9005

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.
B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestopping sealants.
B. Section 08 8000 - Glazing: Glazing sealants and accessories.
C. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

1.03 REFERENCE STANDARDS


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3300, for submittal procedures.
B. Product Data: Provide data indicating sealant chemical characteristics.
C. Manufacturer’s Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years’ experience.

1.07 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 4000.
B. Construct mock-up with specified sealant types and with other components noted.
C. Locate where directed.
D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 SEALANTS

A. Type A - General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   2. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

B. Type B - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
   1. Size as required to provide weathertight seal when installed.
   2. Applications: Use for:
      a. Exterior wall expansion joints.

C. Type C - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.

D. Type D - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

E. Type E - Bathtub/Tile Sealant: White silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

F. Type F - Acoustical Sealant: Butyl or acrylic sealant; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
   1. Applications: Use for concealed locations only:
      a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

G. Type G - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and A; single component.
   2. Applications: Use for:
      a. Expansion joints in floors.


2.02 ACCESSORIES
A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.
B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION
A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean and prime joints in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION
A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C 1193.
C. Perform acoustical sealant application work in accordance with ASTM C 919.
D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
E. Install bond breaker where joint backing is not used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
H. Tool joints concave.
I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING
A. Clean adjacent soiled surfaces.

3.05 PROTECTION
A. Protect sealants until cured.

END OF SECTION
Division Eight
OPENINGS
SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Non-fire-rated steel doors and frames.
   B. Steel frames for wood doors.
   C. Fire-rated steel doors and frames.
   D. Thermally insulated steel doors.
   E. Steel glazing frames.

1.02 RELATED REQUIREMENTS
   A. Section 08 7100 - Door Hardware.
   B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
   C. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS
   B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; Current Edition.
   G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
   H. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; Current Addition (ANSI/DHI A115 Series).
   L. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; Current Edition.
   N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition.
1.04 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit two samples of metal, 2 x 2 inches in size showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

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

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   4. Substitutions: See Section 01 6300 - Product Substitution Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Smooth seamless.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
   8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 1, full flush, extra heavy duty.
2. Core: Polystyrene rigid insulation.
4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C 1363 or C 236.
5. Weatherstripping: Separate, see Section 08 7100.
6. Finish: Factory primed, for field finishing.
7. Hardware Reinforcement:
   a. Hinge: 7 gauge.
   b. Lock: 16 gauge.
   c. Closer: 14 gauge.

B. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Core: Cardboard honeycomb.
5. Finish: Factory primed, for field finishing.

C. Interior Doors, Fire-Rated:
1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
3. Fire Rating: As indicated on Door and Frame Schedule, with temperature rise ratings as required by code, tested in accordance with NFPA 252.
   a. Provide units listed and labeled by UL.
   b. Attach fire rating label to each fire rated unit.
4. Smoke and Draft Control Doors: In addition to required fire rating, comply with air leakage requirements of UBC Std 7-2, Part II; with "S" label; if necessary, provide additional gasketing or edge sealing.
5. Core: Mineral fiberboard.
7. Finish: Factory primed, for field finishing.

D. Panels: Same construction, performance, and finish as doors.

2.04 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door, except:
   a. ANSI A250.8 Level 1 Doors: 16 gage frames.
   b. ANSI A250.8 Level 3 Doors: 14 gage frames.
   c. ANSI A250.8 Level 4 Doors: 12 gage frames.
   d. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
   e. Frames for Sound-Rated Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

B. Exterior Door Frames: Face welded, seamless with joints filled.
1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Face welded type.

D. Interior Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
   E. Mullions for Pairs of Doors: Removable type, of profile similar to jambs.
   F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 ACCESSORIES
   A. Glazing: As specified in Section 08 8000, factory installed.
   B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
   C. Astragals for Double Doors: Specified in Section 08 7100.
      2. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.
   D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center Mullions.
   E. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.
   F. All interior and exterior doors shall have a kick plate along the bottom 12" of the push side of the door.

2.06 FINISH MATERIALS
   A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
   B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify that opening sizes and tolerances are acceptable.
   C. Prepare existing frames for new doors and hardware.

3.02 PREPARATION
   A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
   B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION
   A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
   B. In addition, install fire rated units in accordance with NFPA 80.
   C. Coordinate frame anchor placement with wall construction.
   D. Coordinate installation of hardware.
   E. Coordinate installation of glazing.
   F. Coordinate installation of electrical connections to electrical hardware items.
   G. Touch up damaged factory finishes.

3.04 TOLERANCES
   A. Clearances Between Door and Frame: As specified in ANSI A250.8.
   B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.
3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.
   B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE
   A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION
SECTION 08 1416

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Flush wood doors; flush configuration; fire rated, and non-rated.

1.02 RELATED REQUIREMENTS
   A. Section 05 4000 - Cold Form Metal Framing
   B. Section 06 1000 - Rough Carpentry
   C. Section 08 1113 - Hollow Metal Doors and Frames.
   D. Section 08 7100 - Door Hardware.
   E. Section 08 8000 - Glazing.
   F. Section 09 2116 - Gypsum Board Assemblies.
   G. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS
   A. ASTM E 413 - Classification for Rating Sound Insulation; Current Edition.

1.04 SUBMITTALS
   A. See Section 01 3300 - for submittal procedures.
   B. Product Data: For each type of door indicated.
      1. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
      2. Include data indicating that the product does not contain urea-formaldehyde resins.
   C. Shop Drawings: 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.
      1. Indicate dimensions and locations of mortises and holes for hardware.
      2. Indicate dimensions and locations of cutouts.
      3. Indicate requirements for veneer matching.
      4. Indicate doors to be factory finished and finish requirements.
      5. Indicate fire-protection ratings for fire-rated doors.
   D. Samples for Initial Selection: For factory-finished doors.
      1. 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 two samples showing typical range of color and grain to be expected in the finished work.
         a. Provide samples for each species of veneer and solid lumber required.
b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

2. Frames for light openings, 6 inches long, for each material, type, and finish required.

E. Warranty: Sample of special warranty.

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

1.05 QUALITY ASSURANCE

A. Maintain a copy of the specified door quality standard on site for review.

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

C. Installed Fire Rated Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   5. Substitutions: See Section 01 6300 - Product Substitution Requirements.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, Extra Heavy Duty performance with WDMA I.S.1-A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations.
   2. Wood veneer facing with factory transparent finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: Veneer grade as specified above, plain sliced,
book veneer match, running assembly match; unless otherwise indicated.

1. Vertical Edges: Any option allowed by quality standard for grade.
2. Pairs: Match each pair set, match pairs within 10 feet of each other when doors are closed.
3. Color: Refer to Finish Schedule for wood veneer type and stain color.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000 - glazing. Refer to Door and Window Schedule.
   1. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
      a. Wood glazing stops with metal clips for fire rated doors.

B. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, removable, only at exterior doors.

C. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors, removable.

D. All interior and exterior doors shall have a kick plate along the bottom 12” of the push side of the door.

2.07 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.
B. Cores Constructed with stiles and rails:
C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
E. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material indicated and coordinate openings with light kits and glazing for compatibility.
F. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.08 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer’s instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Use machine tools to cut or drill for hardware.
D. Coordinate installation of doors with installation of frames and hardware.
E. Coordinate installation of glazing.

3.03 TOLERANCES
   A. Conform to specified quality standard for fit, clearance tolerances, maximum diagonal distortion.

3.04 ADJUSTING
   A. Adjust doors for smooth and balanced door movement.
   B. Adjust closers for full closure.

3.05 SCHEDULE - See Drawings

END OF SECTION
SECTION 08 5213
ALUMINUM-CLAD WINDOWS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aluminum-clad wood single-hung windows.

1.02 RELATED SECTIONS

A. Section 07270 (07 27 00) - Air Barriers: Water-resistant barrier.
B. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.

1.03 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
B. American Society for Testing and Materials (ASTM):
   2. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
   4. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
C. Screen Manufacturers Association (SMA):
   1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.
D. Window and Door Manufacturers Association (WDMA):
   1. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

1.04 PERFORMANCE REQUIREMENTS

A. Window Unit Air Leakage, ASTM E 283, 7.5 psf (52 mph): 0.3 cfm per square foot of frame or less.
B. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 7.5 psf (52 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.
1.05 SUBMITTALS
   A. Comply with Division 1 requirements.
   B. Product Data: Submit manufacturer’s product data, including installation instructions.
   C. Shop Drawings: Submit manufacturer’s shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
   D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.
   E. Warranty: Submit manufacturer’s standard warranty.

1.06 QUALITY ASSURANCE
   A. Mockup:
      1. Provide sample installation for field testing window performance requirements and to determine acceptability of window installation methods.
      2. Approved mockup shall represent minimum quality required for the Work.
      3. Approved mockup shall [not] remain in place within the Work.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
   B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
   C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2- PRODUCTS

2.01 MANUFACTURER
   A. Basis of Design: Sierra Pacific Windows, 8601 President Place NE Suite A, Albuquerque, NM 87113.
   B. Substitutions: See Section 01 6000 – Product Requirements

2.02 ALUMINUM-CLAD SINGLE-HUNG AND PICTURE WINDOWS
      Traditional factory-assembled aluminum-clad wood single-hung windows. Sash shall tilt to interior without removal for cleaning.
   B. Frame:
      1. Interior Exposed Surfaces: Clear Pine with no visible fastener holes.
      2. Exterior Surfaces: Clad with aluminum.
      3. Overall Frame Depth: 5 inches (127 mm).
C. Sash:
1. Interior Exposed Surfaces: Clear Pine with no visible fastener holes.
2. Exterior Surfaces: Clad with aluminum, lap-jointed at corners.
3. Corners: Mortised and tenoned, glued and secured with metal fasteners.
4. Operable sash tilt to interior for cleaning or removal.
5. Sash Thickness: 1-3/4 inches (44 mm).

D. Weather Stripping:
1. Water-stop santoprene wrapped foam at head and sill.
2. Thermal-plastic elastomer bulb with slip coating set into lower sash for tight contact at checkrail.
3. Vinyl-wrapped foam inserted into jambliner or jambliner components to seal to sides of sash.

2.03 GLAZING
A. Glazing:
1. Integral Light Technology Glazing and Grilles:
   a. Insulating glass contains non-glare grid between 2 panes of glass.
   b. Non-glare Grid: Adhered to glass.
   c. Room Side Grilles: 5/8” wide ogee profile that are solid Clear Pine.
   e. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with foam grid.
   f. Finish: Finish color matches interior and exterior finish colors.

2. Type: Dual-seal, annealed insulating glass, silicone-glazed. multi-layer Low-E coated with argon.

2.04 OPTIONS
A. Insect Screens: Standard half.
2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
3. Set in aluminum frame fitted to outside of window.
4. Complete with necessary hardware.
5. Screen Frame Finish: Baked enamel.
   a. Color: Finish to match existing exterior window cladding.

2.05 HARDWARE
A. Balances:
1. Block-and-tackle balances.
2. Balances are attached to frame and connected to sash with polyester cord.

B. Locking System:
1. Rustic Collection: Distressed Bronze.
2. One installed on units with frame width less than 37 inches, 2 locks installed on units with
frame width of 37 inches or greater.

D. Lock and Sash Lift Finish: Oil-rubbed bronze
E. Manufacture Standard casement, awning, and double hung hardware.

2.06 TOLERANCES

A. Windows shall accommodate the following opening tolerances:
   1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
   2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
   3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

2.07 FINISH

A. Exterior Finish System: Carmel Single Hung and Picture Windows
   1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
      a. Clean and etch aluminum surface of oxides.
      b. Pre-treat with conversion coating.
      c. Top coat with baked-on polyester enamel.
   2. Color: Antique Bronze 057.
   3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all
      performance requirements of AAMA 2603 and the following performance requirements of
      AAMA 2605:
      a. Dry Film Hardness: Eagle Turquoise Pencil, H minimum.
      b. Film Adhesion: 1 mm crosshatch, dry, wet, boiling water.
      d. Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24
         hours.
      e. Detergent Resistance: 3 percent at 100 degrees F, 72 hours.
         exceeds 3,000 hours.


PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect
   installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are
   corrected.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions and approved shop drawings.
B. Install windows to be weather-tight and freely operating.
C. Maintain alignment with adjacent work.
D. Secure assembly to framed openings, plumb and square, without distortion.
E. Integrate window system installation with exterior weather-resistant barrier using flashing/sealant
   tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed
   principles in accordance with window manufacturer's instructions.
F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

H. Leave windows closed and locked.

3.03 FIELD QUALITY CONTROL

3.04 CLEANING

A. Clean window frames and glass in accordance with Division 1 requirements.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. Remove labels and visible markings.

3.05 PROTECTION

A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION
SECTION 08 7100
DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Mechanical door hardware for:
   a. Swinging doors.

2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.03 REFERENCES

A. Fire/Life Safety

1. NFPA - National Fire Protection Association
   a. NFPA 70 – National Electric Code
   b. NFPA 80 - Standard for Fire Doors and Fire Windows
   d. NFPA 105 - Smoke and Draft Control Door Assemblies

B. UL - Underwriters Laboratories
NEW MEXICO STATE UNIVERSITY AG SCIENCE CENTER EXTENSIONS

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

C. Accessibility
   1. ADA - Americans with Disabilities Act.

D. DHI - Door and Hardware Institute
   1. Sequence and Format for the Hardware Schedule
   2. Recommended Locations for Builders Hardware
   3. Key Systems and Nomenclature

E. ANSI - American National Standards Institute
   1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:
   1. Submit in accordance with Conditions of Contract and Division 01 requirements.
   2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
   3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:
   1. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
   2. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
      a. Door Index; include door number, heading number, and Architects hardware set number.
      b. Type, style, function, size, and finish of each hardware item.
      c. Name and manufacturer of each item.
      d. Fastenings and other pertinent information.
      e. Location of each hardware set cross-referenced to indications on Drawings.
      f. Explanation of all abbreviations, symbols, and codes contained in schedule.
      g. Mounting locations for hardware.
      h. Door and frame sizes and materials.
      i. Name and phone number for local manufacturer’s representative for each product.

   3. Key Schedule:
a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
b. Use ANSI A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
   1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

4. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Name, address, and phone number of local representative for each manufacturer.
   d. Parts list for each product.
   e. Final approved hardware schedule, edited to reflect conditions as-installed.
   f. Final keying schedule
   g. Copies of floor plans with keying nomenclature
   h. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer’s product is named and accompanied by “No Substitute,” including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
   a. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

2. Where products indicate “acceptable substitute” or “acceptable manufacturer”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural
Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.


2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
   a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   b. Preliminary key system schematic diagram.
   c. Requirements for key control system.
   d. Requirements for access control.
   e. Address for delivery of keys.

K. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

   a. Attendees: Door hardware supplier, door hardware installer, Contractor.
   b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

   1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

   1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
   2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

   1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.07 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Direct shipments not permitted.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
   a. Closers:
      1) Mechanical: 30 years.
   b. Exit Devices:
      1) Mechanical: 5 years.
   c. Locksets:
      1) Mechanical: 10 years.

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers other than those listed shall be in accordance with QUALITY ASSURANCE article, herein.

B. Approval of products from manufacturers indicated as “Acceptable Manufacturer” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.
### 2.02 MATERIALS

**A. Fasteners**

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

**B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.**

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

### 2.03 HINGES

**A. Provide five-knuckle, ball bearing hinges.**

1. Manufacturers and Products:

   a. Scheduled Manufacturer and Product: Ives 5BB Series.

B. Requirements:

1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight steel, 4-1/2 inches (114 mm) high as listed in hdw sets
   b. Interior: Standard weight steel, 4-1/2 inches (114 mm) high as listed in hdw sets

2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets

3. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze steel, 5 inches (127 mm) high as listed in hdw sets
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high as listed in hdw sets

4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.

5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.

6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

8. Doors 36 inches (914 mm) wide or less furnish hinges 4 ½ inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.
2.05 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Schlage ND Series

B. Requirements:
   1. Provide cylindrical locks conforming to the following standards and requirements:
      a. ANSI/BHMA A156.2 Series 4000, Grade 1.
      b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
   2. Cylinders: Refer to “KEYING” article, herein.
   3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
      a. Abusive Locked Lever Torque Test – minimum 3,000 inch-pounds without gaining access
      b. Cycle life - tested to minimum 10 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.
   4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
   5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
   6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
   7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
   8. Provide electrified options as scheduled in the hardware sets.
   9. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
      b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.06 EXIT DEVICES

A. Manufacturers:
   1. Scheduled Manufacturer: Von Duprin 99 Series

B. Requirements:
   1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to “KEYING” article, herein.
   2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
   3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
   4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish,
stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.

5. Provide rim devices with a dual cylinder or inside thumb turn cylinder option with a visual security indicator that identifies the trims locked/unlocked status of the door from the inside of the room. Indicator in unlocked state presents a 1/2 inch x 1/2 inch white metal flag with black icon at top of device head. Indicator in locked state has no flag present. Provide rim devices without the dual cylinder or inside thumb turn cylinder option capable of being retrofitted with the visual security indicator.

6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
   a. Projection: maximum 1-5/8 inch (41mm) in the neutral position and 1-1/4 inch (32mm) when fully depressed.
   b. Endcaps: die-cast aluminum with sloped design.
   c. Fasteners: include for surface mounting to recessed door prep and through bolting to device trim.
   d. Concealed Vertical Rod Devices: provide two-piece adjustable rods, 5/8 inch (16mm) throw latchbolt. Top and bottom latching standard with optional less bottom rod.
   e. Mortise Lock Devices: provide 3/4 inch anti-friction latchbolt, field reversible

7. Provide exit devices with manufacturer’s approved strikes.
8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
   a. Lever Style: Match lever style of locksets.
   b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
13. Provide UL labeled fire exit hardware for fire rated openings.
14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled in the hardware sets.

2.07 ELECTRIC STRIKES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Von Duprin 6000 series
   2. Acceptable Manufacturers and Products: Folger Adam 300 series, HES 1006 series

B. Requirements:
1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.08 POWER SUPPLIES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Schlage Electronics or Von Duprin PS900 series

B. Requirements:
   1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
   2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
   3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
   4. Options:
      a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
      b. Provide sealed batteries for battery back-up at each power supply where specified.
      c. Provide keyed power supply cabinet.
   5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
   6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating “no delay” exiting mode.

2.09 CYLINDERS

A. Manufacturer:
   1. Scheduled Manufacturer: Schlage Primus – Owner’s Standard

B. Requirements: Provide cylinders/cores complying with the following requirements.
   1. Furnished by same manufacturer as locks.
   2. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer’s series as indicated.

C. Full-sized cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
   1. Primus FSIC cylinder in keyway as selected by owner at all Doors.
D. Nickel silver bottom pins.

E. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication “Keying Systems and Nomenclature” for identification. Blind code marks shall not include actual key cuts.

F. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   1. Forward cylinders/cores to Owner, separately from keys, by means as directed by Owner.

G. Replaceable Construction Cores.
   1. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      a. 12 construction change (day) keys.
   2. Install permanent cores immediately prior to substantial completion and prior to owner occupancy.

2.10 KEYING

A. Keying Requirements – General
   1. Permanent cylinders/cores keyed by the manufacturer according to the following key system.

B. Keying system: Key to existing system as directed by the Owner.
   1. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.

C. Keys
   1. Material: Nickel silver; minimum thickness of .092-inch (2.3mm)

D. Coordinate with cylinder/core and key identification requirements above.

E. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.

F. Quantity: Furnish in the following quantities.
   1. Grandmaster Keys: 2
   2. Master Keys: 6
   3. Permanent Control Keys: 3
   4. Change Keys: 3 per cylinder/core

G. Delivery: Individually tagged and delivered direct to “Director”, Maintenance Building and Grounds, P.O. Box 20100, 6531 Boeing Drive, El Paso, Texas 79925 by registered mail.
2.11 KEY CONTROL SYSTEM

A. Key Control System Manufacturers:
   1. Scheduled Manufacturer: Telkee
   2. Acceptable Manufacturers: HPC, Lund

B. Requirements:
   1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
      a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
      b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: LCN 4040XP Series

B. Requirements:
   1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
   2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
   3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
   4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
   5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
   6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
   7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
   8. Pressure Relief Valve (PRV) Technology: Not permitted.
   9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
   10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:
1. Scheduled Manufacturer and Product: LCN Senior Swing.

B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19.
   a. Opening: Powered by DC motor working through reduction gears.
   b. Closing: Spring force.
   d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
   e. Cover: Aluminum.

2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.

3. Provide drop plates, brackets, or adapters for arms as required to suit details.

4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.

5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to “KEYING” article, herein.

6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

7. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, presence detector input, which prevents closed door from opening or door that is fully opened from closing, hold open toggle input, which allows remote activation for indefinite hold open and close second time input is activated, vestibule inputs, which allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.

2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as specified. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Requirements:
   1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes of plates:
      a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
      b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
      c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturers: Glynn-Johnson
   2. Acceptable Manufacturers: Rixson, Sargent, ABH

B. Requirements:
   1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
   2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
   3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
   4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.
2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood, Trimco

B. Provide door stops at each door leaf:
   1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
   2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
   3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:
   2. Acceptable Manufacturers: Pemko, National Guard Products, Reese

B. Requirements:
   1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
   2. Size of thresholds:
      a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
      b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
   3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.19 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.
2.20 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Overhead Stops and Holders: BHMA 630 (US32D)
4. Door Closers: Powder Coat to Match
5. Wall Stops: BHMA 630 (US32D)
6. Latch Protectors: BHMA 630 (US32D)
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Remove existing hardware being replaced, tag, and store according to contract documents.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations in accordance with:
   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
   c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

2. Custom Steel Doors and Frames: HMMA 831.

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.
C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage Architect's Architectural Hardware Consultant or Equivalent as defined in section 1.5 “Quality Assurance” and manufacturers' representative of locks, exits and closers to perform inspections and to prepare inspection reports.

1. The two parties will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

A. Provide training for Owner’s maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section “Demonstration and Training.”

3.08 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

\[\neq\text{ Hardware Item Requiring Electrical Coordination}\]

HARDWARE SET: 1

DOOR NUMBER: 101A

EACH TO HAVE:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Supplier Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>HINGE</td>
<td>3</td>
<td>5BB1HW 4.5 X 4.5 NRP</td>
<td>652 IVE</td>
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<td>RIM CYLINDER</td>
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<td>626 SCH</td>
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<td>20-740</td>
<td>626 SCH</td>
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<td>689 LCN</td>
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<td>KICK PLATE</td>
<td>1</td>
<td>8400 10” X 2” LDW B-CS</td>
<td>630 IVE</td>
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<tr>
<td>WALL STOP</td>
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<td>WS407CVX</td>
<td>630 IVE</td>
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<tr>
<td>SEALS</td>
<td>1 SET</td>
<td>BY ALUMINUM FRAME SUPPLIER</td>
<td></td>
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</tbody>
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DOORS NORMALLY CLOSED AND LOCKED.
FREE EGRESS AT ALL TIMES.
HARDWARE SET: 2

DOOR NUMBER:
101

EACH TO HAVE:
6 EA HINGE 5BB1 4.5 X 4.5 NRP 652 IVE
2 EA MANUAL FLUSH BOLT FB458 626 IVE
1 EA DUST PROOF STRIKE DP2 626 IVE
1 EA STOREROOM LOCK ND80TD RHO 626 SCH
1 EA PERMANENT CORE 20-740 626 SCH
2 EA OH STOP 900S SNB 630 GLY
1 EA ASTRAGAL 44SP X 188S X D.H. 600 ZER
2 EA SILENCER SR64 GRY IVE

HARDWARE SET: 3

DOOR NUMBER:
102

EACH TO HAVE:
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA PRIVACY LOCK ND40S RHO 626 SCH
1 EA WALL STOP WS407CCV 630 IVE
3 EA SILENCER SR64 GRY IVE

END OF SECTION
(Door/Hardware Index to Follow)
# Door/Hardware Index

Mark # | HWSet # |
---|---|
101A | 01 |
101 | 02 |
102 | 03 |

= Opening Requiring Electrical Coordination
SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Glass.
B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Sealant and back-up material.
B. Section 08 4313 - Aluminum-Framed Storefronts.
C. Section 10 2800 – Toilet and Utility Accessories: Mirrors.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.
B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
D. Manufacturer's Certificate: Certify that glass meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
1.07  WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 - PRODUCTS
2.01  GLAZING TYPES
   A. Type A (Clayton Project): Clear Tempered Insulating Glass Units: Fully tempered glazing.
      1. Application(s): Exterior hazardous locations
      2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
         a. Tint: None
         b. Coating: None
      3. Total Thickness: 1 inch.

2.02  EXTERIOR GLAZING ASSEMBLIES
   A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
      1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
      2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
      3. Thicknesses listed are minimum.
   B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
      1. In conjunction with vapor retarder and joint sealer materials described in other sections.
      2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.03  GLASS MATERIALS
   A. Float Glass Manufacturers:
      4. Substitutions: Refer to Section 01 6300.
   B. Float Glass: All glazing is to be float glass unless otherwise indicated.
      1. Annealed Type: ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
      3. Tinted Types: Color and performance characteristics as indicated.
      4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
   C. Fire-Resistance-Rated Composite Glazing: Multi-layer glazing UL- or WH-listed as fire-resistance-rated glazing and complying with 16 CFR 1201 test requirements for Category II without the use of a surface-applied film.
   D. NOTE: All open edges of glazing shall be polished.

2.04  SEALED INSULATING GLASS UNITS
   A. Manufacturers:
      1. Any of the manufacturers specified for float glass.
      2. Substitutions: Refer to Section 01 6300.
   B. Sealed Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E 2190.
2. Edge Spacers: Aluminum, bent and soldered corners.
3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

A. Manufacturers:
   4. Substitutions: Refer to Section 01 6300.

B. Butyl Sealant: Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
   a. Substitutions: Refer to Section 01 6300.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Prime surfaces scheduled to receive sealant.
C. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

G. Apply cap bead of appropriate type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.06 CLEANING

A. Remove glazing materials from finish surfaces. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION
Division Nine
FINISHES
SECTION 09 2116

GYPSUM BOARD ASSEMBLIES

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Fire rated area separation walls.
E. Acoustic insulation.
F. Gypsum sheathing.
G. Cementitious backing board.
H. Gypsum wallboard.
I. Joint treatment and accessories.
J. Textured finish system.
K. Water-resistive barrier over exterior wall sheathing.

1.02  RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
B. Section 07 2100 - Thermal Insulation: Wall insulation.
C. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
D. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.
E. Section 07 9005 - Joint Sealers: Acoustic sealant.
F. Section 09 3000 - Tiling (Tile): Tile backing board.
G. Section 13 4813 – Sound and Vibration Control Components

1.03  REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
B. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; 1996, with 2000 Supplement.
M.  ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2007.

1.04 SUBMITTALS
A.  See Section 01 3300 - Submittal Procedures.
B.  Shop Drawings:  Indicate special details associated with fireproofing.
C.  Product Data:  Provide data on metal framing, gypsum board, accessories, joint finishing system, accessories, and joint finishing system.
D.  Product Data:  Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
E.  Test Reports:  For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
F. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.
   1. Accepted sample shall be used as basis of acceptance for field applied texture.
   2. Provide additional samples as requested by Architect.

1.05 QUALITY ASSURANCE

A. Maintain one copy of all installation standards at project site.

B. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

C. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C 840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC as indicated on drawings calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

D. Fire Rated Assemblies: Provide completed assemblies complying with applicable code. See drawings for location and assembly information.

2.02 MANUFACTURERS

A. Gypsum Board:
   1. American Gypsum: www.americangypsum.com
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Framing:
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Metal Framing Connectors and Accessories:
   1. Same manufacturer as framing.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size
and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum
deflection of wall framing of L/240 at 5 psf (240 Pa).

1. Exception: The minimum metal thickness and section properties requirements of ASTM C
   645 are waived provided steel of 40 ksi (275 MPa) minimum yield strength is used, the
   metal is continuously dimpled, the effective thickness is at least twice the base metal
   thickness, and maximum stud heights are determined by testing in accordance with ASTM
   E 72 using assemblies specified by ASTM C 754.

2. Studs: "C" shaped with flat or formed webs with knurled faces.
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

B. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.

C. Shaft Wall Studs and Accessories: ASTM C 645; galvanized sheet steel, of size and properties
   necessary to comply with ASTM C 754 and specified performance requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that
   accommodate deflection using slotted holes, screws and anti-friction bushings, preventing
   rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity
      required by applicable code, when evaluated in accordance with AISI North American
      Specification for the Design of Cold-Formed Steel Structural Members.
      galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems
      indicated on drawings.
   4. Provide top track preassembled with connection devices spaced to fit stud spacing
      indicated on drawings; minimum track length of 12 feet (3660 mm).
   5. Acceptable Products: VertiClip(r) or VertiTrack(tm) manufactured by The Steel Network
      Inc.

F. Channel Bridging: Wall bracing for stud walls.
   1. Channel bridging inside wall:
      a. "BridgeBar/BuckleBridge" as manufactured by The Steel Network, Inc.;
      b. "Spazzer Bar" as manufactured by Dietrich Metal Framing, Inc.;
      c. Provide bridging clips where required.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Wallboard: Paper-faced gypsum wallboard as defined in ASTM C 1396/C 1396M; sizes to
   minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.
   1. Application: In High-traffic areas indicated on drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   3. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Edges: Tapered.
   6. Extend impact rated wallboard to 6" above ceiling or to deck.

D. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and other areas as indicated on drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C 1325.
      a. Thickness: 1/2 inch
   4. Glass-Mat-Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C 1178.
      a. Standard Type: Thickness 1/2 inch.
      b. Fire-Resistant Type: Type X core, thickness 5/8 inch where required.
      c. Products:
         1) Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
         2) Substitutions: See Section 01 6000 - Product Requirements.

E. Gypsum Board - All Types: Complying with applicable requirements of ASTM C 1396/C 1396M.

F. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
   1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      a. Other Applications: Use at all vertical surfaces, unless otherwise indicated.
   2. Application: Where required for fire-rated assemblies, unless otherwise indicated.
      a. Thickness: 5/8 inch, as indicated.
   3. Ceiling Board: Special sag-resistant type.
      a. Application: Ceilings, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.
   4. Abuse-Resistant Type: Gypsum wallboard especially formulated for increased impact resistance, with enhanced gypsum core and heavy duty face and back paper.
      a. Application: 8 feet high at all circulating corridors/hallways, vestibules, and Cafeteria Room 137.
      b. Core Type: Type X, as indicated.
      c. Thickness: 5/8 inch, as indicated.
      d. Edges: Tapered.

G. Water-Resistant Gypsum Board: ASTM C 630/C 630M and ASTM C 1396/C 1396M; ends square cut.
   1. Application: Wet areas except behind ceramic wall tile.
   2. Core Type: Regular and Type X, as indicated.
   3. Thickness: 5/8 inch, as indicated.

H. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C 1177/C 1177M.
3. Core Type: Type X.
4. Type X Thickness: 5/8 inch.
5. Regular Board Thickness: 5/8 inch.
6. Edges: Square, for vertical application.
7. Glass-Mat-Faced Products:
   a. Georgia-Pacific Gypsum LLC; DensGlass Gold Sheathing.
8. Parapet and roof walls that receive TPO need Georgia-Pacific Gypsum LLC; DensDeck.

I. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
   2. Types: Regular and Type X, in locations indicated.
   3. Type X Thickness: 5/8 inch.
   4. Regular Type Thickness: 1/2 inch.
   5. Edges: Tapered.
   6. Vents as shown on drawings.
   7. Products:
      a. Georgia-Pacific Gypsum LLC; ToughRock Soffit Board.

2.05 FIBERGLASS REINFORCED BOARD MATERIALS

A. Cementitious Backer Board: ANSI A118.9, aggregated portland cement panels with glass fiber mesh embedded in front and back surfaces, 1/2 inch thick.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners.

2.06 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, un-faced. Thickness as required to achieve or exceed STC ratings as indicated on drawings. Product: CertainTeed “NoiseReducer” or equal approved by architect.

B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Water-Resistive Barrier: No. 15 asphalt felt.


E. Edge Trim: Bead type(s) as detailed.

F. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   4. Chemical hardening type compound.

G. Textured Finish Materials: Latex-based compound; plain.

H. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

I. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

J. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

K. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C 754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board as indicated on drawings.

F. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

G. Blocking: Install mechanically fastened steel sheet blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.
   7. Where required or as indicated on drawings

H. Bridging: Attach wall stud bridging when required in a manner to prevent stud rotation.
   1. Space bridging rows according to manufacturer's recommendations (maximum 4 feet on center).
   2. Install bridging in stud walls with cladding on one-side only and other framing where recommended by manufacturer and code requirements.
   3. Avoid bracing interference with thermal break of rigid wall board insulation on exterior walls.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer’s instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.04 BOARD AND GLASS MAT FACED BOARD INSTALLATION
A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Single-Layer Fire-Rated: Install gypsum board vertically, with edges and ends occurring over firm bearing.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing (Glass-Mat-Faced): Comply with ASTM C 1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

F. Exterior Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.

G. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

H. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

J. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.


C. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.
B. Texture: Orange Peel

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 FINISH LEVEL SCHEDULE

A. Level 1: Above finished ceilings concealed from view.
B. Level 2: Utility areas and areas behind cabinetry.
C. Level 3: Walls scheduled to receive textured wall finish.

END OF SECTION
SECTION 09 2400
PORTLAND CEMENT STUCCO

PART 1 – GENERAL

1.1 SECTION INCLUDES
A. Section Includes: Installation of the Portland cement stucco as an exterior wall cladding. The extent of stucco base and finish coat assembly is as indicated on the drawings. This system is to be mechanically attached over sheathing, (over continuous insulation at designed window wraps), metal studs or steel studs, and CMU or concrete.

1. Z Furring over CMU or concrete as noted in drawings.

B. The types of stucco base coat assembly include:
1. Factory blended, fiber-reinforced cement plaster basecoat for jobsite mixing to provide scratch and brown coats to receive secondary fiberglass crack suppression reinforcement and an acrylic based colored stucco finish.

C. Products installed but not supplied under this section:
1. Joint Sealant: Refer to Division 7 Joint Treatment (Sealants) Section. Installation of joint sealant shall be by coating applicator or a separate installer. Joint sealant installer shall be experienced and competent in the installation of elastomeric construction sealants.
2. Reference SECTION 07 6500 FLEXIBLE FLASHING. (Required at all existing HM Door and Window frames and general openings through the exterior sheathing)

1.2 RELATED SECTIONS
A. Section 07 25 00 - Weather Barriers
B. Section 07 62 00 - Sheet Metal Flashing and Trim
C. Section 07 90 00 - Joint Protection
D. Section 09 21 16 - Gypsum Board Assemblies

1.3 DESCRIPTION
A. Scratch and Brown Concentrate fiber reinforced stucco that is a factory blended formulation of Portland cement, lime, fibers and proprietary ingredients. For use with jobsite added ASTM C-897 stucco sand and clean potable water.

B. Scratch and Brown Functional Criteria:
1. Stucco application shall be sloped a minimum of 4”/12" (15˚) for positive drainage.
2. Substrate conditions:
   a. Sheathing substrates shall be sound, dry and free of dust, dirt, and other contaminants.
   b. Substrate Dimensional Tolerances: Flat with ¼ inch within any 4 foot radius to maintain a uniform thickness of basecoat material.
   c. Maximum deflection of substrate assembly under positive or negative design loads shall not exceed L/360 of span.
C. Expansion Joints:

1. Continuous expansion joints shall be installed at all areas of dissimilar materials, multiple story plate lines or existing engineered through wall expansion joints.
2. Per ASTM C 1063, “Expansion and or contraction joints shall be installed in walls not more than 144 ft² in area and not more than areas of 100 ft² for all horizontal applications. The distance between joints shall not exceed 18 ft in either direction or a length-to-width ratio of 2-1/2 to 1.”
3. Location and frequency of control joints to be detailed by the design professional and shown on drawings when applicable.

1.4 SUBMITTALS

A. General: Applicator to submit:

1. Manufacturer’s technical information including installation instructions and recommendations.
2. Samples: Submit samples for approval. Samples shall be of materials specified and of suitable size as required to accurately represent each color and texture to be used on project. Prepare each sample using same tools and techniques for actual project application. Approved samples shall be maintained and available at job site.
   a. Fastener samples (approved by manufacturer)
3. Warranty: At substantial project completion the Contractor shall issue to the owner the stucco manufacturers standard 13-year material and labor warranty.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Install stucco basecoat assembly to comply with all applicable codes and standards and with requirements of local agencies having jurisdiction.

B. Manufacturer: Shall have marketed stucco products in United States for at least ten years; shall have completed projects of same building size and type as this project.

C. Applicator Qualifications: Applicators specializing in the installation of exterior stucco assembly with a minimum of 5 years experience in work similar to that required by this section.

D. Single Source Responsibility: All stucco base coat and finish materials shall be from a single manufacturing source, and delivered to jobsite with labels intact.

E. Surface Deviation: Shall not be more than ¼” in 10’ when utilizing a straight edge placed anywhere on the wall(s)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original packages or containers, with manufacturer’s labels intact and legible.

B. Keep materials dry, above freezing, stored off ground, under cover and away from damp surfaces. At the time they are mixed, all materials shall be at a minimum temperature of 40°F.

C. Remove wet, frozen, damaged or detrimental materials from site immediately.
1.7 PROJECT SITE AND INSTALLATION CONDITIONS

A. Environmental Conditions: Comply with manufacturer’s recommendations of environmental conditions affecting product installation requirements.

1. Installation Ambient Air Temperature: Minimum of 40°F and rising, and remain so for 48 hours thereafter. Maximum Ambient Air Temperature of 120°F Protect stucco from uneven and excessive evaporation during hot, dry weather.
2. Do not use frozen materials in cement stucco.
3. Do not apply cement stucco to frozen surfaces or surfaces containing frost or ice.
4. Inclement Weather: Do not apply basecoat during inclement weather, unless appropriate protection is employed.
5. Wall and Substrate Temperatures: Avoid, when possible, installation of the basecoat and the finish coats over substrates that are over 120°F.

B. Protection:

1. Protect adjacent finished surfaces prior to stuccoing,
2. Maintain protection in place until completion of work.
3. Protect finished work when stopping for the day or when completing an area.

1.8 COORDINATION AND SCHEDULING:

A. Coordination: Coordinate stucco system installation with other construction operations.

1.9 WARRANTY

A. Warranty: Upon request, at completion of installation, provide manufacturer’s Standard Limited Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807
Contact: Andy Townes, Architectural Sales Manager (505) 338-4433
andy.townes@parexusa.com

B. Components: Obtain components from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from Parex USA for this project.

C. Other manufacturers as approved according to Section 01 6000 Contract Documents

2.2 MATERIALS AND ACCESSORIES

A. Fluid Applied Air and Water Barrier: A spray or roller applied air and water barrier with sheathing joint tape for reinforcement. Weather Seal by Parex USA. Refer to Section 07 2726 - Liquid Applied Water and Air Membrane.

B. Continuous insulation wrapping existing HM windows (Reference Drawings) adhesively installed with Parex USA Adhesive installed in vertical ribbons forming a drainage plain in accordance with Commercial Drainage EIFS Application Guide.
C. Continuous Insulation: Refer to Section 07 2100 – Thermal Insulation

D. Weather Barrier and/or Building Paper: Asphalt-saturated kraft building paper complying with requirements of ICC-ES AC38 Grade D, location between continuous insulation and lath.

1. Water Resistance: 60 minutes, minimum, when tested in accordance with ASTM D 779.

E. Lath and Trim Accessories: Conform to ASTM C1063 lathing and furring.

1. Exterior components field walls: Minimum 3.4lb expanded metal self-furred to lath to be used in accordance with ASTM C897.
2. Terminations: J-Metal or Stucco stop, general purpose type with expanded or perforated flanges. Plaster stops to be utilized around all through wall penetrations with gaps between the back of the plaster stops and the window or door frames wide enough to installed backer rod and sealant. See manufactures publish details.
3. Corner Reinforcement: (galvanized welded wire, minimum 18 gage): Manufacturer's standard pre-formed corner reinforcement made from 1.7 lbs. per square yard of diamond mesh lath.
4. Square Edge Corner Beads: expanded or flanged to suit application. (For square corners).
5. Round-Edged Corner Beads: expanded or flanged to suit application. (For rounded corners).
6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.
8. Reveal joints: Provide factory fabricated intersections, reveals 1 inch wide by 1 inch deep as indicated on drawings. Fry Reglet PCS-100-100 or approved equal.
9. Soffit Vent and/or HM Window and Door frame Venting: Ventilating drip screed.
   a. Refer to drawings.
10. Weep Screeds: foundation weep screed, with perforations and minimum 3-1/2 inch vertical attachment flange.
11. Fasteners: steel nail or screw of furring type with a cap of sufficient length and strength for minimum ½ inch penetration into brick, block, concrete or stud system.
   a. Fasteners shall be approved by the stucco manufacturer for each application.
12. 3.4lb. per square yard expanded metal strip-lath 4 inches wide to be used at around all windows, doorways, openings and through wall penetrations.
13. 3.4lb density expanded metal lath for use on all soffits and overhangs as shown on drawings.

E. Fiber-reinforced Portland cement stucco basecoat: Manufacturer’s standard factory formulated, concentrate scratch and brown stucco basecoats consisting of Portland cement, lime, fibers, and proprietary ingredients. Fiber-47® Concentrate or approved equal.

F. Fiberglass mesh for increased crack suppression: Krak-Master mesh as manufactured by Parex USA for embedment into the surface of the brown coat for increased crack
suppression. A 4.5oz fiberglass woven fiberglass that has been treated for Alkali resistance.

G. Water: Potable.

H. Sand: Comply with all requirements of ASTM C 897.

I. Primer and Surface Conditioner: Tintable primer: Consisting of acrylic polymers and design for use over fully cured brown coats prior to the application of acrylic finish coats. To be tinted to the finish coat color, prior to the application of the finish coat.

J. Finish coat, Acrylic Based Elastomeric Tinted Stucco Finish:

1. Acrylic based Elastomeric stucco finish coat, consisting of acrylic polymers, properly graded aggregate, colorant and proprietary ingredients. Parex E'Lastic or approved equal.
2. Texture and color as per Architects and or Owners directions.

2.3 RELATED MATERIALS AND ACCESSORIES

A. General: Stucco system materials and related materials shall conform to ASTM C926, this specification and Parex Product Data Sheets.

2.4 ELASTOMERIC SOFFIT FINISH

A. System description: An exterior soffit coating system consisting of Base Coat with embedded Reinforcing Fabric Mesh, and Finish Coat.

B. General

1. This application is for soffits only.
2. Control joints shall be installed 30 ft. on center maximum as per sheathing manufacturer's recommendations.
3. Building code conformance: The construction shall be acceptable for use under the building code in force in the jurisdiction of the project.

C. Manufacturer: Parex USA, Inc., Anaheim, CA or equal as approved by Architect.

D. Materials

1. Base Coat: Insul-Bond Base Coat: 100% acrylic polymer base, requiring the addition of portland cement.
2. Reinforcing Mesh:
   b. Short Detail Mesh: Reinforcing mesh used for backwrapping and details, and to embed in and Insul-Bond Base Coat & Adhesive.
   c. Self Adhesive Detail Mesh: Reinforcing mesh used for complex details

E. Finish:

1. Perma-Flex Finish: Factory blended, 100% acrylic polymer based finish, integrally colored. Finish type, texture and color as selected by Architect.
   a. Finish type, texture and color as selected by Architect

F. Water: Clean, cool, potable water

G. Portland Cement: ASTM C150, Type I or Type I-II.

H. Application:
1. General: Installation shall conform to this specification and manufacturer’s written instructions and drawing details.

2. Base Coat: Apply base coat and fully embed mesh in base coat; include diagonal mesh patches at corners of openings and reinforcing mesh patches at joints of track sections.

3. Finish Coat: Apply finish coat to match specified finish type, texture, and color. Do not apply finish coat to surfaces to receive sealant. Keep finish out of sealant joint gaps.

I. Protection:
   1. Provide protection of installed materials from water infiltration into or behind them.
   2. Provide protection of installed stucco from dust, dirt, precipitation, and freezing during installation.
   3. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry.
   4. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the Architect/Owner.

2.5 ELASTOMERIC SEALANTS

A. Sealant Type A:

   1. For exterior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
      a. Control and expansion joints in cast-in-place concrete.
      b. Joints between architectural pre-cast concrete units.
      c. Control and expansion joints in stucco
      d. Butt joints between metal panels.
      e. Joints between marble and/or granite or tile
      f. Joints between different materials listed above.
      g. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
      i. Control and expansion joints in ceiling and overhead surfaces.

   2. Provide single-component, low-modulus, non-sag sealant; comply with ASTM C920, Type S or M, Grade NS, Class 25, Class 35, Class +50/-50, Class +100/-50

   3. Acceptable sealants:
      a. Silicones: Single Component (or approved equal)
         1) Sikasil - WS 290
         2) Sikasil – WS 295
         3) Sika Silbridge 300
         4) Sikasil 728 NS

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Verify project site conditions under provisions of Section 01 00 00.
   B. Compliance: Comply with manufacturer's instructions for installation of stucco system materials.
   C. Substrate Examination: Examine prior to stucco base installation as follows:

2. Substrate shall be examined for soundness, and other harmful conditions.

3. Substrate shall be free of dust, dirt, laitance, efflorescence, and other harmful contaminants.

4. Substrate construction in accordance with substrate material manufacturer's specifications and applicable building codes.

D. Advise Contractor of discrepancies preventing proper installation of stucco system. Do not proceed with the stucco system work until unsatisfactory conditions are corrected.

3.2 INSTRUCTIONS

A. Compliance: Comply with manufacturer’s instructions for installation of base & finish coats.

3.3 INSPECTION

A. Substrate Examination: Examine prior to stucco installation as follows:

1. Substrate shall be of a type listed in IBC 2003 or as required by local codes and agency’s having jurisdiction. Wood based sheathing substrates must be gapped 1/8 inch between panels.

2. Substrate shall be examined for soundness, and/or other harmful conditions.

3. Substrate shall be free of dust, dirt, efflorescence, and other harmful contaminants.

4. Notify contractor of discrepancies preventing installation of the stucco assembly.

B. Install fluid applied weather resistant barrier, sheet good barrier and flashing system in compliance with requirements of applicable codes, regulations, and agencies having jurisdiction.

C. Install lath tight utilizing approved fasteners, properly secured, and that all accessories are properly set and secured.

D. Isolation: Where lath and metal support assembly abuts building structure horizontally, and where partition wall work abuts the overhead structure, isolate work from structure movements. Install expansion or control joints to absorb deflections but maintain lateral support. Frame both sides of expansion and control joints separately and do not bridge joints with furring or lath.

E. Examine substrates, grounds and accessories to insure that finished stucco work will be true to line, plane, level and plumb.

3.4 PREPARATION OVER MASONRY SUBSTRATES: DIRECT BOND APPLICATIONS

A. Conform to preparation requirements of ASTM C926.

B. Verify that masonry and concrete surfaces to receive direct bond applications of stucco basecoats are rough, free from form release agents or otherwise properly prepared to provide for adequate bond.

C. Apply a uniform coating of the acrylic bonding agent in accordance with manufacturer’s recommendations and instructions.
3.5 INSTALLATION

A. General:
   1. Apply Fluid Applied Weather and Air Barrier over all sheathing and CMU or Concrete substrates with sheathing tape at all seams and at all through wall penetrations.
   2. Install continuous insulation utilizing fasteners long enough to penetrate the studs a minimum of 1 inch.
   3. Install lathing and accessories followed by stucco basecoat assembly in accordance with manufacturer’s instructions and recommendations as written in manufacturer’s data sheets, and in compliance with requirements of applicable codes, regulations and agencies having jurisdiction, over all areas of continuous insulation.

B. Lathing: Install according to ASTM 1063 and install through polyisocyanurate and into block, brick or concrete and or stud assemblies with a minimum of 1 inch penetration into framing or block substrates. Install at a rate of one fastener per square foot.

C. Interrupt stucco application only at junctions of stucco planes, at openings, at control joints or at expansion joints.

D. Installation of Z furring where noted on drawings:
   1. Install Z furring per manufacturers requirements at 24” centers vertically.
   2. Install continuous insulation by fitting between the Z Furring.
   3. Install lathing and accessories followed by stucco basecoat assembly in accordance with manufacturer’s instructions and recommendations as written in manufacturer’s data sheets, and in compliance with requirements of applicable codes, regulations and agencies having jurisdiction.

E. Basecoat:
   1. Apply scratch coat to a thickness of 3/8 inch using sufficient trowel pressure or spray velocity to key stucco into lath or onto direct bond substrate.
   2. Scratch horizontally and in order to provide for a key with the brown coat.
   3. Apply Brown coat directly over scratch coat to a thickness of 3/8 inch, using sufficient trowel pressure or spray velocity to key brown coat into scratch coat.
   4. Darby, then rod surface to true plane.
   5. While basecoat is still wet, embed secondary fiberglass reinforcement utilizing a wood float, and smooth to flush. Take care to completely embed mesh not more than 1/32 inch into surface of wet brown coat. Overlap all seams 2 inches and remove all wrinkles, rough edges etc. Or, install an additional skim coat with an acrylic modified basecoat and embed mesh into it.
   6. Float or lightly broom surface to provide bond with cement stucco finish coat, or trowel smooth in preparation for acrylic finish coat.
   7. Tool brown coat to provide a V-joint at intersection of stucco with frames or other items of metal, wood, or plastic which act as stucco grounds.

F. Finish Coat: Acrylic Based Stucco Finish
   1. Apply primer coats to fully cured basecoats, allow to dry until tacky.
   2. Apply exterior wall finish coat to thickness recommended by manufacturer to achieve texture indicated, using sufficient trowel pressure or spray velocity to bond finish coat to basecoat.
   3. Apply exterior wall finish in number of coats and consistency required to achieve texture to match approved sample.
3.6 CURING

A. Moist cure cement base coats with a fog spray of clear water with sufficiently frequent applications to maintain stucco uniformly moist for a minimum of 48 hours following applications. Allow an additional 5 days of air curing before the application of any primers or finish coats.

B. Air Cure acrylic finish coats only, do not wet cure.

3.7 CLEANING

A. Patching: Repair damaged exterior wall finish coat to match surrounding finish.

B. Cleanup:
   1. Remove excess finish and protective materials from adjacent surfaces.
   2. Remove all excess materials from the project site.

END OF SECTION
SECTION 09 3000
TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Tile for floor applications.
B. Tile for wall applications.
C. Backer board as tile substrate.
D. Accessories.

1.02 RELATED REQUIREMENTS
A. Section 07 9200 - Joint Sealers.
B. Section 09 2116 - Gypsum Board Assemblies: Installation of tile backer board.
C. Section 22 4000 - Plumbing Fixtures

1.03 REFERENCE STANDARDS
   7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; current edition
  13. ANSI A118.7 - American National Standard Specifications for Polymer Modified Cement
Grouts for Tile Installation; current edition


1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS
A. See Section 01 3300 - for submittal procedures.
B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.06 ASSURANCE
A. Maintain one copy of TCA Handbook and ANSI A108 Series/A118 Series on site.
B. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
C. 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.
D. 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.
E. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   4. Metal edge strips.
F. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.
G. Installer must have a minimum 3 years of documented experience on projects of similar size and scope. Installer must be licensed in the State of New Mexico.

1.07 MOCK-UP
A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where indicated on the drawings or as directed by Architect, incorporating all components specified for the location.
   1. Minimum size of mock-up at least 48” square, but no fewer than 4 tiles.

**1.08 DELIVERY, STORAGE, AND HANDLING**

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. 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 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.

**1.09 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.

B. Do not install adhesives in an unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

**1.10 EXTRA MATERIALS**

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated. Minimum 1 box of each color and type of tile.

   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

**PART 2 - PRODUCTS**

**2.01 PRODUCTS, GENERAL**

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

   1. Provide tile complying with Standard grade requirements unless otherwise indicated.
B. 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 TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. 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.

2.02 TILE PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products indicated on the Drawings on the Finish Schedule (or equal approved by Architect), by one of the following:
   5. Substitutions: See Section 01 6300 - Product Substitution Procedures.

B. Ceramic Wall Tile WT-5: ANSI A137.1, and as follows: Kitchen
   1. Annapolis by Daltile, www.daltile.com
   2. Moisture Absorption (ASTM C373): ≤ 20.0 percent
   5. Size & Shape: 6 x 16 inch rectangle, 5/16" thick
   6. Color: Sand AP07
   7. Grout Joint: 1/16 inch (1/8" when rectangular sizes are used in a staggered brick-joint pattern, overlap not to exceed 33%)

2.03 TRIM AND ACCESSORIES

A. Types: Ceramic cove base tile, ANSI 137.1. Base tile may be cut.

B. Trim: Match color and pattern of floor and wall tile as shown on Drawings. Provide shapes as required by project conditions for finished work.

2.04 ACCESSORIES

A. Metal Floor Transition Strips: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Tile Trim Units: Matching bullnose, cove base, and cove ceramic shapes in sizes coordinated
with field tile. Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

1. Applications: Use in the following locations:
   b. Inside Corners: Coved Quarry Tile. Aluminum Trim at all other applications. Reference C. Aluminum Trim below.
   c. Floor to Wall Joints: Cove base at Quarry Tile. Aluminum Trim at all other applications. Reference C. Aluminum Trim below.

2. Manufacturer: Same as for tile.

C. Aluminum Trim: Decorative profile trim pieces for wall and skirting edges, edge protection profile for all changes in tiled surfaces, and sanitary cove base application. Thickness to be equal to the thickness of the tile. Trim pieces manufactured by Schluter; www.schluter.com or equal as approved by Architect.

1. Applications:
   a. Open wall edges: Schluter Rondec-DB.
   b. Outside Corners: Schluter Rondec.
   c. Inside Corners: Schluter Dilex-AHK.
   d. Floor to Wall Joints: Schluter Dilex-AHKA.

2.05 ADHESIVE MATERIALS

A. Manufacturers:
   1. Bonsal American, Inc: www.sakrete.com
   3. Substitutions: See Section 01 6300.

B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.

2.06 ACCESSORY MATERIALS

A. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

B. Metal Lath: ASTM C 847, Flat diamond mesh, of weight to suit application, galvanized finish.

C. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

D. Thresholds: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

2.07 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
1. Products: Subject to compliance with requirements, provide the following:
   a. Noble Company (The); Nobleseal CIS.

2.08 SETTING MATERIALS


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.09 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Custom Building Products.
   b. Laticrete International, Inc.
   c. MAPEI Corporation.

B. Water-Cleanable Epoxy Grout: ANSI A118.3. Required for all tile work. (per EPISD Guidelines, Addendum No.3, page 1)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Mer-Kote Products, Inc.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.

2.10 ELASTOMERIC SEALANTS

A. 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."

1. 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).

2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.11 MISCELLANEOUS MATERIALS
A. **Trowelable Underlayments and Patching Compounds**: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. **Metal Edge Strips**: Angle or L-shape, height to match tile and setting-bed thickness, metallic, designed specifically for flooring applications; white zinc alloy or stainless-steel, ASTM A 666, 300 Series exposed-edge material where meeting dissimilar materials

C. **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.

D. **Grout Sealer**: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. Bonsal American; an Oldcastle company; Grout Sealer.
   b. Bostik, Inc.; CeramaSeal or Siloxane 220
   c. Custom Building Products; Grout Sealer.
   d. MAPEI Corp.; KER 004, Keraseal Penetrating Sealer for Unglazed Grout & Tile

### 2.12 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

### 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. All wall tile substrate shall be cementitious backer board; Coated glass mat (each side) water-resistant gypsum backing panel as defined in ASTM C 1178. *(District Standard)*
2. Verify that substrates for setting tile are firm, dry, clean, 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 A108.01 for installations indicated.
3. Verify that substrates for setting tile are firm, dry, clean, 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 A108.01 for installations indicated.
4. Verify that concrete substrates for tile floors installed with bonded mortar bed 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.

5. 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.

6. 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 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles square and external angles bullnosed.

F. Sound tile after setting. Replace hollow sounding units.

G. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

H. Follow Tile Council of America guideline EJ 171 for expansion joints. Note: Glass tile does expand and contract more than ceramic or porcelain tile. This movement needs to be accommodated in the installation, particularly where high and low temperature change may occur. Be sure to use flexible sealant/caulk joints anywhere it meets dissimilar restraining surfaces.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grout tile joints.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.03 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer. Level existing substrate surfaces to acceptable flatness tolerances.

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 (1:50) toward drains.

C. Protect surrounding work from damage.

D. Vacuum clean surfaces and damp clean.

E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

F. 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.

G. 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.

3.04 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile floors in laundries.
   d. Tile floors composed of tiles 8 by 8 inches or larger.
   e. Tile floors composed of rib-backed tiles.

B. 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.

C. 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.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. 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.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

2. Glazed Wall Tile: 1/16 inch.
3. Decorative Thin Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. 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.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
H. Metal Edge Strips: Install at locations indicated on the drawings and in 2.03 above.

I. 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 on grout and sealer from tile faces by wiping with soft cloth.

3.05 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.

3.06 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate. Apply as required.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.07 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 Polymer-Modified Tile 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.

3.08 TILE INSTALLATION SCHEDULE

E. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F113: Thin-set mortar; TCNA F113.
      a. Tile Type: Porcelain.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.
   2. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy grout; TCNA F114 and ANSI A108.1B.
      a. Tile Type: Quarry tile.
c. Grout: Water-cleanable epoxy grout.

3. Tile Installation F122: Thin-set mortar on waterproof membrane; TCNA F122.
   a. Tile Type: Porcelain tile.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Water-cleanable epoxy grout.

F. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W244.
      a. Tile Type: Ceramic, porcelain or glass tile.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.

   2. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCNA W245.
      a. Tile Type: Ceramic, porcelain or glass tile.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.

END OF SECTION
SECTION 09 6500
RESILIENT FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Luxury Vinyl Tile flooring.
B. Resilient base.
C. Installation accessories.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS
F. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
H. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

1.04 SUBMITTALS
A. See Section 01 3300 - Submittal Procedures for requirements.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Shop Drawings: Indicate Layout plan.
D. Selection Samples: Submit manufacturer's complete set of color samples.
E. Verification Samples: Submit two samples, 3 x 3 inch in size illustrating color and pattern for each resilient flooring product specified.
F. Concrete Testing Standard: Submit a copy of ASTM F 710.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 5 percent of each type and color; but no less than one box of each.
   3. Extra Wall Base: 5 percent of each type and color.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

   1. Local Rep: Lisa McNary, 505-220-1312, lisa.mcnary@shawinc.com

B. Substitutions: See Section 01 6000 – Product Requirements

2.02 TILE FLOORING

A. Luxury Vinyl Tile Plank: Homogeneous without backing, with color and pattern throughout full thickness, and:
   1. Minimum Requirements: Comply with ASTM F1700, Class III Type B
   2. Radiant Panel: Class 1 when tested in accordance with ASTM E 648.
   3. Total Thickness and Wear Layer Thickness: 3.0 mm nominal.
   4. Wear Layer Thickness: 30 mil
   5. Plank Size: 5.96” x 48”
   6. Static Load: Passes, modified 1500 psi, when tested as specified in ASTM F970.
   7. Color & Pattern: To be selected by Architect from the manufacturer’s full range.
2.03 RESILIENT BASE

A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch thick.
   5. Length: Roll.
   6. Color: Color as selected from manufacturer's full range
   7. Accessories: Premolded external corners and end stops.
   8. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.
3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.

B. Prepare sub-floor surfaces as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is cured.

E. Clean substrate.

F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.

   2. Resilient Strips: Attach to substrate using adhesive.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install flooring in recessed floor access covers, maintaining floor pattern.

J. At movable partitions, install flooring under partitions without interrupting floor pattern.

K. Install feature strips where indicated.

3.04 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
C. Install tile to **ashlar** pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

### 3.05 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of **18 inches** between joints.

B. Miter internal corners. At external corners, **use premolded units**. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

### 3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

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

### 3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION**
SECTION 09 9000
PAINTING AND COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Surface preparation.
B. Field application of paints, stains, varnishes, and other coatings.
C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 RELATED REQUIREMENTS
A. Section 32 1723 - Painted Pavement Markings: Pavement markings.
B. Section 05 5000 - Metal Fabrications: Shop-primed items.

1.03 REFERENCE STANDARDS
F. Green Seal requirements.

1.04 SUBMITTALS
A. See Section 01 3300 - for submittal procedures.
B. Product Data: Provide complete list of all products to be used, with the following information for each: Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel"). Provide data on all finishing products, including VOC content.
C. Samples: Submit two paper chip samples, 3 x 5 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Allow 30 days for approval process, after receipt of complete samples by Architect.
D. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE
A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.
1.06 MOCK-UP
   A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
   B. Provide wall panel, 4 feet long by 4 feet wide, illustrating coating color, texture, and finish.
   C. Provide door and frame assembly illustrating coating color, texture, and finish.
   D. Locate where directed. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
   B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand
code, coverage, surface preparation, drying time, cleanup requirements, color designation, and
instructions for mixing and reducing.
   C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90
degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS
   A. Do not apply materials when surface and ambient temperatures are outside the temperature
ranges required by the paint product manufacturer.
   B. Follow manufacturer's recommended procedures for producing best results, including testing of
substrates, moisture in substrates, and humidity and temperature limitations.
   C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F
for exterior; unless required otherwise by manufacturer's instructions.
   D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior,
unless required otherwise by manufacturer's instructions.
   E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA MATERIALS
   A. See Section 01 6300 - Product Requirements, for additional provisions.
   B. Supply 1 gallon of each color; store where directed.
   C. Label each container with color and room locations in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Provide all paint and coating products from the same manufacturer to the greatest extent
possible.
   B. In the event that a single manufacturer cannot provide all specified products, minor exceptions
will be permitted provided approval by Architect is obtained using the specified procedures for
substitutions.
   C. Paints: Acceptable manufacturers:

2.02 MATERIALS - GENERAL
   A. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List,
current edition available at www.paintinfo.com, for specified MPI Categories, except as
otherwise indicated.
      1. Provide ready mixed paints and coatings.
      2. Provide materials that are compatible with one another and the substrates indicated under
conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

C. Provide colors as directed by Architect.
   1. Allow for minimum of four colors for each system, unless otherwise indicated, without additional cost to Owner. Accent wall colors may be used on up to 60% of walls.

2.04 EXTERIOR PAINT SYSTEMS

A. Structural Steel and Metal Fabrications:
   1. Steel, unprimed, three coats:
      a. One coat: Rust-inhibitive primer recommended by top coat manufacturer.
      b. Two coats: Waterborne, acrylic latex, semi-gloss enamel.
   2. Steel, primed, two coats:
      a. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
      b. Two coats: Waterborne, acrylic latex, semi-gloss enamel.
   3. Steel, galvanized, three coats:
      a. One coat: White, fast-drying primer for aluminum and galvanized surfaces recommended by top coat manufacturer.
      b. Two coats: Waterborne, acrylic latex, semi-gloss enamel.

B. Interior Intumescent Paint

1. Fire Retardant Coating for Structural members, Intumescent:
   a. Fire Retardant primer sealer.
   b. Intumescent coating, flame/smoke rating 25/50.
   c. Acceptable Manufacturers:
      1) Carboline Company
      2) Coatmaster
      3) Flame Stop Inc.

C. Woodwork:

1. Opaque finish, three coats:
   a. One coat: Waterborne, acrylic, undercoater recommended by top coat manufacturer.
   b. Two coats: Waterborne, acrylic polymer satin enamel.

2. Transparent finish, three coats:
a. One coat: Oil stain.
   b. Two coats: Satin polyurethane varnish.

D. Gypsum Board, three coats:
   1. Applications include but are not limited to walls, ceilings, soffits, and bulkheads (except as
      noted below.)
      a. One coat: Waterborne, vinyl acrylic, flat sealer.
      b. Two Coats: Waterborne acrylic polymer, satin enamel.

   2. Applications include but are not limited to walls, ceilings, soffits, and bulkheads located in
      halls and restrooms.
      a. One coat: Waterborne, vinyl acrylic, flat sealer.
      b. Two Coats: Waterborne acrylic polymer, semi-gloss enamel.

E. Concrete, three coats:
   1. One coats: Waterborne, acrylic, primer sealer.
   2. Two coats: Waterborne, acrylic polymer, satin enamel.

F. Concrete Masonry Units: Field finish exposed concrete masonry units with a water-based, clear,
   penetrating water-repellent sealer, as approved by CMU manufacturer.

G. Concrete Masonry Units (Standard):
   1. Applications include but are not limited to walls, ceilings, soffits, and bulkheads.
      a. One coat: Waterborne, vinyl acrylic, flat sealer.
      b. Two Coats: Waterborne acrylic polymer, satin and semi-gloss enamel.

H. Concrete Floor Sealer:
   1. Transparent finish. Application per manufacturer’s instructions.
      a. Two coats: Water–based coating such as Okon Seal & Finish Concrete & Masonry
         Sealer or approved equal.

PART 3 - EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the
   term "exposed" includes areas visible through permanent and built-in fixtures when they are in
   place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as
      similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed
      surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and
      furnishings, using primer only, prior to installation of the permanent item.
   4. Paint back sides of access panels and removable and hinged covers to match exposed
      surfaces.
   5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   6. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according
      to the color coding scheme indicated.
   7. Paint interior surfaces of air ducts and convectors and baseboard heating cabinets with flat,
      nonspecular black paint where visible through registers, grilles, or louvers.
   8. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to
      match face panels.
C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Anodized aluminum.
   6. Polished and brushed stainless steel items.
   10. Exposed ductwork.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Board: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.

3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of...
tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

1. Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in MPI Manual. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present.


H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

M. Metal Doors to be painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.

1. Provide completed work matching approved samples for color, texture, and coverage.
2. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.

1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for surface or item being painted; produce results free of visible brush marks.
2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.

1. Number of coats and film thickness required are the same regardless of application method.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.

1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.

2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.

3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.

4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.

5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.

6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.05 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION
SECTION 09 9113
EXTERIOR PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete.
   2. Fiber-cement board.
   3. Clay masonry.
   4. Concrete masonry units (CMU).
   5. Steel.
   7. Aluminum (not anodized or otherwise coated).
   8. Stainless-steel flashing.
   12. Exterior gypsum board.

B. Related Requirements:
   1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
   2. Division 09 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
2. Label each coat of each Sample.
3. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Indicate VOC content.

1.04 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
2. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Architect will designate items or areas required.
3. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:
1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co: www.benjaminmoore.com
   2. Dunn-Edwards Paint: www.dunnedwards.com
   3. PPG Paints: www.ppgpaints.com
   5. Substitutions: As per Section 01 6000.

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 01 6000 “Product Requirements,” and the following:
   1. Products are approved by manufacturer in writing for application specified.
   2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications, provide paints and coatings that complies with VOC content limits of authorities having jurisdiction.

C. Colors: As indicated in a color schedule.
   1. 10 percent of surface area will be painted with deep tones.

2.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
a. Concrete: 12 percent.
b. Fiber-Cement Board: 12 percent.
c. Masonry (Clay and CMU): 12 percent.
d. Wood: 15 percent.
e. Portland Cement Plaster: 12 percent.
f. Gypsum Board: 12 percent.

2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION
A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Paint entire exposed surface of window frames and sashes.
  5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Paint the following work where exposed to view:
     a. Equipment, including panelboards.
     b. Uninsulated metal piping.
     c. Uninsulated plastic piping.
     d. Pipe hangers and supports.
     e. Metal conduit.
     f. Plastic conduit.
     g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

A. Concrete, Clay Masonry, Portland Cement Plaster (Stucco), Cementitious Siding, Nontraffic Surfaces:

1. Latex System:
   a. Prime Coat: Primer sealer, latex.
      1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
   c. Topcoat: Latex, exterior, flat.
      1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
   d. Topcoat: Latex, exterior, satin.
      1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

2. Concrete Substrates, Clear Exterior Sealer: Clear Sealer, Flat:
   a. First Coat:
      1) S-W Loxon® 40% Silane Water Repellent, A31T40, at 100 to 200 sq. ft. per gal.

B. CMU Substrates:

1. Latex System:
   a. Block Filler: Block filler, latex, interior/exterior:
      1) S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal.
c. Topcoat: Latex, exterior, flat.
   1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

d. Topcoat: Latex, exterior, satin.
   1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:

1. Waterbased Acrylic System: (Standard system for doors & frames)
   a. Prime Coat: Primer, rust-inhibitive, water based:
      1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
   c. Topcoat: Water-based Acrylic, semi-gloss, interior:
      1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

2. Waterbased/Alkyd Urethane System: (Alternative upgrade for exterior metals 5h pencil hardness)
   a. Prime Coat: Primer, rust-inhibitive, water based:
      1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
   c. Topcoat: Water-based alkyd-urethane, semi-gloss, interior:
      1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils wet, 1.4 mils dry, per coat.

3. High Performance: Pigmented Polyurethane System: (Hand Rails, Canopies)
   a. Prime Coat: Alkyd anti-corrosive, quick dry:
      1) S-W Pro-Cryl Universal Primer, B66-310 Series, at 2.0 to 4.0 mils dry, per coat.
   c. Topcoat: Polyurethane, two-component, pigmented, gloss:
      1) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series, at 2.0 to 4.0 mils dry, per coat.

D. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.

1. Latex System:
   a. Prime Coat: Primer, latex for exterior wood.
      1) S-W Exterior Latex Primer, B42, at 4.0 mils wet, 1.4 mils dry, per coat.
   c. Topcoat: Latex, exterior, flat:
1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

   d. Topcoat: Latex, exterior, satin:
      1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

E. Wood Substrates, Semi-Transparent Surfaces:

1. Semi-Transparent Stain System:
   b. Topcoat: Semi-Transparent stain, latex:
      1) S-W WoodScapes® Semi-Transparent Stain, A15 Series.

F. Exterior Gypsum Board Substrates:

1. Latex System:
      1) S-W PrepRite ProBlock Latex Primer/Sealer, B57-620 Series, at 4.0 mils wet, 1.4 mils dry.
   c. Topcoat: Latex, exterior, flat.
      1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 dry, per coat.
   d. Topcoat: Latex, exterior, satin:
      1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

H. Anti-Graffiti:

1. Non-Sacrificial System:
      1) S-W 2K Waterbased Urethane Anti-Graffiti Coating, B65-194 Gloss / B65V195 Satin. See Manufactures data page for details. (Application of a clear coating may change the color appearance of the base coat. Apply a test patch prior to coating the entire project)

END OF SECTION
SECTION 09 9123
INTERIOR PAINTING

PART 1 - GENERAL

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

1.02 SUMMARY
B. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   5. Aluminum (not anodized or otherwise coated).
   6. Wood.
   7. Gypsum board.
C. Related Requirements:
   1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
   2. Division 09 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates; and "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates; and "High-Performance Coatings" for tile-like coatings.

1.03 ACTION SUBMITTALS
A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.
B. Samples for Initial Selection: For each type of topcoat product.
C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Label each coat of each Sample.
   3. Label each Sample for location and application area.
D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Indicate VOC content.

1.04 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 gallons of the field wall color, and 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.

7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Lead Paint: It is not expected that lead paint will be encountered in the Work.
   1. If suspected lead paint is encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co: www.benjaminmoore.com
   2. Dunn-Edwards Paint: www.dunnedwards.com
   3. PPG Paints: www.ppgpaints.com
   5. Substitutions: As per Section 01 6000.

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

C. Products are approved by manufacturer in writing for application specified.
   1. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

D. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.
2.02 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall provide materials that comply with VOC limits of authorities having jurisdiction and for interior paints and coatings applied at Project site, the following VOC limits exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Floor Coatings: 100 g/L.

C. Colors: As indicated in a color schedule.

1. 10 percent of surface area will be painted with deep tones.

2.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.

2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Gypsum Board: 12 percent.
      e. Plaster: 12 percent.
   2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
   3. Plaster Substrates: Verify that plaster is fully cured.
   4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory-applied final finishes.
   h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
3.06 INTERIOR MICROBICIDAL PAINTING SCHEDULE

A. Gypsum Board, Concrete, CMU, and Wood Substrates: (Locker Rooms, Restrooms, Hallways, Lobbies, etc.).
      a. Prime Coat: Primer, latex, interior:
         1) Manufacturer’s Recommended Primer.
      b. First Coat: Microbicidal Latex, interior, matching topcoat.
      c. Topcoat: Microbicidal Latex, interior, semi-gloss (gloss in restrooms walls and ceilings):
         1) S-W Paint Shield Interior Latex Microbicidal Paint, D12W51, at 4.0 mils wet, 1.8 mils dry, per coat. Brush and roll application only.

3.07 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces (walls):
   1. Latex System:
      a. Prime Coat: Primer, latex, interior. Eggshell
         1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
      c. Topcoat: Latex, interior, semi-gloss:
         1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

B. Concrete Substrates, Pedestrian Traffic Surfaces (floors):
   1. Concrete Floor Sealer: Transparent finish. Application per manufacturer’s instructions.
      a. Two coats: Water–based coating such as Okon Seal & Finish - Concrete & Masonry Sealer or approved equal.

C. CMU Substrates:
   1. Latex System:
      a. Block Filler: Block filler, latex, interior/exterior:
         1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
      c. Topcoat: Latex, interior, semi-gloss:
         1) S-W ProMar 200 Zero VOC Latex, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
      d. Topcoat: Latex, interior, semi-gloss:
         1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
2. Water-Based Light Industrial Coating System: (For added durability)
   a. Block Filler: Block filler, latex, interior/exterior:
      1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
   c. Topcoat: Light industrial coating, interior, water based, semi-gloss:
      1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

3. Epoxy System: Wet Area’s Immersion Grade (Showers, Wet Areas)
   a. Prime Coat: Epoxy, Block Filler
      1) S-W Kem CatI-Coat HS Epoxy Filler/Sealer, B42W400 Series
         (10-20 mils DFT)
   b. Epoxy, high-build matching topcoat.
   c. Topcoat: Epoxy, high-build, semi-gloss:
      1) S-W Macropoxy 646-100, B58-600 Series, at 5.0 to 10 mils dry, per coat

D. Metal Substrates (Aluminum, Steel, Galvanized Steel):
   1. Waterbased Acrylic System: (Standard system for doors & frames).
      a. Prime Coat: Primer, rust-inhibitive, water based:
         1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
      c. Topcoat: Water-based Acrylic, semi-gloss, interior:
         1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
   2. Waterbased/Alkyd Urethane System: (Simple upgrade for interior metals 5h pencil hardness)
      a. Prime Coat: Primer, rust-inhibitive, water based:
         1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
      c. Topcoat: Water-based alkyd-urethane, semi-gloss, interior:
         1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils wet, 1.4 mils dry, per coat.
   3. Water-Based Dry-Fall System: Exposed Ceilings
      a. Top Coat: Dry-fall latex, flat:
         1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils wet, 1.5 mils dry.
      b. Top Coat: Dry-fall latex, eggshell:
         1) S-W Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, at 6.0 mils wet, 1.9 mils dry.
4. Water-Based High Performance: Exposed Ceilings (Pools, Wet Areas)
   a. Prime Coat: Zinc: (call out in Division 5, commercial blast required for zinc)
      1) S-W S-W Zinc Clad III HS – 100 (refer to data sheet), omit if factory primed
   b. Intermediate Coat: Hi-Build Epoxy
      1) S-W Macropoxy® 646-100 Fast Cure Epoxy, B58-600 Series, 5-10 mils dry per coat.
   c. Top Coat: Urethane Gloss:
      1) S-W Waterbased Acrolon 100, B65-720 Series, 2-3 mils dry per coat.

E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
   1. Waterbased/Alkyd Urethane System:
      a. Prime Coat: Primer sealer, latex, interior:
         1) S-W Premium Wall & Wood Primer, B28W8111, at 4.0 mils wet, 1.8 mils dry.
      c. Topcoat: Water-based Acrylic, semi-gloss, interior:
         1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

F. Wood Substrates: Stain and Waterbased Urethane finish.
   1. Transparent System: Low VOC Finish
      c. Topcoat: Clear, interior, satin, Gloss Level 3:
         1) S-W Wood Classics WB Polyurethane, A68 Satin.

G. Gypsum Board Substrates:
   1. Latex System: Select Topcoat Sheen – Semi-gloss for is standard for APS
      a. Prime Coat: Primer, latex, interior:
         1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
      c. Topcoat: Latex, interior, flat:
         1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
      d. Topcoat: Latex, interior, eggshell:
         1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
      e. Topcoat: Latex, interior, semi-gloss:
         1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
2. Water-Based Light Industrial Coating System: (Consider for added durability and burnish protection, hallways, bathrooms, kitchens)
   a. Prime Coat: Primer sealer, latex, interior:
      1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 wet, 1.0 mils dry.
   c. Topcoat: Light industrial coating, interior, water based, eggshell:
      1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   d. Topcoat: Light industrial coating, interior, water based, semi-gloss:
      1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

3. Epoxy System: Wet Area's Immersion Grade (Showers, Wet Areas)
   a. Prime Coat: Epoxy, Block Filler
      1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 wet, 1.0 mils dry Epoxy, high-build matching topcoat.
   c. Topcoat: Epoxy, high-build, semi-gloss:
      1) S-W Macropoxy 646-100, B58-600 Series, at 5.0 to 10 mils dry, per coat

4. Gypsum Board Projection Walls:
   a. Prime Coat: Primer sealer, latex, interior:
      1) S-W ProMar 200 Primer, B28 Series, at 4.0 mils wet, 1.5 mils dry.
   c. Topcoat: Latex, interior, flat, (Gloss Level 1):
      1) S-W SuperPaint Interior Latex, at 4.0 mils wet, 1.6 mils dry, per coat. SW 7757 High Reflective White.

END OF SECTION
Division Ten

SPECIALTIES
SECTION 10 1400

SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior signage of the following types:
   1. ADA compliant interior signage.
   2. Room Signs.
   3. Restroom Signs.

B. Interior letters

C. Building identification letters.

D. Building plaque.

1.02 REFERENCES


1.03 SUBMITTALS

A. See Section 01 3300 - for submittal procedures.

B. Product Data: Manufacturer's descriptive literature.

C. Shop Drawings: List sign styles, letterform and letter heights, locations and dimensions of each interior sign. Submit manufacturer's product data and installation methods for each type of sign required.
   1. Manufacturer to include Owner's finalized signage schedule. The room names and numbers shown on the floor plans may differ from the final names and numbers selected by the Owner. Confirm all signage prior to manufacturing.

D. Submit supplier's standard color samples for purposes of color selection of ADA appliqué. Color samples must be actual materials used in signage, printed color charts are not acceptable.

E. Submit copy of manufacturer's product warranty.

F. Selection Samples: One complete set of color chips representing manufacturer's full range of available colors.

G. Verification Samples: One full size samples, representing type, style and color specified including method of attachment.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.
B. Printed background inserts must be created with the approval of architect and end user and may include use of graphic content such as logos or graphic motifs and may also require matching of colors from approved interior finishes palette.

C. Printed background inserts must be manufactured in color managed work flow with the following capacities:
   1. All printing must be done using a profiled printer with transmissible ICC profile.
   2. All approved colors used in final design must have LAB values recorded and submitted to architect/owner for future reference.
   3. Printing must be performed on calibrated printer such that future orders of insert can be reproduced within 5 Delta E of recorded LAB values.

D. Manufacturer must provide template for changeable (transparency) inserts in MS Office Word format. Template file must include cut lines to indicate proper size of finished insert.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Century Sign Builders; www.csbsigns.com

B. Gemini Incorporated, www.signletters.com; 800-538-8377

C. Vista System Inc., www.vistasysign.com

D. Substitutions: See Section 01 6300 - Product Substitution Procedures.

2.02 INTERIOR SIGNS

A. ROOM IDENTIFICATION, and RESTROOM SIGNS: shall be constructed to be ADA-Compliant (ANSI A117.7) with changeable message inserts and conform to a curved extruded aluminum frame of the sizes specified. This sign/product includes assembly with the following characteristics:

B. Basis of Design: Diversity Signs or Vista System, Inc.

   1. ADA Insert.
      a. Tactile lettering and symbols shall be formed using rotary engraving method and bonded to sign plaque using 3M Scotch 467HP adhesive. Lettering and symbols must have 1/32” return cut to 22 Degree angle. Letters, and symbols must be constructed with materials having embedded coloration that is the final approved color for the signs. Products with painted or otherwise applied coloration method are not acceptable.
      b. Text shall be accompanied by Grade 2 Braille on signs requiring Braille.
      c. Lettering color black.
d. Room Numbers shown. Information provided by Architect. Schedule in the drawings may not have the most current numbers and names. Finalize all prior to production.
e. Letter Style: As selected by Architect from manufacturer’s standard.
f. Sign plaques, lettering, and symbols shall have a matte or eggshell finish.
g. Insert Base shall be constructed using 0.0625” single-ply non-glare acrylic multipolymer material with either continuous embedded pigment or a micro-surfaced color layer. (depending on color selection).

2. Transparency Insert
   a. Changeable message insert will be fabricated from commonly available transparency media no less than 5 mil thick that is compatible with inkjet or laser printers.
   b. Manufacturer is to provide all changeable inserts for signs during initial installation.
   c. Room names shown. Information provided by Architect.
   d. Manufacturer will provide template file to end-user/client allowing for new inserts to be created for changeable (transparency) inserts. Provided file must integrate with client's already existing software environment and note require the implementation of new or proprietary software.
   e. Printed background inserts must be created with the approval of architect and end user and may include use of graphic content such as logos or graphic motifs and may also require matching of colors from approved interior finishes palette.

3. Opaque (Printed) Insert
   a. Opaque graphic insert will be created using a standard printing process. Insert material may include: Printed paper, artistic papers, velum, etc.
   b. Graphic element as designed by Architect, color selected from manufacturers full range.
   c. Printed insert must be of high quality and perform within the known limitations of the selected printing process.
   d. Printed background inserts must be manufactured in color managed workflow with the following capacities:
      1) Printing must be done using a profiled printer.
      2) Approved colors used in final design must have LAB values recorded and submitted to Architect / Owner for future reference.

4. Curved Aluminum Sign Frame
   a. Provide curved aluminum sign frame as provided by Vista Sign Systems Inc. Produce smooth, curved aluminum based panel sign surfaces with interchangeable faceplates constructed to remain flat under installed conditions and within tolerance of plus or minus .015” when measured diagonally.
   b. Aluminum frame shall be constructed from curved aluminum extrusions and contoured frame edge profiles with two (2) interlocking screw mounted end caps.
   c. Aluminum frame shall be capable of containing both the opaque insert and changeable insert behind the clear ADA insert (which it also must contain)
   d. Aluminum frame allow that inserts are changeable but cannot be accessed without a tool or implement, and do not require any part of the frame to be disassembled to change the insert. Inserts may be removed with a suction cup.
   e. Aluminum sign frame shall be silver, clear anodized.
   f. End caps, provided with matching screws, shall be brushed aluminum, clear anodized.
   g. Clear cover for extrusion thick polycarbonate, glossy one side, non-glare one side.

5. Sign Sizes:
   a. Room identification signs, 8.5” W by 5.5”H (For all rooms)
   b. Restroom signs, 8.5” W by 11”H. (For all restrooms)

6. Text and Numbers: To be selected by Architect.

C. INTERIOR VINYL LETTERING (To be applied to the interior side of the exterior door near the gym, lettering to be read from the outside face of the door as shown on drawings)
1. Provide signs made of individual letters made of cut vinyl graphic film applied directly to mounting surface (glass, smooth wall, doors, etc.).

2. Material & Colors:
   a. Opaque & Translucent: To be constructed of high performance cast vinyl graphic film products such as 3M Scotchcal or equal with a 5 year or greater warranty.

3. All lettering must be computer cut from professional quality artwork. No hand cut vinyl film shall be installed.

4. Signs shall be cut from sufficiently large rolls of material to minimize seams or joining of material to create one sign.

5. Signs shall be provided in the sizes & quantities indicated on the shop drawings.

6. Installation method:
   a. Signs shall be installed free of bubbles, wrinkles or other anomalies.
   b. Provide signs as reverse applied (second surface) as required.

D. EVACUATION PLAN SIGNS

1. General Design: Evacuation plan holder signs shall be constructed to hold a printed graphic insert (evacuation plan) by forming a space between two layers of material (lens & backer) where the insert is contained. Decorative borders will be added to the top and bottom edges.

2. Backer material: Non-Glare plastic sign panel
   a. Colored non-glare acrylic multi-polymer by Rowmark plastics.
   b. Products with painted or otherwise applied coloration method are not acceptable.
   c. Finishes and color as per approved shop drawings.

3. Lens or cover material: lens and covers shall be constructed using 0.0625" (322-101) clear single-ply non-glare acrylic multi-polymer (Rowmark).

4. Decorative Border Material: Non-Glare plastic sign panel
   a. Colored non-glare acrylic multi-polymer by Rowmark plastics.
   b. Products with painted or otherwise applied coloration method are not acceptable.
   c. Bond to sign plaque using 3M Scotch 467HP adhesive.
   d. Border thickness as per approved shop drawings.
   e. Finishes and color as per approved shop drawings.

5. Printed graphic inserts: Printed inserts will be created using a satin-coated, tear-resistant, rigid PVC media with eco-solvent waterfast & UV stable inks.
   a. Printed background inserts must be manufactured in color managed workflow with the following capacities:
      1) All printing must be done using a profiled printer with transmissible ICC profile.
      2) All approved colors used in final design must have LAB values recorded and submitted to architect owner for future reference and duplication.
      3) Printing must be performed on calibrated printer such that future orders of insert can be reproduced within 5 Delta E of recorded LAB values.

6. Installation method:
   1) Wall mounted signs: Signs shall be mounted using double-sided vinyl foam tape (1/16" thickness), silicon adhesive, or mechanical anchors as per the approved shop drawings.

2.03 EXTERIOR SIGNS

A. BUILDING IDENTIFICATION LETTERS:

2. Type: Individual mounted letters.
3. Construction: One-piece; Cast Metal.
4. Lettering Style: Helvetica
5. Wall Mount: Concealed mounting.
7. Finish: Brushed.
9. Building Title: As shown on drawings.
10. Installation Locations: As indicated on drawings.

B. BUILDING PLAQUE:
1. Construction: One-piece; Cast Aluminum, raised lettering and relief, silver color.
2. Plaque Thickness: 3/8 inch thick.
3. Size: 24 inches X 24 inches
5. Background Color & Texture: Black Leatherette.
9. Layout and Artwork: To be provided by Architect. Graphic elements may be included in the design. Allow for at least 1,000 letters in text.
10. Installation Location: To be determined during construction by Owner and Architect.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine installation areas to ensure that conditions are suitable for installation.
B. Examine signage for defects prior to installation. Do not install damaged signage.

3.02 PREPARATION
A. Verify mounting heights and locations for interior signage will comply with referenced standards.
B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.03 INSTALLATION
A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer’s recommended standard mounting system.
B. Remove adhesive from exposed sign surfaces as recommended by manufacturer.
C. Clean signs after installation as recommended by manufacturer.

D. Replace damaged products before Substantial Completion.

END OF SECTION
SECTION 10 2800
TOILET AND UTILITY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Accessories for toilet rooms, utility rooms.
B. Baby Changing Station.
C. Grab bars.
D. Toilet Compartment Accessories.
E. Shower Accessories.
F. Plumbing pipe safety cover.

1.02 RELATED REQUIREMENTS
A. Section 06 1000 - Rough Carpentry
B. Section 09 3000 - Tiling
C. Section 09 2116 - Gypsum Board Assemblies
D. Section 09 5100 - Acoustical Ceilings

1.03 REFERENCE STANDARDS
C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
C. Manufacturer’s Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Prior to ordering any accessories, coordinate with the Owner’s supplier/vendor for preferred products. (OFCI, Owner Furnished and Contractor Installed)
B. Acceptable Manufacturers: Refer to specified products and manufacturers. The Owner has standard fixtures. All substitutions will need Owner approval.
   1. Substitutions: Section 01 6000 - Product Requirements.
C. All items of each type to be made by the same manufacturer.

2.02 MATERIALS
A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
B. Keys: Provide Two keys for each accessory to Owner; master key all lockable accessories.
C. Stainless Steel Sheet: ASTM A 666, Type 304.
D. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.
F. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.
G. Adhesive: Two component epoxy type, waterproof.
H. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

2.03 TOILET ROOM ACCESSORIES
A. Toilet Paper Dispenser: Twin Jumbo Roll Dispenser. Unit 11.83" H x 19.29" W x 5.51" D.
   1. Product: Model 56TR Black, manufactured by TORK.
   2. Contractor Furnished, Contractor Install.
B. Surface-Mounted Paper Towel Dispenser: Mechanical Hand Dispenser. Unit 15.95" H x 12.32" W x 9.32" D.
   1. Product: Model 772828 Black, manufactured by TORK.
   2. Contractor Furnished, Contractor Install.
C. Liquid Soap Dispenser: Contractor Furnished, Contractor Install.
   1. Coordinate with owner for specific on item such as manufacture and product number.
D. Mirrors: Stainless steel framed, 6 mm thick tempered glass mirror.
   1. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   2. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
E. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, exposed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on drawings.
F. Plumbing pipe safety covers: Removable covers designed to insulate exposed plumbing pipes under lavatories and protect users from sharp or rough edges and burns from hot pipes. Fabricated with closed cell foam insulation covered with vinyl cover with velcro sealing strips and tamper-proof strap; Handy Shield as manufactured by Plumberex Specialty products, Inc. manufacturer's standard range.
   1. Types:
a. P-trap safety cover.
b. Supply pipe and valve cover.

toilet and utility accessories

2. Vinyl color: Selected by Architect from manufacturer's standard range.

3. Valve and supply pipe cover.

G. Feminine Hygiene Waste Receptacle: Stainless Steel Finish. 11-5/8" H x 8-1/4" W x 4-1/2"D.

1. Product: Model ND-1E, Manufactured by Hospeco.

2.04 BABY CHANGING STATION

A. Recessed Stainless Steel Baby Changing Station, Model No 9013 as manufactured by American Specialties, Inc. 441 Saw Mill River Road Yonkers, New York 10701-4913.

1. Construction: Recessed Baby Changing Station door, flange and cabinet shall be Type 304 stainless steel, all welded construction. All exposed surfaces shall be polished to a No 4 satin finish. The door shall be 16 gauge (1.6 mm) and the flange and cabinet shall be 18 gauge (1.3mm). The changing table shall be equipped with a rounded contoured pull handle and shall have a concealed damped gas spring to assist user in opening and closing unit with one hand.

2. Bed Liner: light gray, high impact plastic with a smooth finish for easy cleaning. The liner shall be shaped to cradle a child's body and shall be equipped with a child protection safety strap and cam buckle adjustable with one hand.

3. Accessories: Unit shall include two bag hooks, a bed liner dispenser, and a C-fold towel and multi-fold towel dispenser that needs no adapters.

4. Holding Capacity: Unit shall have a minimum holding capacity of 400 lbs. (181.4 kg). The strength of the supporting wall and hardware must be adequate to support the rated load. Unit shall provide graphic safety instructions in 4 languages.

5. Reference Standards: Unit shall comply with ASTM F-2285 and ANSI Z535

6. Warranty: (5) five years against defects in material or workmanship.

2.05 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: Owner Furnished, Owner Install

B. Janitor Room Metal Shelving Units: Owner Furnished, Owner Install

2.06 GRAB BARS

A. Grab Bars - Basic Requirements: Fabricated to comply with ASTM F446 and to withstand a 900 pound force, from ASTM A554 stainless steel tubing, 0.050 inch, Type 304, 18-8 alloy; formed 1-1/2 inch radius return to wall at each end; each end heliarc-welded to minimum 11 gage stainless steel circular flange; welds finished to match tube finish.

1. Sizes and configuration as indicated on drawings.

2.07 TOILET COMPARTMENT ACCESSORIES

A. Coat Hook with Bumper: Attached to back of wall partition; Solid aluminum casting, matte finish. Rubber bumper protects wall or partition surfaces.

1. Model B-212 by Bobrick

2.08 SHOWER ACCESSORIES

A. Folding Shower Seat:

1. Basis-of-Design Product: Bradley, #9569

2. Description: stainless steel tubing frame, stainless steel wall bracket, stainless steel retaining bracket, and melamine laminated seat over 1/2 inch solid phenolic core.

3. Seat: "L" shaped configuration, field convertible to left or right hand. Positive catch holds seat in up or down position.

5. **Seat color:** Matte white standard, or as selected from manufacturer’s standard colors.

B. **Shower Curtain Rod:**
   1. **Basis-of-Design Product:** Bobrick, B-9539
   2. **Description:** Straight shower curtain rod with plastic mounting flanges and stainless steel snap-on escutcheons to conceal hardware. 1-1/4 inch o.d. seamless stainless steel tubing with satin finish on exposed surfaces. Suitable for 36 inch shower stall.

C. **Shower Curtain:**
   1. **Basis-of-Design Product:** Herculite Products
   2. **Description:** 100% FR polyester fabric, water-repellant, mold and mildew resistant with rust-proof bead chain sewn into hem, nickel-plated grommets every 6” along top.
   3. **Size:** width equals length of rod plus 10% fullness, finished length 1/2 inch above shower basin or finished floor.
   4. **Color:** as selected by architect from manufacturer’s full color range.

D. **Robe / Towel Hook:**
   1. **Basis-of-Design Product:** Bobrick, B-76727
   2. **Description:** Double, contoured unit.
   3. **Material and Finish:** Stainless steel, No. 4 finish (satin).

2.09 **UNDER LAVATORY GUARDS**

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. Plumberex Specialty Products, Inc.
   2. Truebro by IPS Corporation.
   3. Equivalent as approved by Architect.

B. **Under Lavatory Guard:**
   1. **Basis-of-Design Product:** Truebro, Lav Guard 2
   2. **Description:** Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   3. **Material and Finish:** Antimicrobial, molded plastic, white.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. Verify that field measurements are as indicated on drawings.

**3.02 PREPARATION**

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

**3.03 INSTALLATION**

A. Install accessories in accordance with manufacturers’ instructions.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.
SECTION 13 3413.13
GREENHOUSE SYSTEM

PART 1– GENERAL

1.01 SECTION INCLUDES
A. Green House Structure
B. Steel Membrane
C. Doors And Frames
D. Ventilation Equipment
E. Heating And Cooling Equipment
F. Environmental Controls
G. Covering Material
H. Benches
I. Irrigation
J. Automated Shade System
K. Double Entry Insect Screen Vestibules
L. Poly Carbonate Coverings
M.

1.02 SUMMARY
A. Section Includes: Installation of pre-manufacture Green House System. The extent of the green house system is as indicated on the drawings. This greenhouse is to be furnished and installed according to the specifications and drawings.

1. Greenhouse dimensions are 30’ wide by 60’ long with a 10’ sidewall height

1.03 REFERENCE STANDARDS
A. ASTM A500 dimensional tolerances

1.03 SUBMITTALS
A. See Section 01 3300 - for submittal procedures.
B. Shop Drawings: Indicate materials, layout, dimensions, component profiles and elevations, assembly methods, cutouts, joint details, fastening methods, accessory listings, and hardware location, to a minimum scale of 1-1/2 inch to 1 foot (1:8). Include a schedule of finishes.
C. Product Data: Provide data for materials and hardware accessories.
D. Samples: Submit actual samples of architectural cabinet construction, illustrating proposed cabinet and shelf unit substrate and finish. Samples are not to be part of constructed work.
   1. Plastic laminate: as selected by Architect, minimum 12 inches square
   2. Hardware: Actual sample items of proposed pulls, shelf standards, locksets, and hinges demonstrating hardware design, quality, and finish
   3. Countertop: Submit actual samples of proposed items, demonstrating quality, color, texture, pattern, and finish. Sample in 3 inches square for with seam filler color samples.
E. No equipment or materials should be ordered or fabricated prior to approval of shop drawings

PART 2 – PRODUCTS

2.01 MANUFACTURES
A. Basis of Design: Stuppy Greenhouse Manufacturing, Incorporated: 1212 Clay North Kansas City, and Missouri 64116; 800-733-5025
B. Substitutions: Refer to Section 01 6300.
2.02 STRUCTURE
   a. The greenhouse will be a CS3 with column and truss spacing as designated by local code
   b. Sidewall height shall be 10 feet

2.03 Primary Structural Steel Members
   a. All steel members shall comply with ASTM A500 dimensional tolerances
   b. Columns shall be fabricated from 4 inch by 2 inch steel or 4 inch by 4 inch steel with minimum yield strength of 50,000 psi
   c. Truss top chords will be fabricated from 3 inch by 2 inch steel with minimum yield strengths of 50,000 psi
   d. Truss bottom chords will be fabricated from 3 inch by 2 inch steel with minimum yield strengths of 50,000 psi
   e. Truss webbing will be fabricated from steel with minimum yield strengths of 50,000 psi. Truss webbing will be attached to top and bottom chords (Standard is 1.5” square tubing)
   f. Roof purlins will be 3 inch by 2 inch steel with minimum yield strength of 50,000 psi. Purlins will have a bolted connection to trusses
   g. Endwalls will be framed with 3 inch by 2 inch rectangular steel tubing with minimum yield strength of 50,000 psi
   h. Gutters are to be extruded aluminum
   i. Column Base Plates will be 10”x10”, welded and galvanized
   j. No wood members are required or allowed to complete structure
   k. No rolled form pipe or round columns allowed

2.03 Doors and Door Frames
   a. (2) single steel insulated ADA approved doors, both to be equipped with both lever lock and panic bar LHL-5. Lock sets are to be included in hardware package. Doors are to comply with ANSI A250.B, Level 3
   b. (1) 8’x8’ Insulated Manual Rollup Door
   c. (1) 8’x10’ Double Sliding Door – 8mm twin-wall polycarbonate material
   d. All doors should be furnished with appropriate framing and hardware

2.04 Ventilation Equipment
   a. Horizontal Air Flow Fans – Acme HAF20A fans. Quantity of 4 to be installed (2 per zone). Fans to have variable speed control capabilities in each zone
   b. Exhaust Fans – Cool Air MAL236H– Single Speed - Quantity of 4
      1. Fans must include automatic shutters, inlet/outlet guards, and belt tighteners.
      2. Exhaust fans to be manufactured by Cool Air Corporation and horizontal air flow fans are to be manufactured by Acme Engineering, Inc.
      3. Exhaust fans are to have aluminum fan blades. Steel propeller fans are not acceptable. Fans are located on sidewall of structure
   d. Inlet Vents and Vent Operators: A single run of vents shall be made up of a top rail and bottom rail of extruded aluminum and bolted together in accordance with manufacturer instructions. All vents shall have provisions made at the hinge point to prevent creeping of the vents. Quantity of (2) 3’x27’ are required and are to be located on sidewall of structure
      1. VC100 Vent opener to be manufactured by Wadsworth Controls

2.05 Heating Equipment
   a. Greenhouse is to be equipped with (2) Modine HD100 Propane heaters (1 per zone)
b. Heaters sized for a Delta T of 55 degrees  
c. Heaters are to have stainless steel burners and exchangers  
d. Heaters with aluminum heat exchangers are not acceptable  
e. Double walled stacking is to be included as well as appropriate heater hangers to mount the heaters

2.06 Cooling Equipment  
  a. Quantity of (2) 3’x27’ Evaporative pad system will consist of 4” pads made of cross-fluted cellulose paper  
b. Distribution and return system to be Self Contained PVC Sump System by Cool Air Corp  
c. No wood support stringers are allowed

2.07 Environmental Controls  
  a. Wadsworth Seed Environmental Controller to be used. Controller is to be complete with contractor panel and wiring diagram.  
b. Controller to include the following:  
  c. (1) Seed 24 Output Multiple Zone Control System M-5650  
d. (1) Custom Contactor Zone 1 & 2 Control Panel - 30” X 24” (shared by both zones)  
e. (2) Custom Contactor Zone 1 or 2 Mech Panel - 20” X 20”  
f. (2) Temp & Humidity Aspirator for Seed  
g. (1) Outdoor Temperature Sensor with Solar Shroud, 25’ Cable  
h. 200 ft Cable 4-PR Shielded #22 AWG  
i. (1) Engineering for Custom Seed Control Package

2.08 Covering Material  
  a. Roof, sides, and ends to be covered with Verolite 1500g 8mm Twin Wall Clear Polycarbonate by Amerilux  
b. Panels are to be of virgin resin. Regrind is not acceptable.

2.09 Benches
  a. (10) stationary benches total with the following sizes: (2) 2’x30’, (8) 5’x 10’  
b. (6) rolling benches with the following sizes: (6) 4’x24’  
c. Benches will be Mor-Space Benches prefabricated by greenhouse manufactured  
d. Benches are to be designed with aluminum side frame, 1.5” square tube legs, adjustable connections, and Durabench Bench tops  
e. Appropriate bracing for design of bench is to be included

2.10 Irrigation  
  a. Irrigation layout per drawing  
b. Each zone to have independent irrigation controls through the Seed controller. Zones will consist of propagation, drip irrigation, and overhead sprinkler irrigation. Both zones will include a propagation system with heating mat, bench watering heads, mist control, 4 station water control, PVC piping and fittings and a fertilizer injector.

2.11 Automated Shade System  
  a. Shade will open and retract between trusses using a VC2000 Wadsworth motor – cable drive system not acceptable.  
b. Quantity of (2) Slope/Flat/Slope 30’ x 30’ Shade System with Tempa 5555 FR shade material  
c. Shade will open and retract between trusses using a VC2000 Wadsworth motor – cable drive system not acceptable

2.12 Root Zone hot water heating system
a. EPDM tube bed heat system with 1” OD End fed manifolds for (1) zone (research zone benches)
b. Zone 1 - (8) – 60” x 10’ bench heat with tubing spaced 2 inches on center (rolling capable)
c. Includes manifolds, flexible PVC tube, EPDM Tubing and fittings, Hose Clamps, zip ties and tube spacers for locking EPDM in place
d. Excludes Hot Water Heater and PVC Tubing

2.13 Double Entry
a. CS3-A frame Double Entry Vestibule to match adjoining structure
b. Doors in vestibule included in 2.3 Doors and Door Frames
c. Covering to be as described in 2.8 Covering Material
d. Columns of vestibule to be baseplated to concrete slab (slab by Others)

2.14 Insect Screen Vestibules
a. In 30’x30’ Research Zone only, cover each 30’ sidewall side with galvanized steel bowed framing and 50 mesh insect screen for insect exclusion. Include all extrusion and hardware as required for installation.

2.15 Polycarbonate Covering Upgrade
a. Replace Verolite 1500g 8mm Twin Wall Clear Polycarbonate with Thermoglas Plus 1700g 8mm Triple Wall Clear Polycarbonate

2.16 Environmental Controller Training
a. Wadsworth Controller Technician Training and Demonstration for (1) day

PART 3 – EXECUTION

3.01 Warranty
a. Greenhouse shall have a warranty period of one year for defects of structural and glazing. Equipment in the greenhouse will carry the manufacturer’s standard warranty for parts and labor.

3.02 Scope of Work
a. It is the responsibility of the greenhouse manufacturer to erect the frame on concrete foundation prepared by Others, apply the greenhouse covering, and hang all of the specified equipment in place. Brining water and electric to the greenhouse and to the equipment within the greenhouse is to be done by Others, not the greenhouse manufacturer.

3.03 Instruction
a. Approved representative of the greenhouse manufacturer to visit the job site a minimum of one time during construction to meet with building erectors and once after construction to meet with the owner.
b. Trailer drop is to be included. All materials will ship on a single trailer. Trailer will set on job site for 30 days. Trailer will supply secured, covered storage for your crew to work from and will eliminate the need to receive and store multiple shipments.
Division Twenty Two

PLUMBING
SECTION 22 0000
PLUMBING INDEX

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Plumbing Work, as indicated on the Drawings and specified herein. Plumbing work indicated on the Drawings and/or specifications covering other trades shall conform to Division 22 of these Specifications.
B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Plumbing systems shall be accomplished without additional cost to the Owner.
C. Furnish all labor and materials required for plumbing service connections to all the various items of equipment requiring plumbing or piping throughout the project shown on the Contract Drawings (even if not shown on Plumbing Drawings). Coordinate with other trades for the installation of required connections and service.

1.03 PLUMBING DIVISION INDEX
220500 GENERAL PLUMBING REQUIREMENTS
220523 VALVES
220700 PIPING INSULATION
221000 PIPE AND PIPE FITTINGS
221113 DOMESTIC WATER SYSTEMS
221123 NATURAL GAS PIPING SYSTEMS
221313 SOIL AND WASTE PIPING SYSTEMS

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION
SECTION 22 0500
GENERAL PLUMBING REQUIREMENTS

PART 1- GENERAL

1.01 SUMMARY
A. Section Includes: General Plumbing Requirements specifically applicable to Division 22 sections in addition to Division 1- General Requirements.
B. Scope:
   1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, ventilating, and plumbing including site utility work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.02 REFERENCES
A. Standard Requirements:
   1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.
C. The Contractor shall secure all permits and licenses for his work and shall pay all fees in connection with such permits and licenses.
D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.
E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.
F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:
   1. AGA American Gas Association
      1515 Wilson Boulevard
      Arlington, VA  22209
   2. ANSI American National Standards Institute
3. ASHRAE  American Society of Heating Refrigerating and Air Conditioning Engineers
   345 East 47th Street
   New York, NY  10017
4. ASME  American Society of Mechanical Engineers
   345 East 45th Street
   New York, NY  10017
5. ASPE  American Society of Plumbing Engineers
   960 Illuminating Building
   Cleveland, OH  44113
6. ASTM  American Society for Testing and Materials
   1916 Race Street
   Philadelphia, PA  19103
7. AWWA  American Water Works Association
   6666 West Quincy Avenue
   Denver, CO  80235
8. AWS  American Welding Society
   2501 NW 7th Street
   Miami, FL  33125
9. CISPI  Cast Iron Soil Pipe Institute
   1499 Chain Bridge Road
   McLean, VA  22101
10. FM  Factory Mutual System
    1151 Boston-Providence Turnpike
    Norwood, MA  02062
11. FS  Federal Specification
    General Services Administration
    Specifications and Consumer Information Distribution
    Section (WFSIS)
    Washington Navy Yard, Building 197
    Washington, DC  20407
12. NBFU  National Board of Fire Underwriters
    5530 Wisconsin Avenue, Suite 750
    Chevy Chase, Maryland 20815
13. NEC  National Electric Code (of NFPA)
14. NEMA National Electrical Manufacturer's Association
   2101 L Street, NW
   Washington, DC 20037

15. NFPA National Fire Protection Association
   Battery March Park
   Quincy, MA 02269

16. NSF National Sanitation Foundation
   Box 1468
   Ann Arbor, MI 48106

17. OSHA Occupational Safety and Health Administration
   U.S. Department of Labor

18. PDI Plumbing and Drainage Institute
   5342 Boulevard Place
   Indianapolis, Indiana 46208

19. TIMA Thermal Insulation Manufacturers Association
   Technical Services
   1420 King Street
   Alexandria, VA 22314

20. UL Underwriters Laboratories, Inc.
   333 Pfingston Road
   Northbrook, IL 60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.03 DRAWINGS

A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.

B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately and his decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at his expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, he shall bear all extra expense involved.

C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect/Engineer whose decision shall be
final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install, require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting his bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at his (the Contractor's own expense).

G. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

I. Utilities: The location, size, and pressure of utility lines are shown in accordance with the data given this office by others. As Architect/Engineers, we cannot and do not guarantee the accuracy of this data. Each Bidder shall check and verify this data. The points of connection to utility lines are approximate only and shall be verified by each Bidder prior to submitting his Bid.

J. Site visit: The Contractor shall visit the site prior to bidding and satisfy himself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy himself as to the extent of work required to be completed.

1.04 SYSTEM DESCRIPTIONS
A. Not Used.

1.05 PRIOR APPROVALS
A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is not required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by him is acceptable.

1.06 SHOP DRAWINGS
A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide him with as many review copies as he
may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless he has, in writing, specifically called attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve him from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra costs is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render him liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: reference to all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.07 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e. AHU/Air Handling Unit) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:

1. Pipe Insulation
2. Coils
3. Plumbing Fixtures and Trim
4. Cross Connection Control Devices
5. Hydronic Air Control Devices
6. Plumbing Equipment
7. Heat Exchangers
8. Flexible Pipe Connections
9. Roof Top Equipment
1.08 QUALITY ASSURANCE

A. General: Comply with Division 1.

B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.

C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install his work with relation to existing building conditions and shall be entirely responsible for the correctness of his work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.

D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.

E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.

F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to his work, and for the correct location of pipe sleeves.

G. Each Contractor shall coordinate his work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.

I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing, Heating, Cooling, Ventilation, and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's
instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt and concrete patching, cutting and patching existing floor, etc., shall be part of this Contractor’s responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at his expense.

K. Cutting and Repairing:

1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.

2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.

3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.

1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.

2. Unless otherwise noted, foundations shall be a minimum of 6-inch high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:

2. Uniform Mechanical Code.
4. Governing Fire Department Requirements
5. Utility Company Requirements
6. National Fire Protection Association Standards
7. NFPA 70 - National Electrical Code
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
10. NFPA 13 - Sprinkler Systems
11. NFPA 101 - Life Safety
12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment

O. Access Panels
1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.09 DELIVERY, STORAGE AND HANDLING
A. General: Comply with Division 1.
B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.
C. Acceptance: Check and sign for materials to be furnished by others for installation under Division 22 upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.
D. Protection: Close ends of pipe at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.
E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.
F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.10 PROJECT CONDITIONS
A. Performance: All systems are to be rated at [5,500 ft.] elevation.

1.11 SEQUENCING AND SCHEDULING
A. General: Comply with Division 1.
B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.
C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT

A. All mechanical equipment controls wiring, conduit, relays, interlocks, and all accessories required for a completely operational controls system shall be the complete responsibility of the mechanical contractor. The mechanical contractor has the option to hire the project electrical contractor or any qualified controls contractor to install mechanical controls wiring and conduit. Section 253000 for coordination requirements between mechanical, electrical, and controls subcontractors.

B. Electrical items such as disconnect switches and motor starters associated with equipment provided by Division 22, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.

C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.

D. All motors shall meet all the requirements of all Electrical Divisions.

   1. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. All motors shall have copper windings. All motors to have minimum power factor of 85% or have switched correction to 90%. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall a service factor of 1.00 with total temperature is of 65°C in the above conditions. Motors located in areas exceeding 40°C ambient shall be factory-rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS

A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.

B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.
1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems, as noted below:

1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

2. For Each Product System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.

3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.

4. Warranties and Bonds: Bind in copy of each.

5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

6. Include color-coded wiring diagrams as installed for control system.

7. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.

8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

9. Provide servicing and lubrication schedule and list of lubricants required.

10. Include manufacturer’s printed operation and maintenance instructions.

11. Include sequence of operation by controls manufacturer.

12. Provide original manufacturer’s part list, illustrations, assembly drawings and diagrams required for maintenance.

13. Provide control diagrams by controls manufacturer as installed.

14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow and control diagrams.

15. Provide list of original manufacturer’s spare parts and recommended quantities and to be maintained in storage.

16. Include Test and Balance (T&B) Reports as specified in Section 230593.

B. The Mechanical Contractor shall also provide training as required by Section 230100 to the Owner’s operation and maintenance personnel.
1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, he agrees to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum.

1. Clean strainers in piping.
2. Fans and/or pumps be lubricated and oiled once every four (4) months.
3. Controls shall be calibrated throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
4. All equipment manufacturer's service recommendations shall be followed during this period.

1.18 FLUSHING AND DRAINING

A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the ducts or pipes shall be repaired by this Contractor at his expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.19 CLEANING

A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned and all obstructions, surplus materials, etc., removed.

1.20 GUARANTEE

A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by him under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at his expense, without expense to the Owner, at any time within one year after installation is accepted by the Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.)
1.21 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.

B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetrations are and the size of the opening.

1.22 PIPE SLEEVES

A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2-inch above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.23 PIPE HANGERS

A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inch, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inch, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:

1. Pipe up to and including 2" 3/8" rods
2. Pipe 2-1/2", 3" and 3-1/2" 1/2" rods
3. Pipe 4" and 5" 5/8" rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1. Pipe up to and including 1-1/4" 8'
2. Pipe 1-1/2" and 2" 10'
3. Pipe 2-1/2" and 3" 12'
4. Pipe 3 1/2" and 4" 14'
5. Pipe 5" and 6" 16'

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:
1. Pipe up to 3/4" in size 5'
2. Pipe 1" and 1-1/4" 6'
3. Pipe 1-1/2" and larger 10'

E. There shall be a hanger within 2 inch of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Expansion bolts shall be Ackerman-Johnson or Hilti.

H. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.24 PRESSURE VESSEL CERTIFICATION
A. Not used.

1.25 ISOLATION
A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

<table>
<thead>
<tr>
<th>Motor HP</th>
<th>Equipment Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 5</td>
<td>90%</td>
</tr>
<tr>
<td>7-1/2 to 15</td>
<td>93%</td>
</tr>
<tr>
<td>20 to 40</td>
<td>95%</td>
</tr>
<tr>
<td>50 to 100</td>
<td>97.5%</td>
</tr>
</tbody>
</table>

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.
1.26 TESTING
   A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.
   
   B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.27 CERTIFICATIONS
   A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.28 GENERAL PIPING INSTALLATION REQUIREMENTS
   A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.
   
   B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.
   
   C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.
   
   D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.
   
   E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.
   
   F. Welding: Refer to Paragraph 1.29 of this section of these specifications.
   
   G. Bending: No bending of pipe will be permitted.
   
   H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such
other work, and not less than 1/2 inch between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
   1. Those in non-hazardous service, such as water, shall discharge directly to outside.
   2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
   3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints
   1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
   2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
   3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.
O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

P. Hanger Supports:

1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.

2. Do not bend rods to circumvent an obstruction.

3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.

4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet), or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.

5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. Remaining straight portion of rod may be used.

1.29 WELDING

A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:

1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to his proficiency. Tests shall be conducted at no additional expense to the Owner.

2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.30.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6 inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.30 TESTING FOR PIPING SYSTEMS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time, to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Safety: Since the Risk of failure, with the attendant possibility of injury, is appreciable greater with further testing, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.

C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.

D. Pressure Ratings: These tests shall not be used to establish pressure ratings.

E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system.
F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.

G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2 hour period. Leaks shall be located by soap testing

1. Test Pressures:
   a) Natural gas piping: as required by governing code
   b) Domestic Hot and Cold Water: 100 psig or 50% more than operating pressure, which ever is greater.

J. Sanitary Waste and Soil System:

1. After all soil and waste pipes and vent stacks have been installed, the outlets shall be plugged and the piping system filled with water in vertical sections to the highest point of the system and allowed to remain filled for twenty-four (24) hours and shall prove to be leaktight under such conditions. A one inch drop will be allowed in water level in standpipe. This test may be conducted in segments as required by the sequence of construction. Contractor shall certify in writing that all tests were satisfactorily completed before piping was concealed, and shall submit the certification to the Architect/Engineer for his records and for transmittal to the owner.

K. Test Report

1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.31 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay or absence of coordination.

1.32 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. He shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.33 SAFETY GUARDS

A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven
equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.34 PROTECTION

A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned and the entire system shall be delivered in a perfect, unblemished condition.

1.35 PAINTING AND IDENTIFICATION

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.

B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave his equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inch in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.36 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.37 SUPPLIER RESPONSIBILITY

A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or his representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at anytime requested by the Architect/Engineer (or his representative) during the construction or warranty periods.

END OF SECTION
## SECTION 22 0523
### VALVES

**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS  
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK  
A. All valves except lubricated plug valves and butterfly valves shall be manufactured by Nibco, Hammond, Lunkenheimer, Kennedy, Stockham, Walworth, Powell or Milwaukee.  
B. Lubricated plug valves shall be as manufactured by Rockwell, Milwaukee or Walworth.

1.03 RELATED WORK IN OTHER SECTIONS  
- 220000 - PLUMBING INDEX  
- 220500 - GENERAL PLUMBING REQUIREMENTS  
- 220700 - PIPING INSULATION  
- 221113 - DOMESTIC WATER SYSTEMS  
- 221123 - NATURAL GAS PIPING SYSTEMS  
- 221313 - SOIL AND WASTE PIPING SYSTEMS  
- 230519 - PIPING SPECIALTIES

1.04 IDENTIFICATION OF VALVES  
A. Each valve shall be provided with a stamped metal tag secured to the valve with metal chain. Tag shall indicate both the service and function of each valve. The Contractor shall furnish two prints of drawings showing floor plan for each floor with all valves accurately located and labeled. These drawings shall be neat and easily read.

**PART 2 - PRODUCTS**

2.01 VALVES  
A. Heating water, domestic water and low pressure steam (<15 psi):  
   1. Gate Valves 2" and Under: Nibco No. T134, rising stem, ductile iron hand wheel, union bonnet, solid wedge disc, bronze body, Class 150 psi working pressure.  
   2. Gate Valves 2-1/2" and Larger: Nibco No. F617-0, bronze trimmed, solid wedge disc, iron body, O.S. & Y., 125 psi working pressure.  
   4. Swing Check, 2-1/2" and Larger: Nibco No. F938-31, iron body, bolted bonnet, Class 150, bronze trimmed, check valves installed at discharge of pumps shall be non-slam type.  
   5. Globe Valves 2" and under: Nibco No. T235, union bonnet, integral seat, Class 150 bronze body with renewable disc.

7. Gate Valves 3" and Under for Copper Pipe: Nibco No. S134, union bonnet, Class 150 bronze rising stem wedge disc.


9. Angle Valves 2" and Under for Copper Pipe: Nibco T335, Class 150, Union Bonnet, integral seat, renewable seat & disc.

10. Angle Valves 2 1/2" and Larger: Nibco F8180-B, Class 125, bolted bonnet cast iron, renewable seat & disc., bronze trim.

11. Check Valve for 3" and under for Copper Pipe: Nibco S-433, Y-pattern, swing type, all bronze, renewable seat & disc.

12. Manual Balancing Valves:
   a) 2" and Under: Nibco T-585-70 ball valve or Milwaukee Butterball butterfly valve with calibrated flow set handle.
   b) 2-1/2" and Larger: W.C. Norris butterfly valves with lever with infinite throttling position as specified below.

13. Circuit Balancing Valves: Balance Valves shall be “Circuit Setter” balance valves as manufactured by Bell & Gossett.

14. Ball Valves:
   a) 1/2" to 2": Nibco No. T-585-70, two piece body, bronze, screwed ends, Teflon seats, straight through flow design.

15. Lubricated Plug Valves: Rockwell Mfg. Co. “Permaturn” lubricated plug valves Fig. No. 143. Provide valve handle for each valve. Valves shall have tapered plugs with thermally bonded lubricated film.

16. Water Pressure Relief Valves for makeup to heating and cooling systems, and relief for heating and cooling system, Bell & Gossett No. 1170 unless otherwise noted.

17. Relief Valves for hot water generators and heating converters. ASME labeled temperature and pressure relief valves shall be installed on the hot water generator. Pressure relief valve shall be installed on the converter set for 30 psi. Valves shall be sized for the full heating capacity. Discharge from valves shall be piped to the nearest floor drain.


B. Median Pressure Steam (15-150 psi)

1. Gate Valves 2" and Under Nibco Co. T-174 SS, union bonnet, solid wedge, rising stem, Class 300, bronze body.

2. Gate Valve 2-1/2" and Larger Nibco No. F-667-0, Class 250 bolted bonnet O.S. & Y., flanged iron body, bronze fitted, solid wedge.


5. Swing check valves 2" and under: Nibco No. T473, class 300 Y-pattern, horizontal swing renewable seat and disc., bronze body.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. All valves shall be installed in locations which will allow easy operation and facilitate maintenance.
   B. Gate and globe valves shall be installed with stems up.
   C. System balancing valves shall be installed where shown or required to balance waterflows to all system components. In general balancing valves shall be provided at the following locations:
      1. Each pump discharge, lubricated plug valve.
      2. Each main branch circuit, circuit balancing valve.
      3. At each water coil, circuit balance valve.

END OF SECTION
SECTION 22 0700
PIPING INSULATION

PART 1- GENERAL

1.01 SUMMARY
A. Furnish and Install:
   1. Piping insulation
   2. Jackets and accessories

1.02 RELATED DOCUMENTS:
A. The General Provisions of the Contract, including General and Special Conditions and
   the General Requirements apply to the work specified in this section.
B. Insulation furnished under this specification shall comply with all requirements of the
   State Energy Code and the recommendations of the latest edition of ASHRAE 90.1 and
   these specifications. The more stringent of these shall be the standard for the work
   provided under these specifications.
C. The work included under this specification consists of furnishing all labor, accessories,
   equipment and materials necessary for installation of all piping, and mechanical
   equipment insulation systems. This includes but is not limited to:
   1. Thermal Insulation
      a) Domestic hot water piping
      b) Steam and steam condensate piping
   2. Condensation Prevention Insulation
      a) Domestic cold water piping

1.03 RELATED WORK IN OTHER SECTIONS
220000 – PLUMBING INDEX
220500 – GENERAL PLUMBING REQUIREMENTS
230500 – GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

1.04 REFERENCES
A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission
   Properties by Means of Guarded Hot Plate Apparatus.
F. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
G. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and
   Tubular Form.
H. All preformed Fiberglass pipe insulation with factory applied jackets shall meet the following standards:

- ASTM E84 - Surface Burning Characteristics of Building Materials
- ASTM E96 – Jacket Permeance
- ASTM C335-Steady-State Heat Transfer Properties of Horizontal Pipe Insulation
- ASTM C547 - Mineral Fiber Preformed Pipe Insulation
- ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- ASTM C795 – Thermal Insulation for use in Contact with Austenitic Stainless Steel
- ASTM C1136 – Flexible Low Permeance Vapor Retarders for Thermal Insulation: Types I-IV.
- NRC 1.36 – Nuclear Regulatory Commission Guide 1.36 Non-Metallic Thermal Insulation
- NFPA 90A
- NFPA 255
- UL 723 – Composite Surface Burning Characteristic
- CAN UL C S102-M
- MIL – I – 22344D – Insulation, Pipe, Thermal, Fibrous Glass
- MIL – I – 24244C (Ships)
- USCG 164.109 – Non-Combustible Materials
- New York City MEA
- GreenGuard Certified for Indoor Air Quality
- GreenGuard Certified for Children and Schools

1.05 DEFINITIONS

A. Exposed Location: Exposed in mechanical rooms, rooms with finished walls or ceilings, and pipe chase between toilet rooms and equipment rooms.

B. Concealed Location: Located in furred spaces, attics, crawl spaces, above suspended ceilings in finished or unfinished rooms, or all other locations not exposed to view.

C. Cold Piping: Shall include domestic water and other piping with surface temperatures less than 70°F.

D. Hot Piping: Domestic hot water, supply and return and other piping with surface temperatures greater than 105°F.

E. Exterior Locations: All locations exposed, unexposed above grade or below grade beyond the building floor, wall or roof line of the structure or building

F. Location and Insulation Requirements:

1. Cold Water, including Non-potable Water (NPW): Insulate as follows:
   a) All piping above ceilings and in walls.
   b) Entire system except for stubouts to fixtures.
2. Domestic Hot: Insulate as follows:
   a) Entire system except for stubouts to fixtures.

3. Steam and Condensate Piping
   a) Entire System

1.06 SUBMITTALS
A. Comply with Section 220500.
B. Product Data: Provide product description, list of materials and thickness for each service and location.
C. Manufacturer's Installation Instructions: Indicate procedures, which ensures acceptable workmanship and installation standards will be achieved.

1.07 QUALITY ASSURANCE
A. Qualifications of Applicator: Company specializing in piping insulation application with five (5) years minimum experience.
B. Regulatory Requirements Fire Hazard Classification: Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E-84, NFPA 255, and UL 723 not to exceed 25 flame spread, 50 fuel contribution, and 50 smoke developed. Materials shall be labeled accordingly.

1.08 DELIVERY, STORAGE AND HANDLING
A. Compliance: Comply with Section 230500. Deliver materials to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness and store in a warm, dry location.

1.09 PROJECT/SITE CONDITIONS
A. Storage Environment: Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation while in storage.
B. Environmental Requirements: Perform work at ambient and equipment temperatures as recommended by the insulation manufacturer.
C. Protection: Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Repair or replace any such insulation or covering damaged prior to final acceptance of work.
D. Application Surfaces: Surface shall be dry, free of dust, oil, construction residues or other foreign materials before insulation is applied. Piping joints shall be dry, leak free and tested before application of insulation occurs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   1. Owens-Corning
   2. Knauf
   3. Johns Manville
   4. Industrial Insulation Group
2.02 MATERIALS

A. Glass Fiber:
   1. Insulation: ASTM C547; rigid molded, noncombustible.
      a) 'K' value: ASTM C335, 0.24 at 75 °F
         1) K values shall conform to the following at 75°F
            a) Heating water to 250°F: 0.28
            b) Heater water and Steam to 350°F or above: 0.32
            c) Chilled water 40°F to 55°F: 0.24
            d) Domestic water 105°F or greater: 0.24
      b) Minimum Service Temperature: -20 °F
      c) Maximum Service Temperature: +450 °F
      d) Maximum Moisture Absorption: 0.2 percent by volume

   2. Vapor Barrier Jacket:
      a) All Service Vapor Retarder Jacket
      b) Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
      c) Secure with self-sealing longitudinal laps and butt strips.
      d) Alternate: Paper Free All Service Vapor Retarder Jacket

B. High Temperature Hydrous Calcium Silicate
   1. Manufacturers
      a) Industrial Insulation Group
      b) Other acceptable manufacturers offering equivalent products.

   2. Insulation: ASTM C533 - Type 1, rigid molded white; asbestos free.
      a) 'K' ('ksi') value: ASTM C177 and C518; 0.44 at 300 °F (0.060 at 147 °C).
      b) Maximum Service Temperature: 1200 °F (815 °C)
      c) Density: 15 lb./cu.ft (208 kg/cu.m) maximum (will need to change KG)

   3. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch centers.

2.03 JACKETS

A. A.PVC Plastic
   1. Jacket: ASTM C921, One piece molded type fitting covers and sheet material, off white color.
      a) Minimum Service Temperature: -40 °F
      b) Maximum Service Temperature: +150 °F
      c) Moisture Vapor Transmission: ASTM E96; 0.002 percent by volume
      e) Maximum Smoke Developed: ASTM E84: 50
      f) Thickness: 20 mil.
g) Connections: Brush on welding adhesive

2. Covering Adhesive Mastic: Compatible with insulation

3. Acceptable Manufacturers
   a) Proto
   b) Zeston
   c) Speedline

B. Canvas Jacket; UL listed.
   2. Lagging Adhesive: Compatible with insulation.
      a) Thickness: 20 mil inch sheet.
      b) Finish: Smooth.
      c) Joining: Longitudinal slip joints with 2 inch laps.
      d) Fittings: 0.016 inch thick die shaped covers with factory attached protective liners.
      e) Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

C. Aluminum Jacket: ASTM B209
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

D. Stainless Steel Jacket: Type 304 stainless steel.
   1. Thickness: 0.016 inch
   2. Finish: Smooth
   3. Metal Jacket Bands: 3/8 inch wide; 0.016 inch thick stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Inspect work in conformance with Section 220500.

3.02 PREPARATION
   B. Pipe Testing: Testing of piping shall be completed and leaks repaired prior to application of insulation. Surfaces shall be clean and dry before proceeding.
   C. Installation: Install materials after piping has been tested and approved. See Section 220500.
D. Surface Cleaning: Clean surfaces for adhesives.

3.03 INSTALLATION

E. Pipe Insulation:

1. Manufacturer's Instructions: Install materials according to manufacturer's instructions.

2. Finished Surface Temperature: Insulation thickness shall conform to those recommended ASHRAE 90.1, latest edition, unless otherwise specified. Thickness of insulation shall be sufficient to keep surface temperatures below 115°F.

3. Continuity: Apply insulation tightly over clean, dry surfaces with sections or edges firmly butted together. Make insulation continuous through sleeves or openings in walls and floors.

4. Make insulation continuous at pipe hangers, trapezes, and other types of supports. Do not notch insulation to fit over hangers, trapezes, and other supports. Install shields at all supports.

5. Name Plates: Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

6. Supports: Finish insulation neatly at hangers, supports and other protrusions. Locate insulation or cover seams in least visible locations.

7. Inserts: Provide an insert, not less than 6-inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2-inches diameter or larger, to prevent insulation from compressing at support points. Inserts shall be cork, hardwood or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used with field fabricated insulation value equal to insulation approved by the Project Engineer. Do not use calcium silicate inserts or other material that can absorb moisture on any below ambient piping system.

8. Enclosures: Do not insulate hot water heating pipe within radiation enclosures.

9. Flanges: On insulated piping without vapor barrier and piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.

10. Equipment Fittings and Valve Coverings: Insulate all equipment, fittings and valves. Terminate insulation neatly with insulating and finishing cement troweled on bevel.

11. Preformed Fittings Locations: All fittings and valves shall be insulated with preformed fiberglass for fittings, mitered sections of pipe insulation or fiberglass blanket insulation of equal thickness to the adjacent pipe insulation. Cover the fittings, valves and insulation with preformed PVC jacket. Close jacket with stainless steel tacks and compatible adhesive.

12. Radiation Barrier: When insulating hot pipe fittings, a layer of kitchen-type aluminum foil shall be applied over the first fiber glass insert applied, making sure the aluminum foil is extended over the adjacent pipe insulation. A second fiber glass insert shall then be applied over the foil with a vapor seal at all the aluminum foil edges. Insulation thickness shall be such that the surface temperature shall not exceed 115°F.
13. Expansion Devices: On insulated piping with vapor barrier; insulate all equipment, fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

14. Fasteners: Avoid the use of staples on vapor barrier jackets. Seal vapor barrier penetrations with white vapor barrier finish and adhesive.

15. Adhesive Limitations: Apply adhesives to not exceed the coverage recommended by the manufacturer.

16. Wall, Floor and Ceiling Penetrations: Continue insulation with vapor barrier through penetrations including walls, floors and ceilings.

17. Enclosure: All insulation ends shall be firmly butted and secured with minimum 3 inch wide butt strips. Exposed end of pipe insulation shall be sealed with vapor barrier mastic.

18. Repairs: Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

19. Service Access: When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

20. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers and other projections shall be insulated and vapor sealed to prevent condensation. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

21. Insulation shall be installed in a workmanlike manner by workmen regularly engaged in this type of work. Insulation shall not be applied until all surfaces are clean and dry and until inspection and release for insulation application.

a) Do not notch insulation to fit around trapezes or wall-mounts fabricated from slotted metal framing (“unistrut or equal”), angle iron or other materials. Insulation shall be continuous across the support and an insulation shield shall be installed to prevent crushing the insulation. Pipe clamps shall be sized to fit around insulation and shield.

b) Insulation may be notched or trimmed around riser clamps. Seal exposed insulation.

F. Jackets:

1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish fittings, joints, and valves with premolded PVC jackets secured with stainless steel tacks. The precut insulation shall be held in place by copper wire or hemp twine and be removable without damage to the insulation or jacket. Leave surfaces clean and ready for painting.

2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied or field-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with premolded PVC jackets.
3. Indoor, Exposed Applications: Mechanical Equipment Rooms, all insulated piping to be finished with aluminum jacket secured with metal jacket bands.

4. Indoor, Exposed Applications: Same as Indoor, Concealed Applications except that in addition the insulation shall be covered with an aluminum jacket secured with metal jacket bands.

5. Exterior Applications: Same as Indoor, Exposed Applications plus connect with a modified S lock equal to Premetco “Loc-Jack” Z-Crimp, Factory or Field installed. All seams shall be sealed with silicone caulking and have seams oriented so that the jacketing will shed water & not tend to trap and enter rainwater.

3.04 APPLICATION

A. Fittings and Valves Insulation:
   1. Premolded Fittings: All insulated pipe fittings shall be insulated with 20 mil PVC Zeston one piece premolded insulated fittings wherever possible. If Zeston fittings are not available for the use required, comply with the following paragraph #2. Insulate fittings with fiberglass tightly wrapped with copper wire or heavy hemp twine to within 1/4 inch of thickness of adjoining copper wire or insulation, finished with 1/4 inch of insulating cement troweled flush with pipe insulation. A tack coat of mastic vapor barrier Foster 60-25 or 26 to 1/16 inch thickness or equal shall be applied to fittings and valves. Apply 6 oz. fiberglass canvas jacket to build-up (not PVC) fitting band valve insulation. Cement laps thoroughly with Foster 81-42 or 30-36 adhesive.

B. Perm Rating Vapor Barrier Mastic Coatings:
   1. Perm rating not more than 0.25 when tested in accordance with ASTM E-96, Procedure A Fire Retardant.

C. Adhesives, Sealers, Facings, and Vapor Barrier Coatings:
   1. Compatible with materials to which applied, and shall not corrode, soften, or otherwise attach the pipe or insulation materials in either the wet or dry state. Use only adhesives, sealers, facings, and vapor barrier coatings recommended by the approved manufacturers of insulation materials.

3.05 SCHEDULE

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<th>Service</th>
<th>Pipe Size</th>
<th>Thickness</th>
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<td>CW, HW, HWC</td>
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<td>1 inch</td>
</tr>
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<td></td>
<td>2-1/2 inch and Larger HW, HWC</td>
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</tr>
<tr>
<td>Steam &amp; Condensate</td>
<td>All sizes</td>
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</tr>
</tbody>
</table>

END OF SECTION
SECTION 22 1000
PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 SCOPE
A. This section of the specifications encompasses the basic materials and methods of the various piping systems covered in Division 25.
B. Standards: The latest edition of each standard referenced shall be used to determine compliance.

1.03 RELATED WORK IN OTHER SECTIONS
220000 - PLUMBING INDEX
220500 - GENERAL PLUMBING REQUIREMENTS
220523 - VALVES
220700 - PIPING INSULATION
221113 - DOMESTIC WATER SYSTEMS
221123 - NATURAL GAS PIPING SYSTEMS
221313 - SOIL AND WASTE PIPING SYSTEMS
230519 - PIPING SPECIALTIES

1.04 IDENTIFICATION OF PIPING
A. All accessible piping shall be labeled at not more than 10 ft. intervals with labels indicating the service and direction of flow. Pipe labels shall be self-adhesive labels, all-temperature Perma-Code pipe markers No. B-500, manufactured by the W.H. Brady Company. The background color code for all markers shall conform to the American National Standard A13.1 - 1975 “Scheme for the Identification of Piping Systems.”
B. The color red shall be for the exclusive use on fire protection service piping and sprinkler piping per OSHA regulations (CFR 1910.144).

PART 2 - PRODUCTS

2.01 PIPING SYSTEMS
A. Exterior Water Distribution
   1. Copper: Type K hard, seamless copper tube conforming to ASTM B-88 with silver brazed joint per ASTM B260 Class BAg-1 with wrought copper fittings per ANSI B16-22.

B. Domestic water system
   1. Above grade:
a) Copper: Shall be Type K soft drawn, or Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.

2. Underground:
   a) Copper: Type K hard, seamless copper tubing conforming to ASTM B-88 with silver brazed joints (ASTM B-260 Class BAg-1) with wrought copper fittings per ANSI B16.22.

C. Soil and waste system

1. Above ground:
   a) Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A-1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS-888 and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C-564 & ASTM 1563.

2. Underground inside building:
   a) Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A-1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS-888 and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C-564 & ASTM 1563.

3. Underground outside buildings:
   a) Under traffic areas and parking lots: Shall be cast iron hub and spigot soil pipe conforming to ASTM A74 and Cast Iron Institute CISPI 301.
   b) All other areas: Piping shall be polyvinylchloride (schedule 40 for size 4" and smaller, SDR-35 for sizes 6" and larger), exterior sewer pipe (PVC) ASTM D3034 with gaskets per ASTM D1869.
   c) Risers and base fittings for grade cleanouts shall be extra heavy cast iron pipe and fittings with compression joints per ASTM C-564 & ASTM-1563.

D. Sanitary vent system

1. Vent piping 2" and smaller in diameter may be schedule 40 galvanized steel pipe conforming to ASTM A-53 with 150 pound galvanized malleable iron screwed fittings conforming with ANSI B16.3. Vent piping larger than 2" shall be cast iron as specified for interior soil and waste.

E. Natural gas piping system

1. Black steel: Above grade piping shall be Schedule 40, black steel pipe conforming to ASTM A-53, with 150 pound malleable iron screwed fittings conforming with ANSI B16.3. or seamless carbon steel weld fittings conform to ASTM A-234.

2. Underground piping shall be schedule 40 black steel pipe conforming to ASTM A-53 machine wrapped with Scotchwrap PVC tape using 50% overlap. Fittings and joints shall be double wrapped to a minimum 6 inches beyond the fitting. Pipe shall be primed prior to wrapping per manufacturer's recommendations.
F. Steam piping
   1. Black steel: Shall be Schedule 80, black steel pipe conforming to ASTM A-53 or A-53, with welded steel fittings 2" and larger. Piping 1 1/2" and smaller shall have 150 pound malleable iron screwed fittings conforming with ANSI B16.3.

G. Steam condensate piping
   1. Black steel: Shall be Schedule 80, black steel pipe conforming to ASTM A-53 or A-53, with welded steel fittings 2" and larger. Piping 1 1/2" and smaller shall have 150 pound malleable iron screwed fittings conforming with ANSI B16.3.

2.02 JOINTS

A. Copper:
   1. Silver brazed joints shall use brazing material containing approximately 45% silver, 15% zinc, 25% cadmium and 15% copper. Joints shall conform to ASTM B-260 Class BAg-1. Approved materials include Mueller #122, Handy and Harmon "Easy Flo45" and United Wire and Supply "Sil-Bond 45".

B. Cast Iron:
   1. Neoprene Rubber gaskets for hub and spigot piping per ASTM C564.
   2. No hub joints shall consist of couplings that conform to CISPI 301.

C. Ductile Iron: Joints shall be of the stuffing box type per ANSI 21.11 as modified by ANSI 21.51 or push-on type per ANSI 21.51. Rubber gaskets and lubricant shall be per ANSI 21.11.

D. Black Steel:
   1. Screwed joints shall be made with no more than three threads showing using teflon tape or teflon joint sealing compound.
   2. Welded joints shall be fusion welded to full metal depth with width at least 2 1/2 times the depth of the metal being joined.

E. Bell and spigot joints shall conform to AWWA C200 with rubber gaskets.

F. Bonded joints shall have metallic bond including joints made with flexible couplings, caulking or rubber gaskets. Metallic bond shall be of ferrous material to effect continuous conductivity. Bond wire shall be type RHW-USE, size 1/0 neoprene gasketed copper conductor. Bond shall be thermal weld type.

G. Insulating joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe. Insulating joints shall consist of a sandwich type flange insulating gasket of the dielectric type, insulating washers and insulating sleeves for flange bolts. Gaskets shall be full faced. Bolt insulating sleeves shall be full length. Units shall be of a construction to prevent metal to metal contact of dissimilar piping materials.

2.03 FLOOR, WALL AND CEILING PLATES

A. Where exposed pipes pass through finished floors, finished walls or finished ceilings, they shall be fitted with chromium plated spun brass flanges or flanges to match the type of pipe or pipe finish used. Plates shall be large enough to completely close the hole around the pipe and shall be not less than 1-1/2" or more than 2-1/2" larger than the diameter of the pipes. All plates shall be securely held in place.

2.04 UNIONS

A. Piping 2-1/2" and larger to have bolted flange unions with gaskets of material suitable for the specified service. Ground joint unions with brass to iron seats shall be used in piping 2" and smaller. Unions shall be installed at all valves and equipment connections.
B. Insulating Unions: See Specification Section 230519.

2.05 HANGERS AND ANCHORS

A. To prevent galvanic action between copper pipe and a dissimilar metal, copper pipe shall be isolated to prevent the pipe from contacting the dissimilar metal. This may be accomplished by mounting the pipe in an isolation fitting, or by wrapping the pipe with a 20-mil thickness of UPC-rated isolation tape. The 20-mil thickness can be accomplished by using a single wrap of 20-mil tape or by using 10-mil tape with a 50% overlap.

B. Copper pipe does not need to be isolated from copper plated pipe hangers that are suspended from hanger rods.

C. Copper pipe mounted on slotted metal framing ("unistrut or equal"), angle iron, or other dissimilar metal support shall be isolated as described above, even if pipe clamps used are copper plated. Painted, epoxy or powder-coated finishes on the metal support are not an acceptable means of isolation.

D. All piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Where pipes run side by side, support on rod and angle trapeze hangers. Hangers shall be spaced not greater than 5 feet on centers for cast iron piping, 6 feet on centers for copper piping and 10 feet on centers for steel piping. Plastic pipe shall be supported on not more than 3 feet centers. Round rods supporting the pipe hangers shall be of the following dimensions:

1. 1/2 inch to 2 inch pipe 3/8 inch rod
2. 2-1/2" inch to 3 inch pipe 1/2 inch rod
3. 4 inch to 5 inch pipe 5/8 inch rod
4. 6 inch pipe 3/4 inch rod

E. Rods for trapeze hangers shall be a minimum of 3/4 inch and shall have the equivalent cross section listed above per pipe supported. The use of pipe hoods, chains, or perforated iron for pipe supports will not be permitted. Insulated piping shall have hangers outside of insulation with 18 ga. protection sleeves 12" long. Anchors and guides shall be as detailed on the drawings. The Contractor shall provide inserts in the building construction at the time the concrete is poured, and the hangers shall be attached to these inserts. Where inserts cannot be used expansion shields may be used provided the hanger is not attached rigidly to the bolt but is supported from an angle held in place by the expansion bolt. The use of expansion shields must be approved by the Architect/Engineer. See drawings and details for support of tunnel piping.

F. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide and erect in a workmanlike manner according to the best practices of the trade all piping shown on drawings and required for the complete installation of the systems. The piping shown on the drawings shall be considered as diagrammatic for clarity in indicating the general run and connections and may or may not in all parts be shown in its true position. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper
erection of systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect/Engineer.

B. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing or forcing, properly clearing equipment and all windows, door, and other openings. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods. All changes in direction shall be made with fittings.

C. Preinsulated Piping Systems

1. All piping adjoining this system shall be anchored at or near the point of connection to avoid imposing any external forces on the carrier pipe. The Contractor shall pour concrete anchor blocks at every change of direction after testing the pipe. The anchor blocks are to be sized in accordance with forces resulting from thermal stress, existing soil conditions, and shall be in accordance with the manufacturer's recommendations.

2. Immediately after the system is installed in the ditch, a partial backfill of selected earth shall be made in the middle of each unit, leaving the joints exposed for inspection of the hydrostatic test. A hydrostatic test of 200-psig shall be required for a period of four hours. No leakage shall be allowed.

3. After hydrostatic testing, final backfill of selected earth shall be hand placed and hand tamped to 12” minimum over the top of the jacket. Remainder of the backfill shall be free of large boulders, rocks over 6" in diameter, frozen earth, or foreign matter. The backfill operation shall now be completed by any convenient means. Do not use wheeled or tracked vehicles for tamping.

4. The services of a factory-trained Field Service Instructor shall be required, and materials shall be stored, handled and installed in accordance with Manufacturer's recommendations. The Field Service Instructor shall be present during critical stages of the installation and testing.

D. All open ends of pipes and equipment shall be properly capped or plugged with plugs manufactured for this purpose to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton waste or similar materials may not be used in plugging.

E. All piping shall be arranged avoiding interference with removal and maintenance of equipment, filters or devices; and not blocking access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided at the piping connections to all items of equipment.

F. Valves and specialties shall be placed to permit easy operation and access, and valves shall be regulated, packed and adjusted at the completion of the work before final acceptance.

G. All piping shall be erected to insure proper draining. Steam mains shall be pitched down in the direction of flow, a minimum of one inch per 40 feet or appropriately trapped. Where steam and condensate flow in opposite directions within the same pipe, the pipe shall be 2 sizes larger than shown unless specifically shown on the drawings that counterflow of condensate was intended by the design. Condensate return mains shall be pitched down in the direction of flow, one inch per 20 feet. Domestic water piping may be run level but shall be free from traps.

H. Soil and waste piping and other gravity drains shall be sloped down in direction of flow minimum one inch in 20 feet.
3.02 ACCESS DOORS

A. Furnish all access doors required for access to valves, controls, or other items for which access is required for either operation or servicing. All costs incurred through failure to perform this function as the proper sequence of the work dictates shall be borne by this Mechanical Contractor.

B. The type of access door shall be as required by the room finish schedule. Acoustical tile access doors shall be equal to Krueger Style B, Style A for acoustical plaster, or Style C-CF for sidewall drywall or plaster construction.

3.03 JOINTS

A. Resilient molded gaskets shall be used on hub and spigot piping. For cast iron soil pipe not located under buildings, the Contractor may also use the No-hub sanitary system for pipe 6" and below with neoprene sealing gaskets, stainless steel retaining sleeves and two draw bands. An adequate torque wrench shall be used for system installation in accordance with manufacturer's recommendations.

B. Screwed Joints: Screwed joints shall be American Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Make up joints using an approved compound or teflon tape, applied to the male threads only.

C. Brazed and Soldered Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections.

D. Welded Joints: On black steel piping 2 inches and above in size, the joints shall be welded. Welding shall be done using either gas or electric welding equipment. Certified welders shall be used. All pipe surfaces shall be thoroughly cleaned before welding. Each joint shall be beveled before being welded. Piping shall be securely aligned and spaced and the width of circumferential welds shall form a gradual increase in thickness from the outside surface to the center of the weld. The Contractor shall use appropriate materials to protect the structure and provide adequate fire protection at all locations where welding is done. All elbows shall be long radius unless otherwise specified. Wherever tee connections are made to piping systems on the main run, welding sockets may be installed for the branch connections up to one half the size of the main run. On connections larger than one half the size of the main run, welding tees shall be used. The use of fittings formed from welded pipe sections will not be permitted.

E. Flanged Joints:

1. Cast iron flanges shall conform to the American Standard for cast iron pipe flanged fittings, Class 125 (B.16.1). Gaskets shall be suitable for the service on which used.

2. Steel flanges shall be 150 lb. raised face type.

F. Solvent Welded Joints:

1. Pipe shall be cut square with pipe cutters designed specifically for plastic pipe. Pipe shall be protected from serrated holding devices and abrasion. Remove burrs from inside and outside of pipe. Clean the joining surfaces using an approved ABS Cleaning compound. Following the instructions on the can, apply the ABS cement and assemble the joint as quickly as possible before the cement dries.

3.04 PUMP AND EQUIPMENT CONNECTIONS

A. All piping connecting to pumps or other equipment shall be installed with isolation valves and flexible connections to prevent strain at the connection to equipment. The Contractor shall be required as directed to disconnect piping to demonstrate that piping has been so
connected. Provide a suction diffuser at each end suction pump where the inlet piping has a straight run of less than 15 pipe diameters in length. Suction diffusers shall consist of angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16 inch diameter openings for pump protection. Strainer free area shall be five times the section area of the pump connection. Provide an adjustable support foot for diffusers installed on end suction pumps.

3.05 PIPE SLEEVES
A. Pipe sleeves shall be furnished and set by the Contractor, and the Contractor shall be responsible for their proper and permanent location. Piping will not be permitted to pass through footings, beams or ribs unless so noted on the drawings or with the consent of the Architect/Engineer. Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through concrete or masonry construction and through all exterior walls, regardless of construction. Pipe sleeves, except sleeves in footings and beams shall be of sufficient diameter to provide approximately 1/4-inch clearance around the pipe, and in cases of insulated pipes, approximately 1/4-inch around the insulation. Pipe sleeves in footings and beams and exterior walls shall be of steel pipe. Sleeves in footings shall be not less than one inch or more than two inches larger in diameter than the pipe to be installed. Pipe sleeves in floors shall be cut flush with finished floor. Openings between piping and sleeves shall be made watertight with plastic cement to a minimum depth of two inches. Openings between piping and sleeves in all masonry or concrete interior walls and partitions shall be similarly caulked for acoustical reasons.

3.06 EXPANSION AND CONTRACTION
A. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets or loops and anchors to prevent undue strain.

3.07 PROTECTIVE COATINGS
A. All underground pipe except exterior cast iron water distribution pipe shall be wrapped with "Scotchwrap" No. 50 tape to give not less than two complete layers on the entire underground piping system, or piping shall have X-TRU Coat factory applied plastic protective covering.
B. All buried exterior cast iron water distribution piping shall be tar coated.

3.08 TESTING
A. Before any insulation is installed or before piping is covered or enclosed all piping systems shall be tested and proved tight at not less than 1 1/2 times the maximum service pressure which the piping systems will be required to handle, unless otherwise specified.
B. All tests shall be conducted in the presence of the Architect/Engineer and the building Owner or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.

3.09 FLUSHING, DRAINING AND CLEANING PIPE SYSTEMS
A. The Contractor shall flush water piping systems with water before placing them in operation. After systems are in operation and during the test period all strainer screens shall be removed and thoroughly cleaned. The Contractor shall notify the Architect/Engineer in writing when this requirement is to be accomplished.
B. All domestic water lines shall be sterilized as described in Section 221113 -DOMESTIC WATER SYSTEM of these specifications.

END OF SECTION
SECTION 221113
DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
   A. The Contractor shall furnish and install the Domestic Water System as shown on the drawings including specialties shown or called out in the fixture and/or equipment list and as necessary for satisfactory operation of the system.

1.03 RELATED WORK IN OTHER SECTIONS
   220000 - PLUMBING INDEX
   220500 - GENERAL PLUMBING REQUIREMENTS
   220523 - VALVES
   220700 - PIPING INSULATION
   221000 – PIPE AND PIPE FITTINGS

1.04 STERILIZATION
   A. All domestic water piping shall be sterilized as described in Part 3 of this section.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS
   A. Pipe and pipe fittings shall be as described in Section 221000 - PIPE AND PIPE FITTINGS.

2.02 SHOCK ABSORBERS
   A. Shock absorbers and/or air cushions shall be installed where shown on the drawings. Shock absorbers shall be equal to Zurn Z-1700, Diatrol Series 500 or approved equal sized for the system being protected.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. The installation shall conform to the requirements of Section 220500 - GENERAL PLUMBING REQUIREMENTS, and Section 221000 - PIPE AND PIPE FITTINGS.
   B. Insulating couplings shall be furnished and installed at all connections between copper and steel pipe to prevent electrolysis.
   C. Each water service main, branch main, riser and branch to a group of fixtures shall be valved. Stop valves shall be provided at each fixture.
3.02 STERILIZATION

A. Domestic Water lines shall be sterilized as follows: Chlorine shall be applied to provide a solution of not less than 250 PPM. The chlorinating material shall be introduced into the waterline in a manner approved by the Architect/Engineer. The solution shall be circulated if provided with pumps and all valves in the line shall be operated several times during the contact period. After a contact period of no less than eight (8) hours the system shall be flushed with clean water until the residual chlorine content is not greater than 0.2 PPM.

B. The sterilization procedure shall be witnessed by the Architect/Engineer and Owner.

3.03 TESTS

A. General: All tests shall be conducted in the presence of the Architect/Engineer or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.

B. Water Systems: The complete water systems shall be hydrostatically tested at a pressure of 150 psi and shall show no loss in pressure for a period of one hour.

END OF SECTION
SECTION 22 1123
NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. The Contractor shall furnish and install the Natural Gas System as shown on the drawings including specialties necessary for satisfactory operation of the system.

1.03 RELATED WORK IN OTHER SECTIONS
220000 - PLUMBING INDEX
220523 - VALVES
221000 - PIPE AND PIPE FITTINGS
230500 – GENERAL PLUMBING REQUIREMENTS

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS
A. Pipe and pipe fittings shall be as described in Section 221000 - PIPE AND PIPE FITTINGS.
B. All underground gas piping shall be welded.
C. Any underground gas piping shall have a protective coating as specified in Section 221000 - PIPE AND PIPE FITTINGS.
D. All gas piping in any utilities tunnel shall be welded.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Furnish and install all piping as indicated on the drawings, and all accessories in strict accordance with the applicable gas code.
B. All gas piping in any utilities tunnel shall be isolated from any metal to metal contact with hangers, supports, rails, etc.
C. Ventilated conduit shall be used to carry natural gas piping whenever such piping is run under any building, building sidewalk, structure, or through or within a concealed return air space. Ventilated conduit construction shall conform to the details shown on the drawings.
D. Gas trains connecting gas fired equipment shall conform to FM requirements.
E. All equipment (AHU, AC, Water Heaters, etc.) connected to the gas system shall be connected with gas valve, union, dirt leg with removable cap (up 4” above any surface) and flexible connection.
F. All piping and accessories shall be supported by unistrut brackets and gasketed pipe clamps, inside of the building.

3.02 TESTS

A. All gas piping shall be tested with air pressure of 60 psi and shall show no loss in pressure for a period of 24 hours on a gauge for recording pressure.

END OF SECTION
SECTION 22 1313
SOIL AND WASTE PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
   A. The Contractor shall furnish and install the soil and waste piping system as shown on the drawings including specialties shown or called out in the equipment list and as necessary for satisfactory operation of the system.

1.03 RELATED WORK IN OTHER SECTIONS
   220000 - PLUMBING INDEX
   220500 - GENERAL PLUMBING REQUIREMENTS
   221000 - PIPE AND PIPE FITTINGS

1.04 REQUIREMENTS
   A. See Sections 220500 - GENERAL PLUMBING REQUIREMENTS and 221000 - Pipe AND PIPE FITTINGS for general requirements.
   B. Furnish and install all concrete, grout and other required materials to fill all block outs and/or sleeves left open for this Subcontractor's convenience or for the installation of this work.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS
   A. The pipe and pipe fittings shall be as described in Section 221000 - PIPE AND PIPE FITTINGS.

2.02 FLOOR DRAINS
   A. Drains shall be Zurn, Wade or Smith and shall be equal to those specified on the drawings.

2.03 FLOOR SINKS
   A. Drains shall be Zurn, Wade or Smith and shall be equal to those specified on the drawings.

2.04 CLEANOUTS
   A. Cleanouts shall be as manufactured by Zurn, Wade or Smith and shall be of the same size as the pipe except that cleanout plugs larger than four inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarterbend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings.
   B. Cleanouts in finish floors shall be of the type made to match the floor and/or covering. All exposed metal shall be polished or chrome plated brass.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall conform to Section 220500 - GENERAL PLUMBING REQUIREMENTS, and Section 221000 - PIPE AND PIPE FITTINGS.

B. Flashings: Vent pipes shall be flashed and made watertight at the roof with sheet lead flashing. Flashing shall weigh at least four pounds per square foot, shall be 24 inches square and shall be turned up around the pipe and into the top of the pipe. Vent pipes shall extend at least 12 inches above roof.

C. Traps: Each fixture and piece of equipment connecting to the drainage system shall be equipped with a trap. Each trap shall be placed as near to the fixture as possible and no fixture shall be double trapped.

D. Floor Drains: All floor drains shall be installed with grates square with the building lines.

3.02 TESTS

A. The entire sanitary system shall be tested in accordance with the requirements of the State Plumbing Code, all local codes and ordinances, and the Uniform Plumbing Code.

END OF SECTION
Division Twenty Three
HVAC
SECTION 23 0000
HEATING, VENTILATING, AND AIR CONDITIONING INDEX

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Heating, Ventilating, And Air Conditioning Work, as indicated on the Drawings and specified herein. Heating, Ventilating, And Air Conditioning work indicated on the Drawings and/or specifications covering other trades shall conform to Division 23 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Heating, Ventilating, And Air Conditioning systems, shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for Heating, Ventilating, and Air Conditioning service connections to all the various items of equipment requiring connection throughout the project shown on the Contract Drawings (even if not shown on Heating, Ventilating, and Air Conditioning Drawings). Coordinate with other trades for the installation of required connections and service.

1.03 HEATING, VENTILATING AND AIR CONDITIONING DIVISION INDEX

230100 DEMONSTRATION AND TRAINING

230500 GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS

230519 PIPING SPECIALTIES

230593 BALANCING OF MECHANICAL SYSTEMS

231126 LIQUID PETROLEUM GAS SYSTEM

233000 AIR DISTRIBUTION

235200 STEAM BOILER PLANT

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION
SECTION 23 0100
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. After completion of the installation and upon completion of the Test and Balancing, the Contractor shall schedule the System Demonstration, Operating Test, and Training Session for the Owner.
B. The following individuals, companies or representatives thereof shall be in attendance.
   1. Mechanical Trade
   2. Electrical Trade
   3. Test and Balance Agency
   4. Steam Equipment Manufacturer(s)
   5. Boiler Manufacturer

1.03 RELATED WORK IN OTHER SECTIONS
230000 - HEATING, VENTILATING AND AIR CONDITIONING INDEX
230500 - GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS

1.04 QUALIFICATIONS
A. The representatives listed in 1.2B above shall be thoroughly familiar with the operation and function of the equipment or systems he represents and be prepared to indoctrinate the Owner or his designated personnel.

PART 2 - PRODUCTS

2.01 SCHEDULE
A. The Contractor shall schedule and coordinate the System Demonstration and Training Session for the Owner over 1 consecutive 8 hour working day.
B. The Owner may, after the training session has started:
   1. Excuse the equipment manufacturer when his indoctrination session is completed.
   2. Conclude the session early if he feels the intent and purpose of the session has been met.

2.02 ADJUSTMENTS
A. The Contractor shall have available, tools, equipment and personnel to readjust or refine the operation of any part of the mechanical system as directed by the Owner or Architect/Engineer.
PART 3 – EXECUTION

3.01 TRAINING

A. The Contractor shall schedule and coordinate the indoctrination of the Owner and his designated personnel during the Operating Test. The proposed time schedule shall be coordinated with the individuals, companies or representatives who will be conducting the indoctrination and training. This proposed time schedule shall be submitted to the Architect/Engineer for approval.

B. Before final inspection, instruct Owner’s designated personnel in operation, adjustment, and maintenance of products, equipment, and system at agreed upon times.

C. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months.
   1. Contractor shall provide a minimum of eight (8) hours of training for seasonal system operation.
   2. Contractor shall prepare a written report of training and submit to architect upon completion of training.

D. Use operation and maintenance manuals as a basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

E. Prepare and insert additional data in Operation and Maintenance manual when need for such data become apparent during instruction.

3.02 DOCUMENTATION

A. The Contractor shall prepare an indoctrination schedule similar to the following:

<table>
<thead>
<tr>
<th>INDROCTRINATION SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT</td>
</tr>
<tr>
<td>LOCATION</td>
</tr>
<tr>
<td>PERSONNEL</td>
</tr>
<tr>
<td>TIME</td>
</tr>
</tbody>
</table>

B. The Owner shall initial each line to verify attendance.

3.03 OPERATING INSTRUCTIONS

A. The operating instructions specified in Sections 230500 and 253000 of these specifications shall be presented at the start of the Session. These instructions shall include manufacturer's published data having all information that does not apply crossed out.

3.04 OPERATING TEST

A. The Contractor shall conduct an operational test on all equipment installed under this Division of the Specifications. This test shall be continuous for a minimum of three consecutive days within seven days prior to the demonstration and training period with required data available at the demonstration and shall continue during the demonstration period. The test shall verify the operation of the mechanical systems and demonstrate the performance of the total system.

B. The following data shall be recorded hourly during normal building occupancy hours.
   1. Outdoor ambient temperatures:
      a) Measure and record outdoor dry bulb and wet bulb temperature.
      b) Calculate and record relative humidity.
2. Indoor space temperature:
   a) Measure dry bulb temperature in several rooms served by each air handling unit including at least one room in each control zone. Note any variation over 2°F from setpoint.
   b) Measure wet bulb temperature in each space having a space humidistat. Calculate space relative humidity and note any variation over 5% from setpoint.

3. Water Temperatures:
   a) Entering and leaving each piece of equipment having a water temperature change including:
      1) Boilers
      2) Unit Ventilator coils
      3) Unit Heater coils
      4) Base Board Radiation
      5) Main branch loops
      6) Air washer sumps

4. Air Temperatures:
   a) Entering and leaving each piece of equipment having air temperature change including:
      1) Steam drum on corn cracker.

5. Air Pressure:
   a) Building static pressure relative to ambient (outside)
   b) Supply static pressure at outlet of each air handling unit
   c) Supply static pressure at the end of each duct run
   d) Supply static pressure at the inlet of each variable air volume terminal

6. Weather Conditions:
   a) Sun
   b) Wind velocity
   c) Precipitation
   d) Barometric pressure

3.05 READINGS AND MEASUREMENTS
A. The Test and Balance Agency shall be available and take any or all readings and measurements required or desired by the Owner or Architect/Engineer during this Demonstration and Training Session.
SECTION 23 0500
GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

PART 1- GENERAL

1.01 SUMMARY

A. Section Includes: General Mechanical Requirements specifically applicable to Division 23 sections in addition to Division 1- General Requirements.

B. Scope:

1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, ventilating, and plumbing including site utility work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.02 REFERENCES

A. Standard Requirements:

1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. The Contractor shall secure all permits and licenses for his work and shall pay all fees in connection with such permits and licenses.

D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.

E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.

F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

1. AABC Associated Air Balance Council
2. ADC Air Diffusion Council

435 North Michigan Ave.
Chicago, IL  60611
| 3. | AGA | American Gas Association  
1515 Wilson Boulevard  
Arlington, VA  22209 |
| 4. | AMCA | Air Movement and Control Association  
30 West University Drive  
Arlington Heights, IL  60004 |
| 5. | ANSI | American National Standards Institute  
1430 Broadway  
New York, NY  10018 |
| 6. | ASHRAE | American Society of Heating Refrigerating and Air Conditioning Engineers  
345 East 47th Street  
New York, NY  10017 |
| 7. | ASME | American Society of Mechanical Engineers  
345 East 45th Street  
New York, NY  10017 |
| 8. | ASTM | American Society for Testing and Materials  
1916 Race Street  
Philadelphia, PA  19103 |
| 9. | AWWA | American Water Works Association  
6666 West Quincy Avenue  
Denver, CO  80235 |
| 10. | AWS | American Welding Society  
2501 NW 7th Street  
Miami, FL  33125 |
| 11. | FM | Factory Mutual System  
1151 Boston-Providence Turnpike  
Norwood, MA  02062 |
| 12. | FS | Federal Specification  
General Services Administration  
Specifications and Consumer Information Distribution Section (WFSIS)  
Washington Navy Yard, Building 197  
Washington, DC  20407 |
| 13. | NBFU | National Board of Fire Underwriters  
5530 Wisconsin Avenue, Suite 750  
Chevy Chase, Maryland  20815 |
14. NEC  National Electric Code (of NFPA)
15. NEBB  National Environmental Balancing Bureau
     8224 Old Courthouse Road
     Vienna, VA  22180
16. NEMA  National Electrical Manufacturer's Association
     2101 L Street, NW
     Washington, DC  20037
17. NFPA  National Fire Protection Association
     Battery March Park
     Quincy, MA  02269
18. NSF  National Sanitation Foundation
     Box 1468
     Ann Arbor, MI  48106
19. OSHA  Occupational Safety and Health Administration
     U.S. Department of Labor
20. SMACNA  Sheet Metal and Air Conditioning Contractor's
     National Association
     8224 Old Courthouse Road
     Vienna, VA  22180
21. TIMA  Thermal Insulation Manufacturers Association
     Technical Services
     1420 King Street
     Alexandria, VA  22314
22. UL  Underwriters Laboratories, Inc.
     333 Pfingston Road
     Northbrook, IL  60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices or
   appurtenances shall conform to the applicable standards of Underwriters Laboratories
   Inc., where such standards have been established.

1.03 DRAWINGS
A. Drawings and specifications shall be considered as cooperative, and work or materials
called for by one and not mentioned in the other, or vice versa, shall be done and
furnished as though treated by both.
B. In the cases of discrepancies in figures, drawings, or specifications, the
   Architect/Engineer shall be notified immediately and his decision shall determine the
   necessary adjustment. Without such decision, said discrepancies shall not be adjusted
   by the Contractor save only at his expense, and, in case of any settlement or any
   complication arising from such adjustment to the Contractor, he shall bear all extra
   expense involved.
C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect/Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install, require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting his bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at his (the Contractor's own expense).

G. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

I. Site visit: The Contractor shall visit the site prior to bidding and satisfy himself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy himself as to the extent of work required to be completed.

1.04 SYSTEM DESCRIPTIONS
A. Not Used.

1.05 PRIOR APPROVALS
A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is not required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by him is acceptable.

1.06 SHOP DRAWINGS
A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc.
The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide him with as many review copies as he may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless he has, in writing, specifically called attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve him from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra costs is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render him liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: reference to all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.07 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e. AHU/Air Handling Unit) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:

1. Air Conditioning Units
2. Fans
3. Diffusers, Registers and Grilles
4. Pipe Insulation
5. Duct Insulation
6. Coils
7. Temperature Controls
8. Cross Connection Control Devices
9. Hydronic Air Control Devices
10. Heat Exchangers
11. Heating Terminal Equipment
12. Roof Top Equipment
13. Vibration Isolation Equipment and Calculations

1.08 QUALITY ASSURANCE

A. General: Comply with Division 1.
B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators’ certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.
C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install his work with relation to existing building conditions and shall be entirely responsible for the correctness of his work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.
D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.
E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.
F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to his work, and for the correct location of pipe sleeves.
G. Each Contractor shall coordinate his work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.
H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.
I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing, Heating, Cooling, Ventilation, and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same
manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt and concrete patching, cutting and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at his expense.

K. Cutting and Repairing:

1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.

2. Lay out and locate equipment, openings, and chase. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.

3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.

1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.
2. Unless otherwise noted, foundations shall be a minimum of 6-inch high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:

2. Uniform Mechanical Code.
4. Governing Fire Department Requirements
5. Utility Company Requirements
6. National Fire Protection Association Standards
7. NFPA 70 - National Electrical Code
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
10. NFPA 13 - Sprinkler Systems
11. NFPA 101 - Life Safety
12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment

O. Access Panels

1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.09 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1

B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.

C. Acceptance: Check and sign for materials to be furnished by others for installation under all Mechanical Divisions upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.

D. Protection: Close ends of pipe and ductwork at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.

E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.

F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.
1.10 PROJECT CONDITIONS
A. Performance: All systems are to be rated at [5,500 ft.] elevation.

1.11 SEQUENCING AND SCHEDULING
A. General: Comply with Division 1.
B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.
C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT
A. All mechanical equipment controls wiring, conduit, relays, interlocks, and all accessories required for a completely operational controls system shall be the complete responsibility of the mechanical contractor. The mechanical contractor has the option to hire the project electrical contractor or any qualified controls contractor to install mechanical controls wiring and conduit. Refer to Specification Section 253000 for coordination requirements between mechanical, electrical, and controls subcontractors.
B. Electrical items such as disconnect switches and motor starters associated with equipment provided by Division 23, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.
C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.
D. All motors shall meet all the requirements of all Electrical Divisions.
1. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. All motors shall have copper windings. All motors to have minimum power factor of 85% or have switched correction to 90%. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall a service factor of 1.00 with total temperature is of 65°C in the above conditions. Motors located in areas exceeding 40°C ambient shall be factory-rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS
A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.
B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: Hazardous Area - Authorized Personnel Only.

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems, as noted below:

1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

2. For Each Product System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.

3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.

4. Warranties and Bonds: Bind in copy of each.

5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

6. Include color-coded wiring diagrams as installed for control system.

7. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.

8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

9. Provide servicing and lubrication schedule and list of lubricants required.

10. Include manufacturer’s printed operation and maintenance instructions.

11. Include sequence of operation by controls manufacturer.

12. Provide original manufacturer’s part list, illustrations, assembly drawings and diagrams required for maintenance.

13. Provide control diagrams by controls manufacturer as installed.

14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow and control diagrams.
15. Provide list of original manufacturer’s spare parts and recommended quantities and to be maintained in storage.

16. Include Test and Balance (T&B) Reports as specified in Section 230593.

B. The Mechanical Contractor shall also provide training as required by Section 230100 to the Owner’s operation and maintenance personnel.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, he agrees to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum.

1. Clean strainers in piping.
2. Fans and/or pumps be lubricated and oiled once every four (4) months.
3. Controls shall be calibrated throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
4. All equipment manufacturer's service recommendations shall be followed during this period.

1.18 FLUSHING AND DRAINING

A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the ducts or pipes shall be repaired by this Contractor at his expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.19 CLEANING

A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned and all obstructions, surplus materials, etc., removed.
1.20 GUARANTEE
A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by him under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at his expense, without expense to the Owner, at any time within one year after installation is accepted by the Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner’s responsibility.)

1.21 FLOOR, WALL, AND CEILING PLATES
A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.
B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetrations is and the size of the opening.

1.22 PIPE SLEEVES
A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2-inch above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.23 PIPE HANGERS
A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inch, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inch, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:
   1. Pipe up to and including 2"  3/8" rods
   2. Pipe 2-1/2", 3" and 3-1/2"  1/2" rods
   3. Pipe 4" and 5"  5/8" rods
   4. Pipe 6"  3/4" rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:
   1. Pipe up to and including 1-1/4"  8'
   2. Pipe 1-1/2" and 2"  10'
3. Pipe 2-1/2" and 3" 12'
4. Pipe 3 1/2" and 4" 14'
5. Pipe 5" and 6" 16'

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:
1. Pipe up to 3/4" in size 5'
2. Pipe 1" and 1-1/4" 6'
3. Pipe 1-1/2" and larger 10'

E. There shall be a hanger within 2 inch of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.

H. Expansion bolts shall be Ackerman-Johnson or Hilti.

I. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.24 PRESSURE VESSEL CERTIFICATION
A. Not used.

1.25 ISOLATION
A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:
Motor HP | Equipment Room
--- | ---
Up to 5 | 90%
7-1/2 to 15 | 93%
20 to 40 | 95%
50 to 100 | 97.5%

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.26 TESTING

A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.

B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.27 CERTIFICATIONS

A. Before receiving final payment, the contractor shall verify that all equipment furnished, and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.28 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.

B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.

C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.

D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.

E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.

F. Welding: Refer to Paragraph 1.29 of this section of these specifications.

G. Bending: No bending of pipe will be permitted.

H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a
conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.

1. Those in non-hazardous service, such as water, shall discharge directly to outside.
2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints

1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be
made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.

3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.

O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

P. Hanger Supports:
1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.
2. Do not bend rods to circumvent an obstruction.
3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.
4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet), or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.
5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. Remaining straight portion of rod may be used.

1.29 WELDING
A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to his proficiency. Tests shall be conducted at no additional expense to the Owner.
2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.30.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6 inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.

3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.30 TESTING FOR PIPING SYSTEMS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time, to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Safety: Since the Risk of failure, with the attendant possibility of injury, is appreciable greater with further testing, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.

C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled
prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.

D. Pressure Ratings: These tests shall not be used to establish pressure ratings.

E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system.

F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.

G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2 hour period. Leaks shall be located by soap testing.

1. Test Pressures:
   a) Condenser or Tower Water Supply & Return: 100 psig.
   b) Heating Water Supply and Return: 100 psig.
   c) Chilled Water Supply and Return: 100 psig.
   d) Steam and condensate (high pressure): 250 psig.
   e) Steam and condensate (low pressure): 125 psig.

J. Test Report

1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.31 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay or absence of coordination.

1.32 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. He shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.
1.33 SAFETY GUARDS
A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.34 PROTECTION
A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned and the entire system shall be delivered in a perfect, unblemished condition.

1.35 PAINTING AND IDENTIFICATION
A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.
B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave his equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.
C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.
D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inch in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.36 RECORD DRAWINGS
A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.37 SUPPLIER RESPONSIBILITY
A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or his representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at anytime requested by the Architect/Engineer (or his representative) during the construction or warranty periods.

END OF SECTION
SECTION 23 0519
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. The Contractor shall furnish and install all piping specialties necessary for satisfactory operation of the systems.
B. Manual air vents shall be installed at all high points in heating and cooling water piping systems and as shown on the contract drawings.
C. Valves shall be installed in all primary and secondary plumbing loops and branch lines feeding groups of fixtures in order to isolate such loops and branches without disrupting the service as a whole.
D. Unions shall be installed where necessary to facilitate maintenance of pumps, valves, regulators and other specialties.
E. Dielectric unions shall be installed wherever dissimilar metals are joined, except valves in closed loop piping systems.

1.03 RELATED WORK IN OTHER SECTIONS
220523 - VALVES
220700 - PIPING INSULATION
221000 - PIPE AND PIPE FITTINGS
221113 - DOMESTIC WATER SYSTEMS
221123 - NATURAL GAS PIPING SYSTEMS
221313 - SOIL AND WASTE PIPING SYSTEMS
230000 - HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230500 - GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

PART 2 - PRODUCTS

2.01 STRAINERS
A. Mueller Steam Specialty model 352M cast bronze, threaded ends, y-strainer, 20 mesh stainless steel screens for water service and .033” dia. opening screens for steam service. Provide blow-off valves full size of strainer tapping with drain lines to nearest drain.
B. Mueller Steam Specialty model 752, 250 SWP, flanged for size 2-1/2” and larger with 1/16” dia openings screen for water and 3/64” dia openings stainless steel screen for steam. Provide blow-off valves full size of strainer tapping with drain lines to nearest drain.
2.02 PRESSURE GAUGES  
A. Marshalltown “Permagage”, Ashcroft “Duragage”, “Trerice No. 500X, or approved equal. Dials shall be 4-1/2” unless otherwise noted. Proved needle valve for each gauge, and syphon for each steam gauge. Pressure gauges shall be range noted on plans or at mid-range of service (as shown on drawings).

2.03 THERMOMETERS  
A. Where indicated on the drawings and the piping diagrams, thermometers shall be installed as manufactured by the H.O. Trerice Co., Mueller, Albert Weiss, or approved equal. Thermometers shall be provided with expansion heads so that thermometer will not break under extremes of temperature. Each thermometer shall be provided with a separable socket well which shall be place in the piping system. The well shall be the length required for accurate reading of the thermometer.

2.04 AIR VENTS  
A. Manual air vents shall be 1/2” brass ball valves, Nibco No. T-585-70 or approved equal.

2.05 THERMOMETER WELLS  
A. Machined brass test wells with screwed caps and chains. H.O. Trerice No. 5573 or 5574 as required or approved equal.

B. Temperature and Pressure Test Plugs: Furnish pressure and temperature test plugs at all locations as shown on the drawings and at every connection to each piece of equipment. These test plugs shall be furnished with a Nordel valve core and 1/2” NPT brass body complete with gasket cap.

C. Furnish 4 each thermometers and pressure gauges for use by the Owner for checking temperatures and pressures.

2.06 INSULATING UNIONS  
A. Insulating unions having a plastic insert for electrical isolation shall be similar to EPCO Sales Company.

PART 3 - EXECUTION

3.01 INSTALLATION  
A. All specialties shall be installed in accordance with the best standard practices and as recommended by the manufacturer.

B. Where thermometers or test fittings occur in insulated piping systems or on insulated equipment, extension necks shall be provided to extend beyond the insulation.

C. Dielectric union shall be installed wherever piping of dissimilar metallic material is connected. Insulating unions are not required between bronze valve bodies and connecting steel pipe in closed loop systems such as heating and chilled water systems.

END OF SECTION
SECTION 23 0593
BALANCING OF MECHANICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish all labor, materials and equipment required to test and balance the mechanical systems identified on the contract drawings and these specifications, including but not limited to:
   1. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
   2. Measurement of final operating condition of HVAC systems.
   3. Sound measurement of equipment operating conditions.
   4. Vibration measurement of equipment operating conditions.
   5. Adjustment of the mechanical systems shall include but not limited to impellers trimmed, new sheeves and belts to match cfm required, etc. as required to match equipment specified.
   6. Operating Test

1.03 RELATED SECTIONS
230000 - HEATING, VENTILATING AND AIR CONDITIONING INDEX
230100 - DEMONSTRATION AND TRAINING
230500 - GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
233000 - AIR DISTRIBUTION
251100 - ELECTRICAL CONTROLS AND INTERLOCKS
253000 - CONTROLS AND INSTRUMENTATION

1.04 REFERENCES
A. The publications listed below form a part of these specifications to the extent referenced. Each publication shall be the latest edition of each except as noted.
   1. AABC - National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning System.
   2. ADC - Test Code for Grilles, Registers, and Diffusers.
1.05  **SUBMITTALS**

A. **Field Reports:** Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

B. **Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.**

C. **Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.**

D. **Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.**

E. **Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.**

F. **Test Reports: Indicate data on AABC National Standards for Total System Balance forms.**

G. **When test and balancing has been completed, the balancing agency shall prepare a complete report including design and test conditions compared. The report shall be as outlined below.**

H. **Seven copies of the complete and compiled test data shall be submitted to the Contractor for forwarding to the Architect/Engineer for evaluation and approval.**

   1. The Report shall be on standard 8-1/2” x 11” good quality paper and bound together to form a complete report. All forms shall be typewritten. Field data may be handwritten on appropriate printed or typewritten forms. Copies of handwritten field notes shall be legible.

   2. Each sheet shall have the Building number, name of the Testing Firm, instruments used to perform the tests, name of personnel performing the test, and date test was performed. Date and firm performing the calibration on photometry equipment shall also be included.

   3. Outside weather conditions shall be noted during the times the tests were made, cloud cover, temperature, wind speed and direction, precipitation, etc.

I. **The Report shall have a T & B Summary section including:**

   1. Identification of any system or equipment item the Contractor had difficulty balancing to specification or could not be balanced to specification.

   2. Identification of any piece of equipment or system whose balance should be rechecked and/or reset during weather conditions different from those present during system balancing.

1.06  **PROJECT RECORD DOCUMENTS**

A. **Record actual locations of flow measuring stations balancing valves and rough setting. Show locations on Test and Balance report reduced size plan drawings.**

1.07  **QUALITY ASSURANCE**

A. **Perform total system balance in accordance with NEBB Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.**

1.08  **QUALIFICATIONS**

A. **The balancing shall be performed by Energy Balance, Inc., De La Pena LLC, or Kirk Air. Qualified personnel are limited to registered mechanical Engineers and agencies**
regularly engaged in testing and balancing work. The Contractor shall submit, prior to the start of the balancing work, the qualifications and experience record of the balancing personnel for approval by the Architect/Engineer.

B. Perform Work under supervision of registered Professional Engineer experienced in performance of this Work and licensed in the state where the Project is located.

C. The balancing agency shall not be associated with or the same contractor furnishing the controls or instrumentation.

1.09 PRE-BALANCING CONFERENCE
A. Convene pre-balancing conference one week prior to commencing work of this section in coordination with Architect/Engineer/General Contractor and his Subcontractors.

1.10 SEQUENCING
A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. See section 3.1 for pre-balancing inspection.

PART 2 - PRODUCT

2.01 INSTRUMENTS
A. Instruments in general shall be direct reading. Pressures between 2” W.G. and 12” W.G. shall be measured with manometers. Duct velocities above 600 fpm shall be measured with a pitot tube. Averaging hoods with tight seal shall be used for airflow measurement at diffusers, registers and grilles. RPM shall be measured with a revolution counter and stopwatch. Mercury thermometers are preferred; bi-metallic thermometers may be used if calibration is checked daily. Test report shall list all instruments used and include accuracy and date calibrated. The Contractor shall provide all instruments to make the tests herein specified and required for complete system balancing.

2.02 AIR HANDLERS
A. After the air system is balanced and an optimum fan speed is selected, the adjustable sheaf or sheaves furnished shall be replaced by the Mechanical Contractor with new non-adjustable sheaves for permanent operation.

2.03 PUMPS
A. After the water system is balanced and an optimum pump operating point is selected, the pump impeller shall be trimmed to supply the required capacity for pumps over 2 HP, without throttling the flow.

PART 3 - EXECUTION

3.01 EXAMINATION
A. The test and balance agency shall review the plans and specifications prior to installation of the system and submit a report to the Architect/Engineer of any deficiencies in the system which could preclude proper adjusting, balancing and testing of the system.

B. The test and balance agency shall inspect the system prior to adjusting, balancing, and testing work to ensure that all specified components which will affect proper execution of such work are installed and are operating properly. A report shall be submitted to the Architect/Engineer indicating the results of the inspection within three days of the inspection. The following is a partial list of items to be inspected and report provided to the Architect/Engineer.
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems and control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire/smoke and volume dampers are in place and open. The smoke detectors and power to them is installed and the dampers are operational. Air coil fins are cleaned and combed.
8. Access doors are closed and duct end caps are in place.
9. Air outlets are installed and connected.
10. Duct system leakage is minimized.
11. Hydronic systems are flushed, filled, and vented.
12. Pumps are rotating correctly.
13. Proper strainer baskets are clean and in place.
14. Service and balance valves are open.

C. Submit field reports in a timely manner within one week of pre-balancing conference. Report defects and deficiencies noted during performance of services which prevent system balance.

D. Beginning of work means acceptance of existing conditions of the installed system and equipment on the project.

3.02 PREPARATION
A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.
B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES
A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 ADJUSTING
A. Ensure recorded data represents actual measured or observed conditions.
B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust airflow switches for proper operation.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.
E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.07 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing
1. Boiler Feedwater Pumps
2. Packaged Steel Fire Tube Boilers

B. Report Forms
1. Title Page
   a) Name of Testing, Adjusting, and Balancing Agency
   b) Address of Testing, Adjusting, and Balancing Agency
   c) Telephone number of Testing, Adjusting, and Balancing Agency
   d) Project name
   e) Project location
   f) Project Architect
   g) Project Engineer
   h) Project Contractor
   i) Project altitude
   j) Report date

2. Summary Comments
   a) Design versus final performance
   b) Notable characteristics of system
   c) Description of systems operation sequence
   d) Summary of outdoor and exhaust flows to indicate amount of building pressurization
   e) Nomenclature used throughout report
   f) Test conditions, including weather conditions

3. Instrument List:
   a) Instrument
   b) Manufacturer
   c) Model number
   d) Serial number
   e) Range
   f) Calibration date

4. Electric Motors:
   a) Manufacturer
b) Model/Frame

c) HP/BHP

d) Phase, voltage, amperage; nameplate, actual, no load

e) RPM

f) Service factor

g) Starter size, rating, heater elements

h) Sheave Make/Size/Bore

5. V-Belt Drive:

a) Identification/location

b) Required driven RPM

c) Driven sheave, diameter and RPM

d) Belt, size and quantity

e) Motor sheave diameter and RPM

f) Center to center distance, maximum, minimum, and actual

6. Combustion Test:

a) Boiler manufacturer

b) Model number

c) Serial number

d) Firing rate

e) Overfire draft

f) Gas meter timing dial size

g) Gas meter time per revolution

h) Gas pressure at meter outlet

i) Gas flow rate

j) Heat input

k) Burner manifold gas pressure

l) Percent carbon monoxide (CO)

m) Percent carbon dioxide (CO2)

n) Percent oxygen (O2)

o) Percent excess air

p) Flue gas temperature at outlet

q) Ambient temperature

r) Net stack temperature

s) Percent stack loss

t) Percent combustion efficiency

u) Heat output

7. Gas Fired Equipment
a) Manufacturer
b) Model number
c) Serial number
d) Firing rate
e) Overfire draft
f) BTUH at sea level
g) BTUH at altitude
h) Gas pressure at meter outlet
i) Gas flow rate in cfh
j) Heat input
k) Burner manifold gas pressure
l) Orifice size
m) Air temperature rise for gas fired equipment
n) Check all limit devices for proper operation, setting and calibration
o) Make up water pressure setting
p) Working pressure
q) Ambient temperature
r) Relief valve setting
s) Static pressure
t) Fan hydronic system and fan cfm
u) Heat output

8. Air Moving Equipment
a) Location
b) Manufacturer
c) Model number
d) Serial number
e) Arrangement/Class/Discharge
f) Air flow, specified and actual
g) Return air flow, specified and actual
h) Outside air flow, specified and actual
i) Total static pressure (total external), specified and actual
j) Inlet pressure
k) Discharge pressure
l) Sheave Make/Size/Bore
m) Number of Belts/Make/Size
n) Fan RPM

9. Return Air/Outside Air Data:
10. Exhaust Fan Data:
   a) Location
   b) Manufacturer
   c) Model number
   d) Serial number
   e) Air flow, specified and actual
   f) Total static pressure (total external), specified and actual
   g) Inlet pressure
   h) Discharge pressure
   i) Sheave Make/Size/Bore
   j) Number of Belts/Make/Size
   k) Fan RPM

11. Duct Traverse:
   a) System zone/branch
   b) Duct size
   c) Area
   d) Design velocity
   e) Design air flow
   f) Test velocity
   g) Test air flow
   h) Duct static pressure
   i) Air temperature
   j) Air correction factor

12. Duct Leak Test:
a) Description of ductwork under test
b) Duct design operating pressure
c) Duct design test static pressure
d) Duct capacity, air flow
e) Maximum allowable leakage duct capacity times leak factor
f) Test apparatus
   1) Blower
   2) Orifice, tube size
   3) Orifice size
   4) Calibrated
g) Test static pressure
h) Test orifice differential pressure
i) Leakage

13. Terminal Unit Data:
a) Manufacturer
b) Type, constant, variable, single, dual duct
c) Identification/number
d) Location
e) Model number
f) Size
g) Minimum static pressure
h) Minimum design air flow
i) Maximum design air flow
j) Maximum actual air flow
k) Inlet static pressure

14. Air Distribution Test Sheet:
a) Air terminal number
b) Room number/location
c) Terminal type
d) Terminal size
e) Area factor
f) Design velocity
g) Design air flow
h) Test (final) velocity
i) Test (final) air flow
j) Percent of design air flow

15. Sound Level Report:
a) Location
b) Octave bands - equipment off
c) Octave bands - equipment on

3.08 CALCULATIONS
A. The following calculations shall be made and become part of the reported data.
   1. The fuel flow to each gas fired unit and the BTUH input.

3.09 OPERATING TEST
A. The test and balance agency shall coordinate and set up an operating test when Test & Balance is completed to ensure complete operation of the system in all modes. The controls contractor, sheet metal trade and the general contractor shall certify in writing test completion and all units are operating as designed. Attach copy of operating test to Test & Balance report.

END OF SECTION
SECTION 23 1126
LIQUID PETROLEUM GAS SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.
B. Division 2 – Trenching and Backfilling section is included as work under this section.
C. Division 23 Related Sections.

1.02 DESCRIPTION OF WORK

A. Extent of Liquid Petroleum Gas System (LPG) work is indicated on drawings and schedules, and by requirements of this section. Obtain all permits as required by State in which work is completed and pay all fees and costs. All underground components of the system shall be polyethylene and shall be fully compatible for fusion welding.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of gas system products, of types, materials, and sizes required, whose products have been satisfactory use in similar service for not less than 5 years.
B. Installer’s Qualifications: Firm with at least 5 years of successful installation experience on projects with gas systems work similar to that required for this project and licensed for gas installation in the state of where the project is located. Provide certification that the individual installer(s) have been trained in and have passed the manufacturer’s qualification procedures for the welding and installation of the polyethylene pipe, fittings, and valves to be installed on this project.
C. Personnel responsible for making heat fusion bonded joints in plastic piping shall be certified in accordance with CFR Title 49, Part 192, Section 192.285. Additionally, personnel shall be trained by electrofusion equipment manufacturer or by manufacturer’s authorized representatives.
D. The entire installation shall be fabricated and installed in accordance with the latest edition of the following Codes and Standards:

1. ASME B16. Standards for Pipes and Fittings
2. ASME B1.20.1: American conical pipe thread ACC. ANSI/ASME B 1.20.1 - 1983 inside thread conical, outside thread conical
3. ASTM Compliance: All polyethylene piping, tubing, fittings, and valves shall comply with:
   a) ASTM D-1248: Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
   b) ASTM D-3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials for P.E.
   c) ASTM D-2306: Standard Test Method for C 8 Aromatic Hydrocarbon Analysis by Gas Chromatography
   d) ASTM D-2406: Method of Testing Flexible Cellular Materials-Molded Urethane Foam
e) ASTM D-2837: Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

4. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded or Seamless


7. ANSI B31.2: "Fuel Gas Piping"

8. CFR Title 49, Part 190: Pipeline Safety Programs and Rulemaking Procedures

9. CFR Title 49, Part 191: Transportation of natural and other gas by pipeline; annual reports, incident reports, and safety-related condition reports

10. CFR Title 49, Part 192, Section 192.285: Transportation of Natural and Other Gas by Pipeline Minimum Safety Standards


15. NAPCA 14-83-94: External Application Procedures for Polyolefin Pipe Coating Applied by the Cross-Head Extrusion Method or the Side Extrusion Method to Steel Pipe

16. NAPCA 15-83-94: External Application Procedures for Plant Applied Tape Coating to Steel Pipe

17. Uniform Plumbing Code (UPC)

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in the gas system. Where more than one type of materials or products are indicated, selection is Installer’s option, but shall comply with these specifications and all applicable codes.

2.02 LPG TANK

A. Tank shall be furnished, designed and installed for use with propane and have ASME stamp under this contract. Accessories, as a minimum, shall include filling provisions with gage, liquid valve and vapor valve; ASME pressure relief valves and loading bulkhead with features shown on the drawings. Tank shall have a minimum of one coat primer and finish coat of silver or white reflective paint.
2.03 GAS REGULATORS AND METERS

A. Two (2) or three (3) stages shall allow for reduction of tank pressure to 10 psig for distribution to a range of 11 to 13 inches of water column at the point of use for building service. All regulator, relief openings shall be piped to 24” above median average snow level.

1. First stage regulators located at the tank, shall be rated with capacity for use with propane as indicated in the drawings and be equal to Fisher model noted, reducing tank pressure to 15 psig.

2. Second stage regulator shall be provided and installed at or near the storage tank rated for capacity use of propane as indicated on Drawings, and shall be equal to Fisher Model as noted, insuring distribution pressure of not greater than 10 psig.

3. Third stage regulator, one located at each building or point of use, shall be rated in BTUH or CFH for use with propane, also as indicated in the drawings. Device shall reduce pressure to a range of 11 to 13 inches W.C. and have full capacity relief with freeze resistant vent and low pressure shut-off with manual reset. Regulator shall be equal to Fisher Model S106 or approved equal.

4. Gas meter, one located at each building, as noted on plans, shall be a diaphragm, large capacity type. Cover body, and valve plate, shall be constructed to aluminum alloy. Meter shall have a single joint between the cover and body with a Buna N “O” ring seal, cast in steel feet and connections, relief valve, powdered metal parts, interchangeable valve plate assembly, Teflon faced bakelite valves, nylon valve guides, and a high impact index box.

2.04 PIPE

A. Underground distribution 10 psig pipe, tube and fittings shall be 2306/2406 polyethylene meeting the requirements of ASTM D-1248 and D-3350 for P.E. 2306/2406 and the appropriate requirements of ASTM D-2513 and ASTM D-2837.

B. Gas Service and Liquid Piping above grade – exterior to and from tank and before vaporizer.

1. All pipe sizes: Black steel pipe; ASTM A53 or A106 Schedule 80; wrought steel buttwelding fittings.

C. Gas Service below grade and above grade after vaporizer to appliances Steel Pipe: ASTM A53, Type E or S, Schedule 40, black steel pipe.

1. All pipe sizes.


3. Unions: ASME B16.39, Class 150, black malleable iron, female pattern, brass to iron seat, ground joint.

4. Dielectric Unions: Forged steel, ground joint, with high impact nylon insulators, threaded ends, 3,000 psi working pressure.

5. Cast iron fittings are not allowed.

D. Coating for Underground Steel Pipe and Fittings

1. The coating may be one of the following:

   a) Fusion Bond Epoxy: NAPCA 12-78-94 (polyethylene)

   b) Extruded Polyolefin: NAPCA 14-83-94
c) Tape Coating: NAPCA 15-83-94

E. Cathodic Protection

1. Anodes: Cast magnesium alloy, galvanized steel core rod, and 10 feet of No. 12 AWG solid TW insulated lead wire, Harco Certified Magnesium Anodes by Harco Technologies, Corrpro Co., Inc. Medina, OH, or approved equal.

2. Test Stations: Test station to test pipeline to soil potentials for determining cathodic protection system performance. Handley Industries, Inc., Jackson, MI, or approved equal.

2.05 VALVES

A. Above ground valves 1-1/2" and smaller shall be Rockwell-Nordstrom No. 142 lubricated plug valve with lubricant for LPG gas service or approved equal. 2" and larger, Rockwell-Nordstrom No. 143 lubricated plug valve with lubricant plug valve No. 555 lubricated for LPG service or approved equal.

B. Underground valves shall be polyethylene plug or ball type designed and approved for gas service. Valves shall be of the proper material to be fully compatible for welding into 2306/2406 piping as specified in Paragraph 2.04A above. Valves shall be Rockwell International (Flow Control Division) Polyvalve or approved equal.

2.06 PIPING SPECIALTIES

A. Flexible Connector: NFPA 58, corrugated stainless steel inner hose, stainless steel cover, 350 psig working pressure. Approved for LP gas service.

B. Transition Riser: Anodeless type polyethylene carrier pipe, fusion-bonded epoxy coated steel jacket pipe, threaded aboveground end. Sized to match connecting piping. Horizontal and vertical leg dimensions to meet depth-of-cover requirements. ASR by Uponer Aldyl Co., Shawnee, OK, or approved equal.

C. Strainer: Wye pattern, full line size, threaded ends, designed for LP gas service, 600 psig working pressure. Removable 80 mesh stainless steel screen and access flange with O-ring gasket. Type W, as manufactured by Smith Precision Products Company, Newberrt Park, CA, or approved equal.

2.07 VALVE BOXES

A. All underground valves shall be provided with an adjustable cast iron valve box with locking lid with “GAS” cast on top. Valve box shall be Tyler No. 6870 Roadway Box or approved equal.

2.08 SLEEVES

A. Schedule 40 black steel pipe with inside edge reamed smooth. Underground sleeves shall be protected against corrosion by a coal tar or asphalt coating.

2.09 UNDERGROUND WARNING TAPE

A. Tape shall be yellow with black letters (CAUTION – GAS LINE BURIED BELOW), SETON 210 GAS or approved equal.

2.10 TRACER WIRE

A. Provide approved 14 gage (orange covered) tracer wire along all underground piping.

2.11 TRANSITION FITTINGS

A. Pre-manufactured plastic covered threaded transition fittings shall be installed where connection to existing steel pipe is made. Each transition fitting shall be provided with a five pound cathodic protection anode connected. Transition fittings shall be installed with a strap wrench to prevent damage to the coating. Fittings with damaged coating will be
replaced. Clean, coat, and wrap connection between existing steel pipe and the transition fitting to result in a continuous protective coating for pipe to fitting.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where gas lines are indicated to be sleeved below walks and rise at building, install in accordance with industry standard GAS sleeve details; vent all such sleeves to the out-of-doors.

B. All welding shall be performed using established welding procedures by welders who have been certified for the welding procedure to be used in accordance with Title 49 – Transportation Code of Federal Regulations, Parts 190, 191, and 192.

C. Polyethylene pipe, tubing and fittings shall be installed and welded by certified welders in strict conformance with the manufacturer's recommendations and all code requirements.

D. Union, plug cock, and drip leg with removable cap is required at all points of use.

E. Support all above grade piping, regulators, etc, on pipe stands mounted in concrete to keep load off the connecting pipe.

F. Exterior below grade piping shall be protected by minimum of 30 inches earth cover. Pipe running under roads shall be provided with schedule 40 black steel sleeve which will provide at least 1-1/2" clearance all around the pipe. A continuous two inch wide warning tape shall be buried one foot below grade directly over the gas line and a continuous trace wire shall be run along the pipe. Trenching and backfilling shall comply with Division 2 – Sitework.

G. Piping exposed to the weather will receive two coats (brushed) coal tar varnish.

H. Valve boxes shall be set on concrete base with no weight bearing on the pipe.

I. Protect tanks from corrosion and vehicle damage. Install bollards 4-feet on center all around tank, vaporizer and fill station.

3.02 SUBMITTALS

A. Submit manufacturer's data and certifications on all piping, tubing, fittings, valves, valve boxes, and anodeless risers, that are to be installed in GAS system complete. The submittal shall contain a complete detailed schematic drawing of the tank installation, tank support, (reviewed and stamped by Structural Engineer) and fuel transfer station with support details. Clearly identify all components (excess flow valves, pressure reducing valves, pipe sizes, etc). Submit complete manufacturer's recommendations, requirements, procedures, temperatures (welding) for the fusion welding of the polyethylene pipe, tubing, fittings, and valves. Submit a copy of the installing company's current gas license and copies of individual installer's certificate that they have passed the manufacturer's qualification procedures for the welding and installation of polyethylene pipe, fittings, and valves to be installed on this project. Submittal of all GAS system components, schematic drawings, manufacturer's data, fusion welding procedures, etc, shall be made at one time as a package; partial submittals will not be accepted.

3.03 TESTING

A. Test GAS system with 60 psi air pressure and hold for four (4) hours. Purge tank and piping of air in accordance with NFPA 54 and 58. Purge tank four (4) times in accordance with REGO LPG Serviceman's manual to achieve no more than 6.25% air remaining in tank.
3.04 FUEL SUPPLY
A. The Contractor shall provide all GAS required heating, operating, construction use and testing of the system until the time the Owner takes beneficial occupancy or gives final acceptance (whichever comes first) of the project.

3.05 CLOSEOUT SUBMITTALS
A. As specified in Division 1 and 23.
B. Operation and Maintenance data as required by Division 1 and 23.
   1. Submit operation and maintenance data for the following:
      a) Valves
      b) Meter
      c) Regulators
      d) Storage Tank
      e) Tank appurtenances
      f) All piping
      g) Pipe manufacture installer Certifications
C. Test Reports

3.06 FIELD QUALITY CONTROL
A. Inspect, test, and purge gas system in accordance with NFPA 54 and NFPA 58. Test with air or inert gas only.
B. Test at pressure of 60 psi for a period of not less than four (4) hours without showing any drop in pressure.
C. Check connections with a leak test solution, which is listed for this purpose. So not use soap solution or solutions containing ammonia, which made corrode the pipe.
D. Repair leaks and defects with new materials. Makeshift remedies will not be permitted. Retest system until satisfactory results are obtained.
E. Submit written test report to Architect/Engineer for review.
F. Verify capacities and pressure ratings of gas meters, regulators, valves and specialties.
G. After pressure testing has been completed, fully purge all air from gas piping. No not purge open end of piping systems into confined spaces or areas where there are sources of ignition, unless the space is adequately ventilated, purging rate is controlled, and all hazardous conditions are eliminated.

END OF SECTION
SECTION 23 3000
AIR DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish and install fans, filters, sheet metal work, grilles, louvers, diffusers, registers, sound traps, special fan bases, fire dampers, combination fire and smoke dampers and sleeves, accessories and natural gas fired appliance flue vents.
B. All automatically controlled dampers furnished under Section 253000 - CONTROLS AND INSTRUMENTATION will be installed under this section. After dampers are set, they shall be balanced for free and easy operation.
C. Where ductwork has an interior lining, dimensions shown on drawings shall be clear dimensions inside the liner.
D. Prior to system test and balance, supply and install new, clean air filters throughout the air handling systems except for any high efficiency filters, which have pressure drop within normal operating limits.

1.03 REQUIREMENTS AND RELATED WORK
230000 - HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230500 - GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS
230593 - BALANCING OF MECHANICAL SYSTEMS
253000 - CONTROLS AND INSTRUMENTATION

1.04 REFERENCES
A. ASTM A 36 - Structural Steel
B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality
E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
F. ASTM A 525 - General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process
G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality
H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate
K. AWS D9.1 - Welding of Sheet Metal  
M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems - Latest Edition  
N. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying - Latest Edition  
P. SMACNA - HVAC Air Duct Leakage Test Manual  
Q. SMACNA - HVAC Duct Construction Standards - Metal and Flexible - 1985  
R. UL STANDARD 181 - Factory-Made Air Ducts and Connectors  
S. UL STANDARD 555 – Standard for Safety Fire Dampers  
T. UL STANDARD 555S – Leakage Rated Dampers for use in Smoke Control Systems

PART 2 - PRODUCTS

2.01 EQUIPMENT SCHEDULES  
A. All major items of equipment are specified in the equipment schedule on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.  
B. All registers, grilles and diffusers shall be as listed in the schedule on the drawings. Frame style shall be coordinated by the Contractor to match the ceiling type shown on the reflected ceiling plans of the Contract Documents.

2.02 DUCTWORK  
A. SHEET METAL  
1. Materials and Gauges: Construct all ducts, casings, plenums, etc., of galvanized steel sheets, of the gauges specified below, unless otherwise shown. Sheets shall be free from blisters, slivers, pits and imperfectly galvanized spots.  
2. All ductwork shall be constructed in accordance with "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE". First Edition, 1985 as published by Sheet Metal and Air Conditioning Contractors National Association, Inc. Pressure class for all ductwork shall be 2” or unless otherwise noted on plans.  
3. Construct low velocity ducts using Pittsburgh or "Snap-Lock" corner seams. All seams shall be made airtight. Using United Mc Grill "UNI-FLEX" duct sealer or approved equal.  
4. Connections of high pressure and/or velocity ducts, fittings and high pressure boxes shall be made airtight by tack welding on 8” centers and coating joints with United Mc Grill "United duct Sealer".  
5. Round ducts and fittings for high velocity systems shall be spiral lock seam conduit as manufactured by United Mc Grill Co., Inc., or approved equal. All 90 elbows shall be at least 5-piece construction. Standard manufactured ducts of other than spiral construction will be acceptable if constructed of the following
gauges with welded seams. Sizes thru 12-inch diameter shall be 22 gauge, 13 inch thru 36 inch diameter shall be 20 gauge, 37 inches and over shall be 18 gauge. Basic high velocity fittings are detailed on the drawings. Spun or tapered takeoffs shall be used from all vertical high velocity risers.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 time's width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible, maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45-degree lateral wye takeoffs unless otherwise indicated where 90-degree conical tee connections may be used.

F. Flexible

1. Flexible ducts for connections between rigid ductwork and variable volume boxes shall be Factory Insulated flexible conduit capable of holding 5 inches W.C. without development leaks and shall not exceed a flame spread of 25 or a smoke development of 50. Thermo flex Type N-KH or approved equal.

2. Flexible connections between the diffusers and the run-out ducts shall be factory insulated, sound absorbing low velocity flexible conduit conforming to the following duct fabrication shall not exceed a flame spread of 25 or a smoke development of 50.
   a) Two ply vinyl film supported by helically wound spring steel wire: fiberglass insulation: polyethylene vapor barrier film.
   b) Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   c) Maximum Velocity: 4000 fpm (20.3 m/sec).
   d) Temperature Range: -10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C).

2.03 ACCESS DOORS

A. Wall and Ceiling Access Doors: Furnish as required in Section 230500, paragraph 3.6.

B. Duct Access Doors: Duct access doors at fire dampers and other locations which require access to mechanical devices inside of ductwork shall be Controlair 16 gauge access door with continuous hinge, neoprene gasket, thumb screw locks and baked enamel finish. Doors shall be sized for easy access to mechanical device.

C. Walk Thru Plenum Access Doors: Doors shall be provided with a flat iron or angle iron stiffening frame and so constructed that they can be operated without twisting or distortion. Doors on insulated ductwork shall be of double panel construction provided with an approved type insulated filler, not less than one inch thick. The duct opening at each door shall be provided with a continuous reinforcing galvanized bar or angle against which the door will close, this being provided with a sponge rubber gasket to make the door airtight.

D. Doorframes on insulated ductwork shall be placed on an extended metal collar flush with the face of the finished insulation.
2.04 FILTERS
   A. Filters shall be as listed in the schedule on the drawings.
   B. Filter gauge for each bank of filters in the mechanical rooms and roof top equipment will be supplied and installed by the Controls Contractor as specified in Section 253000 - CONTROLS AND INSTRUMENTATION.

2.05 TURNING VANES
   A. Turning vanes shall be installed in all square elbows. Turning Vanes shall be air foil blade type, shop or factory fabricated.

2.06 FLUE GAS VENTS
   A. Gas fired equipment shall be vented in accordance with the Uniform Mechanical Code, Uniform Plumbing Code and local codes and ordinances. Natural draft appliances shall have Type "B" vents. Forced draft appliances shall have Metalbestos Type PS, 16 gauge black steel vents.

PART 3 - EXECUTION

3.01 INSTALLATION OF SHEET METAL WORK
   A. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary the required area shall be maintained. All of these changes, however, must be approved and installed as directed at the project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering. Whenever exposed ducts pass through walls, floors or ceilings, a flanged sheet metal collar fitting close around ducts shall be slipped along duct until flange is tight against finished surface covering edges of openings and presenting a neat appearance. Collar shall be locked to duct.
   B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
   C. Use double nuts and lock washers on threaded rod supports.
   D. Connect diffusers or light troffer boots to low-pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
   E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
   F. All ducts, coils, housings, registers, grilles, fans, etc., shall be clean when installed and shall be kept clean until the system is completed. As the various parts of the system are installed, they shall be wiped or blown clean and openings taped dust-tight with heavy paper or cardboard until the system is completed and ready for testing. At that time all covers and protective wrappings shall be removed. Where one has been torn or previously removed, the duct, coil, register, etc., shall be carefully cleaned of any dirt or dust that has entered the opening.

3.02 DUCTS AT MASONRY
   A. Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron.
3.03 HAND AND SPLITTER DAMPERS

A. Install hand operated volume and splitter dampers at all locations of branches of main ducts, from equipment, supply ducts, return ducts and at all locations where air flow splits or is balanced, whether shown or not. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct. Where ducts are insulated the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be made in two sections and each independently operated. Splitter dampers shall be at least 1 1/2 times as long as the narrowest adjacent split. All damper fittings must be heavy commercial items and must be approved by the Architect/Engineer before installation.

3.04 FLEXIBLE CONNECTIONS

A. Provide glass fabric, neoprene coated flexible connections, not less than 6" wide at the inlet and outlet connection of each fan unit, securely fastened to the unit and to the ductwork. Material shall comply with Underwriter's Laboratories Standard 214.

B. Indoor applications shall have Metaledge Ventglas with heavy glass fabric, double coated with Dupont's Neoprene.

C. Outdoor applications shall have Metaledge Ventlon with heavy glass fabric, double coated with Dupont's Hypalon.

3.05 CROSS BREAKING

A. Rectangular sheet metal ducts shall be cross-broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross-broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles. The center of the cross break shall be of the required height to assure surfaces being rigid. High velocity plenum panels and ductwork shall not be cross-broken.

3.06 TEST HOLES IN DUCTWORK

A. Furnish test holes in ducts at locations required by the testing and balancing team for testing of air quantities in ducts. Ventlok No. 699, closures shall be provided and installed for each test hole, with sufficient neck length to penetrate the insulation.

3.07 HANGERS AND SUPPORTS

A. Hangers for ducts up to 18 inches in width or diameter shall be placed not more than ten-foot centers. Ducts 19 inches and over in width or diameter shall be supported on not more than five foot centers. Hangers shall be placed plumb and present for a neat appearance. Construct hangers for high velocity boxes and for ductwork form galvanized iron 1" x 1" x 1/16" for ducts up to 36 inches in width or diameter. For ducts over 36 inches in width or diameter, support ducts every 4'-0" with 1 1/4" x 1 1/2" x 1/8" angles. The use of perforated band iron for duct support is prohibited. Hangers shall extend down the sides of the ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs heavy supporting angles shall be attached to ducts and to the structure. Angles shall be of sufficient size to support ductwork rigidly. Place supporting angles on at least two sides of the duct.

3.08 FABRICATION

A. All ductwork shall be fabricated with the mill markings on the outside.

3.09 TESTS

A. Testing and balancing of the air tempering systems will be as specified in Section 230593 - BALANCING OF MECHANICAL SYSTEMS.
B. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor shall make any changes necessary to provide the specified conditions.

C. Cleaning ducts and testing for tightness: Before the ceiling is installed and final connections are made to air outlet devices, operate the fans at full capacity to blow out dirt and debris from the ducts. If it is not practical to use the main supply blower for cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned, an air tightness test shall be made on all ductwork. A minimum pressure equal to fan static pressure at less than 10% of design flow or 2 1/2 times design external static pressure, whichever is less shall be maintained during the test. A soap test shall be applied to all sheet metal connections and joints to locate air leaks. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away), shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. In lieu of the above tightness tests, the Contractor may test the ducts by attaching a fan with a capacity of not over 300 cfm at 2 1/2" static pressure to the ductwork and with outlets blocked air tight, build up the pressure in the ducts to 2" water gauge. If this pressure cannot be obtained the Contractor shall locate and repair the leaks as specified above. The Architect/Engineer and Owner's Representative shall witness the test and the Contractor shall notify the Insulation Contractor in writing when the test has been satisfactorily completed.
SECTION 23 5200
STEAM BOILER PLANT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. The manufacturer's representative shall supply and deliver the natural gas-fired steam boiler, thermal feed pump, and related controls, pumps, and accessories as specified herein to the site.
B. All materials and equipment to be delivered and unloaded at a location specified by the Architect/Engineer or the owner's delegated representative.
C. The manufacturer's representative is fully responsible for coordination of all equipment and materials with the contractor at the project. In the event of any discrepancies of preparation of the systems, the manufacturer's representative shall notify the Architect/Engineer immediately in writing.

1.03 RELATED WORK IN OTHER SECTIONS
220523 - VALVES
220700 - PIPING INSULATION
221000 - PIPE AND PIPE FITTINGS
230000 - HEATING, VENTILATING, AND AIR CONDITIONING INDEX
230100 - DEMONSTRATION AND TRAINING
230500 - GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
230519 - PIPING SPECIALTIES

PART 2 - PRODUCTS

2.01 PACKAGED STEAM BOILER
A. Provide one natural-gas fired steam boiler as specified on the drawings dryback, horizontal firetube Scotch Marine Boiler. Each boiler shall be a packaged unit consisting of the boiler, burner, controls and fuel trains. The unit must be assembled, wired, and piped in the boiler manufacturer's plant, be fire tested as a packaged prior to shipment and carry the UL package boiler label. The boiler and burner must be manufactured by the same firm to assure compatibility and single source responsibility for the package's performance.
B. The Vessel: Each boiler must be designed and built for 160 PSI steam pressure in accordance with Section I ASME boiler and Pressure Vessel codes. The unit shall provide 5 square feet of fireside heating surface per boiler horsepower. The furnace must be cylindrical. The furnace, rear turnaround area, and rear furnace wall shall be water cooled. Two passes of fire tubes and two rear tube sheets shall be provided. The flues shall be attached by rolling and beading. Welded tube attachment is not allowed. A 16" diameter gasketed refractory lined rear combustion chamber access opening with
pyrex observation port shall be provided. A manhole and hand holes shall be provided in accordance with ASME codes.

C. Each boiler shall be provided with a heavy-duty structural steel base. Lifting loops and rigging holes in the skid shall be provided to facilitate installation.

D. A smoke outlet shall be provided. Front and rear flue doors must be gasketed to provide gas tight construction for pressurized firing. The front doors must be hinged and provide access to all fire tubes without removal or disconnection of any unit components. A 22 gauge factory installed enameled jacket is required. Two inches of shell insulation is required. The insulation and jacket shall cover the entire diameter of the shell.

E. Each unit shall include the following items:
   1. Safety valves selected in accordance with ASME code requirements, set at 75 PSI.
   2. McDonnell and Miller 157 combination water column, primary low water cutoff, and pump control.
   4. Side feed water tapping with internal baffle connection.
   5. Feed water stop and check valves factory mounted.
   6. Quick and slow opening bottom blow down valves.
   7. Surface blow-off tapping.
   8. 0-300 PSI steam pressure gauge.
   9. 3” flue gas thermometer mounted below rear flue outlet.

F. Combustion Equipment: The boiler shall be as scheduled on the drawings per hour of steam at 160 PSI with feedwater from and at 212°F. The burner shall be a forced draft, multiple orifice, flame retention type, and include sound attenuation material on the combustion air inlet.

G. Equipment shall include: forced draft fan with air damper; dual controls (limit and operating); flame sensing device; and NEMA-1A control cabinet containing electronic flame safeguard and programmer, control circuit switch, necessary switching relays, numbered terminal strip, numbered wiring, engraved nameplates. All motors shall be for 480 volts, 60 hertz, three phase operation. Controls shall be 115 volts, 60 hertz, single phase. Necessary fuses, motor contactor or magnetic motor starters with thermal overload protection, and a step-down control circuit transformer shall be provided with the control cabinet. Four indicating lights will be provided: low water, flame failure, ignition and main flame.

H. The main control cabinet shall be mounted on the side of the boiler. A secondary control cabinet shall be mounted on the burner and include a manual potentiometer or hi-low switch, a stop switch, a “power-on” light, a “main fuel” light, a terminal strip, combustion air switch, and oil pressure switches.

I. The pilot assembly and flame scanner will be located on the outside of the burner to allow easy adjustment and maintenance. Spring loaded roller cam followers will be provided for positive positioning of the air damper and fuel valves throughout the operating range. The turndown ration will be at least 3 to 1. The unit will have a modulating firing sequence with low fire start.

J. Combination Gas-Pressure Atomizing
   1. The combustion equipment will be capable of producing scheduled steam capacity. The fuel trains and controls will meet UL and IRI requirements.
2. Gas burner shall consist of a combination multiple orifice flame retention type gas burner. Gas side shall include necessary controls for modulated firing with proved low fire start. Gas controls shall include a main gas control group consisting of one motorized gas valve with proof of closure; gas volume control valve with adjustable cam operator; gas pressure regulator; gas gauge and two lubricated plug cocks; high and low gas pressure interlocks; normally open vent valve; gas gauge; provisions for pressure check. Controls shall include an ultra-violet flame detector; air flow safety switch and gas-electric ignition assembly consisting of a pilot burner, 6,000 volt ignition transformer, unitized safety gas valve, gas pressure regulator and gas cock. Fuel-air control shall provide modutrol motor. The unit will be capable of extended operation on natural gas fuel. The gas manifold will be continuously seal welded and pressure tested.

K. Feed Water Control

1. The feed water control system shall provide modulation of the feed water to the boiler. The feed water control shall consist of a Magnetrol APM-W-131L Pneumatic Level Controller with a Cashco Feed Water Control Valve. The system shall be mounted on the boiler and be piping and wiring in the manufacturer's plant. The system shall include a three-valve bypass and a feed water stop and check valve.

L. Guarantees: The seller shall provide with the quotation guaranteed fuel to steam efficiencies at the time of start-up when the boiler is producing saturated steam at 40 PSIG.

<table>
<thead>
<tr>
<th>LOAD</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel to Steam Efficiency</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

M. The seller shall provide with the quotation guaranteed levels of CO2, O2, and flue gas temperature for each of the listed guaranteed efficiencies. The quotation shall include the shell losses of the boiler as a percentage of the full fire boiler input.

N. Performance tests shall be preformed by a factory authorized representative at the time of start-up. The buyer shall make provisions for venting the steam if an insufficient load exists for the duration of the tests.

O. The equipment supplier shall warrant the boiler for one year from start-up, or 18 months from shipment, whichever occurs first.

P. The boiler supplier must guarantee to replace or repair front and rear door refractory in the event of failure within five years from date of start-up.

Q. Start-up Service: Start-up shall be performed by a factory authorized start-up technician. Warranty service will be provided for a period of one year from date of start-up by a factory authorized technician.

R. Service Parts: The boiler shall provide a stock of service parts. These parts would be those necessary to prevent extended equipment outages. The parts provided should include:

1. 1 set of sight glass and gauge glasses
2. 1 complete pilot electrode
3. 1 ignition transformer
4. 1 pilot manifold per boiler
5. 1 air switch
6. 1 set of gauges per boiler
7. 1 set of switches per boiler
8. 1 set of lights
9. 1 set of fuses
10. 1 Blower wheel and motor
11. 1 combustion control, timer, and amplifier
12. 1 flame scanner
13. 1 set of gaskets per boiler
14. 1 set of operating, limit and modulating controls
15. 1 set of gas valve actuators per boiler
16. 1 Low Water Cutoff

2.02 THERMAL FEED WATER SYSTEM SPECIFICATION

A. Furnish and install thermal feed water system. The unit shall be as scheduled on drawings.

B. The thermal feed water system must be fully assembled at the factory and shipped assembled to minimize installation time. All wiring, piping and tubing will be completed prior to shipment. The overall height of the unit shall not exceed 96".

C. Approximately 20% of the total load will be made up at 40°F, and 80% will be low pressure or pumps returns at 180°F.

D. Vessel: The deaerator will consist of a two compartment vessel, consisting of a deaerating section and a scrubbing section. A recycle pump will be provided to transfer the deaerated condensate to the spray nozzles at a constant, continuous rate. A quick opening bypass assembly shall be provided to interconnect the deaerating section and scrubbing section. The deaerating and scrubbing sections shall have 11" x 15" manways for easy access to all internal components and inspection of the unit.

1. All makeup, and low pressure or pumped returns enter the mixing section.

2. The thermal feed water unit shall be equipped with a stainless steel internal direct contact vent condenser. The vent condenser shall be equipped with spring-loaded, stainless steel, wide-angle spray nozzles sized to condense all steam vapors. Undeaerated water contact surfaces shall be fabricated of stainless steel.

3. Initial shall take place in the deaerating section by blending new makeup with condensate returns and constantly recycled, fully deaerated water.

4. Final shall take place in the scrubbing section through a pressurized alloy spray scrubbing manifold. The manifold shall be equipped with all stainless steel wide-angle spray nozzles. The nozzles are to be fixed orifice type with no spring or weight-loaded spray assemblies.

E. Makeup Assembly: Furnish a water makeup assembly with a capacity of 20 GPM at 30 PSIG inlet water supply pressure. The assembly shall consist of a properly sized pneumatic modulating control valve with water inlet y-strainer, pneumatic modulating controller, and three-valve bypass. The control valve shall be stainless steel trim and dead-end shut-off capability. The controller shall be a pneumatic modulating type with a dial adjustable level setting and proportional band.

F. Pressure Control System: Furnish a pressure control system with capacity to raise 27.6 GPM from 140°F to 227°F with 40 PSIG minimum steam supply at the regulator. The...
pressure control system shall consist of a pneumatic diaphragm control valve and pneumatic pressure controller. The control valve shall have stainless steel trim and dead-end shut-off capability. The controller shall be of the adjustable proportional type and feature manual reset, adjustable pressure setting and incorporate pressure gauge as part of the instrument. The system shall include a steam inlet y-strainer.

G. Boiler Feed Pumps: Furnish boiler feed pumps as scheduled. Each pump shall have 250°F mechanical shaft seal and be close-coupled. The pump shall not cavitate nor overload motor at any time during normal operation. The pump shall have a low NPSH requirement which shall not be exceed at any time during normal operation. The contractor shall be required to submit details of pump construction, head capacity curves and NPSH requirements of the pump. The pump section shall have a shut-off valve, compression type coupling, and suction piping.

H. Accessories:
1. All of the following shall be provided:
   a) Two 3" stainless steel temperature gauges
   b) Two 1/2" water gauge cocks, 5/8" red line glass and protector rods.
   c) Two drain valves
   d) High and low water alarm scrubbing section
   e) Alarm silencer
   f) Overflow trap
   g) Sentinel relief valve
   h) Vent valve
   i) Opening for returns

I. Power and Control Panel: Furnish one central control and power panel mounted on the deaerator. The enclosure shall be of steel and exterior shall be phosphatized, double prime coated and finished with an oven baked enamel. The panel shall be NEMA 1 and all compartments physically isolated. Two compartments shall be for boiler feed pumps driven by 3 HP, 480 volt, 3 phase, 60 cycle motors, and one compartment shall be for recycle pumps driven by 1 1/2 HP, 480 volt, 3 phase, 60 cycle motors.

1. Each compartment shall include a fused disconnect switch with dual-element fuses, auxiliary contacts and external operating handle, starter with three-leg overload protection, motor control switch and running light.

2. One compartment shall house all necessary control components including a 120 volt fused secondary control circuit transformer, dual element fuses, numbered terminal block, indicated lights, alarm horn, with alarm silence relays and push button and other required controls. The enclosure shall require only one power connection.

3. All of the above shall be factory pre-wired and tested in accordance with the provisions of the National Electric Code.

J. Start-up Training and Service: Services of a factory representative shall be provided to check installation, start the unit, and to instruct plant personnel in recommended operating and maintenance procedures. Warranty service shall be provided for a period of one year from date of start-up by a factory authorized technician.
Division Twenty Five

AUTOMATION
SECTION 25 0000
INTEGRATED AUTOMATION INDEX

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Integrated Automation Work, as indicated on the Drawings and specified herein. Integrated Automation work indicated on the Drawings and/or specifications covering other trades shall conform to Division 25 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Integrated Automation systems shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for Integrated Automation service connections to all the various items of equipment requiring controls service throughout the project shown on the Contract Drawings (even if not shown on Integrated Automation Drawings). Coordinate with other trades for the installation of required connections and service.

1.03 INTEGRATED AUTOMATION DIVISION INDEX

251100 ELECTRICAL CONTROLS AND INTERLOCKS
253000 CONTROLS AND INSTRUMENTATION

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION
SECTION 25 1100
ELECTRICAL CONTROLS AND INTERLOCKS

PART 1 - GENERAL

1.01 Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.02 RELATED WORK IN OTHER SECTIONS
260500 - GENERAL ELECTRICAL PROVISIONS
260519 – CONDUCTORS
260526 - GROUNDING
260533 - RACEWAYS, BOXES AND FITTINGS
262726 - WIRING DEVICES AND PLATES

1.03 DESCRIPTION OF WORK
A. All disconnect means, motor controllers, electrical controls, protective, and signal devices for equipment furnished under Division 25 of these specifications will be installed and connected as scheduled herein or as otherwise noted on the drawings.

B. Electrical items not shown on the electrical drawings, but which are required for equipment furnished under Division 25 of this specification shall be furnished under this section of the specifications and shall be installed and electrically connected in conformance with Division 26 Specifications.

1.04 SUBMITTALS
A. Submittal data for each individual electrically controlled item of equipment or device furnished under this Division of these specifications shall include complete electrical wiring diagrams, and elementary control diagrams (ladder form) showing all internal and external wiring connections and services. The submittal data shall itemize all electrical characteristics that are of a special nature or critical to the electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met. These submittals shall form a part Section 250500 requirements and shall be properly coordinated by the Contractor.

B. As soon as possible after contract notice to proceed, one print of the ladder diagrams shall be submitted by the contractor showing all necessary wiring for the mechanical equipment and devices proposed for installation. This print shall be reviewed and approved by the contractor, and then submitted to the Architect/Engineer for approval. The print shall indicate all components which shall be wired to the control/power circuits by the contractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer’s designations. Internal or factory installed wiring of package-type components need not be shown. Control diagrams shall show all internal and external wiring connection and shall clearly indicate field wiring furnished and installed under Division 25, differentiated from field wiring furnished and installed under Division 26.

C. Revised Drawings: After the Architect/Engineer has approved the marked copy of the control diagrams submitted in accordance with Paragraph B above, the Contractor shall issue prints to all involved parties. The control diagrams shall be certified in writing as being acceptable to the contractor. The approved drawings will then be included in the control submittal and the Operating and Maintenance Manual.
1.05 INSTALLATION
A. No control work shall be performed until control submittal has been approved by the Architect/Engineer.

1.06 CHANGES DURING CONSTRUCTION
A. The complete responsibility and costs for revisions during construction to the approved control diagrams, and the resultant changes to the installation requirements, not covered by contract change order, shall be assigned to the contractor requesting such revisions.

PART 2 - PRODUCTS

2.01 CONTROL AND INTERPOSING RELAYS
A. Relays other than those on I/O cards shall be general purpose, enclosed plug-in type with 8 pin octal plug and protected by a heat and shock resistant dust cover. Relays shall be of the Neon or LED indicator type.
B. Relay contact configuration and ratings shall be for rated load voltage and exceed load current rating by no less than fifty percent. Minimum contact rating shall be 10 amps at 120 volts AC.

2.02 TERMINAL STRIPS
A. Terminal strips shall be of the molded nylon or polypropylene barrier type, individual plug-in mounted on a mounting channel. Terminal connections shall be rated 300 volt, 40 amp and shall be of the tubular clamp type for use with bare wire ends, or of the strap screw type for use with crimp spade lug prepared wire ends. Terminal strips shall provide for removable marking strips or have prepainted matte finish marking surfaces. Buchanan 600 series or approved substitute.

PART 3 - EXECUTION

3.01 RELAYS
A. All remote field devices shall be controlled through the use of an interposing relay. In no case shall a contactor or motor starter be directly controlled from a solid state device output or relay contact of a rating less than that stated above.

3.02 COMPONENT IDENTIFICATION
A. All individual components (relays, timers, terminal strips, etc.) shall be clearly marked with the identification nomenclature shown on the manufacturer's shop drawings. Identification shall be by the use of press-type tape strip (kroy) covered with Scotch 600 clear tape or approved substitute method.

3.03 CONTROL WIRING INSTALLATION
A. The installation and wiring of all electrical equipment installed under this contract shall meet all Electrical Division specifications. Special attention is called to the following:
1. All wiring to be in conduit.
2. All control wiring to be color-coded throughout. Conductor color shall be consistent for the entire length of circuit.
3. All splices shall be made in junction boxes on terminal strips.
4. All control wiring to terminate on marked terminal strips and shall be marked at all terminal points. Both ends of each wire shall be marked with a designation
shown on the manufacturer's shop drawings, using interlocking chevron shaped snap-on plastic markers, hot-marked shrinkable tubing, hot stamping of the wire, or clear shrink-on tubing securing adhesive labels. Markers which depend solely on adhesive are not acceptable.

END OF SECTION
SECTION 25 3000
CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. Furnish and install a control system, complete in all respects to provide the Sequence of Control shown on the drawings.

B. All disconnect means, motor controllers, and all protective and signal devices for all electrical equipment provided under all Electrical Divisions will be furnished, installed and connected under all Electrical Divisions with the following exceptions:

1. All controls wiring and conduit for HVAC equipment is the complete responsibility of all Mechanical Divisions. Electrical connections, relays, interlocks, etc. not shown on the electrical drawings, but which are required for equipment furnished under all Mechanical Divisions shall be installed and electrically connected by all Mechanical Divisions in conformance with all Electrical Division Specifications.

2. All disconnect means, motor controllers, and all protective and signal devices furnished with, mounted on and connected integral with equipment furnished under other divisions.

3. All disconnect means, motor controllers, electrical controls, protective, and signal devices for equipment furnished under all Mechanical Divisions of these specifications will be installed and connected as scheduled herein or as otherwise noted on the drawings.

C. The mechanical trade is entirely responsible for furnishing, installing, wiring, connecting and placing the control systems in operation. Electrical work required will be the final responsibility of the Mechanical Contractor either by his own electricians or by his subcontract with an Electrical Contractor.

1.03 RELATED WORK IN OTHER SECTIONS

230593 - BALANCING OF MECHANICAL SYSTEMS

250000 - INTEGRATED AUTOMATION INDEX

1.04 GENERAL REQUIREMENTS

A. The control system shall be furnished complete for the heating and air conditioning systems by Alteron, Invensys (Siebe), Delta, TAC (Andover), and Honeywell. The temperature control company shall have a permanent, fully staffed, well-established, local office and service organization. A complete stock of all repair and replacement parts for all items furnished under this contract shall be carried in stock at the local office at all times.

B. Submittals: Shall include plan size drawings, with individual literature on each item, showing control sequences, complete electrical ladder diagrams and all control components and their wiring requirements. The Contractor shall be responsible to see that all systems are properly coordinated.

C. Operation and Maintenance Manuals: As soon as possible after Award of Contract, the Contractor shall prepare an Operation and Maintenance (O & M) Manual and submit it to
the Engineer for review and approval. The control system testing and training specified hereafter shall not be conducted until the O & M Manual has been approved. See Specification Section 251000 – Direct Digital Control Software and Components. The Manual shall contain, as a minimum:

1. Approved control diagrams.

2. Equipment and device catalog cuts identifying each control device with a unique number or symbol coordinated with the control diagram symbols.

3. A Sequence of Control for each system's control diagram identifying the function and physical location of each adjustable control device, written in language understandable to personnel not specifically trained in HVAC control systems.

4. A Troubleshooting section for each control system indicating what tests and/or adjustments can be made to identify and/or correct common problems with control systems of the type installed. This description should address procedures to determine the cause of high or low space temperature and/or humidity in a typical room served by each air handling system. The description should be adequate to lead untrained persons to conclude, at minimum, whether the unit is receiving adequate primary cooling or heating, whether mixed air and supply air temperatures are reasonable and whether field adjustments or technical service is required to solve the problem. This troubleshooting section shall be bound in a separate section of O & M Manual and shall clearly refer to control device symbols shown on the Control Diagram drawings.

1.05 SPECIAL REQUIREMENTS

A. The controls trade shall check and adjust his control system completely, four (4) times during the warranty period. The fourth (4) check to be made during the final thirty days of the warranty period.

B. The controls trade will furnish the Owner with an accurate, up-to-date wiring diagram of all electrical and electronic equipment installed under this contract.

C. The Contractor shall furnish a complete set of parts lists, operating instructions and maintenance literature, in duplicate, for proper maintenance of all control equipment.

D. Steel lockable covers shall be provided for all space thermostats where shown on the drawings and where the space thermostat could be damaged.

PART 2 - PRODUCTS

2.01 CONTROL AND INTERPOSING RELAYS

A. Relays other than those on I/O cards shall be general purpose, enclosed plug-in type with 8 pin octal plug and protected by a heat and shock resistant dust cover. Relays shall be of the Neon or LED indicator type.

B. Relay contact configuration and ratings shall be for rated load voltage and exceed load current rating by no less than fifty percent. Minimum contact rating shall be 10 amps at 120 volts AC.

2.02 TERMINAL STRIPS

A. Terminal strips shall be individual plug-in type on a mounting channel. Terminal connections shall be rated 300 volt, 40 amp and shall be of the tubular clamp type for use with bare wire ends, or of the strap screw type for use with crimp spade lug prepared wire ends. Buchanan 600 series or approved substitute.
2.03 CONTROL PANELS
   A. An enclosed control panel or panels with hinged door and locking device shall be
      installed where shown on the drawings. Panel layout shall be as shown. Thermometers
      switches and pilot lights will be flush mounted on the hinged door. Hard tubing shall be
      brought into the panel. Tubing within the panel may be plastic neatly bundled and
      tagged. All indicators and controllers will have descriptive bakelite tags.

2.04 SEQUENCE OF OPERATION
   A. The operation of the control system shall be as indicated on the drawings and control
      diagrams. The sequence shall be rewritten and shown on the control submittal drawing
      diagramming that system. The sequence on the submittal drawing shall identify control
      devices by number and physical location coordinated with the submittal drawing device
      numbers.

PART 3 - EXECUTION

3.01 RELAYS
   A. All remote field devices shall be controlled through the use of an interposing relay.

3.02 INSTALLATION
   A. No control work shall be performed until the control system shop drawings have been
      approved by the Engineer and returned to the contractor.

3.03 CONTROL WIRING
   A. The installation and wiring of all electrical equipment installed under this contract shall
      meet all Division 16 specifications. Special attention is called to the following:
      1. All wiring to be in conduit.
      2. All control wiring to be color-coded throughout. Conductor color shall be
         consistent for the entire length of circuit.
      3. All splices shall be made in junction boxes on terminal strips.
      4. All control wiring to terminate on marked terminal strips and shall be marked at
         all terminal points. Both ends of each wire shall be marked with a designation
         shown on the manufacturer's shop drawings, using interlocking chevron shaped
         snap-on plastic markers, hot-marked shrinkable tubing, hot stamping of the wire,
         or clear shrink-on tubing securing adhesive labels. Markers which depend solely
         on adhesive are not acceptable.
   
   B. Terminal strips shall be used in all boxes and cabinets where more than six control wires
      are terminated, spliced or both.

   C. All control wiring shall be color coded and marked in each box, at each termination with
      Brady wrap around labels or suitable tags approved by the Architect. The schematic
      control diagrams shown on the contract drawings are for the convenience of the
      contractor and may not be complete in all details of control wiring for the equipment
      purchased for installation.

3.04 SYSTEM TESTING
   A. The integrity and accuracy of each function and control point shall be demonstrated to
      the satisfaction of the Architect/Engineer during the test period. At the termination of
      the testing period the Contractor shall spend one working day instructing the Owner or his
      designated personnel in the control system operation. A complete operating booklet shall
      be provided and used during the training period.
B. Upon completion of the installation, the Contractor or his authorized representative shall be sent to the installation to certify that all necessary electrical tests and control adjustments have been completed. He shall then file a letter of Certification indicating that the system functions and conforms to the intent of these specifications.

END OF SECTION
Division Twenty Six

ELECTRICAL
SECTION 260000
ELECTRICAL INDEX

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Electrical Work, as indicated on the Drawings and specified herein. Electrical work indicated on the Drawings and/or specifications covering other trades shall conform to Division 26 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Electrical systems, shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for electrical service and control connections to all the various items of equipment requiring electric or wiring service throughout the project shown on the Contract Drawings (even if not shown on the Electrical Drawings). Coordinate with other trades for the installation of required connections and service.

1.03 ELECTRICAL DIVISION INDEX
260500 GENERAL ELECTRICAL PROVISIONS
260519 LOW VOLTAGE CONDUCTORS
260526 GROUNDING
260533 RACEWAYS, BOXES AND FITTINGS
262416 PANELBOARDS
262716 CABINETS
262726 WIRING DEVICES AND PLATES
262813 FUSES
264300 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)
265000 LIGHTING EQUIPMENT

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION
SECTION 26 0500
GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Occupational Safety and Health Act (OSHA) all local, state and national codes, ordinances and regulations governing the particular class of work involved and the terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge to the Owner. The Contractor shall secure all permits and licenses required for his work and shall pay all fees in connection with such permits and licenses.

B. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved; and, on completion of the work, the Contractor shall obtain and deliver to the Owner, final certificates of acceptance. The Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. Underwriter's Laboratories (UL): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriter’s Laboratories, Inc. where such standards have been established.

D. Standards: The current edition of the following specifications and standards shall form a part of these specifications:

1. National Fire Protection Association Standards
2. National Electrical Code, NFPA 70 (NEC)
4. NFPA 72
5. Occupational Safety and Health Act (OSHA)
7. Underwriter's Laboratories, Inc. (Standards)
8. American National Standards Institute (ANSI)
10. Institute of Electrical and Electronic Engineers (IEEE)
11. Insulated Cable Engineer's Association (ICEA)
12. National Electrical Manufacturer's Association (NEMA)
13. Americans with disabilities Act Accessibility Guidelines (ADA)

1.03 DRAWINGS

A. The electrical drawings show the general arrangement of all conduit, outlets, equipment, etc. and shall be followed as closely as actual building construction and the work of other
trades will permit. The architectural and structural drawings shall be considered as a part of the work insofar as these drawings furnish the Contractor with information relating to the design and construction of the building. Architectural drawings shall take precedence over electrical drawings. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.

B. The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings.

C. Drawings and specifications shall be considered as complementary. Work or materials called for by one and not mentioned in other shall be provided as though treated by both.

D. In the case of conflict between drawings and specifications, the greater or more restrictive requirement shall apply.

E. Any question as to the intent of the drawings or specifications shall be referred to the Architect/Engineer, whose decision shall be final and conclusive.

F. Should the Contractor observe any conflict or variation in the plans and specifications, he shall notify the Architect/Engineer in writing no later than seven (7) days prior to date of bid opening. Failure to clarify such variations will result in the Contractor bearing all costs arising from electrical work necessary to resolve the conflict or variation.

1.04 SERVICES

A. General: Requirements of the serving power and telephone utilities and availability of services have been determined as accurately as possible. The Contractor shall verify availability of services and determine actual details pertaining to the exact locations and requirements of utilities before submitting bid. No consideration for extra cost will be given resulting from failure to comply with these requirements by the Contractor. Contractor shall immediately notify the serving utilities that he has the job, and also furnish information as to the total lighting and power loads for the job. He shall also furnish, at the same time, information as to the established completion date of the job.

B. Telephone: Contractor shall immediately notify the serving utility of the estimated date when service will be desired.

1.05 AS-BUILT DRAWINGS

A. During progress of the work, the contractor shall maintain an accurate record of the installation of the system, locating each outlet, and note all circuiting deviations from the contract drawings. Upon completion of the installation, the contractor shall transfer all record data to a single neat and legible set of blue line prints of the original drawings.

1.06 OPERATING INSTRUCTIONS AND MANUALS

A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment and operation of all parts of the electrical equipment and systems.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed, suitably bound in book form and must be originals. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.

C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.
1.07 SITE VISIT
   A. The Contractor shall visit the site prior to bidding and satisfy himself as to the conditions under which the systems are to be installed. No subsequent allowance shall be made in his behalf for failure to make such a visit.

1.08 FIELD MEASUREMENTS
   A. The Contractor shall verify the dimensions covering the work. No extra compensation shall be claimed or allowed due to difference between actual dimensions and those indicated on the drawings. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting the work.

1.09 PERFORMANCE TESTS
   A. Thoroughly test all fixtures, batteries, services and all circuits for proper operating condition, required durations and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances and devices shall be operated under load conditions.
   B. After the interior wiring system installation is complete and at such time as the Architect/Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these specifications.
   C. After occupancy of the building has taken place and nominal building power loads established, make voltage readings at all panelboards. Based on these readings, make final adjustments of taps on all transformers in the building as directed.
   D. Perform such other tests as required by other sections of these specifications or as requested to prove acceptability.
   E. Furnish all instruments and labor for testing.

1.10 REMODELING WORK
   A. Where remodeling work is indicated, the Contractor shall be responsible for all electrical work associated with changes in, or removals of existing walls, ceilings or floors. This work shall include rerouting of conduits, relocation of fixtures, devices and conduits as well as provision for circuit continuity for circuits in remodeled areas. The cost of all of this work shall be included in the Contractor’s price with no additional compensation allowed for failure to include this work.

1.11 MISCELLANEOUS ITEMS
   A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed and connected in the proper manner and as recommended by the manufacturer.

1.12 GUARANTEE
   A. All equipment and workmanship to be furnished under this contract shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials, design and workmanship. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. The labor incident to the installation of these replacements shall be furnished by the Contractor.

1.13 STANDARDS OF MATERIAL AND WORKMANSHIP
   A. All material shall be new and shall bear the label of the Underwriter's Laboratories, Inc., or be listed under re-examination service. All material shall be of the best grade and
latest pattern of manufacture as specified. All work shall be performed in a neat, workmanlike manner and shall present a neat mechanical appearance when completed.

PART 2 - PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.02 MATERIALS

A. When the product of a specific manufacturer is indicated on the drawings or specified herein by catalog number or trade name, it has been done for convenience in fixing the standard for workmanship, finish, design and the guaranteed performance. Any material, apparatus or appliance which the Contractor desires to substitute for those mentioned herein shall also conform to these standards or exceed them and shall follow the procedure as outlined under substitutions and specified herein.

B. All similar materials and equipment shall be the product of the same manufacturer.

C. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect/Engineer.

D. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

E. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

2.03 NAMEPLATES

A. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates, constructed from laminated phenolic plastic, at least 1/16" thick, three-ply, black surface and white core. Plates shall be attached using stainless plate screws unless indicated otherwise. Nomenclature on the label shall include the name of the item and feeder circuit number. Equipment to be labeled shall include, but not be limited to, the following:

1. Air Conditioning Control
2. Contactors
3. Panels and Switches
4. Time Switches
5. Relays
6. Disconnect Switches
7. Starters
8. Transformers
9. Miscellaneous
10. Similar and/or related items

2.04 IDENTIFICATION AND SIGNS
A. Label each individual motor controller, disconnect switch, transformer and remote control device to identify each item and its respective service.
B. Provide nameplates with engraved lettering not less than 3/8 inch high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.
C. Provide warning signs on all equipment or devices operating at 300 volts or more, reading "DANGER - 480 VOLTS" (insert respective voltage) etc., with white letters on red background of standard code size. Signs may be decals, stencils or nameplates.
D. Identify panelboards and cabinets by nameplates with descriptions indicated on the drawings together with voltage and phase. Install on outside of hinged doors of panelboards and cabinets.

2.05 CHANGES
A. No changes shall be made in the electrical work as shown and herein specified, unless such changes are authorized in writing by the Architect/Engineer and such authorization shall contain a statement covering the amount of the charges involved in the change.

2.06 SUBSTITUTIONS
A. On all material, substitutions will be considered only if requested by letter from the Contractor to the Architect/Engineer. Letters must be in the engineer's office no later than 10 days prior to the bid date and shall be considered as authorized only upon written confirmation from the Architect/Engineer. Where materials are proposed to be substituted in lieu of the items specified, substitutions shall be equal in quality, workmanship and design. The burden of proof of equality of materials shall be placed upon the Contractor. Samples of all materials proposed for substitution shall be submitted to the Architect/Engineer, when requested, for examination.

2.07 SHOP DRAWINGS
A. Shop drawings shall be furnished for all equipment and materials. They shall be furnished by the Contractor as required in the Submittal Section. Where equipment will be furnished "as specified," a statement to that effect is sufficient. Where substitutions are proposed, complete data must be furnished showing performance, quality and dimensions.
B. The Contractor shall submit to the Architect/Engineer for checking a complete descriptive and technical data list for all items of material furnished under this contract. Complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation shall be shown. Fixture submittals shall include scale drawings showing metal gauges and finish together with complete photometric distribution curves and coefficient of utilization tables. Glare factor curves shall also be submitted for each fixture. Failure to submit this information can be the basis for disapproval.
C. All descriptive and technical data and shop drawings shall bear signed certification that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Submittals that have not been checked for compliance will not be considered by the Engineer.
D. Only complete submittals will be considered, partial submittals will not be reviewed.
2.08 SUBMITTALS

A. Submittals shall be complete; bound booklets with an index of all items submitted including associated catalog/part numbers. The Contractor shall make submittals on all the following equipment (in addition to any special items indicated elsewhere in the plans or specifications):

1. Lighting Fixtures
2. Wiring devices
3. Conduit
4. Wire
5. Panelboards
6. Fuses
7. Starters
8. Contactors
9. Disconnect switches
10. Lamps
11. Dimming systems
12. Special Systems equipment (Fire Alarm, Intrusion Alarm, Sound, TV, Lightning Protection, etc.).

B. Electrical System Controls: Refer to Section 253000 for additional submittal requirements.

C. After receiving approval on the make and the type of materials, the Contractor shall order such materials in sufficient time to prevent any delay or changes on the job.

PART 3 - EXECUTION

3.01 GENERAL

A. Fabrication, erection and installation of the complete electrical system shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies the Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.02 EQUIPMENT

A. Equipment and materials furnished by the Contractor shall fit the spaces allocated for them. Should the equipment which the Contractor proposes to install, require space conditions other than indicated on the drawings, it shall be the Contractor's responsibility to reconcile the available space with the equipment and make any changes required to accommodate the equipment. All required changes shall be made at the Contractor's expense.

D. All equipment, both the Contractor and Owner furnished, shall be installed in accordance with the manufacturer's recommendations.
3.03 COORDINATION
A. The Electrical Plans are diagrammatic but shall be followed as closely as actual construction and the work of other trades will allow. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.

3.04 CIRCUITS AND FEEDERS
A. Circuits and feeders shall be as shown and no deviations from the indicated outlet-circuit grouping will be permitted, except by permission of the Architect/Engineer. Branch circuit numbers are mandatory and shall be changed only on written permission from the Architect/Engineer. Any changes in layout or circuit numbering shall be accurately recorded on the "As-Built" drawings.

3.05 CONDUITS
A. In all spaces, such as ceiling spaces and equipment rooms, all conduits shall be run to a continuous grade and square to the building.
B. The plans do not give exact details as to the elevations of conduits, exact locations, etc., and do not show all off-sets, bends, junction boxes and other installation details. The Contractor shall carefully lay out his work at the site to conform to details of installation.

3.06 LOCATION OF EQUIPMENT AND OUTLETS
A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and exact information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Architect/Engineer.
B. Verify with Architect/Engineer, prior to installation, all locations of conduit, boxes, etc. stubbed or in the floor.

3.07 PROTECTION OF MATERIALS AND EQUIPMENT
A. The Contractor shall be responsible for the protection of all materials and equipment under this section of the work whether incorporated into the building or not.
B. The Contractor shall provide protection for all work where necessary and will be responsible for all damage done to property during the construction. The above protection shall be maintained while the work is in progress. In no case shall dirt, grit, etc., be ground into the floor finish or coverings.
C. The Contractor shall provide space for storage of materials and equipment at ground level.

3.08 CUTTING AND REPAIRING
A. Cutting and repairing shall be the responsibility of the Contractor. Coordinate to prevent unnecessary cutting and repairing. Lay out and locate equipment, openings and chases. Install sleeves, inserts and supports.

3.09 EXCAVATION AND BACKFILLING
A. The Contractor shall do all necessary excavation and backfill for the installation of the systems as may be required. Curb cuts, asphalt and concrete patching, etc., shall be part of the Contractor's responsibility. Any required trenching will be done by hand and all existing utilities avoided. Damage done to existing utilities will be repaired by the Contractor with no additional payment for the work. In addition to the above, trenches shall be backfilled with dirt, free from debris, rocks and other foreign matter. Backfill shall be replaced in the trenches in 6" layers and each 6" layer shall be wetted down adequately and properly tamped. Remove surplus dirt and leave premises clean.
Perform excavation, backfilling and repaving required for work under this Division in accordance with DIVISION 2, SITE CONSTRUCTION. In general, backfill and tamp with compaction at least equal to that of the surrounding area.

3.10 WARRANTY
   A. Deliver originals of all guarantees and warranties on this portion of the work to Owner. Warrant all equipment, materials and workmanship for one year in accordance with the terms of this Contract.

3.11 PRODUCT HANDLING
   A. Use all means necessary to protect electrical materials and equipment before, during and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no extra cost to him.

END OF SECTION
SECTION 26 0519
LOW VOLTAGE CONDUCTORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish and install all conductors as required for the complete installation and operation of all electrically serviced and/or operated equipment, devices and systems throughout the project.

1.03 RELATED WORK IN OTHER SECTIONS
A. Conduit, feeders, wiring devices and plates, equipment connections, panelboards, transformers, lighting equipment and lamps.

PART 2 - PRODUCTS

2.01 WIRES AND CABLES (600 VOLTS)
A. Type: Conform to the applicable UL and ICEA Standards for the use intended. Copper conductors with 600 volt insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 6 and larger except where elsewhere specified or noted on the drawings.

B. Use of aluminum conductors will not be permitted.

C. Insulation: Type THWN, 75 degree C. insulation unless otherwise specified or noted on the drawings. 90 degrees C. minimum insulation within fixture wireways of fluorescent fixtures. Where 90 degree C. insulation is specified, the termination points for this conductor shall be rated for 90 degree C.

D. Size: No. 12 minimum unless otherwise specified or noted on the drawings. In the case of "homeruns", no conductor smaller than #10 shall be used for runs over 100 feet in length on 120 volt circuits. Not less than NEC requirements for the system to be installed. If the equipment to be installed requires larger conductor and conduit sizes than indicated on the drawings, the required changes shall be made without additional charge. Remote control wires, other than Class 2 remote control and signal circuits, shall be no smaller than #14.

E. Color Coding: Phase, neutral and equipment ground conductors color-coded. Connect all conductors of the same color to the same phase conductor. Color coding shall be A-black, B-red, C-blue, N-white, for 250 volts or less. A-yellow, B-orange, C-brown, N-off white or grey, for 251-600 volts, with green for all equipment ground conductors. Conductors No. 12 and 10 shall be solid color compounded for the entire length. Conductor sizes larger than No. 10 may be color coded at each termination and in each box or enclosure with six inches of half-lapped 3/4 inch pressure sensitive, plastic tape of respective colors in lieu of solid color compound. The equipment grounding conductor shall be bonded to the outlet box grounding screw with taps to receptacles and equipment. Isolated ground conductors shall be green in color with a yellow trace.
2.02 CONTROL CONDUCTORS

A. Copper, minimum size No. 14 with 19/35 stranding, color coded filled cross linked polyethylene 75 degree C. 600 volt insulation and neoprene or equal outer jacket. Multi conductor control cables shall be provided where more than three control conductors are installed in the same conduit between common terminations. Provide two spare conductors minimum in each control cable.

2.03 DATA/COMMUNICATION AND ELECTRONIC CABLE

A. As required or specified in the section of these specifications specifying the equipment. Splices shall be twisted and soldered or shall use an approved connector.

B. All Cat. 3 and Cat 5 cabling shall be tested in accordance with EIA/TIA performance standards. Refer to 16740 for more detailed information.

2.04 VERTICAL CABLE SUPPORTS

A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used for cables without metallic sheath. Basket weave type supports shall be used for cables with metallic sheath.

2.05 CONNECTORS AND LUGS

A. For Copper Conductors No. 6 and Smaller: 3M Scotch-Lok or T & B Sta-Kon compression or indent type connectors with integral or separate insulating caps.

B. For Copper Conductors Larger Than No. 6: Solderless, indent, hex screw or bolt type pressure connectors, properly taped or insulated.

2.06 TAPE

A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-568 Test Method B.

PART 3 - EXECUTION

3.01 CONDUIT SYSTEMS

A. A complete system of conductors shall be installed in the raceway systems. Control wires shall be run in separate conduits from conductors of other systems. All conductors of all systems shall be installed in raceway or conduit.

B. Lighting fixtures shall not be used as raceways for circuits other than parallel wiring of fixtures. Wiring in fixtures shall be rated for that purpose.

C. When leaving a metal raceway or conduit in a cabinet, box, switch, enclosure, control enclosure or any other like member, conductors shall be protected by means of insulated bushings or end fittings. These protectors shall be “O.Z.” type or similar.

D. Conductors may be run in multiple sizes #1/0 to 500 kcmil inclusive provided all multiple conductors are the same size, length and type of insulation. Multiple runs are to be in separate conduits. Each conduit to include one set of phase conductors, neutral and grounding conductors. All to conform to NEC 300-20.

E. No splices or taps shall be made in any conductors except in outlet boxes, pull boxes, junction boxes, panelboard boxes, manholes or splice boxes. All taps and splices shall be made with solderless connectors and insulated in such a manner that provides an effective insulation equal to that of the adjoining wire. Any splice or tap shall be made only on conductors which are a component part of a single circuit properly protected by approved methods.
Before any wire is pulled into any conduit, the conduit shall be thoroughly swabbed in such a manner as to remove all foreign material and to permit the wire itself to be pulled in a clean, dry conduit. The Contractor shall use only approved wire pulling lubricants for pulling any wire. All conductors shall be pulled into their respective conduits by hand, except where written permission of the Engineer is secured to the contrary.

3.02 WIRE AND CABLE TESTS (600 Volts)
A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Architect/Engineer and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing and conduct tests in the presence of the Architect/Engineer. Submit written reports of the tests and results when requested.

3.03 PULL WIRES
A. In each empty conduit, except underground conduits, install a No.14 galvanized steel pull wire or a plastic line having a tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard drawn copper or copper clad pull wire or a plastic line having a tensile strength of no less than 200 pounds.

3.04 IN RACEWAYS
A. Install conductors in rigid conduit, EMT or flexible metallic conduit, unless otherwise specified or noted on the drawings.

3.05 CABLE BENDS
A. Radius of bends not less than 10 times the outer diameter of the cable.

3.06 BUNDLING
A. In cabinets conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two ply lacing or nylon straps.

3.07 CONDUCTOR PULL
A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture has collected have been swabbed out.

3.08 FEEDER IDENTIFICATION
A. Tag feeder circuits in each enclosure with wrap around circuit designation labels where more than one feeder passes through or terminates in the enclosure.

3.09 CONNECTORS AND LUGS
A. Install with manufacturer’s recommended tools and with the type and quantity of deformations recommended by manufacturer.
B. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

END OF SECTION
SECTION 26 0526
GROUNDING

PART 1 - GENERAL

1.01 RELATED WORK IN OTHER SECTIONS
   260500 General Provisions
   260519 Low Voltage Conductors
   260533 Raceways, Boxes and Fittings
   262416 Panelboards
   262716 Cabinets
   262726 Wiring Devices and Plates

PART 2 - PRODUCTS

2.01 MATERIALS
   A. Materials, equipment and devices related to the grounding system are specified under
      other sections of these specifications.

PART 3 - EXECUTION

3.01 GENERAL
   A. Install two separate grounding systems, a service grounding system and an equipment
      grounding system. The service equipment, conduit systems, supports, cabinets,
      equipment, and neutral conductor shall be grounded in accordance with the minimum code
      requirements and as further indicated on the drawings or specified. Connect the two
      grounding systems together only at the main service equipment and at the secondary
      terminals of transformers creating separately derived distribution systems such as dry-type
      transformers.

3.02 SERVICE GROUNDING SYSTEM
   A. General: The service grounding system is provided for the AC service neutral ground. Current
      return conductors, such as neutrals of the service entrance, feeder circuits and
      branch circuits, shall not be used for equipment grounding. Care must be exercised to
      ensure that neutral bars are not bonded to the enclosures of panelboards, etc., which are
      not part of the main service equipment. Except for separately derived systems, the neutral
      conductors shall be grounded only in the main service equipment.

   B. Common Ground Point: Establish one common ground point in the main service
      equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment
      ground bus (or bar), and service grounding electrode conductor.

   C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service
      equipment for disconnecting and isolating the neutral bus from the common ground. The
      disconnecting means may be disconnecting links in the interconnection between the
      insulated neutral and uninsulated equipment ground.
D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc. which have neutral connections.

3.03 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground bus (or bar) with a conductor or bar sized for 25% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in switchboards, or a separately mounted bar adequately braced or bolted to the enclosure of other types of equipment. The ground bar shall be adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low-voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits unless otherwise indicated. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center of separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.
3.04 SEPARATELY DERIVED SYSTEMS
A. Transformers creating separately derived distribution systems, such as dry-type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.05 GROUNDING ELECTRODE SYSTEM
A. A minimum of two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth (NEC 250-81c). Make the connections to the cold water pipe inside the building at the point of entrance. Other grounding electrodes (building steel, ground counterpoise, etc.) shall be bonded to the grounding electrode system where utilized. The grounding electrode for separately derived systems shall be approved for the application.

3.06 GROUNDING CONDUCTORS
A. The grounding electrode conductors for the service grounding electrode system shall be insulated or bare copper, sized in accordance with NEC 250-94 (a), including the conductor for the supplemental electrodes. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards or transformers, the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal-sheathed holes. All connections shall be available for inspection and maintenance.

3.07 GROUND CONNECTIONS
A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with “Galvanox”, or equal.
B. All grounding connections to bare stranded wire, ground rods, etc. shall be BURNDY HY-GROUND™ or approved equivalent or approved exothermic connection method. All connectors shall meet the requirements of IEEE STD 837 (Latest Revision), “IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding”. All connectors must be listed by Underwriters Laboratories for direct burial in earth or embedment in concrete applications according to ANSI/UL-467 (latest revision), “Standard for Grounding and Bonding Equipment.” Connectors must be suitable for lightning protection applications. Listing to UL-96 “Lightning Protection Components” preferred on applicable items.

3.08 TESTS
A. Test the completed grounding system with a megger at the service ground bar and submit a written report to the Architect/Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Architect/Engineer.

END OF SECTION
SECTION 26 0533
RACEWAYS, BOXES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish and install complete conduit systems for the various electrical systems required for this project. Systems shall be complete with supports, mounting devices, pull boxes, etc., as required for installation of wiring systems and terminal devices.

1.03 RELATED WORK IN OTHER SECTIONS
A. Site work, wiring devices and plates, feeders, panelboards, lighting equipment and lamps, telephone system, transformers and services.

PART 2 - PRODUCTS

2.01 CONDUITS
A. Steel Conduit: Rigid, threaded, thick wall, hot dipped galvanized.
B. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside. Maximum size 2 inch electrical trade size unless noted on the drawings or specifically approved.
C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion resistant coating on the inside.
D. Flexible Conduit: Commercial "Greenfield," galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.
E. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a continuous copper bonding conductor wound spirally between the convolutions. Where a separate grounding conductor is installed in the conduit, bonding conductor in the convolutions may be omitted.
F. Plastic coated rigid steel conduit shall be hot dipped galvanized steel conduit with a coating of polyvinyl chloride, minimum 15 mills (0.015), on the exterior surfaces, shall have an approved corrosion resistant coat inside. To be Pittsburgh, J & L, Republic or approved equal.
G. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 degree F., 11,000 psi flexural strength, 8,600 psi compression strength, approved for 90 degree C. conductors. Carlon, triangle, or approved equal. PVC conduits shall include a ground wire sized as noted or as required by NEC (whichever is larger). No bends shall be made in PVC. Rigid galvanized steel conduit shall be utilized for all elbows, risers and bends.
H. Aluminum Conduit: Shall not be used unless specifically indicated on the drawings for specialized purposes.
I. Conduit Size: Minimum conduit size, 1/2 inch except where specifically approved for equipment connections. Sizes not noted on drawings shall be as required by the NEC. All homeruns to panels shall be 3/4 inch minimum. Conduits for #12 THWN wire shall be sized the same as for #12 THW wire.

2.02 CONDUIT FITTINGS

A. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. EMT couplings and connectors either steel or malleable iron only, "Concrete Tight" or "Raintight" and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set screws or indentations as a means of attachment are not permitted.

B. All conduits shall terminate in bushings or connectors which are insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system.

C. Rigid Steel Conduit, IMC and EMT Fittings: Iron or steel only.

D. Liquid Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.

E. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform with the characteristics defined by UL for aluminum rigid metallic conduit and shall not contain more than 0.04 percent copper.

F. Flexible Conduit Fittings (Commercial Greenfield): Either steel or malleable iron only, with insulated throats and shall be one of the following types:

1. Wedge and screw type with angular wedge fitting between the convolutions of the conduit.

2. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.

3. Steel, multiple point type, for threading into internal wall of the conduit convolutions.

G. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory installed packing and a grounding ring.

H. Sealing Fittings: Threaded, zinc or cadmium plated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

I. Fittings for PVC Coated Rigid Steel Conduit: Els and couplings used with PVC coated rigid steel conduit shall have a factory applied coating of polyvinyl chloride, minimum 15 mills (0.015) on exterior surfaces and shall have a PVC sleeve extruded a minimum of 2" from one end of the fitting.

2.03 WIREWAYS

A. Square-D Company Square-Duct "lay-in" type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors. Use standard lengths. Field cuts permitted where absolutely necessary. Rust inhibiting phosphatizing coating
on sheet metal parts. Blue gray baked enamel finish. Hardware plated to prevent corrosion. Provide all accessories, including tee fittings, junction boxes, cross fittings, transposition section, gusset brackets, nipples, pull boxes, reducer fittings, wall flanges, panel or cabinet flanges, elbows, ceiling and wall support brackets and supporting hardware, etc.

2.04 BUSSED GUTTER
A. Bussed gutter shall be amperage, voltage, and phase configuration as noted on the drawings, with a 50% ground bus. Provide lugs on bus bars as indicated on the drawings. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.05 OUTLET BOXES
A. Construction: Zinc coated or cadmium plated steel boxes of a class to satisfy the condition at each outlet except where unilet or conduit bodies are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4 inch octagon concrete rings and 4 inch octagon hung ceiling boxes with bars may be folded type. One piece deep drawn type for all other boxes.
B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed 6 inches deep except where necessary to permit entrance of conduits into side of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.
C. Fixture Studs: 3/8 inch malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.
D. Exposed: Screw joint type, with gasketed weatherproof covers in locations exposed to the weather. Shall be of the continuous drain type. Where required to be “Raintite.”
E. Tile Boxes: Rectangular in shape with square corners and straight sides for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls. Install without plaster rings.
F. Wall Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified, not less than 4 inches square by 1-1/2 inches deep for single devices, 4-11/16 inches by 1-1/2 inches deep for two devices and multi gang boxes for more than two devices. Boxes for switches and receptacles on unfinished walls may be screw joint type with covers to fit the devices. Provide plaster rings, as required, to provide proper opening for device.
G. Wall Mounted Telephone Outlet Boxes: 4-11/16 inches square by 2-1/8 inches deep, unless otherwise noted on the drawings.
H. Light Fixture Boxes: 4 inch diameter by 1.5 inch deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3 inch diameter openings. Screw joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits.
I. Grounding Terminal: Provide a grounding terminal in each box with circuits serving motor driven equipment or receptacles for grounding to a green equipment ground conductor. Grounding terminal shall be green colored washer-in-head machine screw.

2.06 PULLBOXES
A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.
2.07 FLOOR BOXES

A. Heavy duty, cast, adjustable type, suitable for the device or application indicated, unless noted. Provide carpet flanges in carpet areas.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. Conduit Systems: Conduit shall be provided for all wiring circuits. Material shall be exposed or concealed as required by the Drawings. Rigid Steel conduit, IMC, EMT or Rigid Non-Metallic conduit unless noted. Install rigid steel conduits for underground runs, when specifically noted on the drawings, runs in concrete, feeder circuits and where required by the NEC for mechanical protection, etc. Use flexible conduit only for equipment connections and then only to the extent of minimum lengths required for connections (Typically 1'-0", maximum length 4'-0"). Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to all motors, dry type transformers and wet pipe mechanical systems. Aluminum conduit may be used only if specifically called for. Conduit and tubing shall be kept at least 6 inches from parallel runs of hot water or steam pipes. PVC conduit may be used only for runs below grade or in slab. Concrete encasement is required under all paved areas. Rigid steel, galvanized elbows shall be used for all bends and risers. No PVC shall be extended above grade or slab. Ground wires, sized in accordance with NEC, shall be installed in all conduit runs, except where used for telephone conductors.

B. Conduit Installation: Install concealed conduit and EMT in as direct lines as possible. Install exposed conduits and EMT parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit and EMT runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii no less than those of standard elbows. Exposed conduits below the five (5) foot level shall be galvanized rigid conduit.

C. Concealed Conduits: Install conduit systems concealed where possible unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities and where specifically approved by the Engineer. No conduit shall be run on roof or exposed face of building unless specifically shown on plans or approved by Engineer.

D. Conduit in Concrete: Conduits shall not be installed in floor slabs poured on grade. Conduits under slab shall be installed a minimum 6" below slab, covered with earth. PVC coated rigid steel conduit may be embedded in above grade concrete providing the outside diameter does not exceed 1/3 thickness of concrete slab, wall or beam, is located entirely within the center third of the member and lateral spacing of conduit is not less than 3 diameters.

E. Conduit in Ground: PVC schedule 40 non-metallic conduit may be utilized for all underground runs unless noted otherwise on the drawings. Installation and use of PVC shall comply with Article 347 of NEC. All conduit sizes, shown on the plans, shall be increased to accommodate the installation of the equipment grounding conductor. All joints shall be made with solvent cement per manufacturer's recommendations and shall be watertight. Plastic conduit runs stubbing up to above grade junction boxes or conduit runs shall be converted to PVC plastoid coated rigid steel conduit by installing a female adapter, 90 degree PVC coated rigid steel elbow and a PVC coated rigid steel nipple of length as required to stub conduit up. No plastic conduit shall be installed above grade. Plastic conduit shall be used for straight runs only. PVC coated rigid steel conduit shall be used for all bends, ells and offsets. Where rigid galvanized steel conduit is in contact with dirt, soil, fill or earth, conduits shall be field wrapped with one layer of 3M Scotch 50 plastic tape with a 50% overlap, including all joints or couplings, or shall be coated with a
bonded, 20 mil minimum thickness PVC, permanently fused at the factory, Pittsburgh Standard Co. "PlastiBond," or approved equal. All fittings, couplings, ells, etc., used with PVC coated conduit shall have same factory applied PVC coating. An equipment grounding conductor, in accordance with NEC, shall be installed in all conduits. Minimum burial depth of conduits or ducts shall be as follows:

- **Power:** Primary (above 600v.), 42"
- **Secondary** (below 600v.), 36"  
- **Telephone:** 24"

F. Conduit Bends: In any conduit or EMT run, the number of quarter bends or equivalent between termination's at cabinets or boxes shall not exceed four bends. Conduit runs between cabinets or boxes shall not exceed 200 feet for straight runs nor 100 feet for runs with maximum number of bends. Bends in telephone and data conduits shall be long sweeping bends.

G. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

H. Roof Penetrations: All roof penetrations shall be sealed as called for in the architectural plans and specifications.

I. Pull Cords: The Contractor shall furnish and install a full length, 3/32" nylon pull cord in every "empty" conduit installed hereunder to facilitate the future installation of wires. Identify each terminus of pull wire with linen tags with complete information as to service and location of the terminus of the cord.

J. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

K. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be caulked tight with lead yarn.

L. Identification: Identify all exposed raceways according to the system carried. Identify exposed conduits 3/4 inch or larger in diameter by means of painted-on stencils, and conduits less than 3/4 inch in diameter with enameled-on metal tags. Provide legible lettering in contrasting colors. Abbreviate only when approved. Identification shall be placed at maximum intervals of twenty feet on straight conduit runs, close to all terminations, adjacent to all change in directions and where conduits pass through walls or floors. In general, use yellow color. Painting shall be in accordance with DIVISION 9 - FINISHES.

3.02 CONDUIT SUPPORTS

A. Supports: Provide supports for horizontal conduits and EMT not more than 8 feet apart with not less than two supports for each 10 foot straight length and one support near each elbow or bend including runs above suspended ceilings and within 3 feet of all junction boxes, switches, fittings, etc.

B. Straps: Install one hole pipe straps on conduits 1.5 inch or smaller. Install individual pipe hangers for conduits larger than 1.5 inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Trapezes: Install multiple (trapeze) pipe hangers where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by a U-bolt, one hole strap or other specially designed and approved fastener.
D. Hanger Rods: Install 1/4 inch diameter or larger galvanized steel rods for trapezes, spring steel fasteners, clips and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Wooden plugs and shield shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete only where approved by the Engineer.

F. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy fasteners of ERICO Products, Inc. Wire wrapped around conduits and supporting members will not be accepted.

G. On Roof: All conduits laid on roof shall be supported on 4" redwood blocks, mopped into roof and spaced at 5'-0" on center.

H. Lay-in Ceiling: Conduits routed above acoustical "lay-in" ceilings shall be anchored to the building structure and not laid on the ceiling. Wire shall not be used to anchor boxes to structure. If ceiling support system is adequate, one 3/4" maximum conduit may be supported by a Caddy Clip to hanger wire. Multiple runs of conduit shall be racked on trapeze hanger. All support materials shall be rustproof. Perforated tape or soft iron wire shall not be used.

3.03 CONDUIT STUB-UPS

A. Conduits run under floor shall be stubbed up to a coupling set flush with floor. This excludes conduits stubbed up in walls and feeder conduits. Install flush plug until after floor is finished, then complete connections to boxes or equipment.

3.04 OUTLET BOXES

A. Outlet Boxes: Outlet boxes, covers and fittings, according to the particular use for which they are required, shall be provided in the locations marked on the drawings by symbols, and/or for use to facilitate the installation of the electrical systems. When necessary, outlets shall be relocated so that when fixtures of other fittings are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment required by the drawings and/or specifications.

B. Installation: Unless otherwise specified or shown on the drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plastic covers. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on steel work.

C. Mounting Heights: The mounting height of a wall mounted outlet box shall be construed to mean the height from the finished floor to the horizontal center line of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. Wall Mounted Switch, Receptacle and Signal Outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to trim. Install outlet boxes near the doors on the lock sides (see architectural drawings for correct door swings).

D. Identification: Identify all exposed junction boxes according to the system carried by means of painted-on stencils or labels with legible letters and contrasting colors and
without abbreviations. In general, use yellow color. Painting shall be in accordance with DIVISION 9 - FINISHES.

3.05 PULLBOXES
   A. Provide additional pullboxes wherever necessary to meet requirements for maximum length of conduit runs and maximum numbers of bends.

3.06 FLOOR BOXES
   A. Install level with top covers adjusted flush with finished floor or floor tile.

3.07 FIXTURE CONNECTIONS
   A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2 inch flexible metallic conduit, 4 to 6 feet long with grounding provisions.

3.08 CLOSING OF OPENINGS
   A. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or the spaces left in such openings, shall be filled or closed in an approved manner.

3.09 IDENTIFICATION
   A. Refer to Section 260500 - General Electrical Provisions for identification requirements for raceways and boxes.

END OF SECTION
SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish and install complete, all panelboards.

1.03 RELATED WORK IN OTHER SECTIONS
A. Cabinets: Motor & Circuit Disconnects; Fuses; Service and Distribution; Grounding; Conductors, Raceways, Boxes and Fittings.

1.04 SUBMITTALS
A. Submit complete shop drawings with outline dimensions, descriptive literature and complete descriptions of the frame size, trip setting, class and interrupting rating of all overcurrent devices. Identify available spaces. Complete description of physical layout of panelboards showing conformance with drawings.

PART 2 - PRODUCTS

2.01 GENERAL
A. Dead front, safety type, with voltage and amperage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings or specified. All panelboards shall have a neutral bus and an insulated ground bus. Panelboards shall be as manufactured by General Electric, Cutler-Hammer or Square D and shall be as scheduled.

2.02 CABINETS
A. Each panelboard shall be enclosed in a sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 262716, Cabinets.
B. Door-in-Door: Both surface and flush panels shall be door-in-door. The door over the interior of the panel shall be provided with hinges and combined lock and latch. The outside door over the panel gutters shall be provided with hinge(s) on one side and combined lock and latch. Machine screws into threaded holes in the panelboard cabinet, in lieu of combined lock and latch, to secure the outside door are not acceptable.

2.03 FUSIBLE PANELBOARD
A. Fusible panelboards shall be factory assembled. Each fused switch shall have an etched micarta nameplate secured by two cadmium plated screws. The panelboard shall have a neutral bus and a ground bus connected with a removable link.
   General Electric "QMR" up to 1200 amps
   Square D "QMB" up to 1200 amps
B. Quick-make, quick-break fusible switch units to be of type with external operating handle suitable for padlocking in OFF position. Provide interlock to prevent opening cover when switch is in ON position unless interlock release is operated. Provide frame and fuse clip...
ratings as indicated in the panelboard schedules. Switch and fuse holder shall be rated for 200,000 amp interrupting capacity. Fuse holders shall be provided with Class R rejection feature.

C. Fuses shall be provided for all switches. Fuses for switches serving motors shall be Bussman Fusetrons, sized for heavy service motor running protection. Fuses for other services shall be as designated on the drawings. Proper fuse amp ratings shall be indicated on inside of switch cover, through the use of "Tapewriter" and should read "Use Fusetrons Only" (indicate amperage size as shown on plans).

D. Space Only: Where "space only" in noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device. Spaces shall be sized 200 amps unless noted otherwise.

2.04 CIRCUIT BREAKER PANELBOARDS

A. Panelboard interiors shall be constructed on pre-drilled and tapped channel rails. Main busses shall be pre-drilled and tapped to accommodate any combination of circuit breaker units without further modification. All panelboards shall be complete with doors. Units shall be complete with combination latch and cylinder locks. All locks shall be keyed alike. All bussing shall be of the "sequence type". All connections shall be bolted.

B. Circuit breakers shall be molded case type (minimum 10,000 amp interrupting capacity, larger as required). All multi-pole breakers shall have a common trip and all breakers shall be interchangeable in any combination of poles with the same frame size. All branch circuit straps shall have the capacity of the maximum breaker size in the frame space (i.e. 100 amp strap for 100 amp frame). Minimum 100 amp straps will be accepted.

C. All main and branch breakers shall be of the size and have the interrupting rating scheduled on the Drawings. All incoming and outgoing terminals shall have solderless lugs. Provide, where required, lug landing to accommodate number and size conductors shown on the Power Riser. Panelboards shall be factory assembled.

D. Single pole circuit breakers shall be suitable for switching duty and marked "SWD".

E. Bolted Type: Circuit breaker current carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for 3 phase, 4 wire mains, unless otherwise indicated on the drawings.

F. Space Only: Where "space only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device. Provide blank cover for each space.

G. Directories: Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the drawings.

H. Spare Conduit: Provide three spare 1" conduits for each panel. Extend empty conduit with pullwire into accessible ceiling space and stub-out for future use.

2.05 NAMEPLATE

A. Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws (see "Nameplates" Specifications in Section 260500) or labels supplied by Panel Manufacturer.

B. Nameplates on Panelboards shall give voltage characteristics phase and number of wires. Example: Panel A, 120/208V, 3 phase, 4W.

C. Individual circuit breakers or switches, panelboards, disconnect means and motor starters shall have nameplate showing the load served.
D. Blank name plates shall be mounted on each "spare" unit or on "space" in distribution panels.

2.06 SKIRTS
A. Where noted on the drawings panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

2.07 BUS BARS
A. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.08 CONNECTORS AND LUGS
A. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

PART 3 - EXECUTION

3.01 PANELBOARDS
A. Panelboards shall be located where indicated on the drawings. Panelboards shall have neatly typed circuit directories behind clear plastic. Identify circuits by area designations and use. "Spare" and "Space" shall be indicated with erasable pencil, not typed.

B. Circuiting of all branch circuits shall be as designated on the drawings. Breaker and switch arrangement in panels shall be exactly as specified and all circuits will terminate in the positions indicated.

3.02 PHASE ROTATION
A. Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION
SECTION 26 2716
CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. The general provisions of the Contract, including General and Special Conditions and
      General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
   A. Furnish and install cabinets for panelboards, telephone, and communication systems as
      required.

1.03 RELATED WORK IN OTHER SECTIONS
   A. Panelboards, sound systems, telephone systems.

PART 2 - PRODUCTS

2.01 GENERAL
   A. Sheet steel code gauge, galvanized cabinets with painted fronts and trim. Those exposed
      to wet or rain conditions shall be "raintight" unless otherwise noted. Cabinets without
      through feeder wiring shall be arranged to provide a wiring gutter not less than 4 inches
      wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by
      feeders in excess of 4/0, up to and including 750 kcmil, shall be provided with top, bottom
      and side gutters 8 inches wide. Cabinets shall be of standard make and shall bear the
      Underwriters Laboratories label. All outside surfaces of trim and doors shall be given a
      factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard.
      Cabinets for telephone and communications systems shall have 5/8 inch exterior grade,
      one-face B-grade or equal flame proofed plywood backboard inside with maximum height
      and width.

2.02 FEED-THROUGH GUTTERS
   A. Where feeders go through panelboard cabinets to serve panelboards above or beyond,
      the wiring gutters in panelboard cabinets shall be a minimum of 8 inches on sides, top
      and bottom.

2.03 TRIM
   A. One-piece, sheet steel trim with hinged door with catch and lock. One piece sheet steel
      with 3/4 inch flange around all edges shaped to cover edge of box. For telephone or
      communication cabinets trims with captive nuts or clamps. Trims shall be furnished with
      indicating adjustable trim clamps for panelboards.

2.04 DOORS
   A. Doors shall close against a rabbet placed all around the inside edge of the frame with a
      close fitting joint between door and frame. The doors shall be fitted with substantial flush
      hinges placed not over 24 inches apart, nor more than six inches from ends of doors, and
      fastened permanently to the door and frame with round-headed rivets or spot welds, or
      with concealed flush piano hinges. Fastening screws or clamps or trims shall be set not
      over 24 inches apart. Doors over 48 inches in height shall be equipped with a vault
      handle and a three-point catch.
2.05 LOCKS
   A. Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.06 GROUND BAR
   A. Each cabinet, for a panelboard, shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying capacity to the incoming feeder ground conductor and shall have approved pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 - EXECUTION

3.01 CABINETS
   A. Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6'-6" above floor and bottoms not less than 12 inches above floor.

END OF SECTION
SECTION 26 2726
WIRING DEVICES AND PLATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The general provisions for the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
A. Furnish and install all wiring devices and plates as required for the complete installation and operation of all systems throughout the project.

1.03 RELATED WORK IN OTHER SECTIONS
A. Conductors, Conduit, Boxes and Fittings.

PART 2 - PRODUCTS

2.01 WALL SWITCHES
A. Unless otherwise specified, each wall switch (flush tumbler-toggle) shall be of the A.C. General use type for mounting in a single gang spacing, fully rated 20 amperes minimum at 120/277 volts, conforming to minimum requirements of the latest revision of the Underwriter's Laboratories, Inc., UL 20 Fifth Edition Standard Snap Switches and further requirements herein specified. Specification grade, heavy duty, single pole, 3-way or 4-way, of the maintained, momentary or lock type as indicated on the drawings. Switches shall operate in any position and shall be fully enclosed cup type with entire body of molded phenolic, urea or melamine with cover of molded phenolic, urea or melamine. Fiber, paper or similar insulating material shall not be used for body or cover. Ivory color handles unless otherwise indicated. Silver or silver alloy contacts. A.C. 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publications and shall be as follows unless otherwise noted:

<table>
<thead>
<tr>
<th>Switch</th>
<th>Hubbell</th>
<th>P &amp; S</th>
<th>AH &amp; H</th>
<th>Bryant</th>
<th>Leviton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1P</td>
<td>1221-I</td>
<td>20-AC-1-I</td>
<td>1991-I</td>
<td>4901-I</td>
<td>1221-I</td>
</tr>
<tr>
<td>3-Way</td>
<td>1223-I</td>
<td>20-AC-3-I</td>
<td>1993-I</td>
<td>4903-I</td>
<td>1223-I</td>
</tr>
<tr>
<td>4-Way</td>
<td>1224-I</td>
<td>20-AC-4-I</td>
<td>1994-I</td>
<td>4904-I</td>
<td>1224-I</td>
</tr>
<tr>
<td>3-pos. 2 cct maintained</td>
<td>1385-I</td>
<td>1225-I</td>
<td>4361-I</td>
<td>4922-I</td>
<td></td>
</tr>
<tr>
<td>3-pos. 2 cct momentary</td>
<td>1557-I</td>
<td>1251-I</td>
<td>1995-I</td>
<td>4921-I</td>
<td></td>
</tr>
<tr>
<td>Lighted handle pilot lgt.</td>
<td>1221-PL</td>
<td>2251-SP</td>
<td>2999-R</td>
<td>4901-PL</td>
<td>1220-PL</td>
</tr>
</tbody>
</table>
2.02 RECEPTACLES

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications. Fire resistant, non-absorptive, hot welded, phenolic composition or equal bodies and bases with metal plaster ears (integral with the supporting member). Single or duplex as shown or noted on drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke. Unless otherwise noted, receptacles shall be as follows:

<table>
<thead>
<tr>
<th>Receptacle</th>
<th>Hubbell</th>
<th>P &amp; S</th>
<th>AH &amp; H</th>
<th>Bryant</th>
</tr>
</thead>
<tbody>
<tr>
<td>20A-125V AC 2P 3W</td>
<td>5362-I</td>
<td>6300-I</td>
<td>5739-I</td>
<td>5362-I</td>
</tr>
<tr>
<td>20A-208V AC 4P 4W</td>
<td>7250</td>
<td>7250</td>
<td>7250</td>
<td>7250</td>
</tr>
<tr>
<td>30A-250V AC 3P 3W</td>
<td>9350</td>
<td>3853</td>
<td>9344</td>
<td>9303</td>
</tr>
<tr>
<td>30A-600V AC 4P 4W</td>
<td>3430</td>
<td>3430</td>
<td>LD3430</td>
<td>3430</td>
</tr>
<tr>
<td>Clock</td>
<td>1544</td>
<td>5708</td>
<td>4224-5</td>
<td>2828GS</td>
</tr>
</tbody>
</table>

Special

Receptacles for special applications shall be as indicated on the drawings.

2.03 PLUG CAPS

A. Except for duplex receptacles, and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles. Provide watertight, male plug caps in damp locations or where exposed to weather.

2.04 DEVICE PLATES

A. General: Provide plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi gang outlet plates for multi gang boxes. All plates on finished walls shall be Leviton #84000-40 series, stainless steel. Screws shall be of metal with countersunk heads with finish to match the finish of the plate. Device plates shall be of the one-piece type, of suitable shape for the device to be covered. Where specifically noted as "plastic" plates on the drawings, plates shall be Leviton White #88000 (85000 Brown, 87000 Grey, 86000 Ivory, if noted). Devices in this case shall match, in color, the plastic plates.

B. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. To be heavy cadmium plates, steel, with gasket. Plates for cast type boxes at locations subject to wet or rain conditions, shall be of the cast, vapor tight type. Provide hinged lift covers for devices.

C. Communications: Plates for telephone and signal outlets shall each have a 3/8 inch bushed opening in the center. Wall plates for push button and buzzer outlets shall have openings to suit the push buttons and buzzers.

D. Plates for special purpose outlets shall be of a design suitable for the particular application.

2.05 CLOCK OUTLETS

A. Flush, single receptacle regressed in stainless steel device plate.
2.06 REMOTELY CONTROLLED SWITCHES OR RELAYS
   A. Electro-magnetically operated, mechanically held with clearing contacts for maintained contact control unless otherwise required. Rugged construction conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Industrial Control Equipment. Ratings as indicated on the drawings suitable for the application. Contacts shall be double break renewable, solid wiping type, silver-to-silver Tungsten alloy, self-aligning, quick-make, quick-break, with a minimum inductive load rating of 20 amps. Relays shall be as manufactured by Allen-Bradley, Cutler-Hammer, General Electric, Square D or Westinghouse, equal to Allen-Bridge Bulletin 700 Control Relays. Provide sound deadening mounting and enclosure.

2.07 MOMENTARY CONTACT SWITCHES
   A. Tumbler type single pole double throw momentary contact for 3 wire circuit, with Off position when tumbler handle is in the center, similar in appearance to the conventional snap switch. Handle or key operated as indicated on drawings. 15 ampere at 120/277 volts for control of 30, 60, or 100 ampere remotely controlled switches or relays rated 101 amperes and above. Provide nameplate to identify the circuit or equipment controlled.

PART 3 - EXECUTION

3.01 OUTLET LOCATIONS
   A. Shall be as indicated on the drawings. Align devices and plates horizontally and vertically.
   B. It shall be the responsibility of the Contractor to determine from the architectural drawings and by actual determination on the site, the exact location of each and every outlet. The outlet locations shall be modified from those shown on the plans to accommodate changes in door swings or to clear other interferences that may arise from job construction details as well as modifications within room spaces. These modifications shall be made with no change in contract price and shall be a matter of job coordination at the expense of the Contractor. The Contractor shall check these conditions throughout the entire job and shall notify the Architect/Engineer of discrepancies as they occur before proceeding with the installation of the work to verify the modifications, if any. Wall boxes shall be set in advance of wall construction, shall be blocked in place and secured. All wall boxes shall be set flush with finished building construction and the Contractor shall furnish and install extension sleeves as required to extend boxes to the finished surfaces of special furring. No switches shall be located behind doors without specific written authorization by the Architect.

3.02 YOKES
   A. Wiring device yokes shall be installed in physical contact with the plaster ring. Where the above contact cannot be obtained, a green covered bonding conductor shall be installed.

3.03 PLATES
   A. Shall be installed with all four edges in continuous contact with finished wall surface without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed vertically and with an alignment tolerance of 1/16".
   B. Device cover plates for each and every device shall be furnished and installed by this Contractor.

3.04 RECEPTACLES
   A. Shall have a separate ground wire from the grounding screw to a grounding stud in the outlet box. All receptacles shall be installed with the "U" slot in the upper position.
Substitutions for duplex convenience outlets as listed in 16140 - 2.2 shall only be considered if rated as "Specification Grade".

END OF SECTION
SECTION 26 2813
FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
   A. Furnish and install all fuses required for the various electrical systems required for this project.

1.03 RELATED WORK IN OTHER SECTIONS
   A. Panelboards, motor control centers, motor and circuit disconnects.

PART 2 - PRODUCTS

2.01 FUSES
   A. General: Dual element, time delay type, based on heavy service, Buss Fusetron, or equal, unless otherwise noted or required for installation. For individual motor circuit protection, provide fuse sized approximately 125 percent of full load current with 200,000 amperes interrupting capacity.

   B. Current-Limiting Fuses: Provide where indicated on the drawings. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L or K Buss Limitron fuses sized 125 percent of load current or as required for coordination with air and molded case circuit breakers.
      1. Above 600 amps: Class L, "Hi-Cap" as manufactured by Bussman.
      2. Below 600 amps, as required by short circuit duty, Class RK-1, "Limitron" or Class RK-1, "Low Peak" or Class RK-5, "Fusetron" as manufactured by Bussman.
      3. All switches having current limiting fuses installed shall have a Lamicoid nameplate with white lettering on red background reading:
         WARNING, REPLACE ONLY WITH CURRENT LIMITING FUSES AS ORIGINALY INSTALLED

   C. All fuses shall be rated 200,000 AIC and be of the rejection feature type.

2.02 COORDINATION
   A. Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

2.03 FUSE CABINET
   A. Provide one wall mounted cabinet for storing all spare fuses. The cabinet shall have a hinged door with latch, with the word "FUSES" stenciled on the front.
PART 3 - EXECUTION

3.01 COORDINATION
   A. Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

3.02 SPARE FUSES
   A. Furnish one complete spare set (3) of each size and type of fuse required on this project for panelboards, safety switches, and switchboards. Deliver to Owner in the original boxes and store in the fuse cabinet furnished under this Contract.

END OF SECTION
PART 1 – GENERAL

1.01 DESCRIPTION
A. The specified unit shall provide effective high energy transient voltage suppression, surge current diversion, high frequency attention and line control for all electrical modes of equipment connected downstream from the facility’s meter or main overcurrent device in the afore mentioned ANSI/IEEE C62. 41-1991 environment(s). The unit shall be connected in parallel with the facility’s wiring system.
B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacturer of such products for minimum of ten (10) years.

1.02 ENVIRONMENTAL REQUIREMENTS
A. Storage Temperature. Storage temperature range shall be -40 to + 85C (-40 to +185F).
B. Operating Temperature. Operating temperature range shall be -40 to +140F).
C. Relative Humidity. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
D. Operating Altitude. The unit shall be capable of operation in altitudes up to 13,000 feet above sea level.
E. Audible Noise. The unit shall not generate any audible noise.
F. Magnetic Field. No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

1.03 RELATED DOCUMENTS AND APPLICABLE STANDARDS
A. Systems shall be designed, manufactured, tested and installed in accordance with the following standards:
   1. Underwriters Laboratories (UL 1449, 2nd addition)
   2. Canadian Standard Association (CSA)
   3. National Electrical Manufacturers Association (LS-1-1992, 2.2.9 and 3.9)
   4. American National Standards Institute
   5. Institute of Electrical and Electronic Engineers (C62.41 and C62.45)
   6. Military Standards (SIL-STD 220A)
   8. National Fire Protection Association (NFPA-78)
   10. Underwriter’s Laboratory 248-1 individual MOV fusing requirements.
   11. Items 1 and 2 shown above shall also include industry recognized independent test data, showing the equipment has passed these tests. A copy of these results shall be included with the approval package.
1.04 TRANSPORT VOLTAGE SURGE SUPPRESSION
   B. The system shall be tested to 1,000 sequential ANSI/IEEE C62.41 Category C waveforms.
   C. The system shall be tested to UL1283 for electrical line noise attenuation. A minimum of 8 points shall be shown for specific db attenuation over frequency range of 50KHz - 100MHz.

1.05 WORK INCLUDED
   A. Transient Voltage Surge Suppression (TVSS) System

1.06 SUBMITTALS FOR REVIEW
   A. Section 260500 - Submittals
   B. Product Data: Provide shop drawings for all devices utilized.

PART 2 – PRODUCTS

2.01 UNIT OPERATING VOLTAGE
   A. The nominal unit operating voltage and configuration shall be as indicated on the drawings.

2.02 MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV)
   A. The maximum continuous operating voltage (MCOV) of all suppression components utilized in the unit shall not be less than 115% of the facility’s nominal operating voltage.

2.03 SERVICE ENTRANCE PANELS
   A. Unit shall be rated Category C3 location per ANSI/IEEE C62.41-1991.
   B. The tested single-pulse surge current capacity, in amps, of the unit, based on ANSI/IEEE c62.41-1991’s standard 8X20 microsecond current waveform, and in accordance with NEMA Publication No. LS 1-1992, shall be no less than as follows:

<table>
<thead>
<tr>
<th>Mode of Protection</th>
<th>L-LL-NL-GN-G</th>
<th>Tested Single Pulse Surge Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-LL-NL-GN-G</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>L-LL-NL-GN-G</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>L-LL-NL-GN-G</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>L-LL-NL-GN-G</td>
<td>150,000</td>
<td>150,000</td>
</tr>
</tbody>
</table>

   D. Unit shall have individually fused MOV’s, with the fusing designed to operate only in the event of a fault within the TVSS. In the event of a fuse operating, the remaining fuses shall stay online to protect the system.
   E. The unit’s published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection, as follows:

2.04 Nominal System Voltage
   L-NL-GN-G
   G120/208/400/450/500/450/425/477/480/580/850/875/825/347/600/1000/1200/1000/1200/1000
   1. Note: Numbers following slash indicate UL 1449 suppression rating for models with integral disconnect switch.
   2. The unit shall include a high-frequency extended range tracking filter and shall be UL 1283 Listed as an Electromagnetic Interference Filter.
   3. The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #2 AWG copper conductor with
integral disconnect switch and up to 1/0 AWG copper conductor without integral disconnect switch.

4. Units shall be provided in a NEMA 1 type enclosure of 14 gauge steel. Dimensions shall not be greater than 22” wide by 38” high by 12” deep. Weight shall not exceed 100 lbs. (max).

G. ACCESSORIES
1. INTEGRAL DISCONNECT SWITCH
   a) The unit shall include an integral safety interlocked disconnect switch located in the unit enclosure with an externally mounted manual operator. The switch shall be rated for 600 Vac. Specify “DM” suffix.

2. ON-LINE METERING
   a) The unit shall include an integral multifunction power monitor analyzer. The multimeter shall provide real-time product performance via multiport visual status indicators (LED’s) and a touchpad accessible LED data display. The following features shall include:
      1) Enhanced Status Indicators. At the touch of a button, the indicators shall show the following data:
         (a) % protection available from the TVSS system.
         (b) Neutral to Ground fault indication.
         (c) Neutral to Ground current sensing.
         (d) True RMS voltage of system connected.
         (e) Voltage sag detection. (Any voltage sag<90% of nominal)
         (f) Voltage swell detection. (Any voltage swell >110% on nominal)
         (g) Power dropout detection. (Any voltage dropout of <1 cycle)
         (h) Power outage detection. (Any voltage outage of >1 cycle)
      2) Dual form C contacts (normally open and normally closed design).
      3) Display event counter.
      4) Battery powered audible alarm. (Can be defeated on the front panel)

2.04 DISTRIBUTION PANELS/PANELBOARDS/VFD’S
A. Unit shall be rated Category B3 location per ANSI/IEEE C62.41-1991.
B. The tested single-pulse surge current capacity, in amps, of the unit, based on ANSI/IEEE C62.41-1991’s standard 8X20 microsecond current waveform, and in accordance with NEMA Publication No. LS 1-1992, shall be no less than as follows:
C. Mode of ProtectionL-LL-NL-GN-GPer Phase Tested single Pulse Surge Current100,000100,000100,000100,000100,000
D. Unit shall have indicator status lights for the TVSS device, verifying proper operation.
E. The unit’s published performance ratings shall be the UL 1449, 2nd edition, Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection, as follows:

1. Nominal System Voltage L-NL-GN-
   - G120/208
   - 400/450
   - 400/500
   - 450
   - 425
   - 277
   - 480
   - 850
   - 850
   - 825
   - 347
   - 600
   - 1000
   - 1000
   - 1200
   - 1000
   - 1200
   - 1000
   - 1200
   - 1000
   - 1200
   - 1000
   - 1200

   a) Note: Numbers following slash indicate UL 1449 suppression rating for models with integral disconnect switch.

F. The unit shall include a high-frequency extended range-tracking filter and shall be UL 1283 Listed as an Electromagnetic Interference Filter.

G. The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #8 AWG copper conductor with integral disconnect switch and up to 1/0 AWG copper conductor without integral disconnect switch.

H. Units shall be provided in a NEMA 1 type enclosure of 14-gauge steel. Dimensions shall both be greater than 13” wide by 24” high by 8” deep. Weight shall not exceed 40 lbs. (max).

I. Accessories

1. Integral Disconnect Switch
   a) The unit shall include an integral safety interlocked disconnect switch located in the unit enclosure with an externally mounted manual operator. The switch shall be rated for 600 Vac. Specify “DM” suffix.

PART 3 –EXECUTION

3.01 INSTALLATION

A. The specified system shall be installed no further than ten (10) feet in total wire lead length distance from the service entrance bus, distribution panelboard bus or variable frequency drive it is protecting and shall avoid any unnecessary bends. Insulated conductors shall be provided for all necessary power and ground connections.

B. System shall be complete, including status indicator lights providing independent protection circuit status.

C. Other materials and equipment shall comply with applicable Sections of this Division.

3.02 WARRANTY

A. Manufacturer shall provide a product warranty for (5) five years from date of installation. Warranty shall cover unlimited replacement of system components during the warranty period.

3.03 QUALITY ASSURANCE

A. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design and manufacturing for at least 10 years.

B. Start-Up Testing. Upon completion of installation, a factory-certified local service technician shall provide testing services. The following tests shall be performed: (a) voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line and Neutral-to-Ground (no neutral in DELTA configurations) at the time of the testing procedure, (b) impulse injection to verify the system suppression voltage tolerances for all suppression paths. A copy of the start-up test results and the factory benchmark testing results shall be supplied to the engineer and the owner for confirmation of proper suppression filter
system function. In addition, the integrity of the neutral-ground bond should be verified through testing and visual inspection. A Seven-Year Limited Warranty shall initiate after the owner has accepted the testing results and taken possession of the equipment.

END OF SECTION
SECTION 26 5000
LIGHTING EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. The general provisions of the Contract, including General and Special Conditions and the
      General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK
   A. Furnish and install all lighting equipment and lamps as scheduled on the drawings and as
      specified herein.

1.03 RELATED WORK IN OTHER SECTIONS
   A. Conduit, boxes and fittings, conductors, wiring devices and plates, acoustic ceilings.

1.04 SUBMITTALS
   A. Submit for approval complete shop drawings, catalog cuts, special installation
      instructions, photometric data and descriptive literature.

PART 2 - PRODUCTS

2.01 GENERAL
   A. Furnish all lighting fixtures, of the type indicated on the drawings, complete with lamps,
      sockets, wiring, fitters, hangers, plaster rings, canopies, etc., as required.

2.02 LAMPS
   A. LED lamps will meet the requirements as specified by the manufacturer and model
      number in the fixture schedule on the drawings.
   B. Manufacturers: General Electric, Sylvania, Westinghouse, or an approved equal.

PART 3 - EXECUTION

3.01 GENERAL
   A. The Contractor shall furnish and install a lighting fixture, as hereinafter specified and
      scheduled, on each and every outlet in accordance with the type designation shown on
      the Drawings. If a type designation is omitted, the fixture shall be of the same type as is
      shown for rooms of similar usage. Verify before purchase and installation.

3.02 SUPPORTS
   A. Support ceiling fixtures by anchorage to the ceiling only where the ceiling is concrete or
      masonry units. For ceilings of other construction, anchor ceiling fixtures to metal
      supports provided for that purpose, of suitable strength and stability, adequately attached
      to and supported by joists, trusses or other structural members, unless other methods of
      support are specifically approved by the Architect. Where lay-in construction is used,
      recessed fixtures shall be of the lay-in type. Earthquake clips will be used to secure all
      lay-in fixtures. The Contractor shall coordinate this work with all other trades involved.
      Coordinate supports for lay-in fixtures with ceiling Contractor.
3.03 LOW DENSITY CEILING
   A. Special attention is directed to the code restrictions against mounting fixtures on combustible low density cellulose fiberboard (NEC 410-76). If fixtures are to be installed that are not UL approved for this condition, a suitable mounting arrangement shall be developed which meets the approval of the Architect/Engineer.

3.04 CEILING TRIM AND MEANS OF SUPPORT
   A. The ceiling trim and means of support of recessed fixtures shall be coordinated with the type of ceiling to be installed to insure proper installation.

3.05 SUSPENDED FIXTURES
   A. Provide swivel hangers to insure a plumb installation. For single unit suspended fluorescent fixtures provide tubings or stems for wiring at one point and a tubing or rod suspension provided for each unit of chassis. Provide 3/16 inch diameter rods minimum. All hangers and fittings to be of the same manufacture as the fixture.

3.06 LAMP GUARDS
   A. Provide safety guard clips or spring loaded lampholders on open type fluorescent fixtures to prevent lamps from falling.

3.07 CLEAN-UP
   A. At final inspection all fixtures and lighting equipment shall be in first class operating order, in perfect condition as to finish and free from defects, completely lamped, clean and free from dust, plaster or paint spots and complete with the required glassware, reflectors, side panels, louvers or other components necessary to complete the fixtures.

3.08 CEILING TRIM
   A. Furnish proper ceiling frames for the ceiling material in which recessed fixtures are to be installed, verify prior to ordering. Rims of all fixtures that overlap ceilings shall be installed tight and snug against the ceiling to prevent light leakage around the rim. If unevenness of surface allows light to show, then the Contractor shall provide soft sponge filler or gasket to correct the condition.

3.09 All recessed fixtures shall have top connections to the outlet boxes installed in accordance with the code. Connections to lay-in fixtures shall be made with flexible conduit 4’-0” minimum length.

3.10 The Contractor shall install new lamps in all lighting fixtures.

3.12 All lay-in fixtures shall be adequately supported by at least two ceiling support wires at opposite corners of fixture. If fire rating of the ceiling requires separate fixture support from the structure, such supports shall be installed.

3.13 All surface mounted fixtures shall be furnished with top plates whenever applicable.

3.14 All open reflector type fixtures shall be equipped with lamp safety guards to prevent lamp fallout.

END OF SECTION
Division Thirty One

EARTHWORK
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities.
   2. Compacted fill from top of utility bedding to finished grade.
   3. Backfilling and compaction.

B. Related Sections:
   1. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
   1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

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

C. American Society for Testing and Materials International (ASTM):
   2. ASTM D422 - Particle -Size Analysis of Soils.
   5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
   11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
   15. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   16. ASTM D4254 - Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
   19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS
A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
B. Materials Source: Submit name of imported fill materials suppliers.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE
A. Perform Work in accordance with applicable New Mexico state standards and specifications of the utility provider.
B. Perform Work in accordance with applicable OSHA trench safety standards.

1.5 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

1.6 COORDINATION
A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.
B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS
2.1 FILL MATERIALS
A. Pipe Bedding and Embedment: As specified in Section 31 23 23.
B. Pipe Backfill: As specified in Section 31 23 23.
C. Structural Fill: As specified in Section 31 23 23.
D. Granular Fill: As specified in Section 31 23 23.

PART 3 EXECUTION
3.1 LINES AND GRADES
A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
3.2 PREPARATION

A. Call New Mexico “One Call” at 811 and local utilities not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns and other features remaining as portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 LINES, GRADES AND DIMENSIONS

A. Excavate trench to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required based on field conditions.
   2. Deviations from horizontal and vertical pipe line and grade by Contractor per Section 33 11 00 - Water Utility Distribution Piping.
   3. When bottom of trench is rocky, over-excavate and fill as specified in Section 31 23 23.

B. Excavate trench to minimum width as indicated on Drawings.
   1. Cut trenches to width indicated on Drawings, providing at least 6 inches of clear space between the trench face and the outside diameter of the pipe. The maximum permissible width of the trench shall be the outside diameter of the pipe (or distance between pipes plus pipe diameters in the event that two pipes are buried in the same trench) plus 24 inches, unless otherwise indicated on the Drawings, permission in writing to use a greater width is obtained from the Engineer.
   2. Increase trench width as required to meet required clearances between pipe and trench wall, to avoid voids in the haunch areas of the pipe and to meet embedment compaction requirements. Increased trench width, if needed to meet these requirements, shall be provided at no additional cost to the Owner.

3.4 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up to the size that would require special equipment beyond conventional machinery used for trenching, in which case the Engineer should be notified immediately.

C. Allowable Open Trench: Trenches may be opened in advance of pipe placement and backfill operations under the following conditions:
   1. In developed areas and along traveled roadways, no more than 100 feet of trench shall be opened in advance of pipe laying operations. This distance may be reduced due to traffic control considerations. Backfilling shall begin as soon as pipe is laid and inspected and shall keep pace with the pipe laying. In undeveloped areas outside of roadway rights-of-way and away from any vehicular or pedestrian traffic, open trench shall not be advanced more than 500 feet ahead of installed pipe. Whenever local, county, state or federal regulations impose stricter limitations, such regulations will take precedence.
2. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by traffic weight steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plates may be waived in undeveloped areas, such as where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights, or escape ramps and earthen trench plugs for wildlife, shall be provided and maintained to meet applicable safety requirements. In no case shall more than 100 feet of trench be left open at end of working day.

3. Do not block vehicular traffic or impede access to homes or businesses.

4. Protect open trench to protect the public, livestock, wildlife and the environment.

5. Contractor is solely responsible for safety of all open trenches and bears sole liability for any incidents or accidents arising from open trenches.

6. The Owner may further restrict the amount of open trench as needed due to safety, land use or environmental considerations.

D. Intercept and divert surface drainage and precipitation away from excavation through use of dikes, curb walls, ditches, pipes, or other means.

E. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

F. Do not interfere with 45 degree bearing splay of foundations. Any excavation in this area shall be backfilled and compacted using the same materials and methods as structural fill for new buildings. Refer to Section 31 23 23.

G. Slope or shore trench as needed to meet safety requirements. When sidewalls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

H. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. Backfill and compact to reach specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.

I. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.


K. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

L. Remove excess subsoil not intended for reuse, from site.

M. Protect open trench at all times to prevent danger to the public and to wildlife. Any safety requirements imposed by agencies or entities with jurisdiction must be met.

3.5 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
C. Design sheeting and shoring to be removed at completion of excavation work. If the Engineer orders the sheeting to be left in place for the protection of the work, a payment will be allowed only for the actual cost of the timber left in place.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 BACKFILLING OF TRENCHES

A. See Section 31 23 23 - Backfill, Articles 3.3 and 3.4 for general backfill requirements, as well as trench backfill and bedding requirements around pipelines.

3.7 DISPOSAL OF EXCAVATED MATERIALS

A. Excess excavated material or excavated material not suitable for backfill may be disposed of on-site, provided that:
   1. The finished grade substantially conforms with the Drawings, or any deviation therefrom is approved by the Engineer
      a. Blend with natural terrain.
      b. Minimum slope: 2%.
   2. All excess excavated material spread on the right-of-way is compacted to the same specifications as final backfill, as set forth in Section 31 23 23 - Backfill and the Drawings, and all on-site disposal of material is approved by the Engineer.

B. Do not dispose of waste material by dumping from tops of slopes.

C. Do not dispose of excess material within 15 feet of any wash, drainage or waterway.

3.8 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.9 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Determine compaction characteristics of materials in accordance with ASTM D698.

C. Classify soils in accordance with ASTM D2487.

D. Perform laboratory material tests in accordance with ASTM D1557.

E. Refer to compaction testing requirements in Section 31 22 13 - Rough Grading and/or Section 31 23 23 - Backfill, Field Quality Control, as applicable.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting installed construction.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION
SECTION 31 23 23
BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe bedding material.

B. Related Sections:
   1. Section 31 23 17 - Trenching: Backfilling of utility trenches.
   2. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
   1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

B. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 3050mm (12-in.) Drop.

C. American Society for Testing and Materials International (ASTM):
   2. ASTM D422 - Particle-Size Analysis of Soils.
   4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
   7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³, 2,700 kN-m/m³).
  11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
  15. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
  16. ASTM D4254 - Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
  18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Percentage Compaction: Ratio, expressed as percentage, of actual density of material compared with maximum dry density based on Modified Proctor (ASTM D1557).
B. Optimum Moisture Content: Based on Modified Proctor (ASTM D1557).
C. Unified Soil Classification System: Based on ASTM D2487.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures.
B. Submit samples and certified test documentation of all materials to be used.
C. Materials Source: Submit name of imported fill materials suppliers.
D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
E. Submit field soil test on material in place as backfill and pipe bedding material.
F. Submit construction drawings with compaction test locations marked and labeled with station, date, test number, depth of test below ground surface, and test result.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Suitable materials may be processed on-site, or may be imported. If imported materials are required to meet the quantity requirements of the project, it will be provided at no additional expense to the Owner, unless a unit price item is included for imported materials on the Bid Form. The following types of materials are defined as suitable where scheduled:

1. Type A (three-quarter inch minus aggregate backfill): Crushed rock or gravel, and sand with the gradation requirements below.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4-inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>30 – 50</td>
</tr>
<tr>
<td>No.200</td>
<td>0 – 12</td>
</tr>
</tbody>
</table>
2. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.
   a. This material to be used only when approved by Engineer.

3. Type D: (pipe bedding material): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 5 percent passing a No. 10 sieve and 1 to 2 percent passing a No. 200 sieve.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the Engineer shall be immediately notified. In case of conflict between types of pipe embedment backfills, the Contractor is to use the agency-specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by the Engineer. In case of conflict between types of trench or final backfill types, the Contractor shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.

C. Fill and backfill types, including use of native soil, shall be used in accordance with the following provisions. Native soil used for fill and backfill must meet the requirements of the type of material specified below and as shown for the corresponding type of material shown in 2.1.A above.

1. Embankment fills shall be constructed of Type M material, as defined herein, or other material approved by the Project Engineer. Drainage structures embankments shall be backfilled with materials used in original construction.

2. Pipe zone backfill shall consist of the following materials for each pipe material listed below. All pipe bedding material shall receive prior approval by the Engineer before use.
   a. Concrete pipe, shall be provided Type A or B pipe bedding and embedment backfill material, or native material that meets the criteria described below, and is acceptable to the Engineer.
   b. Plastic pipe shall be provided Type D bedding and embedment zone material, or native material that meets the criteria described below, and is acceptable to the Engineer.
      1) In trenches where dewatering is required, the pipe bedding material and embankment backfill shall be Type A or B as directed by the Engineer.
   c. Excavated native material will be allowed, provided that it is free draining and contains no organic materials, no rocks larger than 1/2-inch, clods or frozen lumps. A proctor of this material shall be submitted to the Engineer for review and approval before use. If native backfill material is approved, on-site screening may be required by Engineer to remove any rock material larger than 1/2-inch at no additional expense to the Owner. The location of such sites must be coordinated with the Owner.

3. Trench zone backfill for pipelines shall be any of Types A through H backfill materials or any mixture thereof.

4. Final backfill material for pipelines under paved areas shall be Type G backfill material.

5. Final backfill under areas not paved shall be the same material as that used for trench backfill, unless otherwise indicated.

6. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 8 inches.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING FOR STRUCTURES, SITE WORK AND APPURTENANCES

A. Backfill areas to contours and elevations with unfrozen materials as indicated on the Drawings or as directed by the Engineer.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

D. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.

E. Employ placement method that does not disturb or damage other work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Slope grade away from building minimum 6 inches in 10 ft, unless noted otherwise.

H. Make gradual grade changes. Blend slope into level areas.

I. Shape and drain embankments and excavations, maintain ditches and drains to provide drainage at all times. Protect graded areas against action of elements prior to acceptance of work, and reestablish grade where settlement or erosion occurs.

J. Bench hillside slopes or fills to key the embankment. Remove and re-compact a minimum of 12 inches normal to the slope of the hillside or fill as the embankment or fill is brought up in layers.
K. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill to same thickness as existing driving surface, or 6 inches, whichever is greater. If paved, apply pavement patch to thickness equal to or greater than existing pavement.

L. Remove surplus backfill materials from site.

M. Leave fill material stockpile areas free of excess fill materials.

N. Repair or replace remaining items damaged by excavation or filling.

3.4 BACKFILLING OF TRENCHES

A. Place a minimum of 4 inches of bedding material in pipe trenches to lines and grades indicated on Drawings or as directed by Engineer and compact before pipe is laid. Grade bedding material parallel to bottom of pipe.

B. Do not place material when either the material or the surface upon which it is to be placed is frozen.

C. Pipe zone backfill materials shall be manually spread around the pipe so that, when compacted, the pipe zone backfill will provide uniform bearing and side support.
   1. Exercise care not to damage pipe or appurtenances when placing embedment material.
   2. Maintain optimum moisture content of fill materials to attain required compaction density.
   3. Ensure material is placed to equal height on both sides of pipe to avoid unequal loading and possible lateral displacement of the pipe. Elevation difference of embedment between each side of pipe shall not exceed 6 inches.
   4. Place material in uniform layers.
   5. Work material into pipe haunches to prevent voids and achieve specified compaction under the haunches.
   6. No backfilling by machine methods permitted until a minimum of one foot of material has been placed by hand over the top of the pipe.
   7. Place material to a compacted depth of 12 inches over the top of the pipe, 15 inches of compacted depth over the top of the pipe in paved or traffic areas, and compacted by hand held compacting tools before other backfilling is done.

D. If pipe laying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

E. When the bottom of the trench is unstable, an additional 4 inches shall be over-excavated and filled with bedding material before pipe is laid.

F. Where rock is present and where there is concern that settling rocks in the surrounding material may rupture the pipeline, the amount of bedding material below and above the pipe shall be increased. In these cases there will be 8 inches of bedding material below the pipe and 15 inches above, as directed by the Engineer.

G. When using free-draining crushed rock or gravel for embedment on stretches longer than 300 feet, install trench plugs composed of silty, non-plastic material at 300 foot intervals to impede flow of trench water through the embedment.

H. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill to same thickness as existing driving surface, or 6 inches, whichever is greater. If paved, apply pavement patch to thickness equal to or greater than existing pavement.
3.5 COMPACTION

A. Do not place and compact soil under the following conditions:
   1. Ambient air temperature below freezing.
   2. Rain that creates puddles in clayey or silty materials.
   3. Ice or snow pockets visible in material being placed.

B. Surface Preparation:
   1. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified percent compaction, if necessary.
   2. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing first layer of material to be compacted.
   3. Do not place material to be compacted on frozen surface.

C. Compact material in trenches in layers having approximately the same top elevation on both sides of the pipeline to avoid unequal loading and displacement of the pipe.

D. Placement:
   1. Place soil to be compacted in horizontal layers.
   2. Blend materials as needed to ensure compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations and other imperfections.

E. Compaction Procedures:
   1. Silty or Clayey Material:
      a. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers or other suitable compaction equipment.
      b. Uniformly distribute equipment passes.
      c. Compact in horizontal layers to compacted thickness of 6 inches or less.
   2. Cohesionless Free-Draining Material: Compact in horizontal layers to maximum compacted thickness of:
      a. Tampers and rollers: 6 inches
      b. Crawler-type tractors, vibrating drum rollers, surface vibrators or similar equipment: 12 inches
      c. Saturation and internal vibration: Penetrating depth of vibrator.
   3. When compacting pipe embedment material, exercise care not to damage the pipe or appurtenances with compaction equipment. Do not apply compaction equipment directly above the pipe.
   4. Demonstration: Lift thicknesses may vary depending on equipment and methods. Field adjustments to the specified lift thicknesses may be allowed or required. Contractor shall demonstrate that proposed equipment and methods will meet required compaction for the proposed lift thickness.
   5. Flooding and jetting is not allowed unless specifically approved by the Engineer.

F. Moisture Content:
   1. Optimum moisture content for each soil type, whether native soil or imported material, shall be determined by the Modified Proctor method, ASTM D1557.
   2. Moisture content during compaction shall be no more than 2 percentage points wet or dry of optimum moisture content.
   3. Moisten or aerate material, as necessary, to provide specified moisture content. Add water to soil in increments that will permit moisture content to be uniform and homogenous through each layer after mixing.
   4. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.
      a. If clayey soil is more than 2 percent below optimum moisture, preconditioning and curing may be required to obtain uniform and homogenous distribution of moisture in clods.
      b. Use of disks, harrows or rakes may be required to blend moisture prior to placement and compaction.
5. For cohesionless soils, add water as necessary during compaction, as these soils are free-draining.

G. Minimum Percent Compaction:
   1. Over-excavation: Backfill of over-excavation to specified or directed lines shall be compacted to same percent compaction as embedment material or undisturbed foundation material, whichever is greater. If the in-place compaction of the undisturbed foundation material is greater than 95%, the over-excavation backfill may be compacted to 95%.

   2. Pipe Bedding Material: Place and compact pipe bedding material as indicated on Drawings for given soil classification, pipe wall thickness, and depth of cover. If native material meets grading requirements and is used, compact to 95%.

   3. Initial and Final Backfill: For trenches outside of roads, driveways, parking areas or wash crossings, compact to 95%, or to a density equal to that of the adjacent undisturbed soil, as directed by the Engineer. For trenches within the driving surfaces of roads, driveways or parking areas (both paved and unpaved) or within wash crossings, compact to 95%.

   4. Embankments: Compact to same requirements as Final Backfill.

   5. Note that all Percent Compaction values in these Technical Specifications and Drawings are based on Modified Proctor, ASTM D1557, unless otherwise noted.

3.6 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling within Building Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

E. Percent Compaction: Shall meet minimum required compaction as set forth in these specifications

F. Moisture Content: As set forth in these specifications.

3.7 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, Adjusting, and Balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:

D. When tests indicate Work does not meet specified requirements, remove material, replace, compact, and retest.

E. Provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations, at the locations and depths required. The cost of all work associated with accessing, preparing, or time delays for testing to be included in the unit price of the applicable pay item being tested.
F. Compaction testing shall be done to the extent such that the Owner and Engineer can be reasonably assured that the backfill has been placed in accordance with the requirements of the Contract Documents, or as required by the utility for which the trenching is being provided, whichever is the more stringent. When a testing allowance is established on the Bid Form, the Owner and Engineer will determine the testing frequency to be used throughout the project. If no allowance is included, the frequency of testing shall be at least once every 200 linear feet of trenching.

G. Correction of Substandard Work: All fill and backfill represented by tests that fail to meet compaction, moisture content, soil classification or other specifications shall be uncovered as needed, replaced as needed, re-compacted and re-tested until all specifications are met, at no additional expense to the Owner.

1. Elevations, lines and grades of replaced material, as well as of pipe and other structures resting against such material, shall be re-surveyed at the direction of the Engineer. Contractor shall correct elevations, lines and grades as needed, at no additional expense to the Owner.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting Installed Construction.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 SCHEDULE

A. Fill Over Drainage Piping Gravel Cover:

1. Fill to 6 inches below finish grade, compact uniformly to 95 percent of maximum density.

END OF SECTION
Division Thirty Three

UTILITIES
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for public line including potable water line.
2. Tapping Sleeves, Tees and Valves.

B. Related Sections:
1. Section 31 23 17 - Trenching: Execution requirements for trenching.
2. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
4. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:
1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes trenching, hand trimming excavation, piping and fittings, all valves and appurtenances not listed separately on the Bid Form, bedding, backfill, compaction, tracer wire, detectable warning tape, concrete thrust restraints (where applicable), concrete wall anchors (if not separately listed on Bid Form), mechanical joint restraints, connection to public utility water source (if not separately listed on Bid Form). Special excavation methods for trenching in rock or hard soils, rock removal and disposal, and/or imported bedding material, if required to meet the project specifications, shall be considered incidental to the cost of the pipe installation. Soil cement, if used, shall be considered incidental to the cost of the pipe installation.
3. The cost of laboratory testing for water quality and the cost of compaction testing shall be reimbursed from testing allowance to the Contractor, upon submittal of invoices. Work performed by Contractor related to such testing shall be considered incidental and shall not be reimbursable from testing allowance. Work shall be coordinated and directed by Engineer. Should initial test fail, Contractor shall pay for all subsequent testing until the results indicate full compliance with the Contract Documents.
4. The cost of work associated with hydrostatic pressure testing and testing of material welds, etc. shall be considered incidental to related work and not be reimbursed. Work shall be coordinated and directed by Engineer.

B. Bedding Material:
1. Basis of Measurement: By the cubic yard.
2. Basis of Payment: Includes delivery to site, installation in pipe trench, and compaction. Quantity calculated from depth of bedding, width of trench and linear feet of waterline installed. Measurements to be taken every 50 feet. Trench dimensions larger than those shown in the Drawings result in additional bedding material and will be deducted from the measured quantities to be included for payment.
C. Fittings:
   2. Basis of Payment: Includes fittings, all appurtenances not listed separately on the
      Bid Form, bedding, pipe joint restraints, and connection of fittings to pipe.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils
      Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers (ASME):

C. American Society for Testing and Materials International (ASTM):
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized)
      Coatings on Iron and Steel Products.
   3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI
      Tensile Strength.
   4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics
      of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC)
      Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   6. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe,
      Schedules 40, 80, and 120.
   7. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-
      Rated Pipe (SDR Series).
   8. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil
      Classification System).
      Materials.
       Flexible Elastomeric Seals.
   11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of
       Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   12. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining
       Plastic Pipe.
       Based on Outside Diameter.
   14. ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE)
       Pressure Piping Systems Using Hydrostatic Pressure.
   15. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and
       Fittings.
   16. ASTM F2634 - Standard Test Method for Laboratory Testing of Polyethylene (PE)
       Butt Fusion Joints using Tensile-Impact Method.

D. American Water Works Association (AWWA):
   1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and
      Fittings for Water.
   2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe
      Systems.
   3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through
      48 In. (76 mm through 1,219 mm), for Water.
   4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure
      Pipe and Fittings.
7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
9. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
11. AWWA C206 - Field Welding of Steel Water Pipe.
12. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
13. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
15. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
17. AWWA C605 - Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
18. AWWA C606 - Grooved and Shouldered Joints.
19. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
20. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 In. through 3 In. (13 mm through 76 mm), for Water Service.
21. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. through 48 In. (350 mm through 1,200 mm), for Water Transmission and Distribution.
22. AWWA C906 - Polyethylene Pressure Pipe and Fittings, 4 In. through 63 In. (100 mm through 1,575 mm), for Water Distribution and Transmission.

E. Manufacturer’s Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Agency
   1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

G. National Sanitation Foundation (NSF):
   1. NSF-14 - Plastics Piping System Components and Related Materials
   2. NSF-61 - Drinking Water System Components - Health Effects

H. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
   1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”

I. Plastic Pipe Institute (PPI):
   1. TR-33 - Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

J. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit data on pipe materials, pipe fittings and accessories, and testing equipment.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Testing Plan: Contractor must submit proposed testing procedure specific to the project, including identifying filling locations, and equipment to be employed for hydrostatic testing of lines, as well as continuity testing for tracer wire, for approval by Engineer.

E. Contractor shall submit a joint restraint table for all types of restrained joints to be used for the project based on the manufacturer's specifications and calculations.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, connections, thrust restraints, and invert elevations. Refer to paragraph 1.51 of Section 01 00 00.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with these specifications, as well as the most recent edition of New Mexico Standard Specifications for Public Works Construction with latest revisions. The most stringent requirement shall apply.

B. All piping, fittings, valves, hydrants and any other potable water system appurtenances shall comply with the “Reduction of Lead in Drinking Water Act”, in effect as of 2014, or any subsequent revision thereof.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Block individual and stockpiled pipe lengths to prevent moving.

C. Do not place pipe or pipe materials on private property without prior authorization, or in areas obstructing pedestrian or vehicular traffic.

D. Store polyethylene materials out of sunlight.

E. Flexible pipe shall be braced as required to maintain roundness of +/- 1% during shipping and handling.

F. Prior to shipment and again prior to installation, all materials shall be visually inspected for damage, including coatings and surfaces. Any damaged materials shall be repaired to original standards or replaced.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.
PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, with Dimension Ratio (DR) of DR18 for C900 pipe and DR21 for C905 pipe, unless otherwise identified on the Drawings or on the Bid Form, for all PVC pipe of 4" diameter and greater; ASTM D2241, IPS Gasketed Pipe, NSF approved, SDR21 with Pressure Rating of 200 psi, or as scheduled, for all PVC pipe with a diameter of 2" and greater but less than 4" diameter; ASTM D1785, PVC 1120 or 1220, NSF approved, Schedule 40, or as scheduled, for all PVC pipe less than 2" diameter:

1. Fittings: AWWA C900 and AWWA C905, for all PVC pipe of 4" diameter and greater; ASTM D1785, Schedule 40, for all PVC pipe less than 4" diameter.


3. Joint Restraints: “EBAA Iron, Megalug®”, or approved equal, for all pipe 4" diameter and greater, “EBAA Iron, Series 6500 and 7500”, or approved equal, for all pipe from 2” to 3-1/2” diameter, installation and spacing as per manufacturer's specifications; or concrete thrust blocking.

4. All buried metallic components shall be wrapped in 8-mil polyethylene. All buried bolts, other than stainless steel bolts, shall be coated with field-applied coal tar epoxy.

B. Polyethylene Pipe: AWWA C901 and ASTM D3035 for sizes up to 3" diameter; AWWA C906 and ASTM F714 for sizes 4" diameter and above.

1. Each production lot of pipe shall be tested for melt index, density, percent carbon, dimensions and ring tensile strength.

2. Polyethylene pipe and fittings shall be PE3608 high-density polyethylene meeting ASTM D3350 cell classification 345464C. The material shall be listed and approved for potable water in accordance with NSF Standard 61.

3. Four permanent co-extruded, equally spaced, blue color stripes in outside surface of pipe.

4. Molded fittings in accordance with ASTM D3261, and tested in accordance with AWWA C906.

5. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings; rated for internal pressure service at least equal to the full service pressure rating of the mating pipe; and tested in accordance with AWWA C906.

6. Polyethylene flange adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder, as per pipe manufacturer's instructions.

7. All HDPE fabricated MJ adapters shall have steel stiffeners.

8. HDPE pipe and fittings shall have a working pressure (as set forth in ASTM F714) of not less than 200 psi for DR 11, not less than 160 psi for DR 13.5, not less than 138 psi for DR 15.5, and not less than 125 psi for DR 17, with a recurring surge pressure allowance (total pressure) of 1.50 times working pressure and occasional surge allowance (total pressure) of 2.00 times working pressure (surge allowances shall be based on AWWA C906 and/or AWWA M55).

9. Nominal sizes indicated on Drawings for both pipe and fittings denote iron pipe size (IPS) unless otherwise noted.

10. All HDPE pipe and fittings shall be manufactured of PPI listed materials.

11. Pre-fabricated HDPE mitered bends and other fittings shall have internal weld bead completely removed prior to installation, using approved method for weld bead removal.
2.2 TAPPING SLEEVES, TEES AND VALVES

A. Tapping Sleeves and Saddles:
   1. Manufacturers:
      a. Mueller Co.
      b. Kennedy Valve Co.
      c. Romac Industries, Inc.
      d. JCM Industries
      e. Ford Meter Box Company, Inc.
      f. Smith-Blair, Inc.
      g. Substitutions: Approved equal.
   2. For taps 2-inches or smaller, use nylon coated ductile iron tapping saddles with dual compression straps.
   3. For taps larger than 2-inches, use fusion-bonded epoxy-coated steel.
   4. All saddles shall be specifically designed for use on the type of piping that is being tapped.
   5. All bands, straps, bolts, nuts and washers shall be SS 304. All bolts shall be provided by manufacturer especially for use with their respective components.
   7. Sleeve Working pressure rating: 175 psi.
   8. Tapped Outlet: FNPT or as indicated on Drawings.
   9. All pipe taps shall be made with an engineer approved “tapping machine”.
   10. Refer to Section 31 12 16 for specification on gate valve to install as tapping valve on sleeve.

B. HDPE Branch Saddle Reducing Tees:
   1. For use on all HDPE pipe.
   2. Shall be factory-fused and tested in accordance with AWWA C906.
   3. Shall be constructed of same HDPE material with the same inner diameter as the pipe to which the tee is joined.
   4. Entire unit shall be rated to the same pressure as the pipe to which the tee is joined.

C. Tapping Valves:
   1. Manufacturers:
      a. Mueller Co.
      b. U.S. Pipe
      c. Kennedy Valve Co.
      d. Or approved equal
      e. Substitutions: Section 01 00 00 - Product Requirements.
   2. AWWA C509, resilient wedge tapping valve with non-rising stem. Inlet flanges shall conform to ANSI B16.1, Pressure Rating of 350 psi and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.

2.3 UNDERGROUND PIPE MARKERS

A. Furnish materials in accordance with the following, as well as the New Mexico Standard Specifications for Public Works Construction, with latest revisions. The most stringent requirement shall apply.

B. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 30 volts, Blue Jacket, UF-XHHW wire or equal, for underground installation.

C. Underground Utility Marking Tape: Bright colored, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" (or similar wording) in large letters, on blue tape in conformance with APWA color code specifications for underground tape systems. The tape shall be constructed of
material that is impervious to alkalis, acids, chemical reagents, and solvents found in the soils.

D. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

2.4 PIPE SUPPORTS AND ANCHORING

A. Metal for pipe support brackets: ASTM A123/A123M, galvanized structural steel thoroughly coated with bituminous paint.

B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24 thoroughly coated with bituminous paint.

2.5 BEDDING AND BACKFILL MATERIALS

A. Bedding: Fill Type as specified in Section 31 23 23.

B. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 23 23. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.6 BOLTS AND NUTS

A. Zinc-plated or fluoropolymer coated bolts and nuts shall be used for the installation of pipelines up to 500 mm (20") diameter and shall be carbon steel conforming to ASTM A307, Grade A, unless otherwise indicated on the approved drawings. Bolts and nuts shall have standard ANSI B1.1, Class 2A coarse threads.

B. Stainless steel bolts and nuts shall be used for the installation of pipelines 600 mm (24") diameter and larger and for submerged flanges. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and Grade 8M for nuts.

C. All bolt heads and nuts shall be hexagonal, except where special shapes are required. Bolts shall be of such length that not less than 6.4 mm (¼") or more than 12.7 mm (½") shall project past the nut in tightened position.

2.7 ACCESSORIES

A. Concrete for Thrust Restraints: Conform to Section 03 30 00 [03 05 00], with minimum compressive strength of 3,000 psi.

B. Steel rods, bolt, lugs and brackets: ASTM A36/A36M or ASTM A307 carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing utility water main size, location, and invert, are as indicated on Drawings.

3.2 PREPARATION

A. Pre-Construction Site Photos:
1. If required in the Contract Documents, take photographs or videotape along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.

2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing site features that may potentially be impacted by the construction work.

3. Include project description, date taken and sequential number on back of each photograph.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

E. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

3.3 TRENCHING AND BACKFILL

A. Excavate trenches in accordance with Section 31 23 17, including dewatering of excavations as required, to maintain dry conditions and preserve final grades at bottom of excavation.

B. Place bedding and trench backfill material in accordance with Section 31 23 23.

3.4 INSTALLATION - PIPE

A. Install PVC pipe in accordance with AWWA C605. Use only lubricants supplied by the pipe manufacturer and apply in accordance with manufacturer’s recommendations. Clean the gasket, bell, groove and spigot immediately prior to connecting pipe joints.

B. Handle and assemble pipe in accordance with manufacturer’s instructions and as indicated on Drawings. Inspect each pipe and fitting prior to lowering into trench to ensure there is no damage to the pipe, fitting or coatings. Repair any damage prior to installation. Clean ends of pipe and remove foreign material from inside of pipe and fittings.

C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

D. Maintain 10 foot horizontal separation of water main from sewer piping in accordance with local code.

E. Install pipe to indicated elevation to within tolerance of 3 inches.

F. Route pipe in straight line. Relay pipe that is out of alignment or grade.

G. Twenty-foot lengths (20’) of PVC pipe shall not be deflected more than 2% of their length (5”) either horizontally or vertically. Any sections of pipe less than twenty feet (20’) in length shall not be deflected.

H. PVC pipe deflections may be made either at joints or by pipe bending.
   1. Deflection both at joints and by pipe bending shall not exceed maximum deflection recommendations by the pipe manufacturer or AWWA C605. In the case of a discrepancy between these recommendations, the smaller maximum deflection value shall apply.
I. Horizontal and vertical deflections in HDPE pipe may be accomplished by pipe bending, provided that:
   1. Such bends meet the minimum bending radius recommended by the pipe manufacturer and AWWA (in case of discrepancy, the longer of the two radii shall be used).
   2. In the case of horizontal bends, the pipe must remain within the established permanent right-of-way.

J. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, increase pipe bury depth or install air release valves as directed by Engineer.

K. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

L. Prevent foreign material from entering pipe during placement.

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

N. Close pipe openings with watertight plugs during work stoppages.

O. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

P. Establish elevations of buried piping with not less than 4 foot of cover. Measure depth of cover from final surface grade to top of pipe barrel.

Q. Install tracer wire continuous, taped to top of pipeline at regular intervals not exceeding 24"; coordinate with Sections 31 23 17 and 31 23 23. Continuity of tracer wire shall be tested periodically as indicated by Engineer, and prior to final acceptance of work. Any segment of tracer wire that fails the continuity test shall be repaired or replaced by Contractor at no additional cost to Owner.

R. Expose tracer wire at every surface penetration (i.e. valves, hydrants, vaults, etc.). Protect wire ends with wire caps and protect from corrosion. Provide extra length of tracer wire at each structure, so tracer wire can be pulled 3 feet out top of structure for connection to detection equipment.

S. Install underground utility marking tape continuous, buried 18 inches directly above pipe buried directly above pipe alignment between 18" and 24" below projected finish grade. Coordinate with Section 31 23 17 and 31 23 23.

3.5 INSTALLATION - TAPPING SLEEVES AND GAUGES

A. Install tapping sleeves and gauges in accordance with Drawings and in accordance with manufacturer’s instructions.

3.6 THRUST RESTRAINTS

A. Install tie rods, clamps, setscrew retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.

B. Install thrust blocks or restrained fittings in accordance with Drawings and in accordance with manufacturer’s instruction.

C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.
3.7 BACKFILLING
   A. Backfill trenches for piping in accordance with Section 31 23 23.

3.8 DISINFECTION OF POTABLE WATER PIPING SYSTEM
   A. Flush and disinfect system in accordance with Section 33 13 00.

3.9 FIELD QUALITY CONTROL
   A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
   B. Perform pressure test on potable water distribution system in accordance with applicable standards:
      1. PVC Pipe: AWWA C605.
      3. HDPE Pipe: ASTM F2164.
   C. Hydrostatic pressure for testing shall be 1.5 times the designed working pressure at the lowest point in the line section being tested, or 150 psi minimum pressure, whichever is greater. In the event it is not possible to measure the pressure at the lowest point directly, this pressure may be calculated by measuring the pressure elsewhere within the section and calculating the pressure based on elevation difference.
      1. Warning: Safety is of paramount importance when conducting hydrostatic pressure leak test due to possibility of sudden violent rupture or failure.
      2. In no case shall the test pressure exceed the manufacturers’ recommended maximum safe test pressure for the pipe or fittings.
      3. Under no circumstances shall HDPE pipe be maintained at test pressure (1.5 times design working pressure) for more than 8 hours. If the test is not completed within this time, the system shall be depressurized and allowed to "relax" for a minimum of 8 hours before commencing the next test sequence.
      4. For all pipe other than HDPE, maintain pressure in the pipeline for 24 hours prior to starting the test, then test the pipeline for 96 hours or until accepted by the Engineer.
      5. No observable leakage is allowed. Measurable leakage must be within the maximum allowable limits set forth by applicable AWWA and ASTM standards.
      6. Any leaks detected during testing shall be repaired. After repairs are completed, another full duration test shall be performed on the section of the pipeline to which the repairs were made.
      7. HDPE pipe: Add make-up water as necessary to maintain maximum test pressure for 4 hours.
      8. HDPE test phase: Pressurize pipe and reduce pressure by 10 psi and monitor pressure for 1 hour. Do not increase pressure or add make-up water.
      9. HDPE pass/fail criteria: If no visual leakage is observed and pressure during the test phase remains steady (within 5% of test pressure) for the 1 hour test phase period, a passing test is indicated.
   D. Qualifications of polyethylene fusion personnel:
      1. Prior to production of heat fusion joints, the heat fusion joint machine operator shall be certified by the machine manufacturer or representative thereof who is approved by the Engineer.
      2. Each fusion machine operator shall receive training on the use of the specific fusion machine and the bonding procedure and shall perform at least one pipe-to-pipe bond and one pipe-to-fitting bond (if used) on each machine they are required to use. All bonds made as part of operator certification shall be visually inspected.
and tested in accordance with the fusion quality testing specifications set forth in this section.

3. A fusion machine operator’s qualification shall remain in effect for a period of six months from the date of qualification. The entity certifying an operator’s qualifications shall retain the ability to revoke an operator’s qualification if it is determined that there is a specific reason to question the operator’s ability to make joints that meet project specifications.

4. E. Thermal contraction and expansion of HDPE pipe:
   1. Engineer reserves the right to unbolt any flange or mechanical joint attached to HDPE pipe (including all valve assemblies) to check for tensile or compressive loading due to thermal contraction or expansion of the HDPE pipe. Excessive tension, indicated by pull-back of the HDPE end, or excessive compression of the flange shall be cause for the Contractor to excavate the HDPE pipe, lengthen or shorten the pipe as necessary, and re-bury. Contractor shall not grout the pipe penetrations of valve vaults until authorized by the Engineer, to allow for proper testing. Refer to Section 33 12 16 - Water Utility Valves.

F. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

G. Tolerances: Lay pipe to lines and grades shown on Drawings or as indicated by the Engineer, to the following tolerances:
   1. Total departure from vertical grade not to exceed 3 inches.
   2. Departure from vertical slope not to exceed 1/16 inch per foot.

H. Contractor shall not connect to existing system until all testing and disinfection is complete and shall obtain written permission from the Owner to proceed with connection to the existing system.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for domestic water service connections to buildings.
   2. 
   4. Bedding and cover materials.

B. Related Sections:
   1. Section 31 23 17 - Trenching.
   2. Section 31 23 23 - Backfill.
   3. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

   1. NMSSPWC - Section 802 - Installation of Water Service Lines.
   2. NMSSPWC - Section 801 - Installation of Water Transmission, Collector, and Distribution Lines.

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

C. American Society of Mechanical Engineers (ASME):
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. American Society of Sanitary Engineering (AMSE):
   1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
   2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

E. American Society for Testing and Materials International (ASTM):
   2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   5. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

F. American Welding Society (AWS):
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

G. American Water Works Association (AWWA):
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
   3. AWWA C800 - Underground Service Line Valves and Fittings.
   4. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
   5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops (if applicable), connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

B. All piping, fittings, valves, and any other service connection appurtenances shall comply with the “Reduction of Lead in Drinking Water Act”, in effect as of 2014, or any subsequent revision thereof.
1.6 DELIVERY, STORAGE, AND HANDLING
   A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
   C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

1.7 MAINTENANCE MATERIALS
   A. Furnish two (2) meter keys to Owner (required length) for each meter type.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS
   A. PVC Pipe: SDR-21 for 200 psig rating:
      1. Fittings: ASTM D2466, PVC.

2.2 BEDDING AND COVER MATERIALS
   A. Bedding: Fill Type as specified in Section 31 23 23.
   B. Cover: Fill Type as specified in Section 31 23 23.
   C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 23 23. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
   B. Verify building service connection and municipal utility water main size, location, and invert elevation are as indicated on Drawings.
   C. Water meter assemblies shall be installed at the locations indicated by the Owner’s Representative. The Owner’s Representative will identify location of existing system components and assist the Contractor with location and verification of the existing system in the field.

3.2 PREPARATION
   A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
B. Remove scale and dirt on inside and outside before assembly.

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

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sewer piping in accordance with New Mexico Public Work Standards.

B. Group piping with other site piping work whenever practical.

C. Route pipe in straight line, as much as possible. Do not crimp polyethylene pipe during installation or at any other time.

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

E. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

G. Establish elevations of buried piping with not less than 4 ft of cover. Install tracer wire continuous, taped to top of pipe at regular intervals not exceeding 24", and plastic warning tape directly above buried piping, all in accordance with Section 33 11 00. Coordinate with Sections 31 23 17 and 31 23 23. Contractor shall test tracer wire for continuity periodically when instructed by Engineer, and prior to final acceptance of work.

H. Backfill trench in accordance with Section 31 23 23.

3.5 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. During testing of the materials at the above ambient temperatures, no visual cracking, checking, blistering, surface pitting or deformation shall be noted.

C. Perform pressure test on domestic site water distribution system in accordance with AWWA C600. Compaction Testing for Bedding: In accordance with ASTM D1557.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
E. Compaction testing shall be done to the extent such that the Owner and Engineer can be reasonably assured that the backfill has been placed in accordance with the requirements of the Contract Documents. When a testing allowance is established on the Bid Form, the Owner and Engineer will determine the testing frequency to be used throughout the project. If no allowance is included, the frequency of testing shall be at least once every 400 linear feet of trenching.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve boxes.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 23 - Backfill.
   3. Section 33 11 00 - Water Utility Distribution Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Valves:
   2. Basis of Payment: Includes excavation, valve, valve box, valve riser and collar, accessories, tests, backfill and compaction.

1.3 REFERENCES

A. American Water Works Association (AWWA):
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C504 - Rubber-Seated Butterfly Valves.
   3. AWWA C508 - Swing-Check Valves for Waterworks Service, 2- through 24-in.
   4. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
   5. AWWA C515 - Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.
   6. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

B. National Sanitation Foundation (NSF):
   1. NSF/ANSI Standard 61 - Drinking Water Components - Health Effects.

C. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
   1. 801 - Installation of Water Transmission, Collector, and Distribution Lines.
   2. 802 - Installation of Water Service Lines.

1.4 SUBMITTALS

A. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.

B. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of all valves. Provide completed Water Valve Cards for each valve installed per NMSSPWC Section 801.4.

B. Provide Operation and Maintenance Data for each type of valve installed.
1.6 QUALITY ASSURANCE

A. Perform work in accordance with applicable New Mexico Standards and the National Fire Protection Act (NFPA).

B. All piping, fittings, valves and any other potable water system appurtenances shall comply with the "Reduction of Lead in Drinking Water Act", in effect as of 2014, or any subsequent revision thereof.

C. Valves: Mark valve body with manufacturer's name and pressure rating.

1.7 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years’ experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.

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

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

D. Coated valves and appurtenances shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coating.

E. Coated valves shall be handled with wide belt slings, padded forks or other means to prevent damage to coating. Chains, cables or other equipment likely to damage coating or valves shall not be used.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

A. Coordinate work with City of Tucumcari, the local fire department, and utilities within construction area.

1.11 MAINTENANCE MATERIALS

A. Furnish two (2) tee wrenches to Owner (required length) for each valve type.

PART 2 PRODUCTS

2.1 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
   1. American Flow Control, Series 2500
   2. American AVK, Series 45
4. J&S Valve, Model 6800 and 6900
5. Kennedy
6. Mueller Company
7. Southern Valve and Fitting USA Inc., Series 801 and 806
8. United Water Products, Model 2010
9. US Pipe, MetroSeal
10. Or approved equal
11. Substitutions: Section 01 00 00 – Product Requirements.

B. Resilient Wedge Gate Valves: AWWA C509/C515, NSF 61.
1. Body, Bonnet, Gland Flange and Stuffing Box: Gray Iron or Ductile Iron for valves meeting AWWA C509, and Ductile Iron for valves meeting AWWA C515.
2. Stem and Stem Nut: Low Zinc (<15%) Bronze or Stainless Steel.
   a. Stem: Non-rising stem (NRS), Minimum yield strength of 40,000 psi and elongation of 12%.
   b. Stem Nut: Minimum yield strength of 30,000 psi.
3. Wedge: Ductile Iron ASTM A536 fully encapsulated with rubber.
5. Operating Nut: Square; open counterclockwise unless otherwise indicated.
6. Ends: Flanged or mechanical joint as directed by the Engineer.
7. Coating: Fusion bonded epoxy conforming to AWWA C550; interior/exterior.
8. Sizes 12 inch diameter and smaller: 250 psig.

C. Where waterline is buried at a depth greater than 4 feet, provide valve stem extensions, complete with extension stem stabilizers, until depth of extension nut at least matches depth of operating nuts on valves installed at four-foot depth.

2.2 VALVE BOXES

A. Manufacturers:
2. Tyler Pipe.
3. DL Foundry.
4. SIP Industries.
5. Or approved equal
6. Substitutions: Section 01 00 00 – Product Requirements.

B. 12-inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw type.
C. Valves larger than 12-inch diameter: Domestic cast iron, three-piece, screw type; round base.

D. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.

E. Concrete for Thrust Restraints

PART 3 EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

B. Verify invert elevations prior to excavation and installation of valves.
3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Engineer not less than 48 hours in advance of proposed utility interruption.
   2. Do not proceed without written permission from the Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

3.3 INSTALLATION

A. Gate Valves and Butterfly Valves:
   1. Install valves in conjunction with pipe laying; set valves plumb.
   2. Provide buried valves with valve boxes installed flush with finished grade.
   3. Install valve stem risers and collars, and valve box extensions as required to match finished grade.
   4. All valve boxes must be centered over the operating nut. When valve key in use, key shall be centered in valve box.
   5. Valves shall require the same joint restraint lengths as dead-ends of similar size and pipe material.
   6. All buried metallic components shall be wrapped in 8-mil polyethylene.

B. Tracer Wire:
   1. For direct buried valves, tape tracer wire to outside of valve box up to last section of box. Bring tracer wire into the valve box above the operating nut. Protect wire ends with wire caps and protect from corrosion. Provide extra length of tracer wire at each structure, so tracer wire can be pulled 3 feet out top of structure for connection to detection equipment.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic site water distribution system in accordance with AWWA C605.

C. All valves, including butterfly valves, gate valves, check valves and air valves shall be manually actuated through their full cycle to ensure proper operation prior to installation.

END OF SECTION
SECTION 33 36 00
SEPTIC TANK SYSTEMS

PART 1 GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Septic tank and distribution box.
   2. Interconnecting piping.
   3. Infiltration field.
B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 17 - Trenching.
   3. Section 31 23 23 - Backfill.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT
A. Septic Tank:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavating, placing and connecting to piping, backfilling.
B. Distribution Box:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, placement, installation of pipe entering from tanks and four pipes exiting to leach field, backfilling, and all appurtenances.
C. Clean-outs and Manways:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, installation of clean-outs and manways, three per tank, as indicated on the Drawings, backfilling, and all appurtenances.
D. Leach Field:
   1. Basis of Measurement: By linear foot, measured in four rows of infiltrator chambers at 150 linear feet each row.
   2. Basis of Payment: Includes excavating, hand trimming, infiltrator chamber units, related pipe and fittings to connect to distribution box, aggregate bed and cover, backfilling.

1.3 REFERENCES
A. American Association of State Highway and Transportation Officials:
B. American Society for Testing and Materials (ASTM):
6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).
7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN·m/m³)).

C. American Water Works Association (AWWA):

D. New Mexico Administrative Code (NMAC)
   1. NMAC 20.7.3 - Liquid Waste Treatment and Disposal.

1.4 SUBMITTALS
   A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
   B. Shop Drawings: Indicate plan, location and inverts of filter field, inverts of connecting piping.
   C. Product Data: Submit data on tank, distribution box, piping, and infiltration chambers.
   D. Manufacturer's Installation Instructions: Submit special procedures for septic tank and infiltration chamber installation.

1.5 CLOSEOUT SUBMITTALS
   A. Section 01 00 00 - Execution Requirements: Requirements for submittals.
   B. Project Record Documents: Accurately record actual locations and inverts of buried pipe, components, and connections.

1.6 COORDINATION
   A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.
   B. Coordinate the Work with connections to building sanitary sewer piping outlet.

PART 2 PRODUCTS

2.1 SEPTIC TANK
   A. Manufacturers:
      1. See approved NMED Product List
      2. Approved equal.
      3. Substitutions: Section 01 00 00 - Product Requirements.
4. Approved by the International Association of Plumbing and Mechanical Officials (IAPMO); or meet IAPMO minimum standards as demonstrated to the engineer by approved laboratory testing; or meet all requirements of Sections 20.7.3.501 and 502 NMAC; or be recommended by the wastewater technical advisory committee created by NMSA 1978 Section 9-7A-15.

B. Product Description:
1. Septic Tank: Precast reinforced concrete
2. Tank Capacity: 750 gallon.
3. Have a minimum live load at the surface of 300 pounds per square foot with twelve (12) inches of cover unless heavier loads are expected.
4. Tank covers shall be capable of supporting an earth load of not less than three hundred (300) pounds per square foot when the maximum fill coverage does not exceed three (3) feet.
5. Not be subject to excessive corrosion or decay.
6. Capable to withstand all reasonable lateral earth pressures under saturated soil conditions with the tank empty.
7. Have manufacturer’s name, New Mexico registration number, year of construction and tank capacity in gallons permanently displayed on the tank above the outlet pipe.
8. Must be watertight.
9. Secure lid shall consist of one or more of the following:
   a. padlock
   b. twist lock cover requiring special tools for removal
   c. covers weighing 58 pounds or more, net weight
   d. a hinge and hasp mechanism that uses stainless steel or other corrosion resistant fasteners to fasten the hinge and hasp to the lid and tank for fiberglass, metal or plastic lids
   e. other mechanisms approved by the New Mexico Environment Department (NMED).
10. Minimum concrete thickness:
    a. Walls: 2 ½ inches in thickness
    b. Floors: 3 inches in thickness
    c. Covers: 3 inches in thickness
11. Tank’s floors shall be an integral part of the tank.
12. Where sections are used, tongue and groove joints or keyways shall be used and shall be sealed with an approved sealer and shall be watertight.
13. Shall be protected from corrosion by coating internally with an approved bituminous coating or by other acceptable means. The coating shall cover all exposed concrete and shall extend to at least 6 inches below the waterline.
15. Each septic tank shall have at least two access openings.
    a. 20 inches in minimum dimension
    b. One access opening shall be placed over the inlet and one access opening shall be placed over the outlet.
16. Inlet and outlet pipe openings shall meet 20.7.3.502.E, F, and G NMAC requirements and specifications.
17. Inlet and outlet pipe shall be at minimum schedule 40 PVC, ABS or cast-in-place concrete. Such approved pipe shall be SDR 35 or better.
18. Include an effluent filter approved by NMED, installed on the outlet of the tank before final discharge, with an access riser installed to grade.

C. Construction Materials:
1. Concrete Strength - 4,000 psi @ 28 days, density 140 PCF
2. Cement Portland Type II or V per ASTM C150-04ael
3. Admixtures per ASTM C233-04
4. Reinforcing per ASTM A615 for wire fabric, grade 40/60 R’d or equivalent.
5. Partitions or baffles between compartments shall be of solid, non-corrosive, durable material and shall extend at least four (4) inches above water level.

6. Capped Inspection Ports
   a. Minimum of 4 inch diameter
   b. SDR 35 or better pipe installed at the end of each trench.
   c. Provide inspection access to the bottom of the trench and terminate at finished ground level.

2.2 DISTRIBUTION BOX

   A. Product Description:
      1. Distribution Box: Reinforced concrete, inlets and outlets as indicated on the Drawings, gate, removable cover.
      2. Shall be coated on the inside with bituminous coating or other approved method acceptable to NMED.

2.3 CONNECTING PIPE MATERIALS

   A. Plastic Pipe PVC: ASTM D3034, SDR 35; nominal inside diameter as indicated on the Drawings, bell and spigot solvent sealed joints.

   B. Fittings: Same material as pipe, tee bends, elbows, cleanouts, reducers, ends to suit pipe joint.

2.4 DISPOSAL FIELD

   A. Product Description:
      1. Distribution Lines
         a. Inside diameter of no less than four (4) inches.
         b. Perforated pipe shall have two rows of holes and a minimum perforated area of one and one-half (1 ½) square inches per linear foot.
         c. Perforations shall be located not less than 30 degrees or more than 60 degrees from the vertical on either side of the center line of the bottom of the pipe.
         d. All plastic pipe shall conform to the current and appropriate ASTM standards.
         e. End caps shall be installed on all distribution lines.

PART 3 EXECUTION

3.1 EXAMINATION

   A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

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

3.2 PREPARATION

   A. Ream pipe ends and remove burrs.

   B. Remove scale and dirt from components before assembly.

   C. Establish invert elevations for each component in system.
D. Hand trim excavation to suit septic tank, distribution box and field tile arrangement. Remove stones, roots or other obstructions.

E. Cannot be constructed or manufactured on site, in the ground, when saturated soil conditions during construction are closer than three (3) inches to the bottom of the excavation.

3.3 TANK AND TANK BEDDING

A. Excavate in accordance with Sections 31 22 13 and 31 23 17 for work of this Section. Hand trim excavation for accurate placement of tank to elevations indicated.

B. Place bedding material level in one continuous layer not exceeding 6 inches compacted depth, compact to 90 percent.

C. Backfill around sides of tank, tamped in place and compacted to 90 percent.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

E. Install septic tank and distribution box and related components on bedding.

F. Protect against flotation under high ground water conditions and for units installed in floodplains.

G. Be installed level on undisturbed or compacted soil.

H. The sidewalls, except on cylindrical tanks, shall extend at least nine (9) inches above the liquid depth.

I. The cover of the septic tank shall be at least two (2) inches above the back vent openings.

3.4 DISTRIBUTION BOX

A. Distribution box to be installed at the head of disposal field.

B. Inverts of all outlets shall be level and the invert of the inlet shall be at least one (1) inch above the outlets.

C. Install on a level base in natural undisturbed or compacted soil or on a concrete footing.

3.5 CONNECTING PIPING

A. Connect outlet between building sanitary piping and septic tank, between septic tank and distribution box, between distribution box and filter field header with PVC pipe, ASTM D-3034, SDR 35 pipe and fittings.

B. All solid wall pipe connections, fittings and penetrations shall be watertight.

C. Place pipe and fittings on clean excavated subsoil.

D. Slope piping to each successive component, maximum of 3° per 100 feet of slope, or as indicated on the Drawings.
3.6 INSTALLATION - DISPOSAL FIELD

A. Prior to placing aggregate or drain lines in prepared excavation, all smeared or compacted surfaces shall be removed from trenches by raking to a depth of one (1) inch and the loose material removed.

B. Aggregate shall be placed in the trench to the depth and grade required.

C. Drain Lines:
   1. Drain lines shall be placed on the aggregate in an approved manner.
   2. Drain lines shall be covered with aggregate to a minimum depth of two (2) inches and then covered with untreated building paper, straw or similar porous material to prevent closure of voids with earth backfill.
      a. When geotextile fabric is utilized, no aggregate cover of the drain lines is required.
      b. No earth backfill shall be placed over the aggregate cover until authorized by engineer or NMED.

D. Disposal fields shall be constructed as follows:

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Drain Lines</td>
<td>1 per field</td>
<td></td>
</tr>
<tr>
<td>Length of Each Line</td>
<td></td>
<td>155 ft.</td>
</tr>
<tr>
<td>Bottom Width of Trench</td>
<td>12 in.</td>
<td>36 in.</td>
</tr>
<tr>
<td>Depth of Earth Cover of Lines</td>
<td>9 in.</td>
<td></td>
</tr>
<tr>
<td>Depth of Trench</td>
<td></td>
<td>6 ft.</td>
</tr>
<tr>
<td>Grade of Lines</td>
<td>Level</td>
<td>3 in./100 ft.</td>
</tr>
<tr>
<td>Aggregate Under Drain Lines</td>
<td>6 in.</td>
<td></td>
</tr>
<tr>
<td>Aggregate over drain lines with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geotextile Fabric</td>
<td>0 in.</td>
<td></td>
</tr>
<tr>
<td>Other Material</td>
<td>2 in.</td>
<td></td>
</tr>
</tbody>
</table>

E. Spacing between trenches shall be four (4) feet plus two (2) feet for each additional foot of depth in excess of one (1) foot below the bottom of the drain line.

F. When necessary to prevent line slope in excess of 3 inches per 100 feet, absorption trenches shall be stepped and shall meet 20.7.3.701.J NMAC requirements and standards.

3.7 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Request inspection by Engineer prior to placing cover over piping and infiltration field.

C. Compaction Testing: Refer to compaction testing requirements in Section 31 22 13 - Rough Grading and/or Section 31 23 17 - Trenching, Field Quality Control, as applicable.
D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting finished work.

B. Do not permit vehicular traffic over drainage field or liquid waste treatment unit.

END OF SECTION