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City of Santa Fe, NM

Senior Center Building Addition

Mary Esther Gonzales

Senior Center
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Santa Fe, NM 87501

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C.I.P. #682

Project Manual

Volume 2
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1. ACCESS

- 1.1 The Contractors shall provide full means of access to all parts of the Work of the Project, including ladders, lighting, etc. as may be required for the Architect's observation of the work under construction, for Substantial and Final Completion and Inspection after eleven months for warranty.

2. FIELD ENGINEERING AND MEASUREMENTS

- 2.1 The Contractor shall perform all necessary engineering and survey work and exercise proper precautions to achieve correct location and layout of elevations, lines and measurements of demolition and construction required for the project. Review results with architect. Before ordering materials for performing work, verify all measurements and drawing dimensions noted for the project in the field and notify the architect of any discrepancies.

3. COORDINATION OF TRADES

The Contract Documents do not necessarily arrange the work of any one trade, subcontractor or supplier into one section of the Specifications or one portion of the Drawings. It is the responsibility of the Contractor and each subcontractor and supplier to review all sections of the Specifications and all Drawings to determine the full extent of the Work for which they are responsible.

END OF SECTION 01000

1. GENERAL

1.1 The Contractors shall construct the work described in these Contract Documents with the Owner's representative.

1.2 PROTECTION

The Contractor shall provide all flagging, barricading and temporary partitioning for the protection of the public from any and all hazards of the work and of the Contractor's operations.

A. The Contractor shall protect existing steel, GWB and finishes, which will remain in the rooms, from damage during construction.

B. The Contractor shall maintain all public, vehicular and pedestrian access to adjacent parking areas at all times.

1.3 DUMPSTER

The Contractor will furnish their own trash dumpster and not use the Owner's dumpster under any circumstance.

2.0 UTILITIES

The Contractor shall be responsible for locating all utility lines possible through coordination with the appropriate utility companies and flag all underground lines for construction.

A. The Contractor will consult the Owner regarding utility line locations prior to beginning any trenching or excavation to determine underground location.

3.0 CONTRACT TIME:

A. The Total Contract time to complete the project is 150 calendar days. See Bid Form for contract time and liquidated damages.

END OF SECTION 01014

1. GENERAL

- 1.1 Keys to the existing building will be available to the Contractor in accomplishing his work as required.

2. PROJECT LIMITS

- 2.1 The Project limits will be set in a meeting with the owner. The Contractor is required to work within these limitations and maintain vehicular traffic undisturbed.

- A. For temporary loading outside the Project limits, proper directional signs, flashers and barricades are required.

2.4 UTILITIES

- A. Temporary Electricity
Power for temporary service connected to the owner's power system, or after the owner's service meter will be furnished by the Owner at no charge. Three phase electricity is not available. The contractor shall supply a 3 phase generator if needed.
- B. Temporary service for heavy loads outside of the current service capacity will be provided by the Contractor.
- C. Water for construction may be obtained from the Owner's service.
- D. Toilets for construction workers must be provided by the Contractor.
- E. Natural gas will be furnished for temporary heat without charge to the Contractor when it is obtained after the Owner's meter.

3. PROTECTION

- 3.1 Barricades and barriers will be provided, installed and maintained by the Contractor as necessary to protect the public, property and plant growth.

END OF SECTION 01015

1. GENERAL

- 1.1 DESCRIPTION: The General Contractor shall coordinate the work of all trades and all Subcontractors on the job. It shall be his responsibility to see that all aspects of the work and the interrelationship of all work to be fully understood by all persons performing any part of the work. No additional costs shall occur to the Owner as a result of any lack of such coordination or understanding.
- 1.2 The General Contractor shall cooperate with the authorities of the State of New Mexico and the Roswell Correctional Center in every respect so as not to disturb the normal activities of the campus wherever possible. The General Contractor shall not interrupt any utilities of services to the surroundings except for the time needed to make connections to, or to remove and relocate such service. They shall consult with the staff regarding scheduling times for his work.
- 1.3 The General Contractor shall submit three (3) days in advance to schedule for approval of any possible hours the electricity, domestic water or gas will be shut off.
- 1.4 UTILITIES: The Contractor shall be responsible for the destruction of or damage to, all existing structures, pipe lines, conduits, cables, sewers, drains, or other utilities encountered in or adjacent to any excavations and he shall use all responsible measures and precautions to protect such properties and shall maintain or replace them in good condition as they were prior to the construction operations. He shall make a diligent effort to locate all underground properties in advance of excavation work and support or protect them so that they will not be broken or their functions interrupted. If utility lines are encountered that are not indicated on the drawings, Contractor shall contact Owner's staff.
- 1.5 Should on site conditions necessitate changes in dimensions or materials, or the rearrangement of piping, fixtures, and electrical equipment, such departures and the reasons therefore shall be submitted to the architect for approval in the form of detail drawings showing the proposed changes. The Contractor shall maintain a set of drawings on which all changes are marked which shall be turned over to the architect at the close of the job.

END OF SECTION 01040

1. GENERAL

1.1 DESCRIPTION OF REQUIREMENTS: "Cutting and Patching is hereby defined to include, but is not necessarily limited to, the cutting and patching of nominally completed and previously existing work, or to uncover other work for access or inspection, or to obtain samples for testing, or for similar purposes. Cutting and patching is also defined to include all work of demolition, repair and modification required by the drawings.

1.2 QUALITY ASSURANCE

A. REQUIREMENTS FOR STRUCTURAL WORK: Do not cut and patch structural work in a manner resulting in a reduction of load carrying capacity or load deflection ratio.

B. OPERATIONAL AND SAFETY LIMITATIONS: Do not cut and patch operational elements and safety related components in a manner resulting in reduction of capacity to perform in a manner intended or resulting in decreased operational life, increased maintenance or decreased safety.

C. PROTECTION OF THE EXISTING CONDITION: During progress of the work, use care to protect existing surfaces, which are to remain, from damage due to construction operations. Repair such damage as required to restore original condition.

1.3 RESPONSIBILITIES: In remodeling, all cutting and patching shall be the responsibility of the General Contractor. Where it becomes necessary to cut and patch work that is already completed, it shall be the responsibility of the trade or craft for whom the cutting and patching is necessary.

2. PRODUCT

2.1 MATERIALS: Except as otherwise indicated or approved by the Architect, provide materials for cutting and patching which will result in equal or better work being cut and patched, in terms of performance characteristics and including visual effects where applicable. Use materials identical with the original material where feasible and where recognized that satisfactory results can be produced thereby.

3. EXECUTION

3.1 PREPARATION

- A. TEMPORARY SUPPORT: Provide adequate support for work to be cut, to prevent failure, and do not endanger other work.
 - B. PROTECTION: Employ skilled tradesmen to perform cutting and patching, to prevent damage and provide protection of the work from adverse weather exposure.
- 3.2 CUTTING AND PATCHING: Employ skilled tradesmen to perform cutting and patching. Except as otherwise indicated or approved by the architect, proceed with cutting and patching at the earliest feasible time, in each instance, and perform the work promptly.
- A. CUTTING: Cut work by methods least likely to damage work to be retained and work adjoining. In general where physical action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete work.
 - B. PATCHING: Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work. Restore exposed finishes of patched areas; and where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.

END OF SECTION 01045

1. GENERAL

- 1.1 PROTECTION: During remodeling operations use special care to prevent damage to adjacent materials and surfaces which are to remain. Remove furnishings and equipment from the work area where possible. If removal is not possible, cover furnishings and equipment with suitable protective coverings.
- 1.2 DEMOLITION: Remove existing walls, flooring, windows, doors, equipment and similar existing installations to the extent necessary for the addition and remodeling. Remove debris from the site to disposal area approved by Local Civil Authority.
- 1.3 CLEANING UP: Keep demolition debris cleaned up and neat.

2. PRODUCTS

- 2.1 GENERAL: Except as otherwise required, products and materials used in remodeling shall be selected and used to blend and match existing adjacent surfaces and finishes. Where exact matching is not possible, the match shall be as close as possible.

3. EXECUTION

- 3.1 WORKMANSHIP: Carry the cutting and patching of remodeling operations into existing work and to the extent required to minimize the effect of patching and repair. Properly feather and bond new materials to old. Finish new surfaces to match adjacent surfaces in materials and texture. Where precise blending of new to old is not possible, carry the repair and refinishing to the nearest corner or control joint where a change in finish can be accomplished in straight lines and uniform planes.
 - A. PAINTING: See PAINTING, Section 09900, where patch work occurs in a painted surface, extend final paint coat over the entire unbroken surface containing the patch, after patched area has received prime and base coats.

END OF SECTION 01046

1. GENERAL

1.1 SHOP DRAWINGS:

Shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on contract drawings. Minimum sheet size: 8-1/2" x 11".

1.2 PRODUCT DATA:

A. Preparation:

1. Clearly mark each copy to identify pertinent products or models.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.
4. Show wiring for piping diagrams and controls.

B. Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information which is not applicable to the work.
2. Supplement standard information to provide information specifically applicable to the work.

1.3 SAMPLES:

Samples shall be sufficient size and quantity to clearly illustrate:

- A. Functional characteristics of the product with integrally related parts and attachment devices.
- B. Full range of color, texture and pattern.

1.4 SUBMISSION REQUIREMENTS:

Make submittal promptly and in such sequence as to cause no delay in the work or in the work of any other contractor.

A. Number of submittals required:

Shop drawings and product data:

Submit the number of copies which the Contractor requires, plus 2, which will be retained by the Owner.

Samples: Submit the number stated in each specification section.

B. Submittals shall contain:

1. The date of submission and the dates of any previous submissions
2. The project title and project number
3. Submittal number
4. Names of Contractor, Supplier, Manufacturer
5. Identification of the product with the specification section number
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or Federal Specification numbers
9. Identification of deviations from Contract Documents
10. Identification of revisions on resubmittals
11. A 3" x 12" blank space for Contractor and Owner stamps.
12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, Field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of the Contract Documents.

1.5 RESUBMISSION REQUIREMENTS:

Make any corrections or changes in the submittals required by the engineer and resubmit until approved.

A. Shop Drawings and Product Data:

1. Revise initial drawings or data and resubmit as specified for the initial submittal.
2. Indicate any changes which have been made other than those requested by the engineer.

B. Samples:

Submit new samples required for the initial submittal.

1.6 ARCHITECT'S AND ENGINEER'S DUTIES:

- A. Checking of shop drawings shall be regarded as gratuitous assistance to Contractors. Review status by the Architect and/or Engineer shall refer only to size and weight of materials and design of detail, and will in no way relieve the Contractor of his responsibilities for the correctness of measurements and the alignment of the work, nor from the necessity of furnishing material and work required by the contract drawings.
- B. The Architect and/or Engineer assumes no responsibilities for errors or omissions on shop drawings and should such be discovered later, all subsequent work, materials, etc., shall be furnished and installed for a complete and proper installation and at the Contractor's expense.
- C. All shop drawings submitted for approval shall be certified thereon by the General Contractor to effect that Contractor or Subcontractor has carefully checked these shop drawings and found them to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.

END OF SECTION 01340

1. GENERAL

- 1.1 In order for the Project to be considered Substantially Complete, all items of the work must be complete and demonstrated operational with only minor items back ordered or needing to be corrected, and all items required under paragraph 2.1 must be provided.

2. SUBSTANTIAL COMPLETION

- 2.1 When the Contractor considers the Work is substantially complete, submit to the Architect:

- A. A written notice that the Work is substantially complete.
- B. A list of items to be completed or corrected, and the cost and time required to complete them.
- C. A written certification that all mechanical, plumbing and electrical equipment and systems have been demonstrated and explained in the presence of the Owner's Representative and are fully operational.
- D. Close Out submittals required at Substantial Completion in paragraph 4.1 below.

- 2.2 Within ten (10) days after the receipt of all items required under paragraph 2.1 above, the Architect will make an inspection to determine the status of completion.

- 2.3 Should the Architect determine that the Work is not substantially complete:

- A. The Architect will promptly notify the Contractor in writing.
- B. The Contractor shall remedy the deficiencies and send a second written notice of substantial completion to the Architect.
- C. The Architect will review the work.

- 2.4 When the Architect concurs that the Work is substantially complete, he will:

- A. Prepare a Certificate of Substantial Completion on AIA form G704 accompanied by the Contractor's list of items to be completed or corrected as verified or amended by the Architect.
- B. Submit the Certificate to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.
- C. Retainage at the time of Substantial Completion shall be not less than the Architect's estimate of the cost to the Owner to have an architect describe and

administer the remaining work and a contractor bid and complete the work remaining.

3. FINAL COMPLETION

3.1 When the Contractor considers that the entire Work is finally complete, submit to the Architect:

- A. Written certification that the Work has been completed in accordance with the Contract Documents and is ready for final inspection.
- B. Close Out Submittals required at Final Completion required in paragraph 4.2 below.
- C. The Architect will review the work.

3.2 When the Architect finds that the Work is acceptable under the Contract Documents, he will prepare a final Change Order if needed and prepare a final Certificate for Payment, and submit these to the Owner for Final Acceptance and Payment.

4. CLOSE OUT SUBMITTALS

4.1 At Substantial Completion, provide sets of the following:

- A. Evidence of compliance with requirements of governing authorities: Certificates of Inspections and Certificates of Occupancy
- B. Operating and Maintenance Manuals with data on all systems and equipment as well as the Test and Balance Report (2 sets)
- C. All Warranties and Bonds (2 sets)
- D. Spare parts and maintenance manuals
- E. Statement of all unsettled claims and approved adjustments to the Contract Sum (if any) which have not been included in Change Orders (2 sets)
- F. Test and Balance Reports (see Mechanical Equipment requirements in Section 15)

4.2 At Final Completion, provide two (2) copies of the following:

- A. Affidavit of Payment, Release of Liens and Consent of Surety (AIA forms G706, G706A and G707)

- B. Record Documents complete and annotated per General Conditions paragraph 4.11 (one copy)
- C. Application for payment in accordance with procedures and requirements stated in the Condition of the Contract and reflecting the Contract Sum (four copies)

5. WARRANTY INSPECTION AT ELEVEN (11) MONTHS

- 5.1 Approximately one (1) month prior to the anniversary date of Substantial Completion, the Architect will schedule an Inspection which shall be attended by the Contractor, the Owner and the Architect.
- 5.2 A punch-list of any items of Correction of Work will be issued by the Architect.
- 5.3 The Contractor shall correct all items on the punch list within fourteen (14) days or provide the Owner and Architect with written explanation and schedule for completion.
- 5.4 Expiration of Warranties shall not be cause for release of Contractor's obligation to perform any of this correction of work.
- 5.5 Correction of punch-list items at this time shall not release Contractor from obligations under any warranties, guarantees or statute of limitation extending beyond the anniversary date of Substantial Completion.

END OF SECTION 01700

1. GENERAL

1.1 During Construction:

- A. The Contractor shall execute cleaning to ensure that the building and adjacent grounds are maintained free from accumulations of waste material and rubbish. At reasonable intervals during progress of Work, clean site and dispose of waste materials, debris and rubbish.
- B. Provide on-site containers for collection of waste materials, debris and rubbish. Remove waste materials, debris and rubbish from site and legally dispose of it at dumping areas off Museum's property.
- C. Extreme precautions shall be taken in protecting all surrounding finished surfaces. Contractor shall be responsible for returning any damaged area to its original condition.

1.2 Final Cleaning:

- A. Remove grease, dust, dirt stains, and other foreign materials from sight-exposed exterior finished surfaces. Repair, patch up marred surfaces to original finish. Broom clean and shop vacuum the Basement work area and the entire access path to the work area from outside the building.
- B. Owner will assume responsibility for cleaning at Owner's acceptance of the work.

2. PRODUCTS

Not used

3. EXECUTION

Not used

END OF SECTION 01710

1. PROJECT RECORD DOCUMENTS

1.1 Form and Content:

Annotate one complete set of Contract Documents with red-colored felt-tip pen, showing all conditions of the Work as actually installed, and fully documenting in detail the following concealed conditions:

A. Utilities:

Show location of all lines, major junctions, bends, valves, clean-outs, stub-outs, etc., by horizontal dimension to surface improvements and vertical dimension from finished grades for all utilities underground or concealed within the building.

B. Assemblies:

Show all changes or variations not otherwise documented, of materials, products and installations concealed from view.

2. MAINTENANCE MANUAL

2.1 Form:

Provide three (3) complete copies of manual. All materials included in the Manual shall be originals or clearly legible copies of typewritten, drawn or printed manufacturer's brochure sheets, 8-1/2" x 11" size. Fold or photo-reduce oversized sheets. Bind in three-ring loose-leaf binders with indexed dividers designating the major Sections and labeled with the Project name on the outside.

2.2 Contents:

Each Maintenance Manual shall contain:

A. Directory listing the name, address, telephone of:

General Contractor
Surety (also list Bond numbers and local Agent)
Subcontractors and their respective suppliers and installers
General Contractor's suppliers

B. Maintenance Submittals:

Provide Table of Contents organized similar to the Technical Specifications.

For all systems, items of equipment, operable components, and materials which require any maintenance, provide the following information:

1. Basic Data:

Item of Work; Installer's name; where appropriate provide manufacturer's name, model, and type number, color name or number for each component installed.

2. **Replacement Materials and Special Tools:**
A list of replacement materials and tools provided by the Contractor, including a place for the Owner's representative to sign that s/he has received same. (The delivery of these items and receipt signatures to be accomplished during the Building Systems Training Session.)
3. **Preventive Maintenance:**
A description of the methods required for the Owner to properly clean, inspect, adjust and, if feasible, repair and/or replace work or damaged components.
4. **Basic Operations:**
A description of the methods of operation, inspection, emergency procedures, and seasonal adjustments required by the various components and systems installed in the Project.

Note: Manufacturer's brochures, catalogs and other industry literature, shop drawings, etc., may be used for the above required information where such materials provide easily accessible data to the non-technically trained person.

- C. Test and Balance Report as specified under Division 15 of these Specifications.
- D. Attendance Record to be filled out on completion of the Training Session showing who was present.

END OF SECTION 01720

1. GENERAL
 - 1.1 Scope:

Perform all salvage work, including removal of demolished materials as required or implied by the Documents.
 - 1.2 Notification:

Notify Architect immediately of any conditions not anticipated in the Documents. Notify Architect prior to patching, repair, new construction or otherwise covering of completed salvage and demolition to observe the then-existing conditions.
 - 1.3 General Procedure:

Schedule demolition to avoid conflict with activities of Owner and adjacent property owners. Prior to commencing salvage and demolition work, assure coordination of trades involved, adequate transfer of structural loads, including temporary shoring, proper by-pass of utility services, and Owner's removal of all not-in-contract items. Take all necessary precautions to provide continuous protection for safety of workmen and all surrounding Work to remain, as well as to minimize noise and dirt disturbance or any hazard to adjacent population and property.
2. SUBMITTALS
 - 2.1 Submit warning and advice to Owner of any potential interruption of utility service to other buildings or other areas within the project site area.
3. SALVAGE

All items from demolition not scheduled for salvage will be the property of the Contractor and should be removed from the site without delay. Only items noted and scheduled for demolition will be demolished. Many items in this construction will remain in service and be used in the new construction.
4. DEMOLITION
 - 4.1 General: Prior to commencing demolition, assure that all items of Paragraph 1.3 above have been addressed.
 - 4.2 Execution:

Perform all demolition shown or implied and notify Architect immediately of any conditions not anticipated in the Documents. In particular, identify all utility lines and structural details encountered that are at variance with Contract Documents.
5. REPAIR: Cap utility lines flush unless otherwise required. Flag utility locations for observation of Architect and utility companies.
 - 5.2 Secure all openings from vandals and unsupervised entry. Notify Architect of any unforeseen openings or conditions.

END OF SECTION 02111

1. GENERAL

1.1 SCOPE:

Perform all site clearing, grubbing, excavation, rough grading and finish grading, backfilling, and compaction for building construction including footings, slabs, sidewalks, grade beams, and utility lines.

1.2 UTILITIES:

Excavation and backfill required in conjunction with underground mechanical and electrical utilities is included as work of this section.

1.3 NOTIFICATION:

Notify Architect of soils encountered that differ from the soils described in the Engineering Soils Notes from the existing construction. Notify Architect when excavation has reached required sub-grade elevations.

1.4 QUALITY ASSURANCE:

Perform Modified Proctor Density testing for in-place fill soils and imported fill soils (ASTM D-1557). Minimum testing is one test per 1,000 square feet per lift. Contractor shall provide this testing.

A. SUBMITTALS: Submit manufacturer's literature and installation instructions for the Vapor Barrier.

1.5 PROTECTION:

Protect benchmarks and existing structures, roads, utility lines, sidewalks, paving, and curbs against damage. Protect excavations by shoring, bracing, underpinning, or by other methods as required to prevent cave-ins or loose dirt from falling into excavations. Protect excavation bottoms from freezing when temperature is less than 35°F.

1.6 Subsurface Soil Data: Soils Notes from the original construction were used for the existing building and will be made available to the contractor for review. The contractor is expected to examine the site and determine for himself the character of materials encountered.

2. PRODUCTS

2.1 SITE GRADING AND EXCAVATION:

A. Strip the site and make all required site excavations.

B. The building area shall be excavated to three (3) feet below the bearing surface of foundations and slabs. This will include an area of three (3) feet outside the building area.

- C. Densification shall consist of scarification of the subgrade to a depth of 8 inches, moisture conditioning, and compaction of the surface to 95 percent of the ASTM D-1557 maximum dry density. The proximity of the existing structures may preclude the use of equipment in some areas.
- D. The site shall then be brought to final grade with properly placed compacted fill.

2.1 SATISFACTORY MATERIALS:

- A. Site Grading: After site clearing and grubbing, the soils throughout the building area shall be over excavated to such an extent as to remove all existing man-made fill soils in their entirety and to provide for at least 2.0 feet of properly compacted non-expansive structural fill beneath all footings and floor slabs. The over excavation limits shall extend laterally beyond the footing perimeters equal to the depth of fill beneath their bases. The exposed native soils shall then be densified prior to placement of structural fill.
- B. Densification: Densification of the exposed native soils shall consist of scarifying to a depth of 8 inches, moisture conditioning to the optimum moisture content or above, and compacting the area to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557.
- C. Engineered Fill: Most of the on site soils will meet the criteria for structural fill; however, some on-site blending may be required. All structural fill or backfill material shall be free of vegetation and debris and contain no rocks larger than 3 inches. Gradation of the backfill material, as determined in accordance with ASTM D-422, shall be as listed below: (The on-site Soils may be blended to meet the criteria below.)

<u>Sieve Size (Square Openings)</u>	<u>Percent Passing by weight</u>
3 inch	100%
no. 4	60-100%
no. 200	10-35%

- 1. The plasticity index of the material, as determined in accordance with ASTM D4318, shall not exceed **15**.
- D. Fill or backfill, consisting of soil approved by the Geotechnical Engineer, shall be placed in 8 inch loose lifts and compacted with approved compaction equipment. Loose lifts shall be reduced to 4 inches when 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 shall be within 2 percent of the optimum moisture content.

- E. Testing: Tests for the degree of compaction shall be determined by the ASTM D-1556 method or ASTM-D-6938. Observation and field tests shall 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% is indicated, additional compaction effort shall be made with adjustment to the moisture content as necessary until 95% compaction is obtained.
- F. Pavements: Minimum asphaltic pavement section of 4.0 inches of asphaltic concrete over 6.0 inches of aggregate base course over 12 inches of compacted subgrade is required. The subgrade shall be scarified to a depth of 12 inches, moisture conditioned and properly compacted as required above. Pavement materials shall conform to the NMDOT standard specification for road construction. Asphaltic pavements shall be compacted to between 93 and 96 percent of the maximum Marshall density.

2.2 Frozen soils shall not be used as fill or backfill.

2.3 MOISTURE PROTECTION

Precautions shall be taken during and after construction to minimize saturation of the shallow foundation soils. Positive drainage shall be established away from the exterior walls of the structure. All utility trenches shall be backfilled with compacted fill. Special care shall be taken during installation of the subfloor sewer and water lines to reduce the possibility of future subsurface saturation.

2.5 VAPOR BARRIER

An impervious membrane vapor barrier shall be placed beneath the slab with two (2) inches of clean non-plastic sand overlying the barrier to minimize differential cracking and curling of floor slabs.

- A. Vapor Barrier: Stego Wrap 15 mil Vapor Barrier (by Stego Industries LLC)
 - 1. Other acceptable Vapor Barriers: VaporGuard by Reef Industries, Inc.; and EcoShield-E15 by E-pro.
- B. Seam Tape by Stego Industries: Water Vapor Transmission Rate ASTM E 96, 0.3 perms or lower.
- C. Vapor Proofing Mastic by Stego Industries: Water Vapor Transmission Rate ASTM E 96, 0.3 perms or lower.
- D. Pipe Boots: Construct Pipe Boots from vapor barrier material, pressure sensitive tape and mastic per manufacturer's instructions.

3. EXECUTION

- 3.1 Carefully locate existing underground utilities and provide protection from damage during construction. Note that every attempt has been made to accurately show all utility lines, but location may vary, and others may be present. Consult Architect immediately if uncharted or incorrectly chartered utilities are encountered.

3.2 DE-WATERING AND VAPOR BARRIER:

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

A. Install Vapor Barrier:

1. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
2. Lap vapor barrier over footings or seal to foundation walls.
3. Overlap joints six (6) inches and seal with seam tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping the damaged area by six (6) inches and taping all four sides with seam tape.

3.3 COLD WEATHER PROTECTION:

Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

3.4 EXCAVATION FOR TRENCHES:

Dig trenches to the uniform width required for a particular item to be installed, sufficiently wide to provide ample working room. Provide six inches (6") to nine inches (9") clearance on both sides of pipe or conduit.

- A. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- B. Where rock is encountered, carry excavation six inches (6") below required elevation and backfill with a six inch (6") layer of crushed stone or gravel prior to installation of pipe.
- C. For pipes or conduit six inches (6") or larger in nominal size, tanks, and other mechanical/electrical work indicated to receive sub-base, excavate to sub-base depth indicated, or if not otherwise indicated, to six inches (6") below bottom of work to be supported.
- D. Except as otherwise indicated, excavate for interior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than three feet six inches (3'-6") below finished grade.
- E. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

- F. Backfill trenches with concrete where trench excavations pass with eighteen inches (18") of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

Concrete is specified in Division 3.

- G. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect/ Engineer. Use care in backfilling to avoid damage or displacement of pipe system.

3.5 EXCAVATION FOR STRUCTURES:

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete form work, installation of services, other construction, and for inspection.

- A. All existing fill, vegetation, debris, asphalt paving, concrete and disturbed natural soils in areas for support of the new construction or pavements shall be excavated to expose undisturbed natural soils. All non-acceptable material shall be disposed of as waste.
- B. Prior to placement of any fill or construction of foundations, floor slabs or pavements, the exposed ground surface shall be compacted in-place by small vibratory compactors. The upper eight inches (8") shall be scarified and watered as necessary to bring the upper foot to within 2 percent of optimum moisture content and compacted to achieve a density of no less than ninety-five percent (95%) of the maximum dry density as determined by ASTM designation D-1557.
- C. All back fill material shall meet the requirements of Paragraph 2.1 with a plasticity index no greater than 15 when tested in accordance with ASTM D-423 and D-424.

3.6 COMPACTION:

A. GENERAL:

Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS:

Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D-1557; and determined in accordance with ASTM D-2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

- I. STRUCTURAL FILL WITHIN THE BUILDING PAD:
Compact each layer of backfill or fill material at ninety-five percent (95%) relative density.
 2. STRUCTURAL FILL OUTSIDE THE BUILDING PAD:
Compact each layer of backfill or fill material at ninety-five percent (95%) relative density.
 - C. MOISTURE CONTROL:
Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
 - D. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - E. GROUND SURFACE PREPARATION:
Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surfaces prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface.
 - F. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break-up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.
 - G. PLACEMENT AND COMPACTION:
Place backfill and fill materials in layers not more than eight inches (8") in loose depth.
 - H. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - J. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- 3.7 GRADING:
- A. GENERAL:

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. GRADING OUTSIDE BUILDING LINES:

Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes.

C. GRADING SURFACE OF FILL UNDER BUILDING SLABS:

Grade smooth and even, free of voids, compacted as specified and to required elevation. Provide final grades within a tolerance of one-half inch (1/2" when tested with a ten foot (10') straightedge.

D. COMPACTION:

After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.8 FIELD QUALITY CONTROL:

A. QUALITY CONTROL TESTING DURING CONSTRUCTION:

Allow testing service to inspect and approve sub-grades and fill layers before further construction work is performed. This service shall be provided by the contractor. The geotechnical engineer shall provide architect with results of field density tests required.

1. Perform field density tests in accordance with ASTM D-1556, ASTM D-1557, or ASTM D-2167 as applicable. Perform one field density test for each 500 square feet of original ground surface prior to placing fill or constructing floor slabs.

2. FOOTINGS:

Make at least one (1) field density test for every twenty (20) lineal feet along footings on fill soils.

3.9 If in opinion of Architect/Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.10 MAINTENANCE

A. PROTECTION OF GRADED AREAS:

Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. RECONDITIONING COMPACTED AREAS:
Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- D. SETTLING:
Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS:

- a. Remove excess excavated material, trash, debris, and waste materials and dispose of it properly. The owner has an area for soils storage on the campus of the building site which can be used for excess material.

END OF SECTION 02200

1. GENERAL

1.1 SCOPE: This Section includes all Potable Water, Fire Protection, Sanitary Sewer, and Natural Gas Lines and Systems outside the building to a point within 5' of building.

1.2 TESTING & INSPECTION:

- A. Earthwork testing and inspection: The contractor shall provide all testing, re-test and inspection services. The testing lab shall provide on-site observation by experienced personnel during earth backfill work. The contractor shall notify the testing lab at least two working days in advance of any field operations of back-filling. Submit test in accordance with Section 02200 Earthwork.
- B. Utilities Testing and Inspection: Inspection shall be performed by the proper utility company, city, testing lab or contractor. The contractor shall notify the proper utility company, testing lab or city prior to any construction and shall pay for all fees associated with testing and inspection.
- C. Lines and Grades: A registered professional land surveyor or civil engineer shall establish all lines and grades. Lines and grades shall conform to the elevations indicated on the Contract Drawings with minor adjustments.

1.3 TEST REPORTS: Submit Laboratory test reports for concrete materials and mix design test as specified.

2. PRODUCTS:

2.1 WATER SYSTEMS:

- A. Potable Water Service Lines:
 - 1. Copper Tubing: hard drawn or annealed, ASTM B88, Type K.
 - 2. Fittings: Wrought Copper, ANSI B16.22
 - 3. Joints: 95/5 Tin-Antimony solder or mechanical joints, Mueller Union no. H-15403, or equivalent.
- B. Water Service Line Tie-In Materials:
 - 1. Curb Valve: Bronze body with conductive compression connections (both ends) for CTS O.D. polyethylene or copper tubing, MFR: Mueller #H-15209 or equivalent.
 - 2. Union: Bronze, conductive compression connections (both ends) for CTS O.D. polyethylene or copper tubing, MFR.: Mueller #H-15403, or equivalent.
 - 3. Service Clamp: Bronze, double strap clamp with I.P. thread and O-ring seal cemented in place, MFR Muller #H-16000 series.

4. Corporation Stop: Bronze body, I.P. thread inlet by conductive compression connection for CTS O.D. polyethylene or copper tubing outlet, MFR: Mueller, #H15028 or equivalent.
- C. Waterlines: Polyvinyl chloride (PVC) water pipe shall conform to ASTM D-2241; produced from PVC compounds meeting ASTM D-1784. Classification 12454-B, PVC 1120 compounds as approved by the National Science Foundation; and be integral gell conforming to ASTM D-262 and D-3139 with elastomeric gaskets that conform to ASTM F-477 and be chemically bonded to piping. Selection of 160 psi pressure rated SDR 21 piping will be based on operating system requirements.
- D. Fire Hydrant: fire hydrants and their extensions shall conform to American Water Works Association Standard C-502 and C-550 and shall be of the Mueller AWWA Improved Traffic Mode, Catalog #A425, “Kennedy” K81A or equivalent hydrants are acceptable. Fire hydrants shall have one, 5-1/4” diameter valve opening; 6” mechanical joint end inlets or Lok-Tyton end inlets as required; two 2-1/2” hose nozzle connections; and one, 4-1/2” pumper nozzle with National Standard Fire Hose coupling crew threads and nozzle caps with attached chains. Fire hydrants for use with PVC pipe shall be push-on type or mechanical joint with appropriate transition gaskets for PVC pipe.

All fire hydrants shall be factory painted from the top to a point one foot below the ground level flange. The bonnet shall be painted with a reflectorized paint. Hydrants shall be yellow in color, as per IFC.

In addition, fire hydrants shall have the following design features:

1. Sealed oil reservoir with “O” rings and automatic lubrication to all working parts.
 2. Breakable safety flange with break-a-way steel stem coupling pinned to the stem.
 3. Neoprene main valve closing with the pressure seal with AWWA bronze seat ring and bronze brushed double drain openings.
- E. Water Tie-in materials:
1. Tapping Sleeve: Cast iron, mechanical joint, 200 psi working pressure, class 125 outlet flange (ANSI B16.1), furnished with the required gaskets. MFR: Mueller, #H-615 or equivalent.
 2. Great Valve: Resilient seat, conform to AWWA C509, 200 PSI working pressure, non-rising stem type, epoxy coated (AWWA C550) inside and outside or outside, full diameter waterway to permit use as a tapping valve, and ends to suit piping system. MFR: Mueller, A-2074 series or Waterous 500 series (UL-listed and/or FM approved) or equivalent.
 3. Valve Box: Cast iron, 5-1/4” shaft screw type, 3 piece with drop lid marked “water”.

4. Meter Boxes: Meter boxes shall be 18" diameter, non-metallic and shall be extended a minimum of 1" below the service line.

The meter box lid shall be a cast iron, double lid cover with 11-1/2" lid opening, plastic or aluminum inner lid, and locking outer lid with pentagon head worm type lock. The meter box shall be equal to Ford #W32.

2.2 SANITARY SEWER SYSTEMS

- A. Polyvinyl Chloride (PVC) Sewer Pipe: Minimum sewer main pipe size shall be 6" nominal diameter, and minimum sewer service pipe size shall be 4" nominal diameter. All PVC sewer pipe shall be made of materials conforming to the requirements of ASTM designation D1784, Type I, Grade I for Rigid Polyvinyl Chloride compounds. The resistance to acids and other reagents shall be established in accordance with ASTM D3034. The pipe shall have an integral bell with a solid cross section rubber ring, which has been factory assembled and securely locked in place to prevent displacement. Standard lengths shall be at least 20 feet to minimize the number of joints required.
- B. Polyvinyl Chloride (PVC) Sewer Pipe Fittings: All PVC sewer pipe fittings shall be SDR 35, Type PSM with elastomeric gasket joints and shall meet the requirements of ASTM D3034. Service connections to the sewer mains shall be wye saddles.
- C. Force Main: PVC pipe, AWWA C900, Class 100. Fittings: Ductile iron, AWWA C110. Pipe Joints: Bell and spigot with rubber gaskets, ASTM D3139. Fitting Joints: Mechanical, AWWA C111.

2.3 NATURAL GAS SYSTEMS:

- A. Gas Piping: Pipe for gas service lines shall be polyethylene pipe, ASTM D25B, SDR11 IPS pipe, cell classification (pipe and fittings) 355434C per ASTM D3350.
- B. Fittings: Polyethylene, ASTM D3261, SDR11, PE3408. Joints: Butt, heat fusing ASTM D2657. MFR: Phillips Drisco-pipe 8000 or equivalent.

2.4 UNDERGROUND UTILITY MARKERS (required on each utility trench):

- A. The identifying tape shall be as manufactured by the Allen System of Underground Utility Control, Wheaton, Illinois; or equal. Tape shall be made from an inert material such as polyethylene plastic and shall be impervious to alkalis, acid or other chemicals likely to be encountered in soils. The tape shall be six (6) inches wide in bright colors for contrast with identifying printing in one (1) inch permanent black letters on one side only.

- B. The tape shall have printed thereon in three rows as following:

CAUTION CAUTION CAUTION
UTILITY DESIGNATION OR NAME
BURIED LINE BELOW

The identifying lettering shall be repeated continuously the full length of the tape. Tapes shall be color coded for the type of utility as follows: Gas = yellow; Sanitary Sewer = Green; Water = blue.

3. EXECUTION

3.1 GENERAL

- A. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate the bells and joints. Relay any pipe that has the grade or joint disturbed after lying in the earth. The interior of the pipe shall be thoroughly cleaned of all foreign matter before setting in place and shall be kept clean during laying operations by means of plugs. Do not lay pipe in water or when weather conditions are unsuitable. Keep water out of trenches. Minimum depth of water lines shall be three (3) feet of cover. Minimum depth of gas lines and sanitary sewer lines shall be 24 inches of cover.

3.2 OVER-EXCAVATION

- A. When solid or loose rock, rocky soil with rocks larger than 3/4" diameter or unsuitable soils incapable of properly supporting the pipe are encountered in the trench bottom, such material shall be over-excavated to a minimum depth of 6" below the pipe and removed.
- B. Except at locations where over-excavation is required, care shall be taken not to excavate below the depths indicated. When over-excavation happens, the trench bottom grade shall be restored in the same manner as over excavation requires.

3.3 TRENCH EXCAVATION

- A. Sides of all trenches shall be as nearly vertical as soil conditions permit below the level of the top of the pipe. Width of the trench shall not be less than 12" wide nor more than 24" wider than the outside diameter of the pipe. Trench excavation shall be centered on pipe alignment such that a minimum clear space of 6" is provided on each side of the pipe.

3.4 PAVEMENT CUTTING:

- A. Asphalt shall be clean cut with approved equipment in a neat line 6" back from the outside edge of the excavation.
- B. The concrete paving shall be saw cut to a depth of not less than 1-1/2" with neat, vertical, true lines in such a manner that the adjoining surface will not be damaged.

3.5 EXISTING UTILITIES

- A. The contractor shall verify the location of any utility lines, pipes or underground lines in the area of work. Repair damaged utilities to the satisfaction of the utility owner at no expense to the owner.

3.6 DISINFECTING AND TESTING

- A. Disinfect and test utility systems in accordance with the utility owner's standards or with the procedures in this section.

3.7 WATER SYSTEMS:

- A. Connections to Existing Water Mains: These shall be dry connections. Each connection with an existing water line shall be made when it will least interfere with operations and water use. The interior of all pipe, fittings and valves installed shall be thoroughly cleaned and swabbed with or dipped in strong chlorine solution with a chlorine content of 200 parts per million. No splices shall be made within 10 feet of a sewer line.

All service connections to water mains shall be made using saddles. The saddle shall be aligned on the water main so that it is at a 45 degree angle above the spring-line of the pipe.

- B. Pipe placing and laying; Pipe shall be inspected for defects and damaged or defective pipe shall be rejected. Deflections from a straight line or grade shall not exceed 5/D inches per linear foot where D is the nominal diameter of the pipe.
- C. Fire Protections Lines: Fire protections lines shall be installed in accordance with NFPA 24.
- D. Thrush Blocking: Thrust blocking shall be placed at bends, tees, crosses and fire hydrants. Blocking shall be concrete poured in place and bear against solid undisturbed earth and shall be shaped so as not to block weep holes or obstruct access to the pipe joints or fittings.
- E. Pressure Testing Water Systems: After the pipe is laid, the joints completed, and the trench partially backfilled, leaving valved section of piping shall be subjected to a pressure test of 200 pounds per square inch minimum for a period of at least

two (2) hours. Examine pipe during the test and replace cracked or defective piping. All fire protection piping shall be tested in accordance with NFPA 24.

F. Disinfecting Water Piping:

1. General: This procedure shall apply to water piping systems. Disinfection of laid pipes shall be completed before any taps are made. Water piping shall be disinfected in accordance with the latest edition of the AWWA standard, C651. Submit documentation from the laboratory showing positive test results.
2. Disinfection Procedures:
 - a. Pre-flush the main at a velocity of 2.5 feet/second until water is clear and free of all foreign matter or debris.
 - b. Apply chlorine to water from the existing supply to expose all interior surfaces of the new system to approximately 300 mg/L (300 ppm) for 3 hours of at least 10 mg/ml (10 ppm) for 24 hours.
 - c. After the initial chlorine test has been completed, flush the system for three (3) hours with potable water until the chlorine concentration is less than 1 ppm.

3.8 SEWER SYSTEMS:

- A. Pipe Laying: The bottom of the trench shall be shaped to give substantially uniform circumferential support to the lower third of each pipe. Pipe laying shall proceed upgrade with the spigot ends pointing in the direction of flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. All new sewer lines shall maintain a minimum slope of 1/4" per linear foot (2% slope) and maintain at least two (2) feet of cover over the line. Services into existing lines may be installed at a slope of 1/8" per linear foot (1% slope) with special circumstances.
- B. Clean-outs: The size of clean-outs shall be of the same size as the line to which it is connected, except that clean-outs need not be larger than 4 inches. Pipe and fittings for clean-outs shall be cast iron and shall have lead-caulked joints. Clean-outs plugs shall be brass.
- C. Testing of Sanitary Sewers: Sewers shall be thoroughly flushed out and inspected and approved before backfilling. Lamp between manholes and show full bore-indicating sewer is true to line and grade. Lips at joints or inside of sewer are not permitted.

Completely fill the system with water and let stand 15 minutes. Visually inspect pipe to insure that it is watertight at all points.

3.9 NATURAL GAS SYSTEM

- A. Lines may conform to the surface profile but should be graded as uniformly as practicable between pronounced high and low points. Pipe shall be laid on firm soil for the full length. Backfill and re-compact any excavations per section 02200.
- B. Testing Gas System: Air test the system under a pressure of 100 pounds per square inch gauge.

3.10 PLACEMENT AND COMPACTION OF PIPE EMBEDMENT AND BACKFILL:

- A. Bedding: Bedding is that portion of the pipe embedment zone beneath the pipe. Existing native soil is suitable for bidding without over-excavation. If rocks or gravel is encountered in the pipe bid it must be removed and replaced with compacted backfill (see section 02200). Embedment and the first 6 inches of backfill above the top of the pipe shall be free of rocks (greater than 3/4" diameter) and debris. This initial backfill shall be placed and compacted in lifts not to exceed 6" thick in loose measure.
- B. Final Backfill: This portion of the pipe embedment extends from 6 inches over the pipe to the surface of grade. See section 02200 for backfill requirements.
- C. Surface Restoration: After the piping has been installed, areas which were disturbed shall be brought to true grades. All slopes shall be trimmed and dressed, and all surfaces graded to maintain drainage.

3.11 UNDERGROUND UTILITY MARKERS:

- A. The location of all utilities found or installed shall be marked by identifying tape buried in the pipe trench above the pipe no less than 12 inches below the surface and approximately three feet above the line.

END OF SECTION 02561

1. GENERAL

1.1 SCOPE: This Section includes all reinforced concrete complete with all necessary accessories for the extent of concrete work shown on the Drawings.

1.2 QUALITY ASSURANCE: Codes and Standards. Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

A. ACI 301 "Specifications for Structural Concrete for Buildings".

B. ACI 318 "Building Code Requirements for Reinforced Concrete".

C. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

1.3 TESTING CONCRETE: Employ, at Contractor's expense, a testing laboratory acceptable to the Architect to perform material evaluation tests and to design concrete mixes.

A. Materials and installed work may require testing and retesting, as directed by the Architect, at anytime during the progress of the work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense.

1. Perform and document standard slump test as per ASTM C-143 at a frequency of one test per truck load of Ready Mixed Concrete, or batch of Job Mixed Concrete. Slump tests also to be taken before and after the addition of superplasticizer and documented before and after. Tests will be rejected if water has been added to mix after slump test and casting of test cylinders.

1.4 TEST REPORTS: Submit Laboratory test reports for concrete materials and mix design test as specified.

2. PRODUCTS:

2.1 REINFORCING MATERIAL: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars. Use wire bar type supports complying with CRSI recommendations, unless otherwise approved.

2.2 CONCRETE MATERIALS:

- A. Portland Cement: ANSI/ASTM C 150, Type I, unless otherwise approved. Use one brand of cement throughout the project.
- B. Normal Weight Aggregates: ANSI/ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete surfaces.
 - 1. Local aggregates not complying with ANSI/ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when approved by the architect.
- C. Water: Potable.
- D. Air-Entraining Admixture: ANSI/ASTM C 260.
- E. Water Reducing Admixture: ANSI/ASTM C 494, Type A, and containing not more than 1% chloride ions.
- F. Water Reducing, Accelerator Admixture: ASTM C 494, Type C or E.
 - 1. Acceptable Products: "Accelguard HE"; Euclid Chemical Co. "Pozzolith 122-HE"; Master Builders. "Darex"; W.R. Grace. "Sikacrete"; Sika Chemical Co.
- G. Water Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 1% chloride ions.
- H. Calcium chloride is not permitted.

2.4 RELATED MATERIALS:

- A. Non-Shrink Grout: CRD-jC 588, factory pre-mixed grout.
 - 1. Type D, Non-metallic: "Masterflow 713" by Master Builders; "SonogROUT" by Sonneborn-Contech; "Euco-NS" by Euclid Chemical Co.; "Five Star Grout" by U.S. Grout Co.; "Duragrout" by L & M Const. Chemical Co.
- B. Curing Compound: Do not use curing compound at surfaces to receive adhered finish material. Do not use curing compound in recessed slab areas for tile in toilet rooms.
 - 1. Acceptable Materials: "MasterSeal" by Master Builders; "A-H 3 Way Sealer" by Anti-Hydro Waterproofing Co.; "Ecocure" by Euclid Chemical Co.; "Clear Seal" by W.R. Grace; "Sealkure" by Toch Div.-Carboline; "Polyclear" by Upco Chemical/USM Corp; "L&M Cure" by L&M Const.

Chem.; "Klearseal" by Setcon Ind.; "LR-151" by Protex Ind.; "Hardtop" by Gifford-Hill.

- C. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials that penetrates, hardens and densifies concrete surfaces: Titan Hard; Burke Group or Ashford Formula Cure-crete Chemical Company, inc.
 - D. Curing Materials
 - 1. Evaporation Retarder: Finishing Aid Concentrate: Burke Group or SikaFilm by Sika Corporation
 - 2. Absorptive Cover: AASHTO M 182, Class 2 burlap cloth from jute or kenaf, weighing 9 oz./ sq. yd.
 - 3. Moisture Retaining Cover: ASTM C 171, polyethylene film.
 - 4. Water: potable.
 - 5. Clear Solvent-Borne Membrane-Forming Curing Compound: Spartan-Cote by Burke Group or Kure-N-Seal by Sonneborn or Clear Seal 150 by Tamms Industries.
 - E. Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - F. Repair Underlayment: Cement based, polymer modified, self leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor level.
- 2.4 PROPORTIONING AND DESIGN OF MIXES: Prepare design mixes for each type and strength of concrete by laboratory trial batch methods as specified in ACI 301. If trial batch method used, use an independent testing facility approved by the architect for preparing and reporting proposed mix designs.
- A. Submit written reports to the architect of each proposed mix for each class of concrete at least 15 days prior to the start of work. Do not begin concrete production until mixes have been reviewed by the engineer.
 - B. Design mixes shall provide normal weight concrete with the following properties, as indicated on the drawings and schedules:
 - 1. Exterior Concrete, Footings and Foundation Walls: Proportion Normal weight concrete mix as follows:
 - a. Compressive Strength: 3,000 psi 28 day compressive strength.
 - b. Maximum Slump: 4 inches.
 - c. Maximum Slump for Concrete Containing High-Range Water reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.

2. Slab on Grade and Slab on steel deck: Proportion Normal weight concrete mix as follows:
 - a. Compressive Strength: 4,000 psi 28 day compressive strength.
 - b. Minimum cementitious materials content: 520 lb./cu. Yd.,
 - c. Maximum slump: 4 inches.
 3. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - a. Fly Ash: 25 percent.
 - b. Combined Fly Ash and Pozzolan: 25 percent.
 4. Maximum Water-Cementitious Materials Ratio: 0.45.
 5. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3%.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to owner and as accepted by the architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the architect before they are used in the work.
- D. Admixtures: Use accelerating admixture (non-chloride based) in concrete slabs placed at ambient temperatures below 50 degrees F.
1. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
 2. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within the following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

4% to 6% for maximum 2" aggregate.
4% to 6% for maximum 3/4" aggregate.
6% to 8% for maximum 1/2" aggregate.

- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement of not less than 2" and not more than 4".

2.5 CONCRETE MIXES:

- A. Job Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd. or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd. or fraction thereof. Provide batch ticket for each batch discharged and used in the work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- B. Ready Mixed Concrete: Comply with requirements of ANSI/ASTM C 94, and ASTM C 1116, and furnish batch ticket information to architect.
 - 1. Addition of water to the batch shall not be permitted.
 - 2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ANSI/ASTM C 94 may be required.
 - 3. When air temperature is between 85 deg. F. and 90 deg. F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg. F., reduce mixing and delivery time to 60 minutes.

3. EXECUTION

- 3.1 PLACING REINFORCEMENT: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
 - A. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
 - B. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - C. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.2 CONCRETE PLACEMENT:

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding and tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- E. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- F. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- G. Bring concrete slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth surfaces, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 1. For concrete slabs recessed for tile at toilets, do not use curing compounds. Slab shall have steel trowel and fine broom finish.
 - 2. Concrete finishers will apply trowel finish to monolithic slab surfaces to be exposed to view. After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when the concrete surface

produces a ringing sound as the trowel is moved over the surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance. Grind smooth surface defects. At junction of slab with wall recess place expansion joint material 3/4" wide, tool slab edge to smooth radius and fill recess with sealant. Cure slab by application of Curing Compound according to the manufacturer's instructions and before placing any insulation blankets.

- H. Maintain reinforcing in the proper position during concrete placement operations.
- 3.3 COLD WEATHER PLACEMENT: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
- A. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees Fahrenheit, and not more than 80 degrees Fahrenheit at the point of placement.
 - B. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - C. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
 - D. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F. for a period of 72 hours after placing, except that where high early strength cement is used, this period may be reduced to 24 hours.
- 3.4 HOT WEATHER PLACING: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
- A. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
 - B. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - C. Wet forms thoroughly before placing concrete.

- D. Use water reducing retarding admixture, type D, when required by high temperatures, low humidity, or other adverse placing conditions.

3.5 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.
- B. Curing Methods: Perform curing of concrete by curing compound and by combinations thereof, as herein specified.

- 36 -Filling In Holes: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

37 CONCRETE SURFACE REPAIRS:

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the architect.
- B. Cut out honeycomb, rock pockets, voids over 3/4" in any dimension (except for holes left by tie rods) down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
- D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace the concrete.
- E. Repair of defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean square cuts and expose reinforcing steel with at least 3/4" clearance. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact

and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

F. Use epoxy based mortar for structural repairs, where directed by architect.

3.8 SAMPLING FRESH CONCRETE: ASTM C 172, except as modified for slump to comply with ASTM C 94.

A. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one test for each set of compressive strength test specimens.

B. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens.

C. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below, and when 80 degree F. and above; and each time a set of compression test specimens are made.

D. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure specimens are required.

E. Compressive Strength Tests: ASTM C 39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 1 specimen tested at 14 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

1. When strength of field cured cylinders is less than 85% of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.

2. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

F. Test results will be reported in writing to the architect and contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for all tests.

- G. Additional Tests: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required.

END OF SECTION 03310

1. GENERAL

- 1.1 Furnish and install all precast concrete splash block units including fasteners and sealants necessary for a complete project.
- 1.2 Standards: Conform to minimum standards of the American Concrete Institute (ACI) ACI 318 Building Code Requirements for Reinforced Concrete; Precast Concrete Institute (PCI) PCI MNL-117 Manual for Quality Concrete for Plants and Production of Architectural Precast Concrete.
- 1.3 Quality Assurance: The precast concrete manufacturing plant shall be certified by the PCI Plant Certification Program.
 - A. Testing:
In general, compliance with testing provisions in PCI MNL-117.
- 1.4 Submittals:
 - A. Submit sample representative of finished exposed face showing typical range of color and texture prior to commencement of manufacture.
 - B. Shop Drawings:
Submit shop drawings showing dimensions, unit shapes (elevation and section), finishes and anchorage.
- 1.5 Product Delivery, Storage and Handling:
 - A. Place nonstaining resilient spacers of even thickness between each unit and support units on nonstaining material.
 - B. Do not place units directly on the ground and store units on firm, level and smooth surfaces to prevent cracking or warping.

2. PRODUCTS

2.1 Materials:

- A. Concrete
 1. Portland Cement
 - a. ASTM C150, general use
 - b. Color: grey
 2. Air-entraining agent ASTM C26D
 3. Water: potable
- B. Reinforcing steel
 1. Deformed steel ASTM A615, grade 60.

- C. Grout
 - 1. Cement grout: Portland cement, sand and water sufficient for placement and hydration.
- 2.2 Mixes:
 - A. Concrete Properties:

Back-up concrete and surface finish concrete shall be identical.

 - 1. Water-cement ratio maximum 40 lbs. of water to 100 lbs. of cement.
 - 2. Air entrainment:

Amount produced by adding dosage of air entraining agent that will provide 18-20% of entrained air in standard 1:4 sand mortar as tested according to ASTM C185. Minimum 3%, maximum 6%.
 - 3. 28 day compressive strength:

Minimum of **5,000 p.s.i.** when tested by 6" x 12" or 4" x 8" cylinders; or minimum 6250 p.s.i. when tested on 4" cubes.
 - B. Design mixes to achieve required strengths shall be prepared by independent testing facility or qualified personnel at precast concrete manufacturer's plant.
- 2.3 Fabrication:
 - A. Manufacturing procedures shall comply with PCI MNL-117.
 - B. Finishes:
 - 1. Smooth finish
 - a. As cast using flat, smooth or nonporous molds.
 - C. Cover:
 - 1. Provide at least 1-1/2" cover for reinforcing steel.
 - 2. Provide embedded anchors, inserts, plates, angles and other cast-in items as indicated on shop drawings with sufficient anchorage and embedment for design requirements.
 - D. Curing:

Cure until the compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of the product.
 - E. Acceptance:

Precast Concrete Units which do not meet the color and texture range or dimensions may be rejected at the opinion of the Architect if they cannot be corrected to the Architect's satisfaction.
- 2.4 Concrete Testing:

Make one compression test at 28 days for each day's production.

3. EXECUTION

- 3.1 Inspection:
Before seating precast concrete, the General Contractor shall verify and determine field condition by actual measurement.
- 3.2 Erection:
Set precast units level, plumb, square and true. General Contractor shall provide true and level bearing surfaces.
- 3.3 Cleaning:
- A. After installation and joint treatment, General Contractor shall clean soiled precast concrete surfaces with detergent and water using fiber brush and sponge, and rinse with water.
 - B. Use acid solution to clean particularly stubborn stains.
- 3.4 Warranty:
The precast concrete manufacturer shall guarantee the precast concrete products against defects in materials and workmanship for a period of one year after substantial completion of the building.

END OF SECTION 03360

1. GENERAL

1.1 Scope: Furnish and install all masonry complete with all necessary accessories.

1.2 Submittals: For masonry units delivered to the site: submit current test results within 90 days verifying compressive strength, moisture content and absorption; within one year for linear shrinkage. Submit samples of any specialty units for approval before manufacturing. Submit mortar and grout design mix (with additives) from a laboratory approved by the Architect. SHOP DRAWINGS, DESIGN MIX AND TEST RESULTS MUST BE REVIEWED BY ARCHITECT PRIOR TO PLACEMENT OF ANY MASONRY.

1.3 Notification: Contractor shall notify Architect for inspection of reinforcing prior to placement of grout and during all grout placements. Notification shall be given at least two weekdays before the grout placement is scheduled.

1.4 Quality Assurance:

1.4.2 Testing:

Perform field tests for mortar and grout in accordance with U.B.C. Standard 24-22. Make four specimens for each test. Test two specimens for compressive strength at 7 days. Test second two specimens at 28 days. Suitable equipment for making mortar and grout specimens shall be available at the site during masonry work. Minimum tests required shall be one mortar test and one grout test (four specimens for each) for every 2000 sq.ft. of wall surface, and in no case fewer than one test (four specimens) for each day of work.

2. MATERIALS

2.1 Portland Cement: ASTM C-150, Type I or II.

2.2 Water: Clean, non-alkali and potable.

2.3 Aggregates: Aggregate for Mortar: ASTM C-144, Aggregate for Grout: ASTM C-404.

2.4 Hydrated Lime: ASTM C-207, Type S, or "Easy Spread" mortar plasticizer by American Colloid Company.

2.5 Reinforcing:

A. Bars: ASTM A-615, Grade 60, Ties and Stirrups, Grade 40.

B. Joint Reinforcing: ASTM A-82 for High Tensile Steel. Truss type with prefabricated corner and intersection sections, standard "Dur-O-Wall" joint reinforcing, or equal with deformed side rods such that minimum surface bond

stress developed is 527 psi when incorporated in Standard ASTM Class A mortar cubes.

2.6 Concrete Masonry Units: "Slump Block" Units; ASTM C-90-75, Grade N, Type I, for hollow load-bearing, and ASTM C-129-75 for hollow non-load-bearing units. Aggregate shall be volcanic scoria and shall meet all other requirements of ASTM C-331. Curing shall be accomplished by high pressure steam (auto-claved method) at 140 psi pressure and 360°F steam temperature.

- A. Minimum compressive strength 1350 psi average gross area.
- B. Linear shrinkage may not exceed .03.
- C. Moisture content shall not exceed 25% of total absorption.

Block manufacturer shall submit current test results on units: within 90 days for compressive strength, moisture content and absorption; within one year for linear shrinkage.

2.7 Anchors and Ties: Galvanized, minimum 20 gauge steel, or approved design.

2.8 Masonry Control Joints: Rubber, cross shape ASTM D-2000 2AA-805 80 durometer hardness when tested in accordance with ASTM C-2240.

2.9 Mortar:

- A. Type "S": Type "S" mortar with compressive strength 1800 psi at 28 days.
- B. Requirements: Follow requirements of U.B.C. Standard 24-30 (ASTM C-270).
- C. Proportions: Proportions (by volume):
 - 1. Portland Cement: 1/2
 - 2. Masonry Cement (Type II): 1
 - 3. Aggregate: 2-1/4 to 3 times the sum of volumes of the cements used when measured in loose, damp condition.

-OR-

- 1. Portland Cement: 1
- 2. Hydrated Lime or Lime Putty: 1/4 to 1/2 (or "Easy Spread": 1/2)
- 3. Aggregate: 2-1/4 to 3 times the sum of the volume of the cement and lime used when measured in loose, damp condition.

2.10 Grout:

- A. Strength: Compressive strength 2000 psi at 28 days.
- B. Proportions (by volume):
 - 1. Portland Cement: 1 part
 - 2. Sand: 2-1/2 to 3 parts
 - 3. Pea Gravel: 1-1/2 to 2 parts
 - 4. Hydrated Lime: 1/10 part
 - 5. Water: To yield slump of 9 to 10 inches
 - 6. Grout Admixture - optional. Approval required.

Minimum Cement:

- 1. 7.9 sacks per yard without admixture.
 - 2. 6.3 sacks per yard with admixture.
- 2.11 Grout Admixture: "Grout-Aid" as manufactured by Super Concrete Emulsions Ltd., or equal.
- .12 Ready Mix Grout: conform to ASTM C-94.
- .13 Masonry Fill Insulation (See Section 07210 Building Insulation): "Core-Fill 500" or "Thermco" Foam Insulation, two component system (Amino-Plast Resin and catalyst foaming agent surfactant), together with compressed air to form a foam insulation in all open cells adjacent to heated building spaces to achieve "R" rating of 14.2 in eight inch (8") hollow concrete block. Install with licensed contractor, approved and licensed by manufacturer. Incorporate the patented product "Bancho" to assure that no measurable outgassing of formaldehyde will occur. Meet Fire Wall Rating test ASTM E-119.
- A. Approved Manufacturers: Tailored Chemical Products (800) 627-1687 for Core-Fill 500, and Thermco Foam Insulation.
 - B. Approved and Licensed installer: Marvin Allen (505) 293-9348, Albuquerque, NM

3. EXECUTION

- 3.1 Handling: Protect masonry units, cementitious materials and reinforcing from moisture by storing off ground and keeping protected from weather. Remove any damaged materials from site.

3.2 Reinforcing:

- A. Vertical Reinforcing: Install where shown on drawings and approved shop drawings. Lap vertical reinforcing a minimum of 40 bar diameters (in no case less than 16") at all splices. Maintain a minimum of 1" clear between bars and masonry units. Fill vertically reinforced cells with grout only after all reinforcing is in place and properly tied in position. Support vertical bars in position at maximum spacing of 192 bar diameters.
- B. Horizontal Reinforcing: Install bond beams, (knock out blocks) and lintels (U-blocks) where shown on drawings and approved shop drawings. Lap reinforcing 40 bar diameters (16" minimum) at all splices. Provide corner bars at all corners and intersections as detailed on the drawings. Grout bond beams and lintels as top course only. Do not lay standard masonry units above an ungrouted bond beam.
- C. Horizontal Joint Reinforcing: Install where shown on drawings and approved shop drawings. Lap a minimum of 6" at all splices. Maintain a minimum of 5/8" mortar coverage on the weather slide.

3.3 Scaffolding: Erect all scaffolding independent of masonry walls.

3.4 Bracing: Brace all walls and other masonry work against lateral loads, such as wind and earth pressure, until masonry and grout has cured and until the floor and roof diaphragms are in place.

3.5 Setting Procedures:

- A. Culling: Cull out defective units to avoid cracked face webs. If placed in wall, these units will be rejected by Architect. Units with chipped corners will be allowed where finishes other than paint are to be applied or where units are concealed from view if chipped areas are pointed up flush before applying coating. Otherwise, chipped corners exposed to view will be rejected.
- B. Mortar: Mix mortar in a mechanical mortar mixer for a minimum of three minutes before using. Mix proportions shall be accurately followed on site. Place mortar within 1_ hours after mixing. Retempering is not permitted.
- C. Setting: Do not wet concrete units before laying. Remove any units that are disturbed after mortar has stiffened, and re-lay with fresh mortar. Provide full mortar coverage (face and webs) around cells to be grouted and on starting courses on solid foundation walls. Clean cells to be grouted of any protruding mortar fins. Completely fill all horizontal face joints with mortar, furrowing

slightly with trowel. Fill cross joints with mortar applied against the end of the block before setting tight to block already in place. Set units in running bond.

D. Mortar Joints: Set units with 3/8 inch nominal mortar joints in accordance with modular coursing. Wipe off excess mortar from surface of block work before mortar sets. Tool mortar joints exposed to view (whether or not the surface is to receive a paint or other coating that will reveal joints). Tool joints slightly concave, smooth and dense so the mortar will be fully compacted and pressed against the edges of the concrete units.

E. Prepare foundations to assure surfaces to support concrete masonry are at the proper elevations and free of all dirt and other deleterious materials.

- 3.6 Mix grout a minimum of five minutes before using. Place grout within 1-1/2 hours after mixing. Solidly fill all cells containing reinforcing and where shown on Drawings. Maximum height of grout lift shall be four feet. Vibrate or rod (completely penetrating grout in cell with a rebar in an up and down motion) in-place grout while placing, and reconsolidate by further rodding after grout takes a plastic consistency, but before it takes initial set. Stop vertical lifts 1_ inches below the top of a course to form a key for the next lift. Be certain cells to be grouted are clean of debris and mortar droppings. Grout all horizontal masonry lintels and bond beams. Grout lintels in a continuous operation over the openings and the end bearings, as shown on Drawings. Clean off all grout spills from surface of work immediately, before grout has a chance to set.
- 3.7 Cutting: Cut blockwork accurately and neatly with saw-cuts only. Make cut-outs sufficient for minimum clearance of equipment or item to be recessed. Cut-outs that exceed the dimensions of cover plates, escutcheons or flanges will not be accepted.
- 3.8 Built-in Items: Build in all equipment, boxes, panels, door frames, windows, accessories, access panels, flashing and other items as the work progresses. Fill spaces around metal frames and other built-in items with mortar in lifts not to exceed 24". Carefully review roofing and waterproofing systems for reglets and flashing before erecting masonry to that point. Chase or recesses are not permitted except where indicated on drawings. Place conduits in ungrouted cells only. Where masonry fill insulation is used in walls where cut-outs are required, plug all holes to prevent loss of insulation. Provide a grouted lintel above all openings in masonry walls even if not specifically called out on the structural drawings.
- 3.9 Unfinished Work: Step back unfinished masonry work for joining with new work. Toothing may be resorted to only when specifically approved. Before new work is started, remove all loose mortar and thoroughly clean out exposed joints.
- 3.10 Tolerances:

- A. Plumb: Maximum variation from plumb in lines and surfaces of columns, walls, expansion joints and other conspicuous lines shall not exceed 1/4" in 20 feet.
 - B. Level: Maximum variation from level or grades for exposed lintels, sills, parapets, horizontal mortar joints and other conspicuous lines shall not exceed 1/4" any bay or 20 feet.
- 3.11 Protection: Keep work dry during erection by covering with waterproof membranes at the end of each day or during any shutdown period. Overhang membranes at least 24" on each side of wall and securely anchor.
- 3.12 Cold Weather Procedures:
- A. Do not erect masonry when the air temperature is below 32°F. Do not use masonry unit having frost, snow or a temperature less than 32°F. Do not build on concrete or masonry that is below 32°F.
 - B. If air temperature is between 32° and 40°F, use heated mortar materials.
 - C. If temperature is even remotely expected to fall below 32°F in the 48 hours after placing masonry, provide proper heated enclosure to maintain temperature of masonry above 40°F for 48 hours. Enclosure shall be strong enough to resist wind loads.
 - D. Do not grout any masonry when the air temperature is below 32°F. Do not place grout in walls that are themselves less than 32°F. If air temperature is between 32° and 40°F, use heated grout materials. If temperature is even remotely expected to fall below 32°F in the 48 hours after grouting, provide proper heated enclosure to maintain temperature of masonry above 40°F for 48 hours. Enclosure shall be strong enough to resist wind loads.
 - E. Contractor shall have blankets, tents, and heaters on site prior to the onset of cold weather.
- 3.13 Control Joints: Build vertical joints at 30 feet spacing, maximum, unless noted otherwise on the Drawings. Control joints are built-in type. Sawed type will not be accepted. Fill control joints with specified elastic caulking and specified control joint filler in place of mortar. Bearing to non-bearing wall intersections shall also have caulking in place of mortar. Use backing rods where recommended by sealant manufacturer.
- 3.14 Pointing and Cleaning: Upon completion of masonry work, rake out all defects in joints, and point and fill all holes and cracks with fresh mortar, tooled as specified. Clean all mortar daubs from surface. Clean exposed surfaces from top down to remove stains and mortar deposited during construction. Soap and mild cleaning solutions are permitted

only after 48 hours after construction of walls. Acid solutions are permitted only after seven days after construction of walls, using one part muriatic acid in ten parts water. Wet walls before applying solution, and protect metal, stone and other work. Scrub a small area at a time with stiff fiber brushes. Immediately rinse surface thoroughly with clean water to avoid etching or staining masonry.

- 3.15 Waterproofing: For exposed masonry, where no finish is called for, waterproof with a full application of silicon based waterproofing such as Protex "Silicon Seal," "Thoroclear 777" or approved equal installed in strict accordance with manufacturer's recommendations. Brush apply on all interior applications.
- 3.16 See Section 09222 Stucco for wall finish required.

END OF SECTION 04220

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of steel joists is shown on drawings, including basic layout and type of joists required.

1.3 QUALITY ASSURANCE

- A. Provide joists fabricated in compliance with the following, and as herein specified.
 - 1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for:
H-Series Open Web Steel Joists ()
- B. Qualifications of Field Welding: Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Standard Qualification Procedure".
- C. Joists welded in place are subject to inspection and testing. Expense of removing and replacing any portion of steel joists for testing purposes will be born by Owner if welds are found to be satisfactory. Remove and replace work found to be defective and provide new acceptable work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications".
- B. Shop Drawings: Submit detailed drawings showing layout of joist units, special connections, jointing and accessories. Include mark, number, type, location and spacing of joists and bridging.
- C. Provide templates or location drawings for installation of anchor bolts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI "Specifications".
- B. High-Strength Threaded Fasteners: ASTM A 325 or A 490 heavy hexagon structural bolts with nuts and hardened washers.
- C. Steel Prime Paint: Comply with SECTION 09900 "Specifications" for painting steel.

2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with SJI "Specifications".
- B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
- C. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.
- D. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within _" of finished wall surface unless otherwise indicated.
- E. Bridging: Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications".
- F. Provide diagonal type bridging for "longspan" joists, complying with SJI "Specifications".
- G. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI "Specifications", unless otherwise indicated.
- H. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.
- J. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.
- K. Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3.1 ERECTION

- A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings, and as herein specified.

STEEL JOISTS 05210

- B. Anchors: Furnish anchor bolts and other devices to be built into concrete and masonry construction.
- C. Furnish unfinished threaded fasteners for anchor bolts, unless otherwise indicated.
- D. Refer to Division-3 sections for installation of anchors set in concrete.
- E. Refer to Division-4 sections for installation of anchors set in masonry.
- F. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.
- G. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.
- H. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.
- I. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- J. Fastening Joists:
 - 1. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.
 - 2. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.
 - 3. Provide unfinished threaded fasteners for bolted connections, unless otherwise indicated.
 - 4. Provide unfinished threaded fasteners for bolted connections except where high-strength bolts or welded connections are shown.
 - 5. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".
- K. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, and welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.
- L. Touch-Up Painting: Cleaning and touch-up painting of field welds, abraded areas, and rust spots of shop painting is included under Division 9 painting work.

END OF SECTION 05210

PART 1 - GENERAL

1.1 SCOPE

- A. This section shall include all materials, equipment, and labor necessary for the installation of steel decking, complete, in accordance with this specification and drawings.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of DECK and accessories.

PART 2 - PRODUCTS

2.1 DECKING

- A. The steel deck shall be manufactured and laced in accordance with the "Basic Design Specifications" as adopted by the Steel Deck Institute and SDI "Design Manual for Floor Decks and Roof Decks".

1. "TORUS" 15 GA. EPIC DECK, PAINTED.
2. 1-1/2" TYPE "B" 22 GA. PAINTED METAL DECK.
 - a. "S" min. = .186 IN.3.
 - b. "I" min. = .169 IN.4

2.2 THICKNESS, depth, properties and welds as shown on the drawings.

2.3 STEEL DECKING shall be: ASTM A611, Grade C.

2.4 PAINT

- A. Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

PART 3 - ERECTION

3.1 GENERAL

- A. Form deck units in lengths to span 2 to 3 or more supports.

3.2 INSTALL deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

- A. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

- B. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
- C. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
- D. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- E. Do not use floor deck units for storage or working platforms until permanently secured.
- F. Fastening Deck Units:
 - 1. Fasten roof deck units to steel supporting members by not less than 1/8" diameter fusion welds or elongated welds of equal strength, spaced not more than 12" o.c. at every support, and at closer spacing where required for lateral force resistance. In addition, secure deck to each supporting member in ribs where side laps occur.

Use welding washers where recommended by deck manufacturer.

1. Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

2. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.
- G. Contractor shall provide all miscellaneous plates or angles to support edges of metal deck at discontinuous edges and deck penetrations.

PART 4 - EXECUTION

4.1 INSTALLATION

- A. Steel deck shall be erected in accordance with the manufacturer's specifications and erection layouts. Cutting openings through the deck less than 2 square feet in area, and all skew cutting, shall be performed in the field.

4.2 QUALIFICATION OF FIELD WELDING

- A. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

4.3 PROVIDE SHOP DRAWINGS for materials and erection.

END OF SECTION 05310

1. GENERAL

1.1 Scope:

Furnish and install all metal fabrications (including fasteners) complete with all necessary accessories required for a completed project.

1.2 Standards: Conform to minimum standards of the American Institute of Steel Construction (AISC) "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings" and applicable publications of the National Association of Architectural Metal Manufacturers. Welding shall be in accordance with AWS Structural Welding Code.

1.3 Description of Work:

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of other metal systems specified elsewhere.

B. Extent of metal fabrications is indicated on the drawings and schedules.

C. Types of work in this section include metal fabrications for:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Miscellaneous framing and supports.
4. Steel ladders.
5. Shelf angles.
6. Steel pipe railings.
7. Stair treads and grating

1.4 Quality Assurance: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.

1.5 Shop Drawings: Submit shop drawings of stair for review and approval prior to fabrication.

2. MATERIALS

2.1 Miscellaneous Steel

- A. Tubing: Cold formed ASTM A-500 or hot-rolled A-501, Minimum yield 36,000 psi.
- B. Steel Pipe: ASTM A 53; Type and grade (if applicable) as selected by fabricator and as required for design loading: black finish; standard weight schedule 40.
- C. Steel Plates, shapes and bars: ASTM A36. As required or:
 - 1. 20 ga. Galv. steel plate for roof deck openings less than 12" inches square. Secure plate with #10 TEK screws @ 12" o.c. to steel deck and extend plate a minimum of 12" from penetration in all directions.
 - 2. Roof openings in metal deck larger than 12" square require welded steel frames from 3.5" x 5" x 1/4" steel angles sized to provide an opening for the equipment or opening needed. See roof plan, mechanical plan and plumbing plans for openings required.
- D. Structural Sheet Steel: Hot rolled ASTM A 500; or hot rolled, ASTM A 501.
- E. Brackets, flanges and anchors: cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- F. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized ASTM A 153.
- G. Metallic non-shrink grout: pre-mixed, factory packaged, ferrous aggregate grout complying with CE CRD-C588 type M.
- H. Fasteners: provide zinc coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
 - 1. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.
 - 2. Lag Bolts: Square head type, FS FF-B-561.
 - 3. Machine Screws: Cadmium plated steel, FS FF-S-92.
 - 4. Wood Screws: Flat head carbon steel, FS FF-W-92.
 - 5. Plain Washers: Round, carbon steel, FS FF-WW-92.

6. Masonry anchorage devices: Expansion shields, FS FF-S-325.
 7. Toggle Bolts: tumble-wing type, FS FF-B-588, type, class and style as required.
 8. Lock Washers: Helical spring type carbon steel, FS FF-W-84.
- I. Paint: Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast-curing, lead free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.

2.2 FABRICATION, GENERAL:

- A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components.
1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 2. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
 3. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
 4. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- B. Shop Painting:
1. Apply shop primer to surfaces of metal fabrications except those which are galvanized or as indicated to be embedded in concrete or masonry, unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "paint application specification #1" for shop painting.

- a. Prepare ferrous metal surfaces to comply with SSPC-SP6 "commercial blast cleaning" for exteriors (SSPC Zone 1B) and SSPC-SP3 "Power Tool Cleaning" for interiors.
- C. Rough Hardware: Fabricate items to sizes, shapes and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish steel washers.
- D. Loose Bearing Plates and Leveling Plates: Drill plates to receive anchor bolts and for grouting as required.
- E. Loose Steel Lintels: Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated.
1. Galvanize loose steel lintels to be installed in exterior walls.
- F. Miscellaneous Framing and Supports: Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
- G. Steel Pipe Railings and Handrails:
1. Fabricate steel pipe railings to design, dimensions and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading.
 2. At tee and cross intersections provide coped joints.
 3. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable, or radiuses indicated.
 4. At elbow bends provide mitered joints.
 5. Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe, at fabricator's option.

6. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.
7. Provide wall returns at ends of wall-mounted handrails, except as otherwise indicated.
8. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fitting.

3. EXECUTION:

3.1 PREPARATION:

- A. Take field measurements prior to fabrication. Coordinate and furnish anchorages, setting, and integral anchors which are to be embedded in concrete or masonry.

3.2 INSTALLATION:

- A. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack. Provide bracing and anchors in formwork for items to be built into concrete or masonry.
- B. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded. Grind exposed weld joints smooth and touch-up shop paint coat.
- C. Field Welding: comply with ASW code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- D. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but cut off flush if protruding, before packing with grout. Use metallic non-shrink grout in exposed locations unless otherwise indicated.
- E. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUST AND CLEAN

- A. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Section 09900.
- C. For galvanized surfaces: Clean field welds, bolted connections and abraded area and apply galvanizing repair paint to comply with ASTM A-780.

END OF SECTION 05550

1. GENERAL

- 1.1 Scope: Furnish and install all rough carpentry with all necessary accessories.
- 1.2 Submittals: Submit samples of rough carpentry materials which will be exposed to view in finished work and all metal framing connectors and accessories prior to use.
- 1.3 Quality Assurance: Grading rules of the West Coast Lumber Inspection Bureau, the Western Wood Products Association, the American Plywood Association and the Redwood Inspection Service, California Redwood Association apply to materials furnished under this Section. Identify all lumber and plywood by official grade mark of these Associations.

2. MATERIALS

- 2.1 Dimensions: Nominal sizes are indicated. Actual dimensions conform to Product Standard 20.
- 2.2 Structural Light Framing and Studs: When grade and type are not called for on Drawings, use grade equal to WWP No. 2 Ponderosa Pine, Grade Fb = 1000 psi, E = 1,100,000 pos, and WWP "Standard" or "Stud" grade for studs, culling out any warped or split studs prior to use.
- 2.3 Plywood: Unless otherwise required on the drawings, use not less than 5/8" Exterior Grade C-C of thickness and structural grade required. Unless otherwise shown, use 5/8" Exterior Grade A-C for exposed to view applications and all paint applications other than millwork.
- 2.4 Preservative Treatment:
 - A. Solid Stock: Pressure treated to the standards of the American Wood Preservers' Association for Use Category designation UC3A, UC3B OR UC3C for above ground applications and UC4A and UC4B for ground contact applications. Dissolved Copper-Based Formula of ammoniacal copper quaternary or alkaline copper quaternary (ACQ).

3. EXECUTION

- 3.1 Storage and Handling:

Store all materials to ensure proper ventilation and full protection from moisture. Do not bring any finish lumber to the job until plaster is completely dry.
- 3.2 Wood Treatment: Treat with preservative treatment all wood called for on the drawings, and all wood which will be in contact with the ground, concrete or masonry, and wood which will be covered by roofing or flashing. Treat all cut edges.

- 3.3 Nailing and Bolting: Bore holes slightly larger than bolts so wood will not be strained. Use galvanized type bolts and nails for all applications exposed to weather, as well as under roofing. Avoid use of nails long enough to penetrate plywood decking which will produce condensation drop points. Avoid hammer marks in exposed wood.

END OF SECTION 06100

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall Sheathing
 - 2. Building Wrap
 - 3. Sheathing joint-and-penetration treatment
 - 4. Flexible flashing at openings in sheathing

- B. Related Sections:
 - 1. Section 06100, Rough Carpentry.
 - 2. Section 09250, Gypsum Board.
 - 3. Section 09300, Tile.
 - 4. Section 07500, EPDM Roofing.

1.2 SUBMITTALS

- A. Product Data: Manufacturers' specifications and literature for each product.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by

PART 2 PRODUCTS

2.1 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
 - 1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches.

- B. Cement Board: Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.
 - 1. Product: DUROCK Brand Cement Board by United States Gypsum Company.

- a. Type and Thickness: 5/8 inch thick.
- b. Size: 32 inches wide, min.

2.1 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C954.

2.2 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
 - b. DuPont (E. I. du Pont de Nemours and Company); Tyvek Commercial Wrap
 - c. Raven Industries Inc.; Rufco-Wrap.
 2. Water-Vapor Permeance: Not less than 50 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 3. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834.

2.4 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, not less than 0.030 inch.
 - 1. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 2. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
- C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

3.2 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. Cover sheathing with weather-resistant sheathing paper as follows: Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

- B. Building Wrap: Comply with manufacturer's written instructions. Seal seams, edges, fasteners, and penetrations with tape. Extend into jambs of openings and seal corners with tape.

3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant.

3.4 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

END OF SECTION 06160

1. GENERAL

1.1 Scope:

Finish carpentry includes carpentry work which is exposed to view, is non-structural and which is not specified as part of other Sections. Types of finish carpentry work in this Section include: running and standing trim, wood door frames, wood door and window trim and laminate work not included in Cabinetry.

1.2 Submittals:

Submit a sample for each species and cut or pattern of Finish Carpentry standing and running trim. Sample shall be two feet (2') long by full board width, unfinished.

1.3 Quality Assurance:

Comply with the requirements of the "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute (AWI) for grading, assembly and finishing all Finish Carpentry.

2. PRODUCTS

2.1 General:

Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber manufactured to sizes or patterns indicated.

2.2 Finish Carpentry Materials:

The species of all woodwork is to be indicated on the Drawings, or if not listed shall be "Ash."

A. Materials to receive transparent finish or as finish shall be AWI "Custom Grade" for transparent finish. Finger joints not allowed.

B. Materials to receive opaque finish shall be AWI "Custom Grade" for opaque finish.

C. Exception No. 1: AWI Economy Grade Materials are allowed for utility shelving.

2.3 Plastic Laminates:

High pressure laminated plastic equal to Formica Grade 10 or 11 (.028" thick). Provide full backer sheet of 1/2 inch thick particleboard, Type I, with 40 pcf minimum density. Install with adhesive as recommended by manufacturer.

3. EXECUTION

3.1 Storage and Handling:

Store all materials to ensure proper ventilation and full protection from moisture. Do not bring any finish lumber to the job until plaster is completely dry, glazing is complete and temperature within the building will remain above 55°F. Thereafter, allow the finish lumber 72 hours inside the building to become acclimated.

3.2 Job Measurements:

Take measurements of actual conditions at the job site before fabricating or purchasing finish carpentry. Notify Architect of any major discrepancies.

3.3 Construction:

All construction and assembly of Finish Carpentry shall conform to Architectural Woodwork Institute's "Architectural Woodwork Quality Standards" for Custom Grade.

3.4 Standing and Running Trim:

All corners, intersections and running joints shall be mitered or coped as appropriate to produce a tight joint. Running joints less than eight feet (8') on center shall not be accepted. All nails and screws shall be countersunk, filled and sanded. Fillers used with transparent finishes shall be stained to match finish prior to placement in nail hole. Joints shall be spliced or pinned as necessary to maintain alignment of faces.

3.5 Plastic Laminates:

Glue, nail and/or screw to substrate surface. Exposed fastenings not permitted without the approval of the Architect. Scribe to adjacent surfaces. Improperly trimmed edges, cuts and chips in the surface, de-lamination, surface staining and improper installation are not acceptable and will be cause for rejection of the Work.

END OF SECTION 06200

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Installation of blindside vertical sheet membrane system and accessories.
- C. Accessory Products.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Sheet Membrane Waterproofing Barrier System must be manufactured by a company with a minimum of ten (10) years of experience in the production and sales of membrane waterproofing materials.
- B. Applicator Qualifications: A firm having at least three (3) years of experience in applying these types of specified materials and specifically accepted in writing by the membrane system manufacturer.
- C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Store adhesives at temperatures of 40° F (4° C) and above to facilitate handling.
- D. Store membrane cartons on pallets.
- E. Do not store at temperatures above 90° F (32° C) for extended periods.
- F. Keep away from sparks and flames.

- G. Completely cover when stored outside. Protect from rain.
- H. Protect materials during handling and application to prevent damage or contamination.
- I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.07 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the membrane manufacturer. Install Blindsided Membrane when temperature is 40°F (4°C) and rising. For low temperature use, between 25°F – 39°F, use the winter-grade formulation.
- B. Proceed with installation only when substrate construction and preparation work is complete. Ensure that subsoil is approved by architect or geotechnical firm.
- C. Warn personnel against breathing of vapors and contact with skin and eyes; wear appropriate protective clothing and respiratory equipment.
- D. Keep flammable products away from spark or flame. Post “No Smoking” signs. Do not allow use of spark-producing equipment during application and until all vapors have dissipated.
- E. Maintain work area in a neat and workmanlike condition. Remove empty cartons and rubbish from the site daily.

1.08 WARRANTY

- A. Manufacturer warrants only that this product is free of defects, since many factors which affect the results obtained from this product are beyond our control; such as weather, workmanship, equipment utilized and prior condition of the substrate. We will replace, at no charge, proven defective product within twelve (12) months of purchase, provided it has been applied in accordance with our written directions for uses we recommended as suitable for this product. Proof of purchase must be provided. A five (5) year material or system warranty may be available upon request. Contact Polyguard Products, Inc. for further details.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Polyguard Products Inc. P.O. Box 755 Ennis, TX 75120-0755; Phone: (214) 515-5000
 Fax: (972) 875-9425 Email: info@polyguardproducts.com

2.02 SYSTEM MATERIALS

- A. High Density Blind Side Waterproofing: Shall be Polyguard Underseal® Blindsight Waterproofing Membrane, a strong sheet membrane with a thick, cross-laminated, high-density polyethylene (HDPE) backing, laminated to thick layer of proprietary waterproofing adhesive compound integrated into a nonwoven geotextile fabric. Total membrane thickness is factory controlled at 73 mils.

PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	TYPICAL VALUE
FILM COLOR		Black/White
MEMBRANE THICKNESS	ASTM D 1000	73 mils
TENSILE STRENGTH OF 1" WIDTH SAMPLE POLYPROPYLENE GEOTEXTILE LAYER	ASTM D 4632	80 lb.
(IN PLANE) HYDRAULIC TRANSMISSIVITY OF A GEOSYNTHETIC BY RADIAL FLOW	ASTM D 6574	No water flow
PERMEABILITY (HYDRAULIC CONDUCTIVITY)	ASTM D 5084-90	$K=1.18 \times 10^{-9} \text{ cm.s}^{-1}$
RESISTANCE TO FUNGI IN SOIL	GSA-PBS 07115 – 16 weeks	No effect
RESISTANCE TO PERMEANCE BY METHANE GAS	ASTM D 1434 tested using 99.99% purity	$6.3 \times 10^{-7} \text{ ft}^3/(\text{ft}^2 \cdot \text{hr} \cdot \text{psi})$
RESISTANCE TO RADIOACTIVE RADON GAS	Radon Reduction Technology Laboratory % reduction in radon gas diffusion	97.1%
LAP PEEL ADHESION	ASTM D 1876* Modified ¹ Die C	9.02 lb./in.
PUNCTURE RESISTANCE, MINIMUM	ASTM E 154	217 lb.
RESISTANCE TO HYDROSTATIC HEAD, MINIMUM	ASTM D 5385	231 ft.
PEEL ADHESION TO CONCRETE	ASTM D 903 Modified	14.9 lb./in.
ELONGATION, RUBBERIZED ASPHALT SEALANT/ADHESIVE COMPONENT	ASTM D 412	655%
WATER ABSORPTION, MAXIMUM	ASTM D 570	0.1%
CRACK CYCLING	ASTM C 836 Tested @-15°F	No effect
LOW TEMPERATURE FLEXIBILITY	ASTM D 1970 180° bend over 1" mandrel at -25°F (-29°C)	No effect
BREAKING STRENGTH OF 1" WIDTH SAMPLE POLYETHYLENE GEOMEMBRANE LAYER	ASTM D 882	6500 PSI
PERMEANCE TO WATER VAPOR TRANSMISSION, MAXIMUM	ASTM E 96 Method B**	0.01 perms

*Test is done using smaller sample than standard and at room temperature.

** Test method used: ASTM E 96. Sample preparation for nail puncture: ASTM D 1970.

2.03 SYSTEM ACCESSORIES

A. Surface Primer Roller-Grade Adhesive:

1. Polyguard® 650 LT Liquid Adhesive: A rubber-based adhesive in solvent solution which is specifically formulated to provide excellent adhesion with the Polyguard Waterproofing Membranes to prime all structural concrete, masonry, insulation, or wood surfaces. Designed to be used on applications down to 25°F (-4°C).
2. Polyguard® California Sealant: A rubber-based sealant in solvent solution which is specifically formulated to provide excellent adhesion with the Polyguard Waterproofing Membrane. The VOC (Volatile Organic Compound) content meets the South Coast Air Quality Management District regulations established under the February 1, 1991 version of Rule 1168 ©) (2) Adhesion and Sealant Applications. California Sealant is classified as an Architectural Sealant Primer Porous; with VOC of 521 g/L. Current SCAQMD regulations for this type sealant primer are 775 g/L.

B. Fabric Tape:

1. Polyguard® Fabric Tape: Rubberized asphalt waterproofing membrane laminated to polypropylene fabric backing. The membrane is wound onto a disposable silicone treated release sheet to prevent the membrane from sticking onto itself while in the roll. Polyguard® Fabric Tape is used around pipe penetrations with an annular space of pipe through opening exceeding 1/2", end laps and for patching damaged areas.

C. Liquid Membrane:

1. Polyguard® LM-95: Two-component urethane waterproofing membrane; trowel applied quick curing, to be used in a variety of applications in conjunction with Polyguard® Waterproofing System.

D. Detail Sealant:

1. Polyguard® Detail Sealant PW™ : Single-component, elastomeric sealant. It is an environmentally friendly, non-isocyanate product that replaces silicone and urethane sealants. It is a low VOC/HAPS free, high-performance, flexible sealant that is solvent free. Used on substrates including: Rigid PVC, bare aluminum, stainless steel, galvanized steel, anodized aluminum, tile, wood, concrete, FRP, polystyrene, molded polyurethane, polyester and ABS.

E. Detail Adhesive Tape:

1. Polyguard® 606 Tape: High-strength, double-sided tape comprised of rubberized asphalt. The tape is supplied in rolls and utilizes both Kraft paper and plastic film release sheets which are removed prior to application.

F. Corner Boots:

1. Polyguard® US Inside Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on an inside corner to reinforce and seal corners of the Blindsight Membrane.
2. Polyguard® US Outside Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on an outside corner to reinforce and seal corners of the Blindsight Membrane.
3. Polyguard® US Pit Top Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on all corners to reinforce and seal corners of the Blindsight Membrane.

H. Drainage Mats:

1. Polyguard® Polyflow® 15 Vertical Drainage Mat: Two-part, prefabricated geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive self-adhering membrane. Notify General Contractor if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.

- B. Clean surfaces to receive waterproofing in accordance with manufacturer's instructions.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- D. Concrete surfaces must be clean, smooth, and free of standing water.
- E. Patch all holes and voids and smooth out any surface misalignments.

3.03 APPLICATION

A. Drainage Board Installation:

1. Drainage board should be applied vertically. Apply drainage board with fabric to lagging, caisson, shotcrete, slurry seal or steel piling walls. Bring drainage board over the top of the surface to be waterproofed and securely tack the drainage board to the top. On lagging walls cut holes in the drainboard where the lag bolts are extending out of the wood lagging into the drainage board.
2. Butt drainboard together at side and end seams.

B. Membrane Installation - Vertical Surfaces:

1. Apply waterproofing membrane vertically with the high-density backing to the drainage board.
2. Install Blindsided Membrane when temperatures are 40°F (4°C) and rising. For low temperature use, between 25°F – 39°F, use the winter-grade formulation.
3. Application up to 20 feet should be done by applying pins with washers every 12 inches across the top lagging thru the membrane and drainage board and allowing the membrane to hang down the wall.
4. For applications over 20 feet, contact the manufacturer for recommendations.
5. Side laps are furnished with edge trim of 4". Apply pins with washers every 24" to secure membrane to wall. Remove any debris and dust on the polyethylene backing, clean the backing with 30% Isopropyl Alcohol, (insert comma here) and then apply to the edge trim. Finish the seal by rolling with a laminate-type roller to obtain full adhesion.

6. Install all end laps in a reverse shingle fashion with all lower end laps installed polyethylene side to the fabric side of the top lift in order to shed water properly.
7. Overlap end lap pieces a minimum of 4" and prime fabric side of seams with Polyguard® 650 LT Liquid Adhesive or Polyguard® California Sealant at a rate of 50 - 75 sq. ft. per gallon and apply a 12" strip of Polyguard® Fabric Tape centered over seam extending out 6" past seam on both sides. Roll fabric with a laminate roller to ensure adhesion.
8. If the gap between the rough opening and the pipe, bolt, or other penetration is 1/2" diameter or less, apply liquid adhesive to the fabric side of the surrounding field course of Blindside Membrane. Then apply a 3/4" cant (fillet) of approved liquid membrane, or sealant provided by manufacturer, around the pipe penetration extending a minimum of 6 inches onto both the fabric side of the Blindside Membrane field course and the penetrating item.
9. If the gap between the rough opening and the pipe, bolt, or penetration exceeds 1/2" diameter, apply a skirt of Blindside Membrane tight around the penetrating item with a minimum distance of 6 inches onto the surrounding field course of Blindside Membrane. Then seal with manufacturer's adhesive or sealant and liquid membrane as a minimum 3/4" cant (fillet) extending onto the Blindside Membrane skirt and the penetrating item a minimum distance of 3 inches. Then apply a heavy coat (approximately 50 – 75 sq. ft. per gallon) of liquid adhesive onto the fabric side of the Blindside Membrane skirt extending 6 inches onto the field coating of Blindside Membrane. Next apply a patch of Polyguard® Fabric Tape around the termination edges of the Blindside Membrane skirt. Press or roll the patch firmly to obtain full adhesion to the field coating of Blindside Membrane. Apply another coat of liquid adhesive to the Polyguard® Fabric Tape patch and apply liquid membrane at Fabric Tape edge terminations.
10. Visually inspect membrane prior to pouring of concrete for any punctures/ damage.
11. Repair damaged areas by applying liquid adhesive at a rate of 50 -75 sq. ft. per gallon and apply patch at least 6 inches larger than damaged area in all directions.

C. Termination Bar

1. Secure at top of wall fastening every 7" O.C.

END OF SECTION

1. GENERAL

1.1 Scope:

Furnish and install insulation complete with all necessary accessories.

1.2 Construction Submittals:

Submit manufacturer's catalog data for all insulating materials and accessories.

1.3 Notification:

Notify Architect prior to covering up installed insulation work.

2. PRODUCTS

2.1 Blanket type building insulation:

Glass fiber batts with foil reinforced Kraft paper facing (FRK-faced), flame spread of twenty-five (25) or less, vapor barrier perm rating of 0.5. R-rating of 19 or better in 6" stud walls; R-rating of 11 in 3-5/8" stud walls, and R-rating of 38 in all existing ceiling areas, and R-rating of 30 in new construction where it is required (except as noted and required on drawings). Conform to ASTM C665, Type III Class A and ASTM E136.

A. Acceptable Manufacturers:

1. Owens Corning
2. Manville

2.2 Blanket-type sound attenuating blanket insulation:

Glass-fiber batts with flame spread less than twenty-five (25). Equal to Manville fiberglass sound control batts or USG Thermafiber sound attenuation blanket. Conform to ASTM C665, Type 1 and ASTM E136. Two inch (2") thickness.

2.3 Perimeter Insulation:

Extruded cellular polystyrene type, square edges, aged thermal conductivity .25 BTU per square foot per hour per degrees Fahrenheit per inch at 75° Fahrenheit. Minimum compressive strength of 35 psi. Maximum water absorption of less than 1.0% by volume. 2" thick, typical at perimeter, 16" beneath grade, typical.

2.4 Accessories:

Staples, stick pins, adhesives, 18 gauge wire, and other accessories as recommended by the insulation manufacturer for the installation used, and as indicated on the drawings.

A. "Pro Wire" insulation supports (1-800--776-9473).

2.4 Masonry Fill Insulation: (see Section 04220) Required on new exterior CMU wall construction.

"Core-Fill 500" Foam Insulation, two component system (Amino-Plast Resin and catalyst foaming agent surfacant), together with compressed air to form a foam insulation all open cells adjacent to heated building spaces to achieve "R" rating of 20 in twelve inches (12") hollow concrete block. Install with licensed contractor, approved and licensed by Manufacturer. Incorporate the patented product "Bancho" to assure that no measurable out-gassing of formaldehyde will occur. Meet Fire Wall RAting test ASTM E-119.

Approved Manufacturer:

Tailored Foam West (405) 946-5813, Midwest City, OK.

Local Installer:

Marvin Allen, 293-9348, Albuquerque, NM.

3. EXECUTION

3.1 Handling:

Protect insulation materials from damage and keep dry at all times.

3.2 All surfaces shall be fully erected, clean, dry, and have all openings completed prior to installation of insulation.

3.3 Batt and Blanket type insulation:

A. Achieve firmly anchored, continuous membrane with all joints, edges, and gaps properly sealed or patched to achieve uniform performance.

B. Install insulation with factory applied membrane facing occupied side of interior spaces. Cap ends and side flanges of membrane over framing members. Tape all butt joints and lap joints not held by staples.

C. Wire up ceiling insulation (R = 30) under roof decks by running 18 gauge wire perpendicular to the insulation every 18 inches to 24 inches on center. Use wire-up fastening devices (staples, stick pins and adhesives) as required by the insulation manufacturer.

3.4 Perimeter Insulation

A. Insure that walls are clean and level. Secure insulation on foundation wall with adhesive using spot bead method. Place long length horizontally.

B. When more than one (1) level of perimeter insulation is used, offset joints on adjacent panels.

END OF SECTION 07210

1. GENERAL

1.1 Scope:

Furnish and install insulation complete with all necessary accessories.

1.2 Construction Submittals:

Submit manufacturer's catalog data for all insulating materials and accessories.

1.3 Acceptable Manufacturer: Owens Corning.

2. PRODUCTS

2.1 Sound Insulation Fire Batt/Mineral Wool:

Un-faced Inorganic Fibers bonded and formed into flexible batts. Noncombustible classification per ASTM E 136. Complies with ASTM C665, Type I. Surface burning characteristics derived from tests per ASTM E 84 for a flame spread of 5.

A. Thickness: Three (3) inches.

B. R value per inch = 3.8

3. INSTALLATION

3.1 Handling:

Protect insulation materials from damage and keep dry at all times. Use goggles or safety glasses and an approved dust respirator when handling Sound Insulation Fire Batt/Mineral Wool.

3.2 Cut Sound Insulation Fire Batt/Mineral Wool with a knife for installation and a snug fit above acoustical ceiling.

3.3 Lay Sound Insulation Fire Batt/Mineral Wool over designated ceiling area laying batts directly on ceiling panels.

END OF SECTION 07215

80 MIL TPO FULLY ADHERED SYSTEM SPECIFICATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE OF WORK

- A. Provide a white, scrim reinforced Ethylene Propylene based elastomeric sheet roofing membrane system, insulation, flashing, sealants and all accessories and labor necessary for a complete insulated sheet roofing system.
- B. Furnish and install this membrane roofing system in strict accordance with Drawings and Specifications approved by Roof Systems Manufacturer.
- C. Related Sections:
 - 1. Section 06100 – Wood Blocking and Curbing
 - 2. Section 07620 – Roof Products and Flashing
 - 3. Section 07900 - Sealants

.03 REFERENCES”

- A. ASTM – American Society for Testing and Materials.
- B. Factory Mutual (FM) Engineering Corporation - Roof Assembly Classifications.
- C. NRCA – National Roofing Contractors Association.
- D. SMACNA – Sheet Metal and Air Conditioners National Association.
- E. Underwriters Laboratories (UL) - Fire Hazard Classifications.

F. FS – Federal Standard

G. ANSI / SPRI ES-1 - (see also, 2003 IBC Section 1504.5)

1.04 BIDDER'S REPRESENTATION

A. A large part of the value of this work is contained in the bidder's and the bidder's proposed manufacturer's capacity to provide long-term responsibility for the satisfactory performance of the roof. A 10-year, no dollar limit warranty is required. To that end, the following requirements are essential provisions of this specification:

1. By offering a bid for this work, the bidder certifies that he has visited the site and determined that all the conditions of the surrounding and underlying work are consistent with his proposed manufacturer's requirements for the specified warranty. In the event that the bidder discovers any condition of the surrounding and underlying work that would prevent him or his manufacturer from providing the specified warranty, he shall report it to the design professional not less than ten days before the bid opening.
2. By offering a bid for this work, the bidder certifies that he has examined the Contract Documents, can meet all imposed time completion requirements and has found all the details and requirements of the scope of work are complete and consistent with his proposed manufacturer's requirements for the specified warranty. In the event that the bidder discovers any detail or requirement in the Contract Documents that would prevent him or his manufacturer from providing the specified warranty, he shall report it to the design professional not less than ten days before the bid opening.
3. By offering a bid for this work, the bidder certifies that he can, within ten calendar days of a notice of award from the Owner, provide a surety bond for the performance of the work, a surety bond for payment of labor and materials, and a specimen warranty certificate from the manufacturer whose system that is proposed to be used on the project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications

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1. The manufacturer of the roofing system shall be the actual manufacturer of the roofing materials. The insulation and the component materials can be made by others, all testing requirements and implied warranties must be verifiable and labeled under the roofing manufacturer's name. All manufacturers and sub-manufacturers shall have not less than fifteen (15) years experience in the production of the specified system components.
2. The manufacturer shall certify the scrim reinforced TPO membrane meets the physical properties specified.
3. The contractor shall include a certification from the manufacturer, on the manufacturer's letterhead, that the proposed membrane, insulation and accessories will be covered in the warranty by the manufacturer of record

B. Installer Qualifications

1. **Applicator:** A company approved by Manufacturer, and specializing in single-ply roofing systems with at least twenty (20) installations of TPO solid adhered, scrim reinforced membrane. The crew shall be composed of experienced and skilled workers in this work. The installer will be required to properly staff the project at all times.

C. Inspections

1. **Manufacturer's Technical Representative:** The manufacturer of the roofing system shall be required to attend the roof pre-installation conference to accept the conditions of the work and to perform interim inspections during installation. After the roof installation is complete, the manufacturer's technical representative, unrelated to the sales department of the manufacturer, shall inspect the work and inform (by written report) the design professional, contractor, owner/owners consultant 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. Copies of all inspection reports from the manufacturer shall be promptly submitted to the design professional and the roofing consultant. The manufacturer shall submit written acceptance of the project to the design professional in issuance of the weather-tightness warranty and that the system has been installed according to the Manufacturer's published specifications and details. Report describing inspections, corrective actions and certifying manufacturer's acceptance of installation shall be submitted to the Architect in accordance with Section 01400 - Quality Requirements.

2. **Roofing Consultant:** The Owner reserves the right to retain, at the Owner's expense, an independent consultant service to review construction documents and provide full-time inspection of the roofing system installation. The inspector shall have free access to inspect and test all items related to the project and the work area. The consultant/inspector will be responsible for accepting the installed roofing on behalf of the owner. The roofing contractor/general contractor will keep the consultant informed of all schedules, delays and inspections of the manufacturer (2 week notice)

D. Work shall conform to:

1. NRCA Roofing and Waterproofing Manual, Latest Editions.
2. SMACNA Architectural Sheet Metal Manual, 2003 Edition.
3. Underwriters Laboratories, Inc. (UL): Class A Fire Hazard Classification.
4. Factory Mutual Engineering Corporation (FM): Roof assembly classification with wind uplift of I-75, FM Construction Bulletin 1-28, Class 1 Construction, latest Edition.

1.06 SUBMITTALS

A. Provide in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Shop Drawings: Submit shop drawings indicating
 - a. Roof size, location, and type of penetrations.
 - b. Roof assembly composition and attachment to deck.
 - c. Insulation system and cricket layout plan with cross sections.
 - d. Insulation fastening patterns that meets FM 1-75 insulation fastening requirements for the field, perimeter and corners.
 - e. Roof perimeter and corner areas as defined by FM with the width dimensioned for each roof section.
 - f. Complete set of details for all perimeters, drains, penetration and roof accessories flashings and terminations and manufacturer's published installation procedure details.
 - g. All roof related sheet metal items submitted in conformance with the submittal requirements of Sheet Metal Flashing & Trim specification section.

2. Product Data Submittals:

- a. Provide technical product data sheets on ALL materials and accessories that are to be used in the roof assembly and associated with the roof including UL product listing and FM System listing for each type of insulation. The data sheets should be clearly marked where choices occur for type and thicknesses.
 - b. The Insulation manufacturer shall certify a warranty to the membrane manufacturer in order to meet the complete system warranty.
 - c. For fasteners that are to penetrate into, or through, pressure preservative treated lumber use stainless steel, hot dipped galvanized coated or provide certification from manufacturer that coating is compatible with preservative used for wood treatment.
3. Fire Resistance: Provide roofing system, insulation, and component materials that have been tested for application and slopes indicated and are listed by UL for Class A external fire exposure over decks specified herein. Provide confirmation in submittal package.
 4. Wind Uplift: Provide rigid insulation, fully adhered roofing system, and component materials suitable for the structural deck and that have been tested as a complete system for application and slopes indicated and are listed in Factory Mutual Research Approval Guide as a Class 1 System.. Provide attachment to the deck that meets FM 1-75 membrane/insulation fastening requirements. Submit data that confirms this requirement.
 5. Copy of certificate documenting manufacturer's approval of installer as required in Paragraph 1.4-B-1.
 6. Copies of test reports showing compliance with requirements as specified in Paragraph 2.02.
 7. Samples:
 - a. 12 inch square minimum sample of roofing membrane including lap seam

8. Provide copy of manufacturers' printed installation instructions and requirement
9. Provide certification that Manufacture has accepted the proposed roof assembly and that the assembly will be eligible for their 20 year total system N.D.L. warranty.
10. Provide copy of warranties required in Paragraph 1.6 for review and approval by design professional.

1.07 WARRANTY

- A. Manufacturer's Warranty: Provide roofing manufacturer's total system leak-tight 10-year labor and 10-year material "No Dollar Limit Warranty," including insulation and all components. The warranty shall contain no exclusion or limitation for improper installation, damage from water that ponds, or does not drain freely. Provide all details necessary to qualify for manufacturer's "No Dollar Limit Warranty" and the manufacturer will respond within 48 hours and repair, within five (5) business days, any leaks in the roofing assembly for the warranty period stated above at no cost to the Owner, unless the leak is determined to be caused by others. The warranty shall cover wind speeds up to and including 72 mph.
- B. Roofer's Guarantee: Provide written guarantee from the Contractor stating that the Contractor will respond within 24 hours and repair within five (5) business days, any leaks in the roofing assembly for 2 years at no cost to the Owner.

.08 PRE INSTALLATION CONFERENCE

- A. Conduct a pre-installation conference prior to commencing work of this section at project site. under provisions in Division 1 Section "Project Management and Coordination". Review methods and procedures related to roofing system including, but not limited to, the following:
 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

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2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and school safety requirements.
7. Review temporary protection requirements for roofing system during and after installation.

1.09 DELIVERY, STORAGE, HANDLING

- A. Deliver products to site in unopened containers showing brand names and instructions.
- B. Store and protect temperature sensitive products in 55° to 80°F environment prior to usage. Store flammable or toxic material according to label instruction. Store each product in weather protected environment, clear of ground and moisture.
- C. Mark wet, damaged & defective materials and remove from site the same day

1.10 JOB SITE CONSIDERATIONS (CAUTIONS AND WARNINGS)

- A. Keep all adhesives, sealants and cleaning materials away from ALL ignition sources (i.e., torches, flames, fire, sparks, etc.).
- B. Consult container labels and Material Safety Data Sheets for specific safety instructions for all products used on the project.
- C. All bonding, splicing, and sealing surfaces must be free of dirt, moisture, and any

other contaminants.

- D. When the outside temperature is below 40°F (4.44°C), certain combinations of temperature and humidity may cause condensation on the surface of the TPO Bonding Adhesive. If this condition occurs, do not mate the surfaces. When the ambient air-conditions no longer cause condensation, apply additional TPO Bonding Adhesive and proceed.
- E. If Bonding Adhesive is used, temperature must be 40°F (4.44°C) and rising for the material to perform as designed.
- F. Do not use open flame sources (i.e., propane torches, etc.) to expedite drying of adhesives, sealants, etc. Allow to air dry only.
- G. Do not thin or modify any materials.
- H. Deliver materials to job site in their original containers as labeled by the manufacturer.
- I. Follow directions for protection of materials prior to and during installation. Do not use materials that have been damaged to the point that they will not perform as specified.
- J. Care should be used when installing fasteners to avoid possible conduits and other piping in and under the deck.
- K. Fumes from adhesive solvents may be drawn into the building during installation, through rooftop intakes. Refer to the Technical Information Sheet "Recommended Guidelines for Application of Roofing Materials to an Occupied Building" in the manufactures manual for specific guidelines.
- L. Store the TPO Membrane in the original undisturbed plastic wrap in a cool shaded area and cover with light-colored, breathable tarpaulins, in a manner to protect it from damage. TPO Membrane that has been exposed to the elements for approximately 12 hours must be prepared with (Splice Wash) prior to hot air welding.
- M. TPO is a reflective membrane. Adequate UV eye protection is necessary during installation.
- N. Do not use oil base or bituminous base roof cement with TPO Membrane.

- O. Contact Manufactures Technical Services for procedures when installing the TPO Membrane during temperatures less than 40°F (4.44°C).

PART 2 - PRODUCTS

2.01 GENERAL

- A. Roof System shall be a class A rated system and attached to the deck in accordance with FM I-75 fastening requirements

2.02 MEMBRANE

- A. Base Specification is 80mil TPO fully adhered system.
- B. Approved Manufacturers:
 - 1. Carlisle
 - 2. Firestone
 - 3. J.P. Stevens
- C. Requests for approval for manufacturers with equivalent products shall be submitted a minimum of 10 days prior to bid, in order to give the Owner adequate time to review the proposal in accordance with Instructions to Bidders Product Substitution Procedure. The request shall be a complete package as noted below and should be submitted on manufacturer's letterhead.
 - 1. Complete specification with details for Architects review, along with certification from Manufacturer of substitute membrane, which proposed material and system, is in compliance with all other requirements of this specification.
 - 2. Proof of experience as a manufacturer of the proposed membrane, with a minimum of fifteen (15) years experience
 - 3. Provide manufacturer certification that membrane contains no plasticizers, or PVC polymers.
 - 4. Provide manufacturers listing of common chemicals that may affect the membrane or the roof system in general.

5. Verification of UL Class A, FM Class 1 system rating with a minimum 6 foot wide membrane full sheet, in order to minimize seams on the roof. Every roll of membrane shall be UL labeled.
6. Provide adequate background information to the owner, to demonstrate that manufacturer has the capability to service, and back the Warranty for the term herein specified.

.03 ROOFING SYSTEM MEMBRANE

- A. Membrane Sheet Material: Membrane shall be 80 mil overall thickness, white Ethylene Propylene membrane reinforced with a polyester, 1000D scrim encapsulated in one pass through the calendar. There shall be more than 20 mils of Ethylene Propylene membrane between the scrim and the weathering surface of the roof. The Ethylene Propylene sheet physical properties must be actual tested properties of the sheet, not typical or hypothetical values. In order to minimize seams on the roof, the minimum width of the membrane full sheet shall be 6 feet. The membrane shall have the following minimum physical properties.

TABLE 1 - Physical Properties

<i>Physical property</i>	<i>Test method</i>	<i>Specification</i>
<i>Weight, minimum (Mass)</i>	<i>ASTM D-751</i>	<i>0.24 lbs./ft' (1.41 Kg/M2)</i>
<i>Thickness tolerance</i>	<i>ASTM D-751</i>	<i>80 mil ±10%</i>
<i>Breaking strength, minimum</i>	<i>ASTM D-751, Grab Method</i>	<i>225 lbs.</i>
<i>Tear Strength, minimum</i>	<i>ASTM D-751, Tongue Tear</i>	<i>100 lbf.</i>
<i>Vapor transmission</i>	<i>ASTM E-96</i>	<i>.035 perms</i>
<i>Elongation*</i>	<i>ASTM D-412</i>	<i>500%</i>
<i>Hydrostatic resistance, minimum</i>	<i>ASTM D-751 Method A</i>	<i>350 psi</i>
<i>Ozone resistance*</i>	<i>ASTM D- 1149 70 hrs. @ 100 F.</i>	<i>Pass</i>
<i>Emmaqua® concentrated natural sunlight, 4 million langleys</i>	<i>ASTMG-90</i>	<i>No visible surface cracking or stiffening</i>
<i>Dimensional stability</i>	<i>ASTM D-1204</i>	<i>0.3%</i>
<i>Puncture resistance, minimum</i>	<i>FTM 101 B, Method 2031</i>	<i>450 lbs.</i>
<i>Test performed on nonreinforced material</i>		

2.04 RELATED MATERIALS

- A. Flashing: Same membrane as Roofing (60 mil reinforced). For field fabricated vent stacks, pipes and corners provide unreinforced 55mil uncured white TPO.
- B. Bonding Adhesive: As provided by Manufacturer to hold flashings in place. Do not apply in seam areas.
- C. TPO Coated Metal: as detailed in the plans other wise use specified colored finished metal as detailed.
- D. Sealant: Provide to serve as water cut-off mastic, pitch-box sealer, and to caulk Ethylene Propylene membrane edge to metal. Provide cut edge sealant where required.
- E. Primer: For preparing contaminated membrane for hot-air welding.
- F. Seam Caulk: Shall be provided for the purpose of sealing any non encapsulated edge of reinforced membrane.
- G. Overnight Seal: As provided by Manufacturer. All seals must be maintained every night.
- H. Sealants: Sealants not a part of the Roofing System shall be compatible with Ethylene Propylene materials and applied according to manufacturer's instructions. Acceptable sealants are one part polysulfide and one part urethane.
- I. Mechanical Fasteners: Manufacturer provided fasteners designed for use on Project roof deck. Where installation incorporates insulation within the system, provide fasteners with anti-blackout devices
- J. Polyurethane Insulation Foam Adhesive: One part or two part as recommended by the Manufacturer to adhere insulation in place and applied to meet wind uplift requirements.
- K. Foam Backer Rod: Provide acceptable foam backer rod materials for expansion joints.
- L. Nailers: No. 2 or better, pressure preservative treated lumber using specified preservatives.

- M. Seam Cleaner: Use a surface cleaner at dirty or contaminated membrane prior to heat weld.
- N. Termination Bar: As provided by manufacturer fastened 6" O.C.
- O. Pipe Boots & Corners: Provide 0.055 inches unsupported TPO flashing at 1" to 6" diameter pipes and at inside and outside corners.
- P. Edge Metal Systems: As specified in Section 07620 – Sheet Metal Flashing and Trim and/or as detailed in plans.
- Q. Counterflashings: As specified in Section 0760 – Sheet Metal Flashing and Trim and/or as detailed in plans.
- R. Where plastic drain strainers exist replace with new cast Iron baskets
- S. Clean drains and pipes to insure that blockage doesn't exist.
- T. Walk Pad: Provide heavy embossed tread pad by TPO manufacture

2.05 ROOF INSULATION PRODUCTS

A. Polyisocyanurate Insulation

- 1. Description: Roof insulation consisting of closed cell polyisocyanurate foam core and a perforated black glass reinforced mat laminated to the face. Nominal Size is 48"x 48" or 48"x 96"
 - a. Reference Standards:
 - (1). FS HH-I-1972/Gen.
 - (2). FS HH-I-1973/3.
 - (3). ASTM C 209 - Water Absorption.
 - (4). ASTM E 96-Water Vapor Transmission of Materials.
 - (5). ASTM D 1621 - Compressive Strength.
 - (6). ASTM D 1622 – Density.
 - (7). ASTM D 2126 - Dimensional Stability.
 - (8). ASTM E 84 - Flame Spread.

B. Cover Board

- 1. Cover board shall be either of the following as required and approved by

membrane manufacturer for total system warranty and roof system code requirements, see drawings.

- a. DensDeck Prime, or equal
- b. High Density Polyisocyanurate

C. Insulation Attachment

1. Mechanical Fasteners:

- a. Heavy duty threaded fastener with 3-coat waterborne fluorocarbon polymer coating and drill point tip capable of penetrating 20 gauge steel. Fastener shall meet minimum thread size of .260" and a 13 threads per inch. Length shall be sufficient to penetrate deck a minimum of 3/4" for steel and 1" for wood and concrete. Structural concrete decks must be pre-drilled with a 7/32" carbide drill bit to a depth 1/2" deeper than the fastener engagement.
- b. Reference Standard: SAE 1022, Heat Treated.
- c. Product/Producer: Heavy Duty (HD) fasteners.
- d. Provide fasteners sufficient to produce FM I-75 uplift resistance attachment to deck.

2. Insulation Foam Adhesive: One part or two part Polyurethane foam adhesive as recommended by the manufacturer to attach insulation to the deck so as to meet FM 1-75 attachment to the deck requirements.

D. Job Requirements:

1. Insulation on all new areas over heated space unless otherwise indicated in drawings:
 - b. Polyisocyanurate tapered Insulation with average R=30 where indicated in drawings: 1/4" per Ft minimum or as indicated in drawings
 - c. Polyisocyanurate Crickets: Installed crickets must provide at least a 1/4" per foot reverse slope. Crickets drawn on drawings are shown for intent only. All crickets should be installed at a minimum 3 to 1

length to width ration and increased as necessary to provide positive drainage.

- a. Cover board: ¼” DensDeck.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Install membrane and accessories in accordance with plans, specifications and manufacturer's requirements following the most stringent requirement of the three.
- B. Do not expose the building and materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day
- C. Protect building surfaces against damage from roofing work.

3.02 DECK EXAMINATION AND PREPARATION

- A. Inspect roof decks for deficiencies and report to the Design Professional immediately any deficiencies. Do not proceed with installation of roof, until all deficiencies have been corrected. Start of roofing shall constitute acceptance of deck.
 1. Verify that deck is supported, secured and free of depressions.
 2. Verify that metal deck surfaces are dry and free of snow or ice.
 3. Verify that roof openings, curbs, pipes, sleeves, ducts & vents through roof are solidly set and wood nailers are in place
 4. On roofs to be recovered, remove and replace any wet roofing and insulation, and remove base flashings, penetration flashings, gravel surfacing, blisters and ridges.
 5. On roofs to be replaced, remove all roofing to the deck. Clean deck of all debris.

3.03 PHASED CONSTRUCTION & COMPLETION REQUIREMENTS

- A. Phased construction will not be permitted on this project.
- B. Once roofing operations are started, the roofing application, including all associated metal work, must be continuous and finalized with all punch lists completed in the number of work days calculated as follows:
700 SF/Day Completion Rate based on a 5 day 40 hour work week, or
875 SF/Day Completion Rate based on a 4 day 40 hour work week.
- C. The contractor will be responsible for additional fees for additional inspection time resulting from the contractor not completing the roofing installation in the allotted time period. The additional inspection fee is \$700.00 per day.

3.04 WOOD NAILER LOCATION AND INSTALLATION

- A. Install wood nailers at roof edges, metal flashings, gutters, and elsewhere as shown on Drawings and approved shop drawings or as required by system manufacturer Install wood nailers as follows:
 - 1. Position Wood Nailer: Wood nailers should be installed with a 1/8" gap between each length and each change of direction.
 - 2. Nailer Height: The nailer height must match the total thickness of insulation. Where tapered insulation is used, the wood nailer must be tapered so that it will always be flush at the point of contact with the insulation (refer to Details).
 - 3. Secure Wood Nailer: Fasten to structural roof and wall framing or deck with fastener heads countersunk with the surface of the nailer. Mechanically fasten wood nailers to resist 200 pounds force per linear foot of nailer in any direction. Nailers must be firmly fastened to the deck at 18 inches o c.
 - 4. Chemical Treating of Wood Nailer: Chemical treating for fire resistance or other purposes (other than pressure treating for rot resistance) may affect the performance of the TPO Membrane and accessories. Consult Manufacturer's Technical Services Department regarding compatibility.
 - 5. Treated Wood Fasteners: All fasteners used in wood that has been pressure treated with preservatives must be hot dipped galvanized coated, stainless steel or approved in writing by the fastener manufacturer for use

in treated wood.

3.05 INSULATION INSTALLATION

- A. Install Insulation: 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. Fit Insulation: 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. Under no circumstances should the membrane be left unsupported over a space greater than 1/4". Tapered or feathered insulation should be installed around roof drains so as to provide proper slope for drainage.
- C. Crickets: Crickets on plans are shown for intent only. The contractor is responsible for installing the crickets with a sufficient length to width ratio to provide positive drainage to drains/scuppers. If the crickets are overlaid with a layer of insulation, a row of fasteners should be applied along the cricket valley line to insure the overlay conforms to the cricket configuration. If the crickets are installed on top of all insulation, a tapered edge strip sized from the cricket edge height down to 0" shall be installed.
- D. Insulation Attachment To Deck:
 - 1. Mechanically Attachment: Attach insulation using Fasteners and Insulation Plates. Refer to the Technical Information on FM 1-75 and manuals for attachment patterns and rates for specific insulation types and thickness. In a multi-layer insulation assembly, the type and thickness of the top layer of insulation determine fastening pattern. Insulation fasteners shall penetrate the top of the flutes and shall not extend into the building interior. Fastener length shall be sufficient to penetrate deck a minimum of 3/4" for steel and 1" for wood and concrete. Structural concrete decks must be pre-drilled with a 7/32" carbide drill bit to a depth 1/2" deeper than the fastener engagement. Roofing contractor is liable for replacing fasteners that extend beyond the bottom of the flutes.
 - 2. Polyurethane Adhesive Attachment: Apply Manufacturer's approved foam adhesive in accordance with the manufacturer's recommended quantities and patterns so as to meet FM 1-75 attachment to the deck requirements.

- E. Stagger Insulation Joints: All joints are to be staggered. When installing multiple layers of insulation, all joints between layers should be staggered.

3.06 MEMBRANE INSTALLATION

- A. The contractor shall be responsible for suitable substrate to accept Ethylene Propylene membrane.
- B. Installer of flexible sheet roofing system shall examine substrate and conditions under which roofing work is to be performed and shall notify the Architect and Owner immediately of unsatisfactory conditions. Do not proceed with roofing work until unsatisfactory conditions have been corrected in manner acceptable to installer and manufacturer.
- A. Place Membrane and Allow to relax: Place membrane panel over the substrate in its final position. Allow membrane to relax one half hour prior to any seaming or flashing. The TPO Adhered System must be installed so that the seams do not impede the flow of water.
- D. Fold the Membrane Back: After making sure the sheet is placed in its final position allowing for a minimum 1-1/2" seam, fold it back evenly onto itself so as to expose the underside. (Note: The sheet fold should lay smooth so as to minimize the formation of wrinkles during and after installation.)
- E. Remove Dust and Dirt: Sweep the mating surface of the membrane with a stiff broom to remove any dirt that may have accumulated.
- F. Apply the Bonding Adhesive:
 - 1. General Application: Apply TPO Bonding Adhesive at about the same time to both the exposed underside of the sheet and the substrate to which it will be adhered so as to allow approximately the same drying time. Apply bonding adhesive so to provide an even and uniform film thickness. Refer to Technical Information Sheets and container labels for specific application instruction.
 - 2. Apply Bonding Adhesive With A Roller: Apply TPO Bonding Adhesive with a roller at about the same time to both the exposed underside of the sheet and the substrate to which it will be adhered so as to allow approximately the same drying time. Roll the adhesive on to the mating surfaces, assuring a relatively even and uniform thickness. When applying

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bonding adhesive to surfaces lighter in color than the back of the membrane, apply adhesive to the light colored surface and shady surfaces before the dark membrane surface to aid in drying. Refer to Technical Information Sheets and container labels for specific application instruction.

3. Stop Bonding Adhesive Short of Splice Area: Care must be taken not to apply TPO Bonding Adhesive over an area that is to be later heat welded to another sheet or flashing. All bonding adhesives must be completely removed before heat welding.
 4. Apply Bonding Adhesive at Specified Coverage Rate: Refer to container label and the Technical Information Sheet for specific application requirements. Adhesive is to be applied at the approximate rate as specified in the Technical Information Sheet for the specific adhesive product.
 5. Test Bonding Adhesive for Readiness: Allow bonding adhesive to flash off until tacky. Touch the bonding adhesive surface in the thickest area with a clean, dry finger to be certain that the adhesive film is dry to the touch and there is no wet adhesive beneath the top adhesive film. If either motion exposes wet or stringy adhesive when the finger is lifted, then it is not ready for mating. Flash off time will vary depending on ambient air conditions. This is especially true for adhesive products.
- G. Bond the Membrane to the Substrate: Starting at the fold, roll the previously coated portion of the sheet into the coated substrate slowly and evenly so as to minimize wrinkles.
- H. Broom the Membrane: To ensure proper contact, compress the bonded half of the sheet to the substrate with a stiff push broom.
- I. Repeat Procedure to Complete the Sheet Installation: Fold the un-adhered half of the membrane sheet back onto itself, and repeat the procedure to complete the bonding of the sheet. Care should be taken at fold area to insure membrane is 100 % adhered.

NOTE: Orient TPO panels such that the exposed (cut) edges of the membrane are used as the bottom panel in splices whenever possible. If cut edges are exposed, they must be sealed with TPO Cut Edge Sealant or TPO General Purpose Sealant.

3.07 MEMBRANE WELDING

- A. Clean the Lap Splice Area: Using a clean white cotton rag dampened with (Splice Wash), thoroughly clean an area on both sheets at least 6 inches (15.24 cm) wide if seam area has become contaminated with dirt, debris, moisture, etc. Membrane left exposed for more than 12 hours must be cleaned prior to any welding activity.
- B. Hot Air Weld Lap Splices:
1. Horizontal field splices: All field splices on the horizontal surface (including flashing) should be completed using an automatic heat welder wherever possible that has been designed for hot air welding of thermoplastic membranes. (Refer to the welding equipment requirements in the Technical Information Sheets for minimum requirements. For specifics, consult the welder manufacturer's data sheets.)
 2. Vertical field splices: Hand held welders can only be used on vertical welds or where an automatic welder is not practical or cannot be used.
 3. Equipment and Test splice requirements: The air intake, temperature and speed of the machine must be adjusted to provide proper seam strength. An ample power supply must be provided to all heat welding equipment. A generator, which is dedicated to the heat welding equipment, must be used on all installations. Refer to the welding and generator equipment requirements in Technical Information Section of this manual, for minimum requirements. For specifics, consult the welder manufacturer's data sheets. When weather conditions vary, adjustments to the welding machine must be made. It is recommended that this be done using spare material before beginning the finished product sheet. In addition, there must be destructive tests performed daily and at the beginning and every time there is an interruption in the welding process (i.e. Power failure, welder shut down, job site conditions change and after lunch). There should be periodic checks (including at the start of each day) to verify good peel strength.
 4. Seam width requirements: Seams made with the automatic welder must be a minimum of 1-1/2" (38.1 mm) wide. Seams made with hand welders must be a minimum of 2" (50.8 mm) wide. Use silicone hand rollers to assure proper mating of surfaces as hand heat welding proceeds.
 5. Seam inspection: Probe all completed welds using a slotted screwdriver

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or dull cotter pin puller type tool to verify seam integrity daily. Do not probe welds until they have had time to cool. Any welds found to be insufficiently welded need to be repaired on a daily basis.

6. T-Joint Patches: T-joint patches must be installed at all intersections of field seams.
7. Cut Edge Sealing: All cut edges with scrim exposed must be sealed with TPO Cut Edge Sealant or TPO General Purpose Sealant.

NOTE: SOLVENT WELDING IS NOT ACCEPTABLE

3.08 MEMBRANE SECUREMENT (BASE TIE-IN) LOCATION AND INSTALLATION

- A. Provide Membrane Securement: Secure the membrane (base tie-in) at all locations where the membrane ends or goes through an angle change greater than 1" in 12" (i.e., roof edges, curbs, interior walls, etc.).
- B. Install TPO 2 3/8" Barbed Seam Plates as shown in Details:
 1. Mechanically fasten 2 3/8" Barbed Seam Plates with Fasteners in accordance with Details.
 2. Refer to the System Design Guide or Technical Information Sheets of this manual to determine the applicable fastener and the associated penetration requirements for the specific substrate conditions.

3.09 FLASHING - PENETRATIONS

- A. General:
 1. Remove all loose existing flashing (i.e., lead, bituminous materials, mastic, etc.).
 2. Flash all penetrations passing through the membrane.
 3. The flashing seal must be made directly to the penetration.

B. Pipes, Round Supports, etc.:

1. Flash pipes with TPO Pre-Molded Pipe Flashing welded to membrane where their installation is practical. Peel and stick flashings are not permitted.

C. Roof Drains: These specifications apply for installation of cast iron drains only. For all other drain types contact Technical Services Department.

1. Remove all existing flashing (including lead flashing), roofing materials and cement from the existing drain in preparation for membrane and Water Block Seal.
2. Provide a clean even finish on the mating surfaces between the clamping ring and the drain bowl.
3. Install tapered insulation with suitable bonding surfaces around the drain to provide a smooth transition from the roof surface to the drain. Slope into drain can not be greater than 1" in 12".
4. Position the membrane, then cut a hole for the roof drain to allow a 1/2" minimum and 3/4" maximum inside the clamping ring.
5. Make round holes in the membrane to align with clamping bolts (a paper punch may be used). Do not cut the membrane back to the bolt holes.
6. Place Water Block Seal on the clamping ring seat flange below the membrane (use a minimum of one half of a 10-oz. tube for a 10" drain).
7. Install the roof drain clamping ring and clamping bolts. Tighten the clamping bolts to achieve constant compression. Install new Cast Iron basket

3.10 FLASHING - WALLS, PARAPETS, MECHANICAL EQUIPMENT CURBS, SKYLIGHTS, ETC.

- A. General: Using the largest pieces of continuous TPO Membrane practical, flash all walls, parapets, curbs, etc., to the height as specified by the project designer. Where applicable, TPO Coated Metal may be utilized.
- B. Existing Flashing: All loose existing flashing must be removed.

- C. Attach flashing to the wall surface first: Apply TPO Bonding Adhesive or Bonding Adhesive at about the same time to both the membrane flashing and the surface to which it is being bonded so as to allow approximately the same drying time. Apply TPO Bonding Adhesive by rolling the adhesive on to the mating surfaces evenly, avoiding globs or puddles.
- D. Apply TPO Bonding Adhesive at Specified Coverage Rate: Apply TPO Bonding Adhesive at the approximate rate as specified in the Technical Information Sheets of this manual for the specific adhesive product. Note: Coverage rate will differ with various substrates and/or climatic conditions.
- E. Roll Membrane Flashing up the Vertical: Roll the flashing into the adhesive evenly and carefully so as to minimize wrinkles.
- F. Broom the Membrane Flashing: To ensure proper contact, compress the flashing to the substrate with a stiff push broom.
- G. Complete splice to roof membrane: Complete the splice between membrane flashing and the main roof sheet by hot air welding. Provide lap splices in accordance with details.
- H. Provide Termination:
 - 1. Provide termination directly to the vertical substrate as shown in Details.
 - 2. Where metal counterflashings are to be installed over top of flashing, apply water block mastic behind top of membrane flashing, terminate top of flashing with termination bar fastened 6" or 8" O.C. (depending on how termination bar is pre-punched) and apply recommended caulking above top of termination bar tooled to facilitate water runoff.

3.11 PROTECTION

- A. Protect building surfaces against damage from roofing work.
- B. Where traffic must continue over finished roof membrane, protect surfaces.

3.12 TEMPORARY CLOSURE

- A. Temporary closures to ensure that moisture does not damage any completed section of the new roofing system are the responsibility of the roofing contractor.

Completion of flashing, terminations, and temporary closures should be completed as required to provide a watertight condition. Any material contaminated by a temporary closure must be cut out and discarded prior to resumption of installation.

3.13 ROOF WALKWAYS

- A. Install walkways from roof hatch to new HVAC units. Walkways may consist of 30"wide TPO Walkway material. Heat weld the edges of the walkway material to the TPO Membrane using the welding procedures stated in Section 2.08. Discontinue at joints in roof membrane.

3.14 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. In areas where finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- D. Remove excess materials, trash, debris, equipment, and parts from the Work.
- E. Repair or replace defaced or disfigured finishes caused by work of this Section.

END OF SECTION 07542

1. GENERAL

1.1 Scope:

The extent of metal roofing patches and flashing work shall be as herein specified and as indicated on the drawings. Furnish and install all roofing and flashing complete with all necessary accessories.

1.2 Submit manufacturer's brochure and color samples for Architect's review, color selection, and approval. Submit shop drawings for new roofing curbs for review and approval prior to fabrication.

1.3 Quality Assurance:

A. Applicator's Qualifications:

Applicator shall have installed, for a minimum of three (3) years, roofing similar to that specified herein.

1.4 Protection:

Protect products and accessories against scratches and damage. Inside dry storage is required to prevent condensate from forming between sheets and components. Do not permit material storage or excessive traffic on completed roof surfaces. Products excessively scratched or damaged in the field shall be replaced without further cost to the Owner.

2. MATERIALS

2.1 Sheet Metal:

ASTM A526, minimum 26 gauge, with minimum 1.25 ounce per square foot galvanized coating (380g/sm.), to be finished with Kynar 500 coating; color to match panels. all paint shall be applied per manufacturer's instructions.

2.2 Roofing panels for Patching and Replacement:

MBCI 26 ga. "PBR" panels, with Signature 200 white paint (to match existing).

2.3 Liquid Applied Roofing Seals: GAF TopCoat at all laps, screw heads and penetrations

- A. TopCoat flashing grade base coat
- B. TopCoat Topester Reinforcing Fabric
- C. TopCoat membrane base coat
- D. TopCoat Fastener Grade Sealant

2.4 Pre-Fabricated Roof Curbs and Equipment Supports:

- A. Fabricate curbs of structural quality aluminum or galvalume sheet, with mitered and welded corner joints, factory primed and prepared for painting. Provide integral base plates and water diverters/crickets. Front base plate must be a

minimum of 15 inches from beginning to cricket to the end of the base plate. Curbs shall be designed to install under metal roof system on the high side and over metal roof system on the low side.

B. Approved roof curb manufacturers:

1. LM Curb, Longview, TX 800-284-1412
2. Mallory Metal Products: Santa Teresa, NM 800-388-1031
3. Metalic Products, Houston, TX 800-356-7746

C. Refer to project drawings and on site measurements for correct curb height.

D. Curbs shall be constructed to match the slope of the roof and provide a level top surface for mounting equipment.

E. Curb flanges must be constructed to match the configuration of the metal roof panels.

F. Coordinate the size of the curbs with the mech. equipment prior to fabrication.

G. Prefabricated Roof jacks by **ITW Buildex Retrofit Dektite**: Through the roof pipe flashings shall be a one piece EPDM molded rubber boot with flanged base ring.

3. EXECUTION

3.1 Preparation:

- A. Remove all roof elements scheduled for replacement or removal.
- C. Thoroughly clean the existing roof.

3.2 Roof Cuts:

- A. Cut out existing roof and structural steel deck for new penetrations.

3.3 Seal all Roofing Seams with GAF TopCoat flashing grade, and Matt tape (GAF Topester reinforcing tape).

3.4 Install Roofing and Flashing in accordance with manufacturer's recommendations.

END OF SECTION 07620

1. GENERAL
 - 1.1 Scope:

Furnish and install roof scuttle complete with all necessary accessories.
 - 1.2 Submittals:

Submit manufacturer's product data, indicating flashing detail, for approval by Architect.
 - 1.3 Guarantee:

Provide manufacturer's guarantee of proper operation and freedom from defects in materials and workmanship for a period of five (5) years.
2. PRODUCTS
 - 2.1 Roof Scuttle:

"Bilco" Type GS, Size 2'-6" x 3'-0". Cover shall be GS-50 aluminum with clear acrylic plastic dome and three inch (3") beaded flange, neatly welded. One inch (1") rigid glass fiber insulation in curbs, fully covered by aluminum liner. Curb shall be twelve inches (12") in height, and of aluminum. It shall be formed with a three and a half inch (3-1/2") flange with holes provided for securing to the roof deck and equipped with integral metal cap flashing fully welded at corners for weather tightness. Scuttle shall be assembled with heavy pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with twin handles and padlock hasps inside and thermoplastic rubber gasket. Cover shall be equipped with automatic hold-open arm, complete with red vinyl grip handle and permit one-hand control of the cover to its closed and latched position.
 - 2.2 Hatch Rail System:

Bil-Guard Hatch Rail System: Posts and rails are pultruded from a fire retardant, fiberglass reinforced polymer (FRP). Mounting brackets are fabricated from 1/4" thick hot dip galvanized steel. Gate hinges and post guides are 6063-T5 aluminum and the torsion rod is type 302 stainless steel.

 - A. Hatch Rail System must satisfy the requirements of OSHA 29 CFR 1910.23 and meet OSHA strength requirements with a safety factor of 2.
 - B. Provide a 25 year warranty against defects in material and workmanship.
 - 2.3 LADDER SAFETY POST

- A. Furnish and install where indicated on plans ladder safety post Model LU-1. The ladder safety post shall be pre-assembled from the manufacturer.
 - B. Performance characteristics:
 - 1. Tubular post shall lock automatically when fully extended.
 - 2. Safety post shall have controlled upward and downward movement.
 - 3. Release lever shall disengage the post to allow it to be returned to its lowered position.
 - 4. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
 - C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
 - D. Material of construction: Shall be steel Model LU-1.
 - E. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post. [For installation in highly corrosive atmospheres, Model LU-3 incorporates a special alloy spring mechanism].
 - F. Hardware: All mounting hardware shall be Type 316 stainless steel.
 - G. Finishes: Factory finish shall be
3. EXECUTION
- 3.1 Install roof scuttle, ladder safety post and hatch rail system in strict accordance with manufacturer's recommendations.

END OF SECTION 07725

1. GENERAL

1.1 Scope: Sealants and joint filler.

2. PRODUCTS

2.1 Materials:

- A. Sealant for exterior use: 2 component urethane, Sonneborne Sonolastic polysulfide sealant or Temco Dymeric 240.
- B. Sealant for interior use: 1 component acrylic latex, Sonneborne Sonolac sealant or Tremco Acrylic Latex Tremflex 834.
- C. Acoustical Sealant: USG Acoustical Sealant or Tremco Acoustical Sealant.
- D. Joint Filler: Preformed compressible, resilient, non-waxing, non-extruding, non-staining strips of polyethylene foam. Sonofoam closed cell polyethylene backer rod.
- E. Sill Sealer: 3/8" closed cell polyethylene foam with self adhesive waterproofing membrane that conforms and seals off the voids and irregularities between the top of the foundation and sill plate.
 - 1. Protecto Premium Energy Sill Sealer (303.777.3001) or equal.
- F. Low Expansion Polyurethane Foam (LEPF): UL Classified, one-component polyurethane foam designed specifically for window and door installation applications. Applied in bead form it shall cure to a semi-rigid *closed cell* foam upon reaction to moisture such as ambient humidity.
 - 1. Tremco "TremGlaze" Low Expansion Polyurethane Foam or equal.
 - 2. Tremco "TremGlaze" Polyurethane Cleaner for cleaning the fresh foam over-spray and dispensing gun.

3. EXECUTION

3.1 Preparation:

- A. Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
- B. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

3.2 Application:

- A. Do not apply when temperature is under 50 degrees F or over 100 degrees F.
- B. Mask sensitive adjacent surfaces and apply sealant with handgun or pressure equipment.
- C. Tool joints to provide smooth, even surface and concave joint.
- D. Clean adjacent non-porous surface before sealant cures, and remove masking tape immediately after tooling.

3.3 Acoustical Sealants: Provide continuous beads of sealant to walls as indicated on the wall section details in the drawings, and set all interior wall electrical boxes in a full bed of sealant to cover any openings.

END OF SECTION 07920

1. GENERAL

1.1 Scope:

The extent of steel doors and frames is shown and scheduled on the Drawings.

1.2 Reference Standards:

Underwriters' Laboratories (UL) as applicable to fire-rated steel doors and frames.
American National Standards Institute (ANSI) 151.1 Performance testing.

1.3 Submittals:

Submit shop drawings for review, indicating location for each door and frame, elevation of each type, details of construction, method of assembly, location and extent of hardware reinforcement, description of materials used and methods of finishing.

2. MATERIALS

2.1 Quality Standards

ANSI-A115 on door and frame preparation. Steel Door Institute (SDI) 100-116 recommended specifications for steel doors and frames.

2.2 Acceptable Manufacturers:

Steelcraft, Fenestra, Steeltech, Curries, Elco, Willco and Southwestern

2.3 Steel:

ASTM A366-72 cold-rolled, commercial quality carbon sheet steel

2.4 Primer:

Rust inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified paint finish.

2.5 Core Filler Material:

Manufacturer's standard honeycomb.

2.6 Vision Panels:

One-quarter inch safety glass (or tempered: see Door Schedule), metal stops and frames.

2.7 Minimum Gauges:

A. Door Framing:

1. Openings up to and including 24 square feet, 16 gauge.

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2. Openings over 24 square feet, 14 gauge.

- B. Adjustable anchors, slides, fasteners, accessories, floor knees, 14 gauge.
- C. Interior Channel spreader, Type T anchor, 16 gauge.
- D. Interior flush door, 18 gauge.
- E. Exterior flush door, 16 gauge.
- F. Interior hardware reinforcements, 12 gauge.
(butts, checks, pulls, overhead door holders
locks, latches)
- G. Exterior hardware reinforcement — 5/16 inch thick

2.8 Frames:

- A. Fabricate frames with neat arc welded reinforced miters. Reinforce frames according to ANSI standards. Do not use filler plates to convert oversize openings to the specified hardware. On frames with closers, reinforce head for closer and prepare hinges for high frequency use with extra 10 gauge reinforcement. Grind smooth all exposed welds.
- B. Prior to shipment, install temporary spreader at bottom of frame. Do not remove spreader until frames are secured in place.
- C. Door Silencers:
Except in weatherstripped frames, drill stops to receive two (2) silencers on strike jambs of single-swing frames and two (2) silencers on heads of double-swing frames.
- D. Plaster Guards:
Provide 26 gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.
- E. Fire-Rated Frames:
Fabricate in accordance with NFPA 80. Place UL/labels on frames visible from installed position.

2.9 Doors:

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- A. Doors shall be flush 1-3/4 inch steel doors with face sheets of cold-rolled, leveled sheet steel. Both faces of the door shall have smooth, seamless and unbroken surfaces, with top and bottom edges closed flush to the door face sheets. No inverted channels.
- B. Lock and hinge edges shall be formed by full overlap of each face sheet around the perimeter vertical channels of a unitized grid structure, meeting at the centerline of each.
- C. All structural components shall be manufactured of steel, utilized maximum strength welding design and techniques throughout.
- D. All doors shall be mortised and reinforced for hinges and locks to allow field application. Hinge reinforcement for doors shall be eight gauge steel, die-formed to provide screw thread depth equivalent to No. 10 U.S. Steel gauge. Do not use filler plates to convert oversize openings to the specified hardware.

2.10 Glazing:

- A. Use manufacturers' standard screw-on type glazing bead attached with screws countersunk flush.
- B. For interior glazing, utilize manufacturers' standard extruded elastomeric "dry" type sealant bead both sides of glass.

2.11 Finish:

- A. Frames:
After fabrication is completed and metal cleaned, bonderize entire units. Follow with a heavy coat of zinc chromate rust inhibitive paint, baked on.
- B. Doors:
Before doors are assembled, bonderize metal and give surfaces a coat of manufacturer's standard primer. After doors are fully assembled, apply one heavy coat of rust inhibitive paint on exposed surfaces, baked on.

2.12 Anchors:

Provide minimum three jamb anchors for each side of frames. Provide floor anchorage in every case and floor jamb anchors each side.

- A. Existing wall anchors: Provide flush bolt heads, grind smooth and patch with "bondo" before painting.

3. EXECUTION

- 3.1 Install metal frames plumb and square, in correct locations indicated and with a maximum diagonal distortion of 1/16 inch (2mm). Ensure frames are securely and rigidly anchored to adjacent construction.
- 3.2 Install borrowed light frames with stops anchored with countersunk screws. Coordinate the installation of glass and glazing and glass block masonry.
- 3.3 Install steel doors plumb and square, and with a maximum diagonal distortion of 1/16 inch (2mm). Install hardware in accordance with requirements of Section 08710. Allow a 3/8 inch door clearance at door bottom.
- 3.4 Fill all steel door frames with grout, unless otherwise specified.

END OF SECTION 08100

1. GENERAL

1.1 Scope:

Furnish and install wood doors complete with all necessary accessories.

1.2 Submittals:

Submit shop drawings and catalog cuts prior to ordering. Include location of each door, elevation of each type, and details of construction.

1.3 Quality Assurance:

The "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute apply and by reference are hereby made part of this Section.

A. Fire-Rated Wood Doors:

Provide wood doors with fire resistance ratings labeled and listed by a testing organization acceptable to Building Code Officials.

1.4 Approved Manufacturer: Weyerhaeuser (800)869-3667.

2. PRODUCTS

2.1 Doors

A. Solid-Core Flush Doors:

Meeting the requirements of AWI "Premium" grade for flush solid core doors, maximum allowable twist or warp of 1/4 inch, core of particleboard which complies with ANSI A208.1LD2, with two-ply 1-1/2" laminated stiles.

1. Laminate faced: high pressure laminate.

a. Submit standard color palette for selection on this project.

2. Bevel strike edge 1/8 inch in 2 inches.

B. Fire Label Doors:

Fire retardant doors shall be Factory Mutual or Underwriters' Laboratory approved fire doors constructed in strict accordance with specifications approved by Underwriters' Laboratories. Doors shall meet the label construction indicated on the Drawings and have the proper label attached. Provide metal frames for view panels in labeled doors as required.

3. EXECUTION

3.1 Handling:

Deliver doors free from visible markings or scratches on surfaces to be exposed. Store in a clean, dry, well-ventilated space, stacked flat and level with ventilation spaces of sufficient number to avoid warping doors.

3.2 Installation of Doors:

Install doors only after completion of all other work which would raise the moisture content of the doors or damage the surface of the doors. Bevel the lock edge at the rate of 1/8 inch in 2 inches. Provide the minimum clearance necessary for smooth operation of the door, not to exceed 1/4 inch at top and sides, and 1/2 inch at bottom. Machine, or otherwise prepare doors for hardware as specified in Section 08710 - "Finish Hardware." Obtain all templates necessary prior to any machining. Seal cuts made on the job as soon as possible to avoid swelling from moisture. Finish doors absolutely as soon as practicable.

3.3 Warranty:

Provide a full warranty on all doors for the life of the installation equal to the Weyerhaeuser Full Warranty by the Door Manufacturer.

END OF SECTION 08200

1. GENERAL

1.1 Scope:

Furnish and install TUBULAR SKYLIGHTS with all necessary accessories for a complete installation.

1.2 Submittals:

Submit shop drawings, catalog cuts and manufacturer's data indicating location of each TUBULAR SKYLIGHT, sizes, details of construction and installation, and finish. Field verify all existing roof penetrations and include flashing details on the shop drawings.

1.3 Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. ASD. Tel: (760) 597-4425. Fax: (760) 597-4488. Email: info@solatube.com. www.solatube.com.

A. Requests for substitutions will be considered in accordance with provisions of the Project Manual.

1.4 WARRANTY

Skylights: Manufacturer's standard warranty for 10 years.

2. PRODUCTS

.1 MANUFACTURERS

A. Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. ASD. Tel: (760) 597-4425. Fax: (760) 597-4488. Email: info@solatube.com. www.solatube.com.

B. Requests for substitutions will be considered in accordance with provisions of PROJECT MANUAL.

.2 TUBULAR SKYLIGHTS

A. Tubular Skylights General : Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.

B. Solatube SolaMaster Series 21-inch (533 mm) diameter tubes: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1. Roof Dome Assembly:

Glazing: 0.143 inch (3.7 mm) minimum thickness injection molded acrylic classified as CC2 material and meeting characteristics of Duradome DR-101 blend.

2. Low-Angled Sun Reflector: LITD(r) light intercepting transfer device, made

- of same material as main tube, to capture low angle sunlight.
3. Roof Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
 - a. Base Style: Self mounted, 11 inches (279 mm) high.
 4. Dome Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
 5. Dome Seal: Polypropylene Fiber Pile weather - strip 0.27 inch (6.85mm) by 0.27 inch (6.85mm).
 6. Reflective Tube: Aluminum sheet, thickness 0.015 inch (0.4 mm).
 - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface; specular reflectance 99 percent for visible spectrum, less than 93 percent for total solar spectrum at 1.5 degree field angle.
 - b. Color: a^* and b^* (defined by CIE $L^*a^*b^*$ color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
 - c. Tube Diameter: Approximately 21 inches (533 mm).
 7. Diffuser Assemblies for Tubes Penetrating Ceilings: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration; 23.8 by 23.8 inches (605 by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.
 - a. Round to square transition box made of opaque polymeric material, classified as CC2, 0.060 inch (1.5 mm) thick.
 - b. Lens: OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame. Visible Light Transmission shall be \geq 90 percent at 0.125 inches (3 mm) thick.
 - c. Seal: Closed cell foam, 3 pounds per cubic foot (48 kg per cubic meter).
 8. Catalog Number: S21C-DD-F11-L1-

2.2 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

3. EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

.2 PREPARATION

- A. 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.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08625

1. GENERAL

1.1 Scope:

Furnish and install aluminum framing system and glazing with all necessary accessories for a complete installation.

1.2 Submittals:

Submit shop drawings, catalog cuts, and manufacturer's data, including indication of profiles, sizes, glazing, reinforcing, anchorage, connections, welds, and types of fasteners. Submit to architect for review prior to fabrication.

1.3 Acceptable Manufacturer:

- A. Kawneer.
- B. Efco.
- C. Tubelite.
- D. Arcadia

2. MATERIALS

2.1 Exterior Aluminum Framing System:

Exterior wall framing shall be Kawneer 451 T (or Efco 403-S).

A. Air Infiltration:

ASTM E283. Not to exceed .06 CFM per square foot of fixed area.

B. Water Infiltration:

ASTM E331. No water penetration at a test pressure of 8 PSF.

C. Structural Restrictions:

Maximum deflection of 1/175 of span. Allowable stress with a safety factor of 1.65. The system shall perform to these requirements under a wind load of seventy (70) mph, basic wind speed (20 PSF).

D. Thermal Performance:

When tested in accordance with AAMA 1502.7-1981 and 1503.1-1980, the "U" value maximum equals .58, with a CRF minimum of 59.

E. Extrusions:

6063-T5 alloy and temper (ASTM B221 allow G.S. 10A-T5). Fasteners, where exposed, shall be aluminum, stainless steel, or zinc plated steel in accordance with ASTM A164. Perimeter anchors shall be aluminum or steel with proper isolation. Glazing gaskets shall be elastomeric extrusions.

- F. Finish:
An Architectural Class I Anodic Coating conforming with Aluminum Association Standard AA-M12C22A42/44. Clear anodized.
 - G. Glass for Exterior Windows:
Hermetically sealed double glazed units, Sigma #65-7-2. One inch (1") thick insulating glass (see Section 08800).
 - H. Break Metal:
Clear anodized Class I Coating, .060 inches minimum thickness, see plans for sizes.
- 2.2 Accessories
- A. Fasteners: Where exposed, shall be Stainless Steel.
 - B. Gaskets: Glazing gaskets shall be extruded EPDM rubber.
 - C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- 2.4 Related Materials
- A. Sealants: Refer to Joint Treatment (Sealants) Section.
 - B. Glass: Refer to Glass and Glazing Section.
- 2.5 Fabrication:
- A. All members shall have a nominal face dimension of 2" and overall depth of 4-1/2".
3. EXECUTION
- 3.1 Installation:
All framing shall be set level, square, plumb, and in alignment with other work. All joints to the building shall be sealed. All frame materials shall be fastened in place using backing, masonry plugs, or anchor straps as required. Make all necessary final adjustments to attain normal operation of each door and its hardware.
- 3.2 Protect work from damages during construction and clean for final completion.

END OF SECTION 08631

1. GENERAL

1.1 Scope:

Furnish and install all finish hardware, complete with all necessary accessories.

1.3 Submittals:

Submit a complete schedule of all hardware for each opening, including materials, finish, function, and manufacturer for each item prior to ordering. Submit keying schedule for approval.

1.4 Keying:

A. Keying Schedule:

1. Submit key schedule for approval with master and 2 sub-masters.

B. Key Cabinet: Yale "Director" wall hung cabinet. Mount in Warehouse office

2. MATERIALS: All materials are as described in the Hardware Schedule included here.

2.1 Acceptable Manufacturers:

A. Hinges: Bommer, Kawneer, Stanley

B. Locks: Schlage, Adams Rite

C. Exit Device: Von Duprin

D. Closers: Norton, L.C.N., Rixon-Firemark

E. Miscellaneous: Ives, Trimco

F. Weatherstrip: Pemko, National Guard.

2.2 Have hardware supplier submit all necessary templates to door fabricators for hardware preparation.

3. EXECUTION

3.1 Install hardware in accordance with the manufacturer's instructions.

3.2 Mount hardware at heights recommended by BHMA.

3.3 Protect hardware from damage during construction process.

SEE HARDWARE SCHEDULE ATTACHED

END OF SECTION 08710

HARDWARE SCHEDULE

MARY ESTHER GONZALES SENIOR CENTER ADDITION 2014-2015

GENERAL NOTES:

1. All hollow metal door frames for doors shall be equipped with insert type rubber silencers: three (3) per jamb, four (4) per head at double doors.
2. All hardware shall be US32D satin stainless steel (BHMA 630) finish.
3. Mount all door closers with thru-bolts.
4. Provide 2x blocking in frame walls for all door stops mounted on frame walls.

HW 1 (Door 1, 2)

1 continuous hinge: 652 HD	Stanley
1 Exit Device: CD-XP99-DT w/cylinder	Von Duprin
1 closer 4040H-CUSH x TB	LCN
1 set weatherstrip 319CN	Pemko
1 threshold 2005AT	Pemko
1 sweep C627A x DW	National Guard
1 door stop W1215 CKU	Trimco
1 door holder 1221-4	Trimco

HW 2 (Door 3, 4, 5, 7, 8)

3 hinges FBB179 4-1/2 x 4-1/2 NRP	Stanley
1 lockset ND70PD - TLR lever	Schlage
1 door stop W1215 CKU	Trimco

HW 3 (Door 6 double door)

6 hinges FBB179 4-1/2 x 4-1/2 NRP	Stanley
1 lockset ND70PD - TLR lever	Schlage
1 set flushbolts #3913	Trimco
2 dust proof strikes	Trimco
2 door stop W1215 CKU	Trimco
2 door holder 1221-4	Trimco

Note: see detail 8/A7 for required aluminum threshold ramp by PEMKO.

END OF HARDWARE SCHEDULE

1. GENERAL

- 1.1 Scope: Furnish and install all glazing complete with all necessary accessories.
- 1.2 Submittals: Provide manufacturer's data, applicable test reports, and cut sheets for all glazing materials proposed to be used.
- 1.3 Delivery, Storage & Handling: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage from condensation, temperature changes and direct exposure to sun or other causes.
- A. For insulating glass units that will be exposed to altitude changes, comply with manufacturer's recommendations for venting and sealing to avoid hermit seal ruptures.
- 1.4 Acceptable Manufacturer: PPG Industries 800-377-5267 or approved equal.

2. PRODUCTS

- 2.1 Glazing Types: Glazing types are defined below. See Drawings for locations of specific types and for thickness.
- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3.
- B. Tempered Glass: Clear float, heat tempered safety glazing conforming to Fed. Spec. DD-G-1403.B, Kind FT, Condition A, Horizontal (tongless) tempering. All lites must be permanently marked with manufacturer's type identification. Tempered glass shall be used if no type is called for on Drawings and safety glass is required by applicable codes. 1/4" thick unless otherwise required.
- C. Insulating Glass: Factory-assembled units certified by Insulating Glass Certification Council (or other authority approved by Architect) as meeting Class CBA of ASTM E 774. Units shall contain desiccants or dehydrating agents to reduce the units dew point to -60°F (-51°C) or less. 1" thickness, typical.
1. Interior sheet clear.
2. Exterior sheet Emerald Green color, low-reflective glass outdoor appearance: "Solarban" 70XL (2) "Atlantica".
- a. Visible Light Transmission: 48%
- b. Shading Coefficient: 0.26

- c. U-Value Winter: 0.28
 - d. U-Value Summer: 0.26
3. Provide Kind HS (heat strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of glass lites.
 4. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
 5. Sealing System: Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
 6. Spacer Material: Aluminum with clear anodic finish.
 7. Desiccant: Molecular sieve or silica gel, or blend of both.
- 2.2 Sealants and Primers: General Electric "Silglaze" Glazing System including tapes and primers.
- 2.3 Accessories: Clips, shims, spacers, setting blocks as necessary for a complete and weatherproof installation. Setting blocks 70 to 90 durometer (Shore "A").
- 2.4 Compression Wedges: Tremko Poly-Wej or approved equal.
3. EXECUTION
- 3.1 Storage and Handling: Deliver all materials to the site and store with manufacturer's labels intact. Handle and protect at all times to avoid stains, scratches, or other damage. Store glass vertically with space between sheets. Avoid standing insulating units in water. Protect all glass from exposure to alkaline or ferrous solutions before, during, and after construction. Take extreme care not to chip edges of tempered glass lites.
- 3.2 Expansion: Size all lites with allowance for expansion as recommended by the glazing manufacturer.
- 3.3 Visible Variations: Install glass with any visible lines or waves in the horizontal direction.
- 3.4 Installation:

- A. Items to be glazed must be free of projections and shall be prime-painted as recommended by the sealant manufacturer to assure sealant adhesion.
 - B. Follow sealant manufacturer's instructions using Silglaze Tape with cap bead of Silglaze Sealant on the exterior side whenever exterior glazing is practical, and using silglaze Tape with toe bead of Silglaze Sealant when interior glazing must be used. Tool sealant with light pressure to completely fill and seal against backup material and joint surfaces. Tool to a slight concave sloping toward center of glass slightly. Sealant line must be perfectly smooth and uniform without excess on adjacent surfaces or glass.
 - C. On interior side, use compression gasket or compression wedge along site line.
 - D. At exterior installations (or areas of high condensation) where wire glass is used, apply sealant to edge of glass prior to installation to prevent wire rusting.
 - E. Install insulating glass units in accordance with SIGMA 70-7-1, "Glazing Recommendations." All edges must float free with glazing system properly drained.
- .5 On completion of installation and just prior to Substantial Completion, clean all glazing as recommended by the manufacturer. Replace scratched, defective and/or broken glazing at no cost to the Owner until the date of Substantial Completion.

END OF SECTION 08800

(Parex® Fiber Reinforced Stucco with Enhanced Water Resistive Barrier and Krak-Shield)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Supply and Installation of Parex Armourwall 300 WaterMaster™ HE (High Efficiency) Stucco Assemblies

1.2 RELATED SECTIONS

- A. Section 06160 - Sheathing
- B. Section 07250 - Weather Barriers
- C. Section 07620 - Sheet Metal Flashing and Trim
- D. Section 07900 - Joint Protection
- E. Section 09250 - Gypsum Board Assemblies

1.3 REFERENCES

- A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
- B. ASTM C578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
- C. ASTM C847 - Standard Specification for Metal Lath
- D. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plaster
- E. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster
- F. ASTM C933 - Standard Specification for Welded Wire Lath
- G. ASTM C1032 - Standard Specification for Woven Wire Plaster Base
- H. ASTM C1063 - Standard Specification for Installation of Lathing and Furring for Portland Cement Based Plaster
- I. ASTM C1177 - Specification for Glass Mat Gypsum for Use as Sheathing
- J. ASTM C1278 - Specification for Fiber-Reinforced Gypsum Panel
- K. ASTM C1396 - Standard Specification for Gypsum Board
- L. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
- M. ASTM E119 - Method for Fire Tests of Building Construction and Materials
- N. ASTM E330 - Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static air Pressure Difference
- O. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
- P. ICC Acceptance Criteria 212 - Acceptance Criteria For Water-Resistive Coatings Used As Water-Resistive Barriers Over Exterior Sheathing
- Q. ICC Acceptance Criteria 219 - Acceptance Criteria for Exterior Insulation And Finish Systems

1.4 ASSEMBLY DESCRIPTION

- A. Parex Armourwall 300 WaterMaster HE Krak-Shield™ Stucco Assembly: Parex USA WeatherSeal (with sheathing tape joint reinforcement), Continuous Insulation, wire fabric or metal lath, Parex Fiber-47 Armourwall Scratch and Brown ¾ in (19 mm), Parex fiberglass reinforcing mesh embedded in Parex Stucco Level Coat, and either a Parex acrylic or elastomeric based finish coat.

1.5 SUBMITTALS

- A. General: Submit Samples, Water resistive barrier coating Evaluation Reports and manufacturers' product datasheets in accordance with Division 1 General Requirements Submittal Section.
- B. Samples: Submit samples for approval. Samples shall be of materials specified and of suitable size as required to accurately represent each color and texture used on project. Prepare each sample using same tools and techniques for actual project application. Maintain and make available, at job site, approved samples.
- C. Manufacturer's Warranty: Submit sample copies of Manufacturer's Warranty indicating Single Source Responsibility for Water Resistive Barrier coating, Stucco Base coat, finish coat and optional Primer, level coat and reinforcing mesh as specified.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Shall have marketed stucco assemblies in United States for at least five years and shall have completed projects of same general scope and complexity.
 - 2. Applicator: Shall be experienced and competent in installation of stucco materials, and shall provide evidence of a minimum of 5 years experience in work similar to that required by this section.
- B. Parex Armourwall 300 WaterMaster HE Stucco Functional Criteria:
 - 1. General: Stucco application shall be to vertical substrates or to substrates sloped for positive drainage. Substrates sloped for drainage shall have additional protection from weather exposure that might be harmful to coating performance.
 - 2. Performance Requirements of Water Resistive Barrier Coating

WeatherSeal Testing	Method	ICC and ASTM E2570 Criteria	Results
Accelerated Weathering	AC 212	25 Cycles followed by Hydrostatic Pressure Test: No water penetration on the plane of the exterior facing side of the substrate.	Pass: no water penetration
Air Infiltration	ASTM E2178	Calculated flow Rate at 75 Pa (1.57 lb/ft ² , 0.3 in H ₂ O) = < 0.02 L/m ² *s (< 0.004 cfm/ft ²)	< .00001 L/m ² *s (0.00001 cfm/ft ²) at 75 Pa (1.57 lb/ft ² , 0.3 in H ₂ O)
Air Leakage	ASTM E283	No Criteria	< 0.004 cfm/ft ²

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Elongation	ASTM D412	No Criteria	360%
Flexibility	ASTM D522	No Criteria	No Cracking at 1/8 in (3 mm)
Freeze-Thaw Resistance	ASTM E 2485	10 Cycles	Pass – No Deleterious Effects
Hydrostatic Pressure Test	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	Pass: no water penetration
Nail Sealability, Head of Water	ASTM D1970	No Criteria	Pass 5 inches of water
Racking	ASTM E72	Deflection at 1/8 in (3.2 mm)	Pass -No cracking at field, joints or flashing connection
Restrained Environmental	ICC ES AC 212 / ASTM E2570	5 Cycles of wetting and drying	Pass -No cracking at field, joints or flashing connection
Structural Loading	ASTM E1233 Procedure A	10 Cycles @ 80% design load	Pass -No cracking at field, joints or flashing connection
Surface Burning Characteristics	ASTM E84	Flame Spread <25 Smoke Developed <450	Flame Spread =0 Smoke Developed =0
Tensile Bond Strength	ASTM E 2134/ ASTM C 297	Minimum 15 psi (104 kPa)	Pass all listed substrates and flashing materials
Water Resistance	ASTM D 2247	14 Days	Pass – No Deleterious Effects.
Water Penetration	ASTM E331	2.86 psf (137 Pa) for 15 minutes	Pass 25.4 psf (1216 Pa) for 165 minutes
Water Penetration	ASTM E331	Tested after Structural Loading, Racking and Restrained Environmental Cycling at 2.86 psf (137 Pa) for 15 minutes	No Water Penetration
Water vapor transmission	ASTM E96 Procedure B	Vapor Permeable	12. perms
Weathering	ICC ES AC 212 / ASTM E2570	210 hours of UV Exposure, 25 cycles of accelerated weathering, 21.6 in (549 mm) water column for 5 hours	Pass
Wind Driven Rain	F.S. TT-C-555B	No Criteria	Pass
VOC	EPA Reference Test Method 24	US EPA, South Coast AQMD and Greenseal Standard	10 g/L

3. Performance Requirements of Coatings applied to Expanded polystyrene features: Must comply with ASTM E 2568 or ICC Acceptance Criteria AC 219 for EIFS.

C. Substrate Conditions:

1. Substrate materials and construction shall conform to the the building code having jurisdiction
2. Substrates shall be sound, dry and free of dust, dirt, laitance, efflorescence and other harmful contaminants.
3. Substrate Dimensional Tolerances: Flat with 1/4 in within any 4 ft radius.

- A. Maximum deflection of substrate system under positive or negative design loads shall not exceed $L/360$ of span.
- B. Expansion and Control Joints: Continuous expansion and control joints shall be installed at locations in accordance with ASTM C1063 and ASTM C926.
 - 1. Substrate movement, and expansion and contraction of Parex Armourwall 300 WaterMaster HE Stucco Assembly and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as specified by the designer or shown on the project drawings.
 - 2. In accordance with ASTM C1063, expansion or control joints shall be installed in walls not more than 144 ft² (13.4 m²) in area, and not more than 100 ft² (9.3 m²) in area for all non-vertical applications. The distance between joints shall not exceed 18 ft (5.5 m) in either direction or a length-to-width ratio of 2-½ to 1.
 - 3. For direct application to concrete or masonry, stucco joints are required only at control/expansion joints in the underlying concrete or masonry.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver Parex Armourwall 300 WaterMaster HE Stucco Assembly products in original packaging with manufacturer's identification.
- B. Storage: Store Parex Armourwall 300 WaterMaster HE Stucco Assembly products in a dry location, out of direct sunlight, off the ground, and protected from moisture.

1.8 SITE / ENVIRONMENTAL CONDITIONS

- A. Substrate Temperature: Do not apply Parex products to substrates whose temperature are below 40°F (4°C) or contain frost or ice.
- B. Inclement Weather: Do not apply Parex products during inclement weather, unless appropriate protection is employed.
- C. Sunlight Exposure: Avoid, when possible, installation of the Parex products in direct sunlight. Application of Parex Finishes in direct sunlight in hot weather may adversely affect aesthetics.
- D. Do not apply stucco base coats or finishes if ambient temperature falls below 40°F (4°C) within 24 hours of application. Protect stucco from uneven and excessive evaporation during dry weather and strong blasts of dry air.
- E. Prior to installation, the wall shall be inspected for surface contamination, or other conditions that may adversely affect the performance of the Parex® Armourwall 300 WaterMaster HE Stucco Assembly, and shall be free of residual moisture.

1.9 COORDINATION AND SCHEDULING:

- A. Coordination: Coordinate Parex Armourwall 300 WaterMaster HE Stucco Assembly installation with other construction operations.

1.10 WARRANTY

- A. Warranty: Upon request, at completion of installation, provide Parex Standard Limited Stucco Warranty

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Parex by Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807
- B. Components: Obtain components manufactured by Parex USA of Parex Armourwall 300 WaterMaster HE Stucco Assembly from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from Parex USA for this project.

2.2 MATERIALS

- A. Parex Armourwall 300 Stucco Base
1. Parex Fiber-47 Armourwall™: Fiber-reinforced factory blended portland cement, hydrated lime and proprietary ingredients, cement scratch and brown coat conforming to ASTM C926.
- B. Parex 290 Adacryl Admix & Bonding Agent: 100% acrylic emulsion additive for portland cement based products, to enhance curing, adhesion, freeze-thaw resistance and workability and as an acrylic polymer bonding agent.
- C. Parex Leveling and Reinforcing Coat (Required for Parex Armourwall 300 WaterMaster Krak-Shield HE Stucco Assembly):
1. Parex Stucco Level Coat™: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
 2. 121 Base Coat: 100% acrylic polymer base, requiring the addition of portland cement.
 3. 121 Dry Base Coat: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
 4. Parex USA Reinforcing Meshes:
 - a. 355 Standard Mesh: Weight 4.5 oz. per sq. yd (153 g/m²) reinforcing mesh.
 - b. 358.10 Intermediate Mesh: Weight 12 oz per sq. yd. (407 g/m²) reinforcing mesh.
- D. Parex Primers:
1. 310 Primer: 100% acrylic based coating to prepare surfaces for Parex finishes.

2. 313 Sanded Primer: 100% acrylic based coating to prepare surface for Parex finishes.

EDITOR NOTE: MODIFY BELOW TO SUIT REQUIREMENTS. CHOOSE ONE FINISH TYPE CHOOSE PAREX OPTIMUM OR E-LASTIC FINISH FOR DIFFERENT LEVELS OF ENHANCED WARRANTY.

A. Parex Finish:

1. Parex DPR Optimum Finish™: Factory blended, 100% acrylic polymer based finish, integrally colored.
 - a. Finish texture and color as selected by Project Architect. Unless otherwise noted, match existing building texture and color.
 - i. Provide on site sample mock up of material for approval.

2.2 RELATED MATERIALS AND ACCESSORIES

A. General: Parex Armourwall 300 WaterMaster and its related materials shall conform to ASTM C926, this specification and Parex Product Data Sheets.

B. Substrate Materials:

1. Gypsum Sheathing: Minimum ½ in (13 mm) thick, core-treated, weather-resistant, exterior gypsum sheathing complying with ASTM C79 or ASTM C1177.
2. Cement Board Sheathing, Minimum ½ in (13 mm) thick, conforming to ASTM C1186.
3. Fiberboard: Minimum ½ in (13 mm) thick fiberboard complying with ANSI/AHA A194.1 as a regular density sheathing.
4. Plywood: Minimum 5/16 in (8 mm) thick exterior grade or Exposure I plywood for studs spaced 16 in (406 mm) o.c. and 3/8 in (9.5 mm) thick exterior type plywood minimum for studs spaced 24 in (610 mm) o.c. Plywood shall comply be exterior grade or Exposure 1 and comply with DOC PS-1
5. Oriented Strand Board (OSB): 7/16 - ½ in 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. The system is qualified for application to OSB (oriented strand board) sheathing only in areas shown in the Parex "Acceptable Substrates and Areas of Use" Technical Bulletin.
6. Concrete Masonry Construction: Painted (coated) and non-painted (uncoated). Shall be in conformance with the building code.
7. Other Approved by Parex USA in writing prior to the project.
8. Water-Resistive Barrier:
 - a. Parex USA WeatherSeal™ Spray & Roll-on water resistive barrier coating. Two coats are required on plywood and OSB

- b. Parex USA WeatherSeal™ Trowel-On water resistive barrier coating. Two coats may be required on plywood and OSB
- c. Parex USA 396 Sheathing Tape: Non-woven synthetic fiber tape to reinforce WeatherSeal water-resistive barrier at sheathing board joints, into rough openings and other terminations into dissimilar materials available in 4 in, 6 in and 9 in widths

C. Optional Drainage

1. Parex USA WeatherSeal covered by Dupont Tyvek Stuccowrap, DrainWrap, CommericalWrap D, or other water resistive barrier incorporating in itself a means of drainage and maintaining a current ICC Evaluation Report covered by Flat Insulation board.

D. Continuous Insulation

2. Polyisocyanurate Foam plastic complying with ASTM C1289 as Type II board with a nominal density of 2 pcf (32 kg/m³), thickness 1 in to 1½ inches.

EDITOR NOTE: THE SELECTION OF AN APPROPRIATE TYPE OF MATERIAL FOR ACCESSORIES SHALL BE DETERMINED BY APPLICABLE SURROUNDING CLIMATIC AND ENVIRONMENTAL CONDITIONS SPECIFIC TO THE PROJECT LOCATION, SUCH AS SALT AIR, INDUSTRIAL POLLUTION, HIGH MOISTURE, OR HUMIDITY.

E. Lath and Accessories: Conform to ASTM C847, ASTM C933, ASTM C1032, ASTM C1063 and Appendix. Metal Accessories: Manufacturer's standard steel products unless otherwise indicated as Zinc Alloy.

1. Exterior components: Minimum of a 17 gauge self-furred stucco netting over all surfaces to receive base and finish coat system.
2. Corner beads: J-Metal or Stucco stop, general purpose type with expanded or perforated flanges.
3. Cornerite: Manufacturer's standard performed interior corner reinforcement made from 2.5 lbs./square yard of diamond mesh lath.
4. Edged Casing Beads: expanded or flanged to suite application.
5. Control Joints: No. XJ15-3 control joint with 1/4" slot, and 1" grounds, or equal. Control joints must be wire tied to the lath and not nailed or screwed to substrate.
6. Expansion Joints: No. 40 adjustable expansion joint, free floating with adjustments from 1/4" to 5/8".
7. Weep Screeds: No. 7 Foundation Sill Screed, with holes for drainage.
8. Fasteners: (CMU Applications), Galvanized steel of furring type and length suitable for at least 1/2" penetration of the brick or block substrate.
9. Fasteners: (Stud Applications) Furring nails and or screws, galvanized steel of type and length suitable for at least a 1/2" penetration of the stud system.

10. Expanded metal Strip-Lath: For use around all windows, doorways, or openings.

- F. Seals, Sealants and Bond Breakers: Sealants shall conform to ASTM C920, Grade NS, Class 25, Use NT. Backer rod shall be closed-cell polyethylene foam.

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 Parex Armourwall 300 WaterMaster HE Stucco Assembly.
- C. Substrate Examination: Examine prior to Parex Armourwall 300 Stucco Base installation as follows:
1. Substrate shall be of a type approved by Parex USA. Plywood and OSB substrates shall be gapped $\frac{1}{8}$ in (3.2 mm) at all edges.
 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
- D. Ensure that flashing has been installed per Specification Section 07 60 00 - Flashing and Sheet Metal.
- E. Advise Contractor of discrepancies preventing installation of the Parex Armourwall 300 WaterMaster HE Stucco Assembly. Do not proceed with y work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Wire Fabric Lath and Metal Lath: Install according to ASTM C1063 and Appendix and the Building Code.

3.3 MIXING

- A. Mix Parex proprietary products in accordance with manufacturer's instructions, including the applicable Parex Armourwall 300 WaterMaster HE Stucco Assembly Product Data Sheets.
- B. Admix - Parex 290 Adacryl Admix & Bonding Agent
1. Mix up to 1 gal (3.8 L) per 1 bag of Parex Armourwall Fiber 47. Add after dry components and the majority of the water has been mixed. Mix no longer than required to provide a uniform mixture. DO NOT OVER-MIX. Overmixing entrains excessive amounts of air which weaken the material. Do not re-temper mixes over 20 minutes old.

3.3 APPLICATION

- A. General: Parex Armourwall 300 WaterMaster and its related materials shall conform to ASTM C926, this specification and Parex Product Data Sheets
- B. Water Resistive Barrier:
1. Treat all sheathing joints with Parex USA WeatherSeal water-resistive barrier with Parex Sheathing Tape
 2. Flash all rough openings with Flashing Membrane or reinforced Parex USA WeatherSeal
 3. Apply Parex USA WeatherSeal Water-resistive barrier to the surface of the appropriate substrate (2 coats for Roll-on on plywood and OSB).
- C. Drainage
1. Parex USA WeatherSeal covered by Dupont Tyvek Stuccowrap, DrainWrap, CommericalWrap D, or other water resistive barrer incorporating in itself a means of drainage and maintaining a current ICC Evaluation Report covered by Flat Insulation board:.
 2. Parex USA WeatherSeal covered by WaterMaster Channeled Insulation Board.
- D. Continuous Insulation:
1. Insulation Boards should be fastened to allow temporary placement until the lath is installed.
 2. The lath is applied tightly over the insulation board and fastened through the insulation board to wood studs or structural sheathing, Care must be taken to avoid overdriving fasteners.
- E. Parex Armourwall 300 Stucco Base:
1. Scratch Coat:
 - a. Apply scratch coat to a minimum thickness of $\frac{3}{8}$ in (9.5 mm), using sufficient trowel pressure to key stucco into lath or to create bond to substrates as applicable.
 - b. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
 - c. Moist cure scratch coat with clean potable water for at least 48 hours in accordance with ASTM C926 and the building codes following initial application (unless brown coat is applied as soon as the scratch coat has achieved sufficient rigidity to support the brown coat).
 2. Brown Coat:
 - a. Apply brown coat to a minimum thickness of $\frac{3}{8}$ in (9.5 mm), using sufficient trowel pressure to key stucco into scratch coat.
 - b. Rod surface to true plane and float to densify.
 - c. Trowel to smooth and uniform surface to receive acrylic polymer finish coat
 - d. Moist cure brown coat with clean potable water for at least 48 hours, in accordance with ASTM C926 and the building codes.

- E. Leveling and Reinforcing Coat (Parex Armourwall 300 WaterMaster Krak-Shield HE Stucco Assembly):
1. After Moist Curing, allow Parex Armourwall Stucco Base to air dry for 24 hours before applying the leveling and reinforcing coat.
 2. Using a stainless steel trowel, apply the Parex Stucco Level Coat over the Parex Armourwall 300 WaterMaster Stucco Base at a thickness of $\frac{1}{16} - \frac{3}{32}$ in. (1.6 – 2.4 mm).
 3. Fully embed the Parex reinforcing mesh, either 355 Standard Mesh or 358.10 Intermediate Mesh, into the wet Stucco Level Coat including diagonal strips at corners of openings and trowel smooth. If 355 Standard Mesh is used, seams are overlapped $2\frac{1}{2}$ in (63 mm), and if the 358.10 Intermediate Mesh is used, seams are butted and covered by strips of Parex Detail Mesh 356.
 4. The Parex acrylic primers and finishes can be applied as soon as the Parex Stucco Level Coat has cured, typically after 24 hours.
- F. Parex Primer and Finish:
1. Remove surface contaminants such as dust or dirt without damaging the substrate.
 2. Ambient and surface temperature must be 40°F (4°C) or higher during application and drying time. Supplemental heat and protection from precipitation must be provided as needed.
 3. Use only on surfaces that are sound, clean, dry, unpainted, and free from any residue that might affect the ability of the finish to bond to the surface.
 4. Parex Armourwall 300 WaterMaster Krak-Shield HE Stucco Assembly
 - a. Before the application of the finish, the base coat must have cured a minimum of 24 hours or longer as required by weather conditions. Examine the cured base coat for any irregularities.
 - b. Correct these irregularities to produce a flat surface.
 5. Apply exterior wall finish coats according to product data sheets.
 6. Protect Parex Finish Coats from inclement weather until completely dry.
- G. Curing:
1. Parex Armourwall 300 Stucco Base: Keep stucco moist for at least 48 hours (longer in dry weather) by lightly fogging walls. Start light fogging after initial set of 1–2 hours.
 2. Air cure acrylic based and elastomeric finish coats only, do not wet cure.

3.4 CLEAN-UP

- A. Removal: Remove and legally dispose of Parex Armourwall 300 WaterMaster HE Stucco Assembly component debris material from job site.

3.5 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.
- B. Provide protection of installed stucco from dust, dirt, precipitation, and freezing during installation.
- C. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry.
- D. 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 09240

1. GENERAL

- 1.1 Provide all labor and materials required for installation of Gypsum board systems, tape, texturing and joint treatment.
- 1.2 Provide sample panel in place, indicating finish texture for Architect's approval.
- 1.3 Submittals: Provide manufacturer's warranty, and descriptive literature indicating material composition, thickness, sizes and fire resistance for all products (including control joints).
- 1.4 Warranty: Exterior gypsum sheathing shall have a 5 year warranty against manufacturing defects and for six months of exterior exposure.

2. PRODUCTS

2.1 Gypsum Wallboard:

- A. Standard 5/8" thick gypsum board, maximum permissible lengths, ends square cut, tapered edges.
- B. Water Resistant gypsum board in all toilets and shower.
- C. Metal corner beads, edge trim at joints with dissimilar materials and unprotected ends.
- D. Self-tapping screws, one inch (1") long at single layer GWB.
- E. Reinforcing tape, joint compound, adhesive and vinyl-based ready-mixed texture compound.
- F. Acoustical Sealant:
Non-hardening, non-drying and non-bleeding sealant specifically manufactured for acoustic installations.
- G. GWB Control Joints:
USG 093, Provide control joints 30 feet o.c. minimum in unbroken wall or ceiling planes. Provide seal behind joints for sound or fire rating throughout.

2.2 Exterior Wall Sheathing and Cement Board: See Section 06160 Wall Sheathing.

2.3 Furring Channels: Roll-formed, hot shaped section of 20 ga. galvanized steel. Face width: 1-3/8", depth: 7/8". As manufactured by U.S. Gypsum.

3. EXECUTION

3.1 Gypsum Board Installation:

- A. Apply gypsum board with long length perpendicular to framing.
- B. Bed electrical boxes and seal wall penetrations with acoustical sealant.
- C. Install GWB with 1/4" wide gap between wallboard and floor slab.

3.2 Texture:

Spray apply medium texture material. Trowel and finish to match existing building wall texture. Provide sample drywall texture for approval prior to placing texture. Level 4.

3.3 FINISHING

- A. General: Comply with ASTM C 840, GA 214 and GA 216. Level 3.
 - 1. Level 1: Plenums, service corridors; above ceilings
 - 2. Level 2: Areas of water resistant gypsum backing board under tile; exposed areas where appearance is not critical.
 - 3. Level 3: Areas to receive heavy or medium textured coatings; heavy-grade wall coverings (not in this project).
 - 4. Level 4: Areas to receive flat sheen paint finish; light textured coatings; lightweight wall coverings.
 - 5. Level 5: Areas to receive gloss, semi-gloss sheen paints; critical lighting conditions.

END OF SECTION 09250

1. GENERAL

1.1 Scope:

Furnish and install acoustic ceilings complete with all necessary accessories.

1.2 Submittals:

Provide brochure of product and a sample tiles for approval before ordering.

1.3 Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

A. Standard for Ceiling Suspension Systems Requiring Seismic Restraint:
Comply with ASTM E580

B. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.4 MAINTENANCE

A. For ceiling projects above 900 square feet, furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing the contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

2. MATERIALS

2.1 Standards:

Installation shall be in accordance with the current bulletin of the Acoustical Materials Association and the manufacturer's recommendations and instructions.

2.2 Acoustical Ceiling Tile in suspension systems shall be:

A. New Acousital Ceiling Tile: USG Interiors Inc., Frost "ClimaPlus", white color, 24" x 48" x 3/4" panels, Class "A", item #488, FL edge, Omni fissured surface. NRC = .75, CAC min. = 40, 71% recycled content.

- 2.3 New Ceiling Panel Suspension system shall be the USG Interiors Inc., Fineline 1/8 (DXFF) Exposed Tee System of double web electro-galvanized steel, with baked polyester paint. ASTM E 580 conformance required;
- A. Wall molding: USG Interiors Inc., Shadow Molding MS174.
- 2.4 Attachment Devices for Suspension System:
- A. Anchors: Provide sizes capable of sustaining 5 times the load-carrying capabilities shown in ASTM C635, Table 1.
- B. Deck inserts and hanger clips: Fabricate from hot-dip galvanized steel.
- C. Hanger wire: Zinc-coated (galvanized) carbon steel wire, ASTM A641, soft temper, with Class 1 coating, minimum 12 gage (0.106 inch diameter).
3. EXECUTION
- 3.1 Environmental Conditions:
Temperature shall remain between 55°F and 70°F prior, during, and after installation. Stabilize moisture and temperature by opening carton ends at least 48 hours before installation, with cartons stored at required temperatures.
- .2 Install tile in strict accordance with the manufacturer's recommendations. Align all tiles for time, level surface, and straight lines to a tolerance of 1/2" in 10 feet.
- A. Coordinate ceiling system installation with work of other sections as required, including the following:
1. Light fixtures.
 2. HVAC components.
 3. Fire suppression system components.
 4. Partitions.
 5. Ceiling penetrations.
 6. Seismic bracing and fixture hold-down clips.
 7. The acoustical ceiling installer shall install all wires and anchors. The mechanical and electrical installers shall terminate all seismic wires to fixtures in ceiling suspension system. The mechanical and electrical installers shall furnish all hold-down clips as indicated by Division 15 Mechanical and Division 16 Electrical Sections for seismic installation.

3.3 Ceiling suspension system shall be installed per the recommendations of ASTM C636. Loading of any component shall not cause deflection of more than 1/360 of the span.

- A. Main runners shall be installed 24" o.c. and be directly suspended by not less than 12 gauge galvanized steel wire spaced 48" o.c. along the main runners. Hanger wires shall be wrapped lightly at least 3 full turns.
- B. Main runners shall be interconnected by cross tees of 24" long to form 24" x 24" modules.
- C. Wall moldings shall be installed wherever suspension components meet vertical surfaces.

3.4 PREPARATION

- A. Layout: Position ceiling components to maximize use of full-sized acoustical units and to provide border units which are equal in size and shape at opposing ceiling edges. Conform to reflected ceiling plans to greatest extent possible.

END OF SECTION 09510

1. GENERAL

1.1 Scope:

Furnish and install all resilient flooring and base complete with all necessary accessories.

1.2 Submittals:

Provide catalogue data and physical samples for review and Architect's approval.

1.3 Quality Assurance:

A. Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants and leveling compounds.

B. Fire Test Performance:

Provide resilient flooring having the following classifications or properties when tested in accordance with the standard fire tests referenced below:

1. Flame Spread: Not more than 75 as per ASTM E-84.
2. Smoke Developed: Not more than 450 as per ASTM E-84.
3. Smoke Density: Not more than 450 as per NFPA 258.

C. Maintenance Instructions:

Submit two copies of manufacturer's recommended maintenance practices for each type of resilient flooring.

D. Replacement Material:

After completion of work, deliver to project site replacement materials from same manufactured lot as materials installed as follows:

Tile Flooring: one box for each 50 boxes installed.

1.4 Produce Delivery, Storage and Handling:

Deliver material in good condition to the job site with manufacturer's original unopened containers with label information clearly marked thereon. Material shall be stored in a heated space protected from weather and maintained at 65°F.

1.5 Job Conditions:

A. Maintain minimum temperature of 65°F in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55°F in areas where work is completed.

- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesives as determined by manufacturer's recommended bond and moisture test.

2. PRODUCTS

2.1 Acceptable Manufacturers:

- A. Premium Vinyl Composition Tile: Federal specifications SS-T-31B(1) Type IV, Composition 1.

- 1. Armstrong Bio Based Tile
 - a. 3 colors in a pattern selected by the architect
- 2. Approved equal

- B. Rubber Wall Base

- 1. Flexco
- 2. Johnsonite
- 3. Roppe

- C. Ramp resilient flooring:

- 1. Raised circular design rubber tile, standard profile
 - a. Roppe
 - b. Musson
 - c. or approved equal

2.2 Materials:

Colors and patterns as shown or scheduled in the drawings.

- A. Vinyl Composition Tile:
Premium Vinyl Composition Tile

- 1. Federal Specifications: SS-T-31B(1) Type IV, Composition 1.
- 2. Composed of vinyl resins, plasticizers, coloring pigments and fillers, 1/8" gauge.
- 3. Indentation Resistance: 75 lbs. per square inch.

- B. Wall Base:
4" high, (.125") thick, extruded rubber cove base, vulcanized. Conform to Federal Specification SS-W-40a Type 1. All cove base shall be standard toe base.
- C. Resilient Edge Strips:
1/2" thick, homogeneous vinyl or rubber composition. Color as selected by Architect from standard colors available, not less than 1" wide.
- D. Adhesives:
Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.
- E. Concrete Slab Primer:
Nonstaining type as recommended by flooring manufacturer.
- F. Leveling Compound:
Latex type as recommended by flooring manufacturer.
- G. Rubber Tile for ramp:
Square block design rubber floor tile, solid color, continuous field design, factory cut 24" x 24" (or 50 cm x 50 cm) tile. Architect will select color from standard color selections.

3. INSTALLATION

- 3.1 Inspection:
Examine substrate and conditions under which flooring is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected. Sub-floor shall be broom clean before installation.
- 3.2 Existing Concrete:
Remove surface coatings by surface wet grinding or by applying the manufacturer's recommended solution of trisodium phosphate and water, followed by thorough rinsing and drying. A bond test should be performed over existing floors in question. All cracks, minor holes and crevices in concrete should be filled with Armstrong S-175 Floor Patch.
- 3.3 General:
Install flooring using method indicated in strict compliance with manufacturer's recommendations. Extend flooring into the spaces, door reveals, and into closets and similar openings. Tightly cement flooring to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand-roll flooring at perimeter of each covered area to assure adhesion. Flooring shall be laid with a minimum number of seams consistent with prudent use of

material. Avoid cross-seams, filler pieces, and strips. Observe the recommended trowel notching, spread rates, and open times for adhesives. All seams shall be finished flush to the floor and free from voids, recesses and raised areas.

3.4 Tile Floors:

Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than one-half tile at room perimeters. Lay tile square to room axis, unless otherwise shown. Broken, cracked, chipped or deformed tiles are not acceptable. Cut tile neatly around all fixtures. Lay tile with grain running in one direction.

3.5 Wall Base:

Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with pre-formed outside corner units, mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece with continuous contact at horizontal and vertical surfaces. On masonry surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

3.6 Place resilient edge strips at edges of flooring which would otherwise be exposed. Coordinate with metal thresholds in Hardware Schedule.

3.7 Cleaning:

Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring with heavy Kraft paper or other covering.

3.8 Finishing:

After completion of the project and just prior to final inspection of work, thoroughly clean floors and accessories. Apply polish and buff, with type of polish, number of coats, and buffing procedures in compliance with flooring manufacturer's instructions.

END OF SECTION 09660

PART 1 - GENERAL

1 RELATED DOCUMENTS

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

2 SUMMARY

- A. This Section includes surface preparation and field painting of exposed interior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- C. Do not paint pre-finished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Pre-finished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Metal toilet enclosures.
 - d. Metal lockers.
 - e. Unit kitchens.
 - f. Elevator entrance doors and frames.
 - g. Elevator equipment.
 - h. Finished mechanical and electrical equipment.
 - i. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.

- c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - g. Elevator shafts.
3. Finished metal surfaces include the following:
- a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
- a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections:
- 1. Division 5 Section "Structural Steel" for shop priming structural steel.
 - 2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
 - 3. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
 - 4. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
 - 5. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
- 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Initial Selection: For each type of finish-coat material indicated.
1. After color selection, Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
 3. Submit Samples on the following substrates for Architect's review of color and texture only:
 - a. Concrete: Provide two 4 inch square samples for each color and finish.
 - b. Painted Wood: Provide two 12 inch square samples of each color and material on hardboard.
 - c. Stained or Natural Wood: Provide two 4 x 8 inch samples of natural- or stained-wood finish on actual wood surfaces.
 - d. Ferrous Metal: Provide two 4 inch square samples of flat metal and two 8 inch long samples of solid metal for each color and finish.
- D. Qualification Data: For Applicator, include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified..

5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
 - b. Small Areas and Items: Accent colors at classroom and toilet entries. Provide samples on at least 100 sq. ft..
 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 3. Final approval of colors will be from job-applied samples.

6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F and 95 degrees F. Maintain storage containers in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 degrees and 90 degrees F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 degrees and 95 degrees F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:
 - 2. Quantity: Furnish Owner with an additional five percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- C. Specified Manufacturer: Products of the Sherwin-Williams Company are the basis of design products specified to establish the level of quality and VOC Product Requirements.
- D. Substitutions: Requests for substitutions will be considered of equal products in quality and VOC Product Requirements. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product. Acceptable Manufactures: Must use equal products and VOC Product Requirements.

1. Dunn Edwards
2. Sherwin-Williams Co. (S-W).
3. ICI Dulux/Glidden
4. Benjamin Moore & Co. (Moore).
5. PPG Industries, Inc. (PPG).

2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Match colors indicated by reference to manufacturer's color designations
 1. Interior Paint colors will be selected by the architect from the manufacturer's available colors. Interior colors will be limited to eight (8) different color selections and exterior colors will be limited to six (6) different color selections.

PART 3 - EXECUTION

1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
- 2 PREPARATION
- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete 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.
 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

- b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
- a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
- 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors:

- a. Exterior:
 - 1) Ferrous Metals: 1 color.
 - b. Interior:
 - 1) Gypsum wall board and plaster: Three (3) colors for the majority of wall surfaces,
 - 2) Woodwork: one paint color for painted woodwork.
 - 3) Stained woodwork: one stain.
 - 4) Ferrous Metals: one color.
 - 5) Galvanized Metal: One color.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 - 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 - 10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 2. Omit primer over metal surfaces that have been shop primed and touchup painted.

3. 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. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:.
1. Uninsulated metal piping.
 2. Uninsulated plastic piping.
 3. Pipe hangers and supports.
 4. Tanks that do not have factory-applied final finishes.
 5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

- G. Electrical items to be painted include, but are not limited to, the following:
1. Switchgear.
 2. Panelboards.
 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:

- a. Quantitative material analysis.
 - b. Abrasion resistance.
 - c. Apparent reflectivity.
 - d. Flexibility.
 - e. Washability.
 - f. Absorption.
 - g. Accelerated weathering.
 - h. Dry opacity.
 - i. Accelerated yellowness.
 - j. Recoating.
 - k. Skinning.
 - l. Color retention.
 - m. Alkali and mildew resistance.
3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

Exterior Ferrous & Galvanized Metals:

Semi-Gloss Finish

- Primer: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310, <100 g/L VOC
 1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
 2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC

High Performance System — Guardrails and Handrails

Gloss Finish

- Primer: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310, <100 g/L VOC
 1st coat: Water-Based Acrolon 100 Polyurethane Gloss, B65-700 series, <100 g/L VOC
 2nd coat: Water-Based Acrolon 100 Polyurethane Gloss, B65-700 series, <100 g/L VOC

Exterior Wood:

Satin Finish

- Primer: Exterior Latex Wood Primer, B42W8041, <100 g/L VOC
 1st coat: A-100 Exterior Latex Satin, A82 series, <50 g/L VOC
 2nd coat: A-100 Exterior Latex Satin, A82 series, <50 g/L VOC

3.8 Interior Paint Schedule - Commercial

Concrete Floors

- 1st coat: H & C Low VOC Concrete Sealer
 2nd coat: H & C Low VOC Concrete Sealer

CMU — Concrete Masonry Units

Eg-Shel Finish — Low Odor Zero VOC Topcoat

- Primer: PrepRite Block Filler, B25W25, <50 g/L VOC
 1st coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC
 2nd coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC

Semi-Gloss Finish — Low Odor Zero VOC Topcoat

- Primer: PrepRite Block Filler, B25W25, <50 g/L VOC
 1st coat: ProMar 200 Zero VOC Semi-Gloss B31-2600 series, 0 g/L VOC
 2nd coat: ProMar 200 Zero VOC Semi-Gloss B31-2600 series, 0 g/L VOC

Gypsum Board (Water-Based Epoxy)

Eg-Shel Finish

- Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC

1st coat: *Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC

2nd coat: *Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC

Semi-Gloss Finish in Janitor Room

Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC

1st coat: *Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC

2nd coat: *Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC

Wood

Wood — Stained Doors, Frames, Trim and Chair Rails

Stained Finish

Stain: Wood Classics 250 g/l Stain, A49W800 series, 250 g/L VOC

2nd coat: Wood Classics WB Polyurethane A68, <350 g/L VOC

3rd coat: Wood Classics WB Polyurethane A68, <350 g/L VOC

Non-Ferrous Metal & Ferrous Metal — Doors, Frames and Miscellaneous Metals

Semi-Gloss Finish

Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC

1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC

2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC

Non-Ferrous Metal & Ferrous Metal — High Performance System for Handrails

Eg-Shel or Gloss Finish

Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC

1st coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or Gloss, B73-300 series, 0 g/L VOC

2nd coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or Gloss, B73-300 series, 0 g/L VOC

Galvanized Metal Decking & Ferrous Decking — Including Bar Joists

High Performance System

Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC

1st coat: *Pro Industrial Multi-Surface Acrylic Eg-Shel, B66-560 series, <150 g/L VOC

2nd coat: *Pro Industrial Multi-Surface Acrylic Eg-Shel, B66-560 series, <150 g/L VOC

END OF SECTION 09900

1. GENERAL

1.1 Scope:

Furnish and install all fire extinguishers and cabinets, complete with all necessary accessories.

1.2 Submittals:

Provide catalog cuts and accurate color samples for review and approval.

2. PRODUCTS

2.1 Acceptable Manufacturers:

A. J. L. Industries

B. Larsen Mfg. Co.

C. Potter-Roemer Inc.

2.2 Components:

A. Larsen Architectural Series "Duo Panel - Break Glass" Door and 2409-6R rolled edge, semi-recessed cabinet, 20 gauge steel, white baked on enamel.

B. Larsen MP 10 extinguishers (A, B, C rated).

3. EXECUTION

3.1 Installation:

Mount in strict accordance with manufacturer's recommendations and in accordance with all code requirements. See Drawings for mounting locations. Mount semi-recessed cabinets in stud wall with screws into full blocking.

END OF SECTION 10520

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work under this section includes furnishing and installing dock leveler equipment and dock bumpers.

1.02 SUBMITTALS

- A. Submit product data for review by architect.
- B. Include sizes, types, finishes, scheduled locations, and details of adjoining work.
- C. Submit manufacturer's spec sheet.

1.03 DELIVERY

- A. Package, handle, deliver and store dock levelers and bumpers at the project site in a manner that will avoid damage.

1.04 QUALITY ASSURANCE

- A. Manufacturer shall provide 10 year warranty.

PART 2: PRODUCTS

2.01 MANUFACTURER

- A. Dock Levelers listed as follows as provided by:
Global Industries.
- B. Approved Equal.

2.02 DOCK LEVELER - EZ-Pull Edge of Dock Leveler.

- A. Stock #T9F 986635.
- B. Useable width 72 inches.
- C. 20,000 Lb. Capacity.
- D. Included with each dock leveler are twin 12" x 10" bumpers that extend 16" from dock face.
- E. 3/8" thick steel safety plate and heavy duty hinges.

2.03 DOCK BUMPER - typical of two (2) bumpers required.

- A. Model #T9 A988029.
- B. Useable width 38 inches each.

2.03 FABRICATION

- A. Furnish as necessary each dock leveler and bumper assembly manufactured complete with all parts ready for installation.

PART 3: EXECUTION

3.01 INSPECTION

- A. Verify that wall and dock are correctly constructed and dimensioned to receive dock levelers and bumpers.

3.02 INSTALLATION

- A. Install according to manufacturers instruction.

3.03 ADJUST AND CLEAN

- A. Adjust latch and lock mechanisms to operate smoothly.

End of Section 11160

SECTION 13930
WET PIPE FIRE SUPPRESSION SPRINKLERS

PART 1 GENERAL

PART 1.1 SECTION INCLUDES

- A. Scope of Work: Provide design, shop drawings, project record drawings (as-built), equipment, fabrication, labor, transportation and supervision necessary to install, flush, test and place into service a complete hydraulically designed automatic wet pipe sprinkler system.
- B. Components: Provide system that consists of, but not be limited to, interconnecting piping, fittings, control valves, check valves, alarm valve with trim, fire department connection, sprinkler heads, hangers, bracing, Inspector's test stations, drains, sprinkler alarm, and other devices for a complete installation in accordance with codes, standards and recommended practice referenced in this Section.

PART 1.2 DESIGN

- A. Design system in accordance with NFPA 13.
 - 1. Minimum classification Ordinary Hazard Group II, or as specified by the Santa Fe County Fire Marshal.
 - 2. Conform to extra or special hazard requirements where required or indicated.
 - 3. Conform to NFPA 13 for storage occupancies with potential storage height greater than 12 feet and other special hazard occupancies.
 - 4. System to operate at 7000 feet altitude.
 - 5. Provide necessary devices to separate system into individual and distinct alarm zones. Provide a minimum of one zone per floor.

PART 1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
- B. Hydraulic Calculations prepared in accordance with NFPA 13. Submit calculations with shop drawings.
 - 1. Calculate demand point for each system so that it remains a minimum of 5 psi below design basis water supply curve. Design basis water supply curve after required 500 gpm hose streams and friction loss to base of riser have been deducted.
 - 2. Include in calculations elevation differences between point of water test and base of riser. Include graphical representation of design basis water supply curve and system demand.
 - 3. The following preliminary flow data is provided to the Contractor for bidding purposes: static 80 psig, residual 70 psig, flow 979 gpm.
 - 4. Base system design on actual flow information provided by Sangre de Cristo Water Company. Request actual flow data in a timely manner to maintain project schedules.
- C. Catalog Data with selected options marked.
- D. Certifications for welders in accordance with NFPA 13.
- E. Installation Instructions
- F. Materials Part List (Bill of Materials) with manufacturer, model number, and quantity.
- G. Shop Drawings using a minimum scale of 1/8" = 1'-0" for plans and 1/4" = 1'-0" for details. All lettering to be a minimum of 1/8 inch high.
 - 1. Show information required by NFPA 13, including piping, sprinklers, hangers, flexible couplings, roof construction, electro-mechanical devices, occupancy of each area, and ceiling and roof heights.
 - 2. Base working plans on actual survey of existing conditions.
 - 3. Show hydraulic reference points and remote areas.

Wet Pipe Fire Suppression System

H. Test Reports

I. Operation and Maintenance Manual: Submit system description, system final inspection, and Contractor's material and test certificates per NFPA 13, of the completed system project record documents.

1. Include in operation and maintenance manuals, instructions, a brief description of type of system installed, routine maintenance work defined by step-by-step instructions, and recommended frequency of performance.
2. Also include in instructions, possible malfunctions with diagnostic methods and suggested correction of each.
3. Describe function of each component or subassembly.
4. List recommended spare parts (manufacturer, model number, and quantity).

J. Project Record Drawings (As-Built) on CD's and prints reflecting as-built conditions showing Work completed under this Section.

1. Base as-built drawings on actual survey of the completed installation.
2. Include notes on all special systems or devices such as dry pendent heads, antifreeze loops and inspector's test stations.
3. Provide revised hydraulic calculations demonstrating water supply restrictions have not been exceeded when conditions of installation are different from those anticipated during preparation of Project Record Documents.

PART 1.4 QUALITY ASSURANCE

A. Provide proof that installation firm has satisfactorily performed at least ten projects of equivalent nature and scope of the Projects herein; and is licensed within the USA to engage in design, fabrication and installation of automatic sprinkler systems for fire protection.

PART 1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials and Equipment: Protect materials and equipment from damage during shipping, storage and installation.

B. Plugs and Cover Plates: Protect threaded ends, flanged openings with gasketed metal cover plates to prevent damage during shipment and to prevent foreign materials from entering. Cap or plug drains, vents, small piping, and gauge connections.

PART 2 PRODUCTS

PART 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with Section 01630, Product Options and Substitutions.

PART 2.2 MATERIALS

A. Provide new fire protection materials and equipment, UL Listed or FM Approved, conforming to NFPA 13.

PART 2.3 PIPING AND FITTING MATERIALS

A. Provide in accordance with NFPA 13.

B. Piping 2 inches and smaller to be Schedule 40 minimum.

PART 2.4 VALVES AND STRAINERS

A. Provide Listed or Approved valves and strainers rated at 175 psi or greater working pressure.

B. Check Valves: In sizes 3 inch and larger, provide 3/4 inch NPT drainage taps.

C. Strainers: Provide "Y" type strainers with cast iron body and 30 mesh stainless steel screen.

D. Alarm Valve: Minimum acceptable size is 4 inches. Provide retardant chamber, 2 water pressure gauges and necessary valves and trim for alarm valve operation.

1. Provide bypass valve in trim to allow test operation of pressure alarm switch.

2. Equipment alarm valve with retard chamber and pressure alarm switch with one normally open contact and one normally closed contact, suitable for 24 VDC.
3. Provide check valve in retard chamber drain line when retard chamber drain line ties into main riser drain.

PART 2.5 PRESSURE GAUGES

- A. Provide listed pressure gauges designed for use with air or water.
 1. Gauge Scale: Dial marking subdivision no finer than 1 percent of maximum scale reading and accurate to 3 percent or less. Provide minimum scale range twice the maximum working pressure (when possible).

PART 2.6 VALVE SUPERVISION (TAMPER SWITCHES)

- A. Equip valves which control water to automatic sprinkler heads with supervisory switches.
 1. Provide valve supervisory switches with single pole double throw switching contacts, housed in gasketed weather tight enclosure, suitable for 24 VDC.
 2. Supply supervisory device specifically designed to mount on, and operate reliably with, type of control valve being monitored.
 3. Adjust valve position switches to transmit a supervisory signal within two revolutions of valve operating hand wheel or crank (away from its full open position).
- B. Provide alarm control valve with supervisory switch, Potter Electric part number BVS, or approved equivalent, suitable for 24 VDC.

PART 2.7 WATER FLOW SWITCHES

- A. Provide Potter Electric vane-type flow switches, or approved equivalent, with field adjustable pneumatic retard and 175 psi working pressure.
 1. Use single pole double throw, normally open switches, suitable for 24 VDC.
 2. Adjust water flow switches to transmit an alarm within 90 seconds of opening the inspector's test valve.
- B. Provide a minimum of one water flow switch per floor.

PART 2.8 SPRINKLERS AND ACCESSORIES

- A. Listed by a nationally recognized testing laboratory and selected in accordance with their Listing, manufacturer's instructions, and applicable NFPA requirements. Provide sprinklers as follows:
 1. Upright Sprinklers: Brass upright type. Use in areas without suspended ceilings.
 2. Pendent Sprinklers: Chrome plated. Use below suspended ceilings.
 3. Sprinkler Guards: Provide where sprinkler heads are exposed to external damage.
 4. Corrosion-Resistant Sprinklers: Provide in locations where chemicals, moisture or other corrosive vapors exist.
 5. Concealed Sprinklers: Use concealed type sprinklers in clean rooms.
- B. Where indicated, provide other types of sprinklers in accordance with their Listing.

PART 2.9 WATER SHIELDS

- A. Provide in areas where there is no ceiling, and when multiple level protection is required, e.g., at open grating or open high roofed areas.
 1. Provide compatible Listed/Approved water shields and/or intermediate level sprinklers in accordance with NFPA 13.

PART 3 EXECUTION

PART 3.1 EXAMINATION

- A. Prior to installation carefully inspect installed Work of other trades, whether pre-existing or part of this Project, and verify that such work is complete to the point where installation of sprinkler system may start.
- B. Notify the Contract Administrator should conditions exist, not resulting from Work of this Project, that prohibits the installation from conforming to referenced codes, regulations, standards and approved design.
- C. Install materials and equipment that are free of moisture, scale, corrosion, dirt and other foreign materials.

PART 3.2 INSTALLATION

A. General:

1. Install system in accordance with NFPA 13.
2. Do not locate sprinkler heads closer than 12 inches to supply air registers.
3. Visually examine pipe, fittings, valves, equipment and accessories to ensure they are clean and free of burrs, cracks and other imperfections before installation. Clean pipe interiors by flushing.
4. Verify dimensions in field.
5. Drawings show only approximate building outlines and interior construction details as an aid in understanding the scope of Work. Investigate structural and finish conditions affecting the Work and arrange Work accordingly, providing such sprinkler heads, fittings, traps, draining valves, piping, and accessories as required to meet such conditions. Show relevant structural details on Drawings.
6. Do not render inoperative any system without the prior approval of the Contract Administrator. Coordinate necessary shutdowns of existing systems by notifying the Contract Administrator a minimum of 7 working days before rendering such systems inoperative.
7. Coordinate sprinkler piping, sprinkler heads and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.
8. Dispose of equipment removed for completion of this Project as directed by the County Construction Inspector or Owner's representative.
9. Provide access openings in areas where concealed sprinkler piping is installed.

B. Piping:

1. Mark and identify sprinkler piping in accordance with Section 15075, Mechanical Identification.
2. Conceal sprinkler piping in areas with suspended ceilings. Install piping in exposed areas as high as possible using necessary fittings and auxiliary drains. Keep sprinkler piping a minimum of 7 feet 6 inches above finish floor. Where not possible, run piping at same elevation as existing piping and ducts. Obtain prior approval from the Construction Inspector.
3. Install Inspector's Test piping at the hydraulically most remote point of automatic sprinkler system and discharge to the exterior of building. Install inspector's test piping for each water flow switch. Where possible, conceal test piping in wall and provide access panels for valve and sight glass and protect from freezing. Locate Inspector's Test Station in an easily accessible location approved by the County Construction Inspector or Owner's representative.
4. Diamond core drill or sleeve concrete penetrations, then grout and seal with fire-resistant material, securely held in place. Use Listed/ through penetration fire stop system assemblies for piping penetrating fire resistance rated construction.

- C. Pipe Support: Install pipe hangers for pipe supports inside buildings in accordance with NFPA 13. Install concrete anchors by drilling using UL Listed or FM anchors. Do not use

Wet Pipe Fire Suppression System

explosive-driven fasteners as a method of installing anchors or hangers. Do not hang other piping or equipment from sprinkler pipe.

D.Welding:

- 1.Shop weld pipe and fittings using approved welding fittings. Comply with NFPA 13 for welding methods.
- 2.Provide a blind flange or grooved cap at each end of welded headers.
- 3.Use certified welders. Check certificates before Work commences.

E.Alarm Valve: Set plumb and unobstructed. Provide minimum clear distances from walls to centerline of alarm valve as follows:

- 1.Rear - 12 inches
- 2.Sides 20 inches
- 3.Front 36 inches

F.Control Valves: Provide Listed OS&Y fire protection control valves. Installed so open or closed status can be readily seen from finish floor.

- 1.Install control valves on supply lines (outside protected area) into elevator shaft and elevator equipment room, computer rooms, and identified special protection areas. Control valves to be accessible from floor level. Provide valve with tamper supervision switches.

G.Sprinklers and Accessories:

- 1.Provide upright sprinklers on exposed piping below ceiling. Pendent sprinklers may be used where necessary due to spacing, location and position requirements.
- 2.Provide chrome plated pendent, recessed, or flush mounted sprinklers below finish ceilings. Route supply piping above ceiling.
- 3.Align sprinklers below ceiling parallel to ceiling features and walls, and locate as close to center as possible in halls and corridors.
- 4.Provide chrome-plated escutcheons where exposed piping passes through finished floors, walls, partitions and ceilings. Secure to pipe with set screws or spring clips.
- 5.Protect sprinklers subject to mechanical injury with guards as follows:
 - a.Provide guards in mechanical equipment rooms, electrical equipment rooms, janitor's closets, and storage areas where distance from sprinkler deflector to finish floor is less than 15 feet.
 - b.In all other areas, provide guards where distance from sprinkler deflector to finish floor is less than 7 feet.
- 6.To prevent freezing, extend dry pendent sprinklers a minimum of 6 inches into heated area before connection to wet sprinkler piping.
- 7.Provide one spare sprinkler cabinet, complete with sprinklers of assorted temperature ratings of the type necessary and in use throughout the installation, at each main riser valve. Equip each cabinet per NFPA 13.

H.Signs:

- 1.Install as required by NFPA 13.

I.Painting: Paint sprinkler risers, unfinished pumper connection piping, exposed piping in stairwells, and sprinkler piping in all equipment rooms with 2 coats of Fire Protection Red. Apply one coat of primer and one coat of paint to match background, on new exposed piping in occupied spaces. Do not paint automatic sprinkler heads.

J.Unsupervised Water Supplies: Install approved water flow detection device on underground water supplies entering buildings when fire protection riser is more than 10 lineal feet from exterior of building.

K.Water Supply Control Valve: Where not otherwise provided for, provide water supply control valve(s) conforming to the requirements of NFPA 24.

- 1.Provide UL Listed or FM valves, with Listed indicating post. When possible, locate valve at least 40 feet from building.

2. When valve is located less than 20 feet from building, or a wall post indicating valve is provided, the wall 10 feet in all directions of the valve to be blank masonry or one hour fire resistance rated construction.

L. Special Tools and Devices: Provide one complete set of special tools or special devices required for operation, testing and/or maintenance of equipment furnished under this Section.

PART 3.3 EQUIPMENT INSTALLATION

A. Install devices or equipment not specifically covered by these Specifications in accordance with manufacturer's instructions.

PART 3.4 CONNECTIONS TO EXISTING SYSTEMS

A. Final connection of new systems to existing underground piping systems will be made by the Contractor with the supervision of City of Santa Fe Sangre De Cristo Water Division.

B. Final connection of new systems to other existing systems above grade to be done by the Contractor after contacting the Project Construction Inspector who will implement County Fire Protection Impairment Procedure. Do all final connections of this type with only one outage per existing system.

PART 3.5 STERILIZATION

A. Sterilize sprinkler system underground piping upstream of alarm valve in accordance with Section 15141, Disinfection of Potable Water Piping.

B. Do not sterilize sprinkler system downstream of alarm valve.

PART 3.6 EXISTING CONDITIONS

A. Area Restoration: Restore areas disturbed by the fire protection system installation to the condition existing prior to start of construction.

B. Field Inspection: Field inspect areas of sprinkler installation for potential interference with ducts, cable trays, electrical or mechanical equipment, and other similar interferences. Carefully coordinate Work under this section with other Work.

PART 3.7 TESTING

A. Hydrostatically test piping in accordance with Section 15992, Testing Piping Systems, and NFPA 13.

B. Flush system with water in accordance with NFPA 13 and 24.

C. Comply with the discharge requirements in Section 01325, Water Discharge Requirements.

D. Notify Construction Manager at least 5 working days in advance to witness tests.

PART 3.8 INSPECTION

A. Inspect new fire protection system in accordance with NFPA 13 and 24, in the presence of the Construction Manager. Give advance notice, as specified below, to the Construction Inspector prior to any tests.

1. Notify the Construction Manager upon completion of installation of all materials and equipment. Construction Manager will schedule inspection of installation within 5 working days after Contractor notification.
2. Correct deficiencies noted during this inspection and correct prior to further testing.

END OF SECTION

SECTION 15060
HANGERS AND SUPPORTS FOR PIPING AND TUBING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe hangers, supports, hanger rods, inserts, and sleeves.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures.
 - 1. Catalog data of hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inches: Carbon steel, adjustable, clevis, or malleable iron or carbon steel, adjustable swivel, split ring.
- B. Hangers for Cold Pipe Sizes 2 inches and over: Carbon steel, adjustable, clevis.
- C. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
- D. Hangers for Hot Pipe Sizes 6 inches and over: Adjustable steel yoke, cast iron roll, double hanger.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
- G. Wall Support for Pipe Sizes to 3 inches: Strut clamp.
- H. Wall Support for Pipe Sizes 4 inches and over: Welded steel bracket and wrought steel clamp.
- I. Wall Support for Hot Pipe Sizes 6 inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
- J. Vertical Support: Steel riser clamp.
- K. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- L. Floor Support for Hot Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- M. Floor Support for Hot Pipe Sizes 6 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- N. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 HANGER RODS

- A. Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment; top slot for reinforcing rods; lugs for attachment to forms; size inserts to suit threaded hanger rods.

2.4 SLEEVES

- A. Sleeves for Pipes through Non-Fire Rated Beams, Walls, Footings, and Floors: Steel pipe or 18 gage galvanized steel.
- B. Sleeves for Pipes through Fire Rated and Fire Resistive Floors, Walls, and Roof: Prefabricated fire rated sleeves including seals, approved by a nationally recognized testing laboratory.
- C. Sleeves for Ductwork: Galvanized steel.

PART 3 EXECUTION

3.1 INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hook rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut.

3.2 PIPE HANGERS AND SUPPORTS

- A. Support piping to maintain its alignment, and prevent sagging.
- B. Place hangers within 12 inches of each horizontal elbow.
- C. Support vertical piping with riser clamps secured to the piping and resting on the building structure at each floor.
- D. Install hangers to provide minimum 1/2 inches space between finished covering and adjacent work.
- E. Use hangers with 1-1/2 inches minimum vertical adjustment.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.
- I. Provide insulation continuous through hangers and rollers. Protect insulation by steel shields in accordance with Section 15080, Mechanical Insulation.
- J. Provide hangers on piping on each side of, and within 6 inches of, hubless pipe couplings so the couplings bear no weight.
- K. Provide supports that allow free axial movement and only support the weight of the piping or tubing. Provide additional hangers or brackets to support valves, flanges, specialties, etc., to prevent excessive deflection.
- L. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and Hanger and Supports for Piping and Tubing

supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 HANGER SPACING

A. Plumbing Piping - Water, Gas, DWV

1. Comply with the requirements of the Uniform Plumbing Code, (IAPMO), Hangers and Supports.

B. Fire Protection Piping

1. Comply with the requirements of NFPA-13, for hanger spacing and materials.

E. Water Building Services Piping, up to 150 psig (Heating, Cooling, and Tower Water)

1. Comply with the requirements of ASME B31.9, Building Services Piping.
2. Maximum Hanger Spacing

Size (Inches)	Less Than 1	1	1 1/4	1 1/2	2	3	4	6	8
Spacing (Feet) Steel Pipe	6	9	11	12	13	15	17	20	21
Spacing (Feet) Copper Tube	5	7	7	8	9	10	12	14	16

F. Air and Laboratory Gas Building Services Piping, up to 150 psig

1. Comply with the requirements of ASME B31.9, Building Services Piping.
2. Maximum Hanger Spacing:

Size (Inches)	1/4 to 1/2	5/8 to 7/8	1	1 1/4	1 1/2	2	3	4	6	8
Spacing (Feet) Steel Pipe	6	6	9	11	13	15	17	21	25	28
Spacing (Feet) Copper/SS Tube	3	5	7	9	10	12	15	17	21	24

3.4 HANGER ROD SIZE

A. Plumbing (UPC) Piping (Water, Gas, DWV)

Pipe Size (Inches)	1/2 - 4	5 - 8
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Rod Size (Inches)	3/8	1/2
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B. HVAC Piping (Steam, Condensate, Water, Air, Laboratory Gas)

Pipe Size (Inches)	1/2 - 2	2	4 - 6	8 - 12
Rod Size (Inches)	3/8	1/2	5/8	7/8

END OF SECTION

PART 1 GENERAL

PART 1.1 SECTION INCLUDES

- A. Valve Tags.
- B. Pipe Markers/Arrow Tape Above Ground.
- C. Underground Piping Warning Tape.
- D. Ceiling Tacks.
- E. Duct Markers.
- F. Mechanical Equipment and HVAC Controls Identification.
- G. Safety Signs.
- H. Fire Hydrants and Isolation Valves Numbering.

PART 1.2 CONTRACTOR PERFORMED WORK

- A. Permanent labeling for mechanical equipment and HVAC controls will be furnished and installed by the Contractor.

PART 1.3 DEFINITIONS

- A. Exposed Areas: Finished areas and other areas used by personnel in normal use of building, such as equipment rooms and storage rooms.
- B. Concealed Areas: Duct or pipe tunnels, duct or pipe chases, spaces above accessible ceilings, and crawl spaces.

PART 1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data.
 - 2. Installation instructions.

PART 2 PRODUCTS

PART 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01630, Product Options and Substitutions.

PART 2.2 MANUFACTURER

- A. W. H. Brady Co. catalog numbers are used as a basis of identification.
- B. Stock catalog numbers are listed in PART 2 and PART 3 schedules. Contractor is responsible to review schedules and provide required markers. In some instances, "non-stock" markers (special) may be required.

PART 2.3 VALVE TAGS

- A. Metal Tags: No. 23211, brass with stamped letters; tag sizes minimum 2 1/2 inches diameter with smooth edges.

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- B. Beaded Chain: No. 23306, size 6 brass 4 1/2 inches long with locking link.

PART 2.4 PIPE MARKERS/ARROW TAPE ABOVE GROUND

- A. Color: Conform to ANSI A13.1.
- B. Self-Sticking Pipe Markers/Arrow Tape: Material B-946, flexible, vinyl film tape with pressure sensitive permanent adhesive backing and printed markings.
 - 1. Suitable for indoor/outdoor application.
 - 2. Temperature range: Minus 40 degrees to 180 degrees F.

PART 2.5 UNDERGROUND PIPING WARNING TAPE

- A. Comply with Section 02310, Grading, Excavating, and Trenching.

PART 2.6 CEILING TACKS

- A. No. 23250 series, steel with 7/8-inch diameter color-coded head.
- B. Color code as follows:
 - 1. Yellow HVAC Equipment
 - 2. Red Fire Dampers / Smoke Dampers
 - 3. Green Plumbing Valves, Trap-Priming Devices, etc.
 - 4. Blue Heating / Cooling Valves

PART 2.7 DUCT MARKERS

- A. Plastic Tape Duct Marker and Arrows: Material No. B-946, flexible vinyl film tapes with pressure sensitive permanent adhesive backing and printed markings.
 - 1. Suitable for indoor/outdoor application.
 - 2. Temperature range: Minus 40 degrees to 180 degrees F.
- B. Letter style block, 2 inches height minimum.

PART 2.8 MECHANICAL EQUIPMENT AND HVAC CONTROLS IDENTIFICATION

- A. Identify mechanical equipment and HVAC controls, e.g., air handling units, pumps, heat transfer equipment, controls instruments, and similar items, with nameplates or tags.
 - 1. Provide nameplates made of durable non-corrosive, non-conductive, and impact resistant plastic material with standard over laminate (use UV resistant over laminate for outdoors) on one side.
 - a. Size: 1-1/2 x 3 inch or 2-1/2 or 4 inch
 - b. Color:
 - c. Manufacturer: Brady No. B418.
 - 2. Provide lettering as follows:
 - d. Size: 10 point minimum (larger preferred).
 - e. Spacing: 1/4 inch from top, 1/8 inch from bottom, 1/16 inch between lines.

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PART 2.9 SAFETY SIGNS

- A. Colors associated with specific words such as "Danger," "Warning," "Caution," or "Notice" to conform to ANSI Z35.1.
- B. Provide signage identifying each fixture, including fume hood cup sinks, being served by non-potable water.

PART 3 EXECUTION

PART 3.1 PREPARATION

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

PART 3.2 INSTALLATION

A. Valve Tags:

- 1. Install with brass beaded chain.
- 2. Steel stamp or engrave valve tag in accordance with schedule herein.
- 3. Letter style block, 1/4-inch height minimum.
- 4. Tag all valves in concealed or exposed areas except isolation and by-pass valves installed adjacent to the equipment they serve.
- 5. Provide typewritten letter size list of applied tags and location. [Frame under glass and hang where directed].

B. Pipe Markers Above Ground:

- 1. Install in accordance with manufacturer's instructions.
- 2. Seal markers with clear lacquer.
- 3. Identify piping in exposed or concealed areas in accordance with schedule herein.
- 4. Pipe marker consists of pipe contents identification with flow direction arrow tape. Provide consistent color scheme, unless otherwise noted.
- 5. Wrap arrow tape completely around pipe at both ends of pipe markers.
- 6. Install in clear view and align with axis of piping.
- 7. Label piping at intervals of not more than 20 feet on horizontal and vertical runs, at each branch connection, and where pipe penetrates walls, ceilings and floors (both sides).
- 8. Label waste piping below laboratory sinks to indicate destination.
- 9. Size of label depends on outside diameter (OD) of pipe. Pipe OD includes insulation or protective coating.
- 10. Minimum length of marker including arrows:

<u>Outside Diameter</u>	<u>Length (inches)</u>
2 inches or smaller	8
Greater than 2 inches to less than 8 inches	12

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8 inches to 10 inches	24
Over 10 inches	32

- C. Ceiling Tacks: Provide ceiling tacks to locate HVAC equipment, valves or dampers above accessible suspended ceilings. Locate tacks in corner of panel closest to equipment.
- D. Duct Markers:
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Seal markers with clear lacquer.
 - 3. Identify ducts in exposed or concealed areas in accordance with the schedule.
 - 4. Duct markers consist of duct identification name with flow direction arrows. Provide consistent color scheme.
 - 5. Install in clear view and align with axis of duct.
 - 6. Label ducts at intervals of not more than 20 feet on horizontal and vertical runs, at each branch connection, and where duct penetrates walls, ceilings and floors (both sides).
- E. Safety Signs: Install in clear view.

PART 3.3 SCHEDULES

A. PIPE MARKERS AND VALVE TAG LEGEND:

Pipe Identification	Background Color/ Letter Color	Outside Diameter (Letter Height)				Valve Tag Legend
		6" or greater (3 1/2" high) Style 1HV*	3" to less than 6" (2" high) Style 1*	1" to less than 3" (3/4" high) Style 4*	Less than 1" (5/16" high) Style 3C*	
Pipe Marker Catalog Numbers						
Drain	Grn/Wht	7090				D
Fire Protection Water	Red/Wht	7110				F
Electric Traced	Yel/Blk	7096				-----
High Pressure Natural Gas (Above 5 PSIG)	Yel/Blk	7139				NG
Low Pressure Natural Gas (Less than 14" W.C.)	Yel/Blk	7177				NGL
Medium Pressure Natural Gas (14" W.C. to 5 PSIG)	Yel/Blk	7190				NGM
Potable/Cold Water	Grn/Wht	7217/7055				PWC
Potable/Hot Water (Use Grn/Wht Arrows)	Grn/Wht/ Yel/Blk	7217/7146				PWH

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Pipe Identification	Background Color/ Letter Color	Outside Diameter (Letter Height)				Valve Tag Legend
		6" or greater (3 1/2" high) Style 1HV*	3" to less than 6" (2" high) Style 1*	1" to less than 3" (3/4" high) Style 4*	Less than 1" (5/16" high) Style 3C*	
		Pipe Marker Catalog Numbers				
Potable/Hot Water Recirculation	Grn/Wht/	7217/7147				PWHR
Sanitary Vent	Yel/Blk	7252				SWV
Sanitary Waste	Yel/Blk	7253				SW
Storm Water	Grn/Wht	7275				STW

* Include style number in parenthesis () following the catalog number.

B. AIR DUCT MARKERS

Duct Identification	Background Color/ Letter Color	Catalog Number
Air Return	Blu/Wht	7008
Air Supply	Blu/Wht	7010
Mixed Air	Blu/Blk	Special/7006
Outside Air	Blu/Wht	7206
Relief Air	Blu/Wht	7240
Toilet Exhaust Air	Blu/Wht	Special/7100

End of Section 15075

Part 1 GENERAL

Part 1.1 SECTION INCLUDES

- A. Piping insulation
- B. Ductwork insulation

Part 1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data of insulation, jackets, covers, adhesives, coatings, and cements.

Part 1.3 QUALITY ASSURANCE

- C. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84.
- D. Provide insulation material 100 percent asbestos free.
- E. Provide products that do not promote or support the growth of mold, fungi, or bacteria.

Part 1.4 QUALIFICATIONS

- F. Installers: Company specializing in performing work of this Section with minimum of 3 years experience.

Part 1.5 DEFINITIONS

- G. Finished Areas: Areas where floor, walls, ceilings, trim, or exposed steel are painted, tiled, or similarly finished.
- H. Unfinished Areas: Areas with unpainted walls.
- I. Exposed Areas: Finished areas and other areas used by personnel in the normal use of the building, such as fan rooms, mechanical room, and storage rooms.
- J. Concealed Areas: Pipe tunnels, covered pipe trenches, spaces inside walls, duct or pipe shafts, spaces above dropped ceilings, unfinished attic spaces and crawl spaces.

Part 1.6 ENVIRONMENTAL REQUIREMENTS

- K. Maintain ambient temperatures and conditions required by manufactures of adhesive, mastic, and insulation cements.
- L. Maintain temperature during installation per manufacture's instructions.

Part 2 PRODUCTS

.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- M. Comply with Section 01630, Product Options and Substitutions.

Part 2.1 GENERAL

- N. K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft²•F.

Part 2.2 MANUFACTURERS

- O. Knauf Fiber Glass, Owens/Corning Fiberglass, Armstrong, Certain Teed, Johns Manville, Rockwool Manufacturing, Armaflex, and others specified herein.

2.4 FIBERGLASS PIPE INSULATION

- A. Insulation: Rigid molded in compliance with ASTM C547, Class 1, minimum density 3.5 pounds/cubic foot, K-factor of approximately 0.24 at 75 degrees F, suitable for temperatures from minus 20 degrees F to 450 degrees F.
- B. Jacket: Factory applied vapor barrier all-service type with self-sealing lap and butt strips.
- P. Valves and Fitting Covers: Pre-molded PVC covers with fiber glass insert. Manufacturers: Proto Corp., Ceelco, and others specified herein.

Part 2.3 ELASTOMERIC PIPE INSULATION

- Q. Insulation: Cellular closed cell in compliance with ASTM C534, Type 1, minimum density 5 pounds/cubic foot, K-factor of approximately 0.29 at 75 degrees F, suitable for temperatures up to 220 degrees F.
- R. Valve and fitting covers: Same as pipe insulation, cut to fit.

Part 2.4 GLASS FIBER BLANKET DUCT INSULATION

- S. Insulation: Flexible blanket, in compliance with ASTM C612, minimum density 3/4 pounds/cubic foot, K-factor of approximately 0.29 at 75 degrees F, suitable for temperature from 35 degrees F to 250 degrees F.
- T. Jacket: Factory applied Foil-Scrim-Kraft (FSK) facing.
- U. Fittings: Same material as insulation.

Part 2.5 GLASS FIBER BOARD DUCT INSULATION

- V. Insulation: Rigid, in compliance with ASTM C612, Class 1, minimum density 3 pounds/cubic foot, K-factor approximately 0.23 at 75 degrees F, suitable for temperature from minus 20 degrees F to 450 degrees F.
- W. Jacket: Factory applied Foil-Scrim-Kraft (FSK) facing.
- X. Fittings: Same material as insulation.

Part 2.6 AIR DUCT BOARD

- Y. Rigid resin-bonded fiberglass board faced on exterior side with foil-scrim-kraft (FSK) vapor retarder, and air stream surface [faced with a tightly bonded non-woven black mat facing] or [impregnated with a polymer coating]. Service temperature 250 degrees F maximum, air velocity 5000 fpm maximum and internal static pressure +/- 2 inches water maximum.

Part 2.7 METAL JACKETING - PIPING/DUCTWORK

- Z. Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.
- AA. Valve and Fitting Insulation Covers: Fabricate from same material as jacketing or use

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prefabricated insulation covers made in two matching halves.

BB. Metal Jacketing Bands: 1/2 inch wide, aluminum or stainless.

CC. Manufacturer: Pabco-Childers Metals.

Part 2.8 PROTECTION SADDLES AND SHIELDS

DD. Provide factory engineered galvanized steel hanger shields on horizontal insulated pipe complying with MSS SP-58 and MSS SP-59 standards for gauge and length of saddle.

EE. Saddles (Piping/tubing up to 2 inches):

2. Use 180 degree saddle on systems utilizing teardrop type hangers.

3. Use 360 degree saddle on systems utilizing trapeze hangers or clamps.

FF. Inserts and Shields (Piping/tubing over 2 inches):

4. Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.

5. Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.

6. Provide unit with an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.

7. Insert: Calcium silicate, minimum density 9 pounds/cubic foot.

Use 180 degree saddle on systems utilizing teardrop type hangers.

GG. Use 360 degree saddle on systems utilizing trapeze hangers or clamps.

HH. Saddle: Galvanized steel, 14 gauge and 8 inches long.

Part 2.9 INSERTS AND SHIELDS (PIPING/TUBING OVER 2 INCHES)

II. Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.

JJ. Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.

KK. Provide unit with an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.

LL. Shield: Galvanized steel, length and gauge in accordance with insert and shield schedule.

MM. Insert: Calcium silicate, minimum density 9 pounds/cubic foot, length in accordance with insert and shield schedule.

NN. Insert and Shield Schedule: Bottom shield only; top shield may be one gauge lighter.

OO. Manufacturer: Value Engineered Products, Shaw Pipe Shields.

8. Quick-Shield (clevis/teardrop type hangers).

9. Pro-Shield (trapeze type hangers).

10. Weather-shield (outdoor installations).

Part 3 EXECUTION

Part 3.1 EXAMINATION

- PP. Verify that items to be insulated have been pressure tested and approved before applying insulation material.
- QQ. Verify that surfaces are clean, foreign material removed, and dry.

Part 3.2 INSTALLATION - GENERAL

- RR. Install materials in accordance with manufacturer's instructions.
- SS. Do not insulate factory-insulated equipment.
- TT. Do not insulate nameplates.
- UU. Fit insulation tightly against surface to which it is applied.
- VV. Do not insulate flexible connections.
- WW. For non-fire rated barriers (e.g., wall, floor, ceiling, or roof) Continue insulation and vapor barrier through penetrations. except where walls or floors are required to be fire stopped or required to have a fire resistive rating for fire rated barriers, provide UL/FM approved through penetration stop systems.
- XX. Weatherproof outdoor installations of piping or ductwork covered with aluminum jacket. Provide watershed lap joints and seal with mastic as required.
- YY. Do not install metal jacketing with raw edges; provide a safety edge.

Part 3.3 INSTALLATION - PIPING

- ZZ. On exposed piping located in finished areas, locate cover seams in least visible area.
- AAA. Provide continuous insulation through pipe hangers or supports. Do not notch insulation.
- BBB. Where insulation terminates, taper to pipe and finish with insulating cement or acrylic mastic.
- CCC. Cover insulated pipes located outdoors or in utility tunnels with aluminum jacket. Secure with aluminum bands and screws as required.
- DDD. Tape circumferential joints of pipe insulation with 3 inch wide white vinyl tape.
- EEE. Insulate fitting and valves where required with same material thickness as specified for adjacent pipe.
- FFF. Insulate potable and non-potable cold water piping within walls, chases, or ceiling plenums where return air is present.
- GGG. Insulate potable and non-potable cold water piping in equipment rooms.
- HHH. Do not insulate unions, flanges and valves in potable or non-potable piping systems of 140 degrees F or less, except for chilled water.
- III. Insulate refrigerant discharge line (hot gas discharge) when there is a danger of personnel coming in contact with piping or when the line is passing through a conditioned space. Insulate refrigerant liquid line when it is passing through spaces having temperatures greater than the refrigerant condensing temperatures.

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Part 3.4 INSTALLATION - DUCTWORK

- JJJ. Secure rigid board insulation to ductwork with metal fasteners (stick-clip) and scrim washer on 12 inch centers each way. Secure fasteners to duct work with recommended adhesive.
- KKK. Tape ductwork insulation joints and penetrations caused by mechanical fasteners with 3 inch wide FSK tape.
- LLL. Cover insulated ductwork located outdoors with aluminum jacketing. Secure with bands and screws as required.

Part 3.5 INSULATION SCHEDULE

MMM. HVAC PIPING SYSTEMS: USE FIBERGLASS PIPE INSULATION.

NOTE: For piping exposed to outdoor temperatures, increase thickness 1/2 inch.

Service	Nominal Pipe Diameter (inches)	Insulation Thickness (inches)
Heating hot water (to 200 degrees F)	All sizes	1 ½
Potable hot water (105 degrees F & greater)	Up to 2 over 2	1 1 ½
Non-potable hot water (105 degrees F & greater)	Up to 2 over 2	1 1 ½

Service	Nominal Pipe Diameter (inches)	Insulation Thickness (inches)
Refrigerant suction	All sizes	1
Refrigerant discharge	All sizes	1
Refrigerant liquid	All sizes	1
Chilled water (40-55 degrees F)	All sizes	1
Potable cold water	All sizes	1
Non-potable cold water	All sizes	1
Roof drain bowl and storm water piping	All sizes	1

NNN. Handicapped Lavatory Piping: Use elastomeric pipe insulation meeting ADA Standard Section 4.19.4, ANSI/ICC A117.1:

Service	Pipe Sizes (inches)	Insulation Thickness (inches)
Exposed drain and hot water lines	All sizes	½

OOO. Exhaust Piping: Use hydrous calcium silicate insulation. Wrap with aluminum jacketing.

Service	Insulation Thickness (inches)
Generator Exhaust Piping/ Muffler	1 ½

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PPP. Concealed Ductwork: Use glass fiber (flexible) duct insulation.

Service	Insulation Thickness (inches)
Supply and return air	1 ½

QQQ. Exposed Rectangular Ductwork: Use glass fiberboard (rigid) duct insulation on the exterior of the ductwork.

NOTE: Use 2 inch thick insulation for ductwork exposed to outdoor temperatures.

Service	Insulation Thickness (inches)
Supply and return air	1 ½

RRR. Exposed Round Ductwork: Use glass fiber (flexible) duct insulation. **NOTE:** Use 2 inch thick insulation for ductwork exposed to outdoor temperatures.

Service	Insulation Thickness (inches)
Supply and return air	1 1/2

END OF SECTION

End of Section 15080

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.

1.02 RELATED REQUIREMENTS

- A. Section 15050 - Basic Mechanical Materials and Methods.
- B. Section 15080 - Mechanical Insulation

1.03 REFERENCE STANDARDS

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
- E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.

1.04 SUBMITTALS

- A. See Section 15050 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.
- D. Maintain one copy of each document on site.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 INSULATION SYSTEM DESCRIPTIONS

- A. The thickness schedules and the following descriptions specify the type of insulation, accessories, etc. and the thicknesses of insulation and the method of installation to be employed for each insulation system.
- B. Ductwork, indoor:
 - 1. Ductwork: By others, rectangular.
 - 2. Blanket insulation: Glass fiber, K factor 0.24 @ 40 degrees F. with factory-applied vapor barrier jacket.
 - 3. Securement: Factory lap, sealed with adhesive and/or staples.
 - 4. Mechanical fasteners: Use on underside to support insulation whenever duct width exceeds 24 inches. Install no closer than 3 inches from the joints.
 - 5. Vapor barrier tape: Install over all tears and penetrations of the vapor barrier.
- C. Ductwork, outdoor:
 - 1. Ductwork: By others, rectangular.
 - 2. Fibrous board insulation: Glass fiber board, K factor 0.28 @ 200 degrees F. with factory-applied vapor barrier jacket.
 - 3. Securement: Factory lap, sealed with adhesive and/or staples.
 - 4. Mechanical fasteners: As required to support insulation wherever. Install no closer than 3 inches from the joints.
 - 5. Vapor barrier tape: Install over all tears and penetrations of the vapor barrier.
 - 6. Weather barrier: Mastic reinforced with mesh and thoroughly sealed for weather tightness.

2.03 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. Or equal performance.
- B. Insulation: ASTM C 553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.
 - 2. Maximum Service Temperature: 1200 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.
 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated ducts conveying air above ambient temperature:
 1. Provide with or without standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting or aluminum jacket.

3.03 SCHEDULES

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
 1. Flexible Glass Fiber Duct Insulation: 1 inch thick.
- B. Exhaust Ducts Exposed to Outdoor Air:
 1. Flexible Glass Fiber Duct Insulation: 1 inch thick with aluminum jacket.
- C. Supply Ducts:
 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
- D. Return Ducts in Unconditioned Spaces:
 1. Flexible Glass Fiber Duct Insulation: 2 inches thick.
- E. Return and Relief Ducts in Mechanical Rooms:
 1. Rigid Glass Fiber Duct Insulation: 1 inch thick.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 15050 - Basic Mechanical Materials and Methods.
- B. Section 15080 - Mechanical Insulation
- C. Section 15145 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- B. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
- E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.

1.04 SUBMITTALS

- A. See Section 15050 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.
- D. Maintain one copy of each document on site.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 INSULATION SYSTEM DESCRIPTIONS

- A. The Thickness Schedules and the following descriptions specify the type of insulation, accessories, etc. and the thicknesses of insulation and the method of installation to be employed for each insulation system.
- B. Domestic hot water piping, indoor:
 - 1. Pipe: By others, copper.
 - 2. Insulation: Glass fiber, K factor 0.28 @ 40 degrees F., one piece, pre-formed.
 - 3. Securement: Tape or bands.
 - 4. Jacket: All purpose fire-retardant jacket, sealed with contact adhesive and tape.
 - 5. Fittings: Form the glass fiber insulation over the fittings and valves, neatly trim excess, and cover with fitting mastic and fiberglass tape and finish to a smooth surface.
- C. Roof drain piping, indoor:
 - 1. Pipe: By others.
 - 2. Insulation: Glass fiber, K factor 0.28 @ 40 degrees F, one piece, pre-formed.
 - 3. Securement: Tape or bands.
 - 4. Jacket: All purpose fire-retardant jacket, sealed with contact adhesive and tape.
 - 5. Fittings: Form the glass fiber insulation over the fittings and valves, neatly trim excess, and cover with fitting mastic and fiberglass tape and finish to a smooth surface.
- D. Vent piping, indoor:
 - 1. Pipe: By others.
 - 2. Insulation: Glass fiber, K factor 0.28 @ 40 degrees F., one piece, pre-formed.
 - 3. Securement: Tape or bands.
 - 4. Jacket: All purpose fire-retardant jacket, sealed with contact adhesive and tape.
 - 5. Fittings: Form the glass fiber insulation over the fittings and valves, neatly trim excess, and cover with fitting mastic and fiberglass tape and finish to a smooth surface.
- E. Domestic cold water piping, indoor:
 - 1. Pipe: By others, copper.
 - 2. Insulation: Glass fiber, K factor 0.28 @ 40 degrees F., one piece, pre-formed.
 - 3. Securement: Tape or bands.
 - 4. Jacket: All purpose fire-retardant jacket, sealed with contact adhesive and tape.
 - 5. Fittings: Form the glass fiber insulation over the fittings and valves, neatly trim excess, and cover with fitting mastic and fiberglass tape and finish to a smooth surface.
- F. Condensate Piping:
 - 1. Pipe: By others, copper.
 - 2. Insulation: Glass fiber, K factor 0.28 @ 40 degrees F., one piece, pre-formed.
 - 3. Securement: Tape or bands.

4. Jacket: All purpose fire-retardant jacket, sealed with contact adhesive and tape.
5. Fittings: Form the glass fiber insulation over the fittings and valves, neatly trim excess, and cover with fitting mastic and fiberglass tape and finish to a smooth surface.

2.03 GLASS FIBER

- A. Manufacturers:
 1. Knauf Insulation: www.knaufusa.com.
 2. Johns Manville Corporation: www.jm.com.
 3. Owens Corning Corp: www.owenscorning.com.
 4. Or equal performance.
- B. Insulation: ASTM C 547 and ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.
 1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
 2. Maximum service temperature: 650 degrees F.
 3. Maximum moisture absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive:
 1. Compatible with insulation.
- F. Insulating Cement/Mastic:
 1. ASTM C 195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
 1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Blanket: 1.0 lb/cu ft density.
- H. Indoor Vapor Barrier Finish:
 1. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

- A. All purpose fire-retardant jacket, sealed with contact adhesive and tape.
- B. PVC Plastic.
 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
 - d. Thickness: 15 mil.
 - e. Connections: Pressure sensitive color matching vinyl tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07840.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply:
 - a. Non Circulation Runouts:
 - 1) Temperature: 100 - 180 degrees F.
 - (a) Pipe Size: Up to 1 inch.
 - (1) Insulation: 1/2 inch.
 - b. Circulating Mains and Runouts:
 - 1) Temperature: 170 - 180 degrees F.
 - (a) Pipe Size: Up to 1-1/4 inch.
 - (1) Insulation: 1 inch.
 - (b) Pipe Size: 1-1/2 inch to 2 inch.
 - (1) Insulation: 1-1/2 inch.
 - (c) Pipe Size: Over 2 inch.
 - (1) Insulation: 2 inch.
 - 2) Temperature: 140 - 160 degrees F.
 - (a) Pipe Size: Up to 1-1/4 inch.
 - (1) Insulation: 1/2 inch.
 - (b) Pipe Size: 1-1/2 inch to 2 inch.
 - (1) Insulation: 1 inch.
 - (c) Pipe Size: Over 2 inch.
 - (1) Insulation: 1-1/2 inch.
 - 3) Temperature: 100 - 130 degrees F.
 - (a) Pipe Size: Up to 1-1/4 inch.
 - (1) Insulation: 1/2 inch.

- (b) Pipe Size: 1-1/2 inch to 2 inch.
 - (1) Insulation: 1/2 inch.
 - (c) Pipe Size: Over 2 inch.
 - (1) Insulation: 1 inch.
 - c. Piping insulation is not required when the heat loss of the piping without insulation does not increase the annual energy requirements of the building.
 - d. For re-circulating systems, the heat loss shall be limited to a maximum of 17.5 BTUH/linear foot in accordance with the above requirements, which applies for a surrounding temperature no lower than 65 degrees F. For lower surrounding temperatures, the loss must be verified by calculations.
2. Domestic Hot Water Recirculation:
- a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
3. Domestic Cold Water:
- a. Pipe Size: Up to 2 inch.
 - 1) Insulation: 1/2 inch.
 - b. Pipe Size: Over 2 inch.
 - 1) Insulation: 1 inch.

END OF SECTION

SECTION 15140
POTABLE AND NON-POTABLE WATER PIPING

PART 1 GENERAL

PART 1.1 SECTION INCLUDES

- A. Building potable and non-potable water piping, valves, fittings, water heater, circulator pump, and accessories within the building envelope.

PART 1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data on pipe materials, pipe fittings, valves, water heater, circulator pump, and accessories.
 - 2. Installation instructions for valves and accessories.

PART 2 PRODUCTS

PART 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01630, Product Options and Substitutions.

PART 2.2 PIPING, BURIED WITHIN THE BUILDING ENVELOPE

- A. Ductile Iron Pipe: AWWA C151.
 - 1. Fittings: AWWA C110, Ductile-Iron or Gray-Iron, Class 350 or AWWA C153, Ductile Iron Compact Fittings, Class 350.
- B. Copper Tubing: ASTM B88, Type K, hard drawn or annealed.
 - 1. Fittings: ANSI/ASME B16.22, wrought copper and copper alloy solder-joint.
 - 2. Joints: AWS A5.8, BCuP silver braze.

PART 2.3 PIPING ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn or annealed.
 - 1. Fittings: ANSI/ASME B16.22, wrought copper and copper alloy solder-joint.
 - 2. Joints: ASTM B32, Solder, Grade 95TA.
 - 3.
- B. CPVC Pipe: ASTM D2846, for water service up to 180 degrees F.
 - 1. Fittings: ASTM D2846, CPVC.
 - 2. Joints: ASTM D2846, solvent weld with ASTM F493 solvent cement.

PART 2.4 UNIONS

- A. Copper Tubing: Class 150 bronze unions with soldered joints.

PART 2.5 VALVES, ABOVE GRADE

- A. Ball Valves up to 2 inches:
 - 1. Manufacturer: Nibco, Series 585-70.

2.MSS SP-110, 600 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blowout proof stem, lever handle, solder or threaded ends.

B. Butterfly Valves over 2 inches:

1.Manufacturer: Nibco, Series LD 2000.

2.MSS SP-67, 200 psi CWP, ductile iron body, aluminum bronze disc, resilient replaceable EPDM seat, lug style, extended neck, lever handle, for use between ANSI Class 125/150 flanges.

C. Globe Valves up to 2 inches:

1.Manufacturer: Nibco, Series 211.

2.MSS SP-80, Class 125 bronze body, bronze trim, hand wheel, bronze disc, solder or threaded ends.

D. Gate Valves up to 2 inches:

1.Manufacturer: Nibco, Series 111.

2.MSS SP-80, Class 125 bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge disc, solders or threaded ends.

E. Manufacturer: CLA-VAL, No. 90-01-AS.

F. Single seated, hydraulically operated, pilot controlled, diaphragm type valve, 175 psi pressure rating, 180 degree F maximum water temperature and 15 to 75 psi adjustment range. Pilot control; direct acting, adjustable, spring loaded, and normally open. Valve construction; globe, ductile iron main valve body and cover, bronze main valve trim, and cast bronze pilot control with stainless steel trim. Repairs must be done without removing valve from line.

1.Optional Features: Flow clean features and CV flow control (opening speed control).

PART 2.6PRESSURE REDUCING VALVE (PRV)

A. Manufacturers:

1.CLA-VAL, No. 990.

2.Wilkins, No. 500YSBR.

B. Balanced single seat with bronze valve body and cover, stainless steel trim, integral strainer, 175 psi maximum water temperature, and standard adjustment range 8-80 psi. Repairs must be done without removing valve from line.

PART 2.7CIRCULATOR PUMP, HOT WATER

A. Manufacturer: Bell and Gossett, Series 100.

B. Bronze body, brass impeller, steel shaft, suitable for 125 psi working pressure and 225 degrees F water temperature, mechanical seal, direct drive, and oil lubricated drip proof motor, 1750 rpm.

C. Performance:

1.See sheet P-7000.

PART 2.8STRAINERS

A. Sizes up to 2 inches:

1.Threaded brass body for 175 psi CSP, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size over 2 inches:

1.Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 2.9HOSE BIB (WALL HYDRANT)

A. Manufacturer: J.R. Smith Mfg. Co.

B. ANSI A112.21.3, non-freeze, integral vacuum breaker, bronze or brass [nickel plated], 3/4 inch exposed hose connection, 1/4 turn, T-handle key.

C. ANSI A112.21.3, exterior use, non-freeze, integral vacuum breaker, bronze or brass, concealed 3/4 inch hose connection, 1/4 turn, T-handle key, stainless steel box with hinged locking cover.

PART 2.10BACKFLOW PREVENTER, FLANGED ENDS

A. Provide models listed in the latest edition of Approved Backflow Prevention Assemblies by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research.

1.Suggested Manufactures:

a.Conbraco, Series 40200.

b.Wilkins, Series 375.

c.Watts, Series 909.

B. Assembly, reduced pressure type, cast iron body epoxy coated internal and external, with OS & Y shut-off valves, flanged ends, test cocks for in-line field testing, and an air gap drain funnel. Maximum water temperature range 33 to 140 degrees F, maximum rated working pressure 175 psi.

1.Size: 2" inch.

PART 2.11BACKFLOW PREVENTERS, THREADED ENDS:

1. Manufacturers:

a. Watts, Model 009.

2. Reduced Pressure Backflow Preventers: ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; pressure relief valve located between check valves; third check valve opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two ball valves, strainer, and four test cocks.

PART 2.12PRESSURE GAUGE

A. Manufacturer: Reotemp Instruments.

B. ANSI B40.1, Grade A, 1 percent full scale accuracy, minimum 2 1/2 inch dial, phenolic or steel case, phosphor bronze bourden tube and 1/4 inch NPT brass bottom connection. Furnish with brass ball valve.

1.Range: 0-200 psi .

PART 2.13 EXPANSION TANK

- A. Manufacturer: Amtrol
- B. Construction: Welded steel, ASME tested and stamped; rated for working pressure of 125 psig (860 kPa), with flexible diaphragm sealed into tank, and steel legs or saddles. Accessories: Pressure gage and air-charging fitting and drain.

PART 2.14 CIRCUIT SETTER BALANCE VALVES

- A. Manufacturer: Bell and Gossett
- B. Construction: Valves to be of bronze/brass body ball valve construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read out ports across valve seat area. Read out ports to be fitted with internal EPT insert and check valve. Valve bodies to have ¼" NPT tapped drain/purge port. Valves to have internal memory stop to allow valve to be closed for service without disturbing the balance position. Valves to be leak-tight at full rated working pressure.

PART 2.15 TRAP PRIMERS

- A. Manufacturer: J.R. Smith
- B. Cast bronze with ½" connection and anti-siphon port

PART 2.16 WATER HAMMER ARRESTORS

- A. Manufacturer: J.R. Smith Mfg. Co.
- B. Stainless steel construction, bellows type, pre-charged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psi (1700kPa) working pressure.

PART 3 EXECUTION

PART 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.

PART 3.2 INSTALLATION

- A. Comply with Uniform Plumbing Code (UPC).
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls
- D. Install piping to maintain headroom and neither interfere with use of space nor take more space than necessary.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide access where valves and other equipment are not exposed.
- H. Install valves with stems upright or horizontal, not inverted.
- I. Pipe relief from safety valves and backflow preventers to nearest floor drain.

- J. Slope water piping and provide drain valves at low points.
- K. Pressure test piping system in accordance with Section 15992.
- L. Label piping system in accordance with Section 15075.
- M. Insulate piping system in accordance with Section 15080.
- N. Support piping system in accordance with Section 15060.
- O. Sleeve and caulk pipes penetrating exterior walls or interior bearing walls. Provide waterproof installation for exterior walls. Provide UL/FM approved through-penetration fire stop system when penetrating fire-rated barriers (i.e., walls, floors, etc.).
- P. Paint exposed piping in occupied spaces to match background color.
- Q. Install chrome-plated steel escutcheons where pipes are not insulated in finished areas.
- R. Provide stops on waterlines for plumbing fixtures.
- S. Above Grade Piping: Provide ball valves or gate valves in piping 2 inches and smaller and butterfly valves in piping 2 1/2 inches and larger. Provide globe valves for throttling application.

END OF SECTION

SECTION 15150
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building piping, fittings, and accessories within 5 feet of building wall.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:

- 1. Catalog data on pipe materials, fittings and accessories.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- a. Comply with Section 01630, Product Options and Substitutions.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe and Fittings: ASTM A74 service weight, bell and spigot ends.
 - 1. Joints: Hub and spigot, CISPI HSN compression type with ASTM C564 rubber gaskets.
- B. PVC Pipe and Fittings: ASTM D2665, polyvinyl chloride (PVC) material, Schedule 40 DWV.
 - 1. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 SANITARY WASTE AND VENT PIPING, ABOVE GRADE INSIDE BUILDING

- A. Cast Iron Pipe and Fittings: CISPI 301 hubless, service weight.
 - 1. Joints: CISPI 310, neoprene gaskets and stainless steel clamp/shield assemblies.
- B. Cast Iron Pipe and Fittings: ASTM A74 service weight, bell and spigot ends.
 - 2. Joints: Hub and spigot, CISPI HSN compression type with ASTM C564 rubber gaskets.

- C. PVC Pipe and Fittings: ASTM D2665, polyvinyl chloride (PVC) material, Schedule 40 DWV.
 - 1. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- D. Ductile Iron Pipe: AWWA C151, Class 150, bell and spigot ends.
 - 1. Fittings: AWWA C110, Ductile-Iron or Gray-Iron, Class 350 or AWWA C153, Ductile-Iron Compact Fittings, Class 350.
 - 2. Joints: Hub and spigot, AWWA C111 rubber gaskets.
- 2.4 FLOOR DRAINS
 - A. Manufacturer: J.R. Smith Mfg. Co.
 - B. Floor Drain: Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- 2.5 FLOOR SINKS
 - A. Manufacturer: J.R. Smith Mfg. Co.
 - B. Floor Sink: Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, epoxy coated, nickel bronze frame and full grate.
- 2.6 CLEANOUTS
 - A. Manufacturer: J.R. Smith Mfg. Co.
 - B. Finished Floor: Lacquered cast iron body with anchor flange, reversible clamping collar, and adjustable nickel-bronze round scored cover in service areas and round depressed cover to accept floor finish in finished floor areas.
- 2.7 ROOF DRAINS
 - A. Manufacturer: J.R. Smith Mfg. Co.
 - B. Coordinate with roofing type. Lacquered cast iron body with sump. Strainer: Removable metal dome.

PART 3 EXECUTION

PART 2.2 PREPARATION

- A. Ream pipe ends and remove burrs.

3.2 INSTALLATION

- A. Comply with Uniform Plumbing Code (UPC).
- B. Extend cleanouts to finish floor or wall surface. Lubricate threaded cleanout plugs with non-hardening thread lubricant. Ensure clearance at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete, flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

- F. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- G. Install bell and spigot pipe with bell end upstream.
- H. Sleeve and caulk pipes penetrating exterior walls or interior bearing walls. Provide waterproof installation for exterior walls. Provide UL/FM approved through-penetration fire stop system when penetrating fire-rated barriers (i.e., walls, floors, etc.).
- I. Test piping system with water in accordance with Section 15992.
- J. Label piping in accordance with Section 15075.
- K. Support piping in accordance with Section 15060.

END OF SECTION

SECTION 15195
NATURAL GAS PIPING

PART I GENERAL

1.1 SECTION INCLUDES

- A. Building gas piping system (above grade) downstream of the site low-pressure gas regulator station.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data on pipe materials, pipefittings, valves, pipe coating, and accessories.
 - 2. Certification of welders and qualified welding procedure.

1.3 QUALITY ASSURANCE

- A. Welders Certification and Qualified Procedure Standards
 - 1. Interior Steel Pipe: Section IX of ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01630, Product Options and Substitutions.

2.2 STEEL PIPING, ABOVE GRADE

- A. Pipe: Standard wall, black steel, ASTM A53. Welded for pipe sizes above 2 inches, threaded for pipe sizes 2 inches or less.
- B. Fittings: Malleable iron, threaded type, ANSI B16.3, Class 150 or standard wall, black steel, butt welding type, ASTM A234, Grade WPB.
- C. Flanges: Steel, weld neck, class 150, raised face, ANSI B16.5.
- D. Gasket Material: Neoprene, durometer hardness 50-65.

2.3 VALVES, ABOVE GRADE

- A. Manufacturer: A.Y. McDonald, Series 10685B.
- B. Valve: Iron body, FIP threaded ends, plug style, flat head wrench operated, 100 psig working pressure.

2.4 TEST PLUG (PETE'S PLUG)

- A. 1/4 inch NPT, brass body, neoprene core, rated for 1,000 psig, complete with sealing cap and gasket, to receive 1/8 inch O.D. probe.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Furnish and install gas piping in accordance with Uniform Plumbing Code, Uniform Mechanical Code, ASME B31.1 Power Piping, and 49 CFR 192 Code of Federal

Regulations.

- B. Do not run gas piping below buildings, structures, or in crawl spaces.
- C. Do not run gas piping under walks and equipment pads adjacent to building unless properly sleeved.
- D. Pressure test piping in accordance with Section 15992.
- E. Label piping in accordance with Section 15075.
- F. Paint outside gas regulator piping, valves, and appurtenances above ground to match building exterior.
- G. Support piping in accordance with Section 15060.
- H. Use threaded joints for above grade piping 2 inches and smaller and butt-welded joints for piping above 2 inches.
- I. Sleeve and caulk pipes penetrating exterior walls or interior bearing walls. Provide waterproof installation for exterior walls. Provide UL/FM approved through-penetration fire stop system when penetrating fire-rated barriers (i.e., walls, floors, etc.).

END OF SECTION

SECTION 15410
PLUMBING FIXTURES

PART 1 GENERAL

PART 1.1 SUMMARY

- A. Section Includes:
 - 1. Water closet
 - 2. Lavatories and insulation kits

PART 1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes of fixtures as shown on drawings or identified in these specifications, which ever is applicable.
- B. Manufacturer's Installation Instructions: Submit installation methods and procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

PART 1.4 QUALITY ASSURANCE

- A. Provide products requiring electrical connections listed and classified by a nationally recognized testing laboratory as suitable for purpose specific and indicated.
- B. Provide ADA compliant products.
- C. Provide water conserving fixtures and fittings complying with the Uniform Plumbing Code.

PART 2 PRODUCTS

PART 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01630, Product Options and Substitutions.

PART 2.2 TANK TYPE WATER CLOSETS (See Drawings)

PART 2.3 WALL HUNG URINALS (Not Applicable)

PART 2.4 LAVATORIES

- A. Vitreous China Wall Hung Lavatory: ASME A112.19.2M; vitreous china wall mount lavatory, with 4 inch high back, 21 x 18 inches rectangular basin with splash lip and front overflow.
 - 1. Manufacturer: Kohler, Model K-2005 (4 inch centers), Kingston.
- B. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with 0.5 gpm battery-operated solenoid operator and infrared sensor, aerator, trim plate, open grid strainer, back check for hot and cold supply, and thermostatic mixing valve.

1. Manufacturer: Sloan, Model EBF-85-A, Optima Plus.
- C. Accessories:
1. Chrome plated 17-gage brass P-trap with clean-out plug and arm with escutcheon.
 2. Chrome plated rigid supplies to fixtures with chrome plated brass [loose key] [screwdriver] [wheel handle] stops, reducers, and escutcheons.
 3. Offset waste with perforated open strainer.
 4. Trap and waste insulated and offset to meet ADA compliance.
- D. Wall Mounted Carrier: ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

PART 3 EXECUTION

PART 3.1 EXAMINATION

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

PART 3.2 PREPARATION

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

PART 3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Install fixture supplies with smooth bends and no kinks.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports or wall carriers and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

PART 3.4 INTERFACE WITH OTHER PRODUCTS

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

PART 3.5 ADJUSTING

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

PART 3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

PART 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 15780

PACKAGED AIR CONDITIONERS

1.0 GENERAL

1.1 SECTION INCLUDES

- A. Packaged roof top air conditioning units.

1.2 SUBMITTALS

- A. Shop Drawings and Product Data: Provide for manufactured products and assemblies required. Indicate water, drain, electrical, and refrigeration rough in connections.
- B. Submit manufacturer's installation instructions.
- C. Operating and Maintenance Instructions: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.3 MAINTENANCE

- A. Furnish complete service and maintenance of packaged roof top air conditioning units for one year of service call, provide work order or report, and include description of work performed.
- B. Provide one extra set of filters.

2.0 PRODUCTS

2.1 PACKAGED ROOF TOP AIR CONDITIONING UNITS

- A. Manufacturers:
 - 1. York
 - 2. Carrier.
 - 3. Lennox.
 - 4. McQuay.
- B. Unit: Self-contained, packaged, factory assembled and pre-wired unit, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor completely contained within cabinet, condenser coil, condenser fan and hail guards.
- C. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fasteners, screwdriver operated flush cam type.
- D. Insulation: One inch thick neoprene coated glass fiber.
- E. Heat Exchangers: Aluminized steel, of welded construction.

- F. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted motor or direct drive.
- G. Air Filters: One inch thick glass fiber disposable media in metal frames.
- H. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, automatic 100 percent shut-off pilot, and high limit control. Temperature sensor sensing bonnet temperatures independent of burner controls, energizes fan.
- I. Evaporator Coil: Copper or aluminum tube fin coil assembly with capillary tubes or thermostatic expansion valves, galvanized drain pan and connection.
- J. Compressor: Hermetic or semi-hermetic compressor, 3600 rpm, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.
1. Outdoor thermostat shall energize compressor above 57 degrees F ambient.
 2. Step Capacity Control: Cycling multi- speed compressors.
- K. Condenser: Copper or aluminum tube aluminum fin coil assembly with sub-cooling rows, direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide refrigerant pressure switches to cycle condenser fans.
- L. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper may be gravity balanced.
- M. Damper Operator: 24 volt with gear train sealed in oil.
- O. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and above 75 degrees F (24 degrees C) ambient.
- P. Low Voltage Thermostat: Controls burner operation, heater stages in sequence with delay between stages, compressor and condenser fan, and supply fan with system selector switch (off-heat-auto-cool) and fan control switch (auto-on).

3.0 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of units with architectural, mechanical, and electrical work.

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- C. Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.
 - D. Mount roof mounted units on 4" concrete pad with ½" rebar, 4" o.c. cross.
 - E. Supply units fully charged with refrigerant and filled with oil.
 - F. Scheduled performance is based on ARI 210/240 test conditions.

END OF SECTION

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SECTION 15810

DUCTS

PART 1 GENERAL

PART 1.1 SUMMARY

- A. Section includes ductwork, duct cleaning, duct sealing, and.

PART 1.2 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

PART 1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Catalog data for duct materials, flexible duct/connectors, sealing materials.
 - 2. Shop drawings indicating duct layout with pressure classification and sizes, fittings, hangers and supports, seam and joint construction, connections to equipment such as coils, etc., for pressure class ducts 2 inches and greater.
 - 3. Test Reports indicating pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

PART 1.4 QUALITY ASSURANCE

- A. Construct ductwork in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible, and NFPA 90A.
- B. Fiberboard duct is not acceptable.

PART 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years experience approved by manufacturer.

PART 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

PART 1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

PART 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01630, Product Options and Substitutions.

PART 2.2 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.
- B. Fasteners: Rivets, bolts, or sheet metal screws.
- C. Hanger Rod: ASTM A36; steel threaded both ends, threaded one end, or continuously threaded. Use galvanized steel or aluminum, 6061-T6, hangers in contact with aluminum duct.
- D. Hanger Straps: ASTM A653 galvanized steel having G90 zinc coating in conformance with ASTM A90.
- E. Structural Steel Members: ASTM A36 steel. Use aluminum, 6061-T6 or galvanized steel members for aluminum ducts.

PART 2.3 DUCTWORK FABRICATION

- A. Fabricate ductwork and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Furnish duct material, gages, reinforcing, and sealing for pressure class indicated.
- B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide single thickness turning vanes constructed and installed in accordance with SMACNA Standards. Vanes are not required in return air sound trap elbows and transfer ducts.
- C. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.
- D. Provide, at minimum, rectangular 45-degree entry fittings for rectangular ducts and 45-degree wye takeoffs for round ducts.
- E. Duct sizes noted are inside clear dimensions. For lined ducts, maintain duct sizes inside lining.
- F. Increase duct size gradually, not exceeding 15 degree divergence wherever possible. Do not exceed 30-degree divergence upstream of equipment. Do not exceed 45-degree convergence downstream of equipment.

PART 2.4 FLEXIBLE DUCTS (INSULATED, LOW PRESSURE)

- A. Manufacturer: Flexmaster, Type 5.
- B. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A.
 - 1. Pressure Rating: 6 inches w.g. positive, 4 inches w.g. negative through 16 inches diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
 - 2. Rated Velocity: 4000 fpm.
 - 3. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.
 - 4. Insulation: Fiberglass, C factor of 0.23 or less.

PART 2.5 FLEXIBLE CONNECTIONS (EXPOSED TO SUN AND WEATHER)

- A. Manufacturer: Ventfabrics, Ventlon.

B.24 gage metaledge ventlon (glass fiber coated with hypalon), fire retardant, UL Standard 214, and comply with NFPA-90A.

1. Pressure Rating: 10 inches w.g., negative and positive.
2. Temperature Rating: Minus 10 degrees F to plus 275 degrees F.
3. Weight: 26 oz/sq yd plus or minus 2 ounces.

PART 2.6 FLEXIBLE CONNECTIONS (INDOOR)

A. Manufacturer: Ventfabrics, Ventlon.

B.24 gage metaledge ventlon (glass fiber coated with hypalon), fire retardant, UL Standard 214, and comply with NFPA-90A.

1. Pressure Rating: 10 inches w.g. negative and positive.
2. Temperature Rating: Minus 20 degrees F to plus 200 degrees F.
3. Weight: 30 oz/sq yd plus or minus 3 ounces.

PART 2.7 SPIRAL ROUND AND FLAT OVAL DUCT

A. Machine made spiral lock-seam duct with light reinforcing corrugations. Fittings: Welded seam construction, manufactured of at least two gages heavier metal than duct.

PART 2.8 DUCT LINER

A. Manufacturer: Certainteed, Tough Gard with Enhanced Surface.

B. Composed of long textile type glass fibers with thermosetting resin overlaid with a tough and durable fire resistive black composite surface on the air stream. The air stream surface to contain an EPA registered antimicrobial agent to reduce the potential of microbial growth. Flame spread/smoke developed 25/50 maximum meeting NFPA 90A requirements.

1. Thickness: 1 inch.
2. Velocity Rating: 6000 fpm.
3. Temperature Rating: 250 degrees F.
4. Minimum Density: 1 1/2 pcf.

PART 3 EXECUTION

PART 3.1 EXAMINATION

A. Verify sizes of equipment connection before fabricating transitions.

PART 3.2 INSTALLATION

A. Install and support ductwork in accordance with SMACNA HVAC Duct Construction Standards- Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use double nuts and lock washers on threaded rod supports.

D. Connect flexible ducts to metal ducts with draw bands.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

- F. Provide factory fabricated balancing dampers with indicating type locking quadrant where noted on drawing.
1. Dampers are not required upstream or downstream of VAV boxes serving only one diffuser.
 2. Do not use splitter dampers.
 3. Locate balancing dampers as far as possible (recommend no closer than 5 feet) from air terminals to avoid excessive noise.
- G. Provide flexible connections with minimum 1-inch slack immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Limit flexible ductwork to diffusers, terminal units, or light troffer boots, to 5 feet in length.
1. Do not install flexible ductwork upstream of VAV boxes.
 2. Provide rigid straight ductwork, 2 duct diameters or a minimum of 12 inches, downstream of VAV boxes.
- I. Provide duct access doors for inspection and cleaning upstream of filters, coils, automatic dampers, and equipment as indicated on drawings. Provide minimum 8 X 8 inch size for hand access, 18 X 18 inch size for shoulder access.
- J. Where indicated, weld or braze duct joints and seams in accordance with AWS D9.1.
- K. Repair damaged galvanized ductwork surfaces (welds, scratches, etc.) by applying minimum 2 coats of a zinc base paint.
- L. Paint exposed ductwork in occupied areas to match surroundings. Refer to Section 09900, Painting.
- M. Provide duct drops to diffuser same size as diffuser neck size.
- N. Provide UL/FM approved through-penetration firestop system when penetrating fire-rated barriers (i.e., walls, floors, etc).
- O. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- P. Secure duct liner with mechanical fasteners and adhesive per SMACNA duct liner standards and/or manufacturer's installation specifications. Coat all raw exposed edges per manufacturer's instructions.
- Q. Insulate ductwork in accordance with 15080.

PART 3.3 CLEANING

- A. After completing system installation and inspection, vacuum ducts to remove dust and debris.

PART 3.4 DUCTWORK PRESSURE CLASSIFICATION

- A. Construct each duct system for a minimum pressure classification of 1 inch w.g., and as follows:
1. Supply Ducts: 3-inch w.g. pressure duct from air handling unit to VAV terminal unit.
 2. Supply Ducts: 2 inches pressure duct from VAV terminal unit to diffuser.
 3. Return Ducts: 2 inches w.g., negative pressure.
 4. Exhaust Ducts: 2 inches w.g., negative pressure.

PART 3.5 DUCT SEALING

- A. Seal duct seams and joints in accordance to the duct pressure classification as described in SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. Do not use pressure-sensitive sealant on ducts with a pressure class of 1 inch w.g. or greater.

PART 3.6 DUCT LEAKAGE

- A. Perform leakage tests in accordance with the SMACNA HVAC Duct Leakage Test Manual, using tests forms equivalent to those outlined in manual.
- B. The entire duct system need not to be tested. Tests may be made for only representative sections provided these sections represent at least 25 percent of the total installed duct area for the tested pressure class.
- C. Maximum Allowable Leakage: Comply with the following requirements
 - 1. Leakage Classification 3 for round and flat oval ducts.
 - 2. Leakage Classification 12 for rectangular ducts, 2 inches w. g. or less.
 - 3. Leakage Classification 6 for rectangular ducts, 2-10 inches w.g.
- D. Remake leaking joints and retest to ensure leakage is less than the minimum allowed.

END OF SECTION

SECTION 15820
DUCT ACCESSORIES

PART 1 GENERAL

PART 1.1 SUMMARY

- A. Section Includes:
 - 1. Duct access doors.
 - 2. Volume control dampers.
 - 3. Flexible duct connections
 - 4. Duct test holes.
- B. Related Sections:
 - 1. Section 15810 - Ducts: Requirements for duct construction and pressure classifications.

PART 1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 92A - Recommended Practice for Smoke-Control Systems.
- B. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. Underwriters Laboratories Inc.:
 - 1. UL 33 - Heat Responsive Links for Fire-Protection Service.
 - 2. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

PART 1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and, duct test holes.
- C. Product Data: Submit data for shop fabricated assemblies including back draft dampers, flexible duct connections, volume control dampers, duct access doors, duct test holes, and, hardware used. Include electrical characteristics and connection requirements.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of test holes.

PART 1.5 QUALIFICATIONS

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

PART 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect dampers from damage to operating linkages and blades.

PART 1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 1.8 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

PART 2 PRODUCTS

PART 2.1 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Quadrants:
 - 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches (750 mm) furnish regulator at both ends.

PART 2.2 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 2 wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.087 lbs. per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

PART 2.3 DUCT TEST HOLES

- A. Permanent Test Holes: Factory fabricated airtight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 EXECUTION

PART 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify ducts and equipment installation are ready for accessories.
- C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

PART 3.2 INSTALLATION

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.

- B. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and as indicated on Drawings. Install minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as indicated on Drawings
- C. Install permanent duct test holes where required for testing and balancing purposes.

END OF SECTION

SECTION 15830

FANS

PART 1 GENERAL

PART 1.1 SUMMARY

- A. Section Includes:
 - 1. Roof exhausters.
 - 2. Cabinet and ceiling exhaust fans.
- B. Related Sections:
 - 1. Section 15080 - Mechanical Insulation: Product requirements for power ventilators for placement by this section.
 - 2. Section 15810 - Ducts: Product requirements for hangers for placement by this section.
 - 3. Section 15820 - Duct Accessories: Product requirements for duct accessories for placement by this section.

PART 1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- C. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- D. Underwriters Laboratories Inc.:
 - 1. UL 705 - Power Ventilators.

PART 1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
 - 1. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
 - 2. Product Data: Submit data on fans and accessories including fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
 - 3. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.
 - 4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 1.4CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 1.5DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect motors, shafts, and bearings from weather and construction dust.

PART 1.6FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

PART 2.1ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Cook
 - 2. Greenheck
 - 3. Acme
- B. Product Requirements:
 - 1. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
 - 2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
 - 3. Fabrication: Conform to AMCA 99.
 - 4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- C. Construction:
 - 1. Fan Unit: V-belt or direct driven as indicated on Drawings, with spun aluminum housing; resilient mounted motor; ½ inch (13 mm) mesh, 0.62 inch (1.6 mm) thick aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
 - 2. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Accessories:
 - 1. Roof Curb: 8 high. Self-flashing with continuously welded and factory installed nailer strip.
 - 2. Disconnect Switch: Factory-wired, non-fusible, in housing for thermal overload protected motor or solid-state speed controller.
 - 3. Back-draft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, and blades linked.
 - 4. Disconnect Switch: Factory mount disconnect switch in on equipment.

PART 2.2CABINET AND CEILING EXHAUST FANS

- A. Manufacturers:

1. Cook
 2. Greenheck
 3. Acme
- B. Construction:
1. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with 1/2 inch (13 mm) acoustic insulation, resilient mounted motor, gravity back-draft damper in discharge.
 2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and solid-state speed controller.
 3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
 4. Disconnect Switch: Factory mount disconnect switch in on equipment.

PART 3 EXECUTION

PART 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

PART 3.2 INSTALLATION

- A. Secure fans with cadmium plated lag screws to roof curb structure.
- B. Suspended Cabinet Fans: Install flexible connections specified in Section 15820 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.
- C. Install backdraft dampers on inlet to exhaust fans ventilators used in relief air applications.
- D. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
- E. Install safety screen where inlet or outlet is exposed.
- F. Pipe scroll drains to nearest floor drain.
- G. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings.
- H. Provide sheaves required for final air balance.

PART 3.3 CLEANING

- A. Section 01700 - Execution Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of fan cabinet.

PART 3.4 DEMONSTRATION

- A. Demonstrate fan operation and maintenance procedures.

PART 3.5 PROTECTION OF FINISHED WORK

- A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 15850
AIR OUTLETS AND INLETS

PART 1 GENERAL

PART 1.1 SUMMARY

A. Section Includes:

1. Diffusers
2. Registers
3. Grilles
4. Louvers

B. Related Sections:

1. Section 09900 - Paints and Coatings: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
2. Section 10210 - Wall Louvers: Wall Louvers.
3. Section 15820 - Duct Accessories: Volume dampers for inlets and outlets.

PART 1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

PART 1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. MANUFACTURER'S CERTIFICATE: CERTIFY PRODUCTS MEET OR EXCEED SPECIFIED REQUIREMENTS.

PART 1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air outlets and inlets.

PART 1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

PART 1.6 QUALIFICATIONS

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

PART 2 PRODUCTS

PART 2.1 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, adjustable pattern, stamped, diffuser to discharge air in four-way pattern.
- B. Frame: Surface mount or Inverted T-bar type. In plaster ceilings, furnish plaster frame and ceiling frame.
- C. Fabrication: Steel with baked enamel off-white finish.

PART 2.2 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.
- B. Fabrication: Aluminum extrusions with factory off-white enamel finish.
- C. Damper: Integral, gang-operated, opposed-blade type with removable key operator, operable from face. Only supply OBD's in grilles and registers mounted in hard ceilings.

PART 2.3 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4" minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.
- B. Frame: 1 inch margin with countersunk screw mounting.
- C. Fabrication: Steel with 20 gage (0.90 mm) minimum frames and 22 gage (0.80 mm) minimum blades, steel and aluminum with 20 gage (0.90 mm) minimum frame, or aluminum extrusions, with factory off-white enamel finish.
- D. Damper: Integral gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

PART 2.4 LOUVERS

- A. Product Description: Stationary, drainable.
- B. Type: 6 deep with blades on 45-degree slope, heavy channel frame.
- C. Fabrication: 16 gage (1.50 mm) thick galvanized steel, welded assembly, with factory prime coat finish.
- D. Bird Screen: Bird screen with 1/2 inch (13 mm) square mesh for exhaust and 3/4 inch (19 mm) for intake.
- E. Insect Screen: Aluminum mesh, set in steel frame.

PART 3 EXECUTION

PART 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify inlet and outlet locations.
- C. Verify systems are ready for installation.

PART 3.2 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.

- B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 15820.
- C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09900.

PART 3.3INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 15950
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

PART 1.1 SECTION INCLUDES

- A. Requirements of Contractor and retained TAB Agency.
- B. TAB of air and hydronic systems.
- C. Sound and vibration measurements of equipment operating conditions.

PART 1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balance Bureau.
- C. TAB: Testing, Adjusting, and Balancing.

PART 1.3 PERFORMED WORK

- A. TAB to be performed by an independent AABC or NEBB-certified TAB Agency, sub-contracted and directed by the General Contractor.

PART 1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures:
 - 1. Qualifications of TAB Agency, per Section 1.6, prior to performing TAB work.
 - 2. Test reports that are signed and stamped by an AABC or NEBB TAB Supervisor on the latest edition of approved AABC or NEBB Report Forms.

PART 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the latest edition of AABC or NEBB procedural standards for TAB of environmental systems.
- B. A Santa Fe City representative may witness all or portions of the TAB Agencies Work.

PART 1.6 QUALIFICATIONS

- A. TAB Agency: AABC or NEBB-certified company specializing in TAB of systems specified in this section with minimum [3] years experience.
- B. TAB Agency to be independent of any HVAC contractors performing the work (i.e., Mechanical or Controls), and a direct sub to the General Contractor.
- C. Submit list of 3 projects and references of TAB Agency.
- D. Submit AABC or NEBB certification of responsible TAB Agency supervisor.

PART 2 PRODUCT

PART 2.1 INSTRUMENTS

- A. The TAB Agency to furnish instruments required for testing, adjusting, and balancing.
- B. Instruments used for measurements to meet AABC or NEBB-specified accuracy and calibration histories, and be available for spot-checking by Santa Fe City Construction Inspector during testing.

PART 3 EXECUTION

PART 3.1 CONTRACTOR RESPONSIBILITIES

- A. Provide window in project schedule for completion of TAB services prior to final inspection of project.
- B. Have mechanical, controls, structural and related electrical systems complete and operable before notifying Santa Fe City Construction Inspector that project is ready for TAB Agency services and the requirements of 3.1 have been met. Advance written notice of not less than 15 calendar days is required.
- C. Complete operational readiness prior to commencement of TAB services. Verify the following:
 - 1. Doors, windows and ceilings are installed.
 - 2. Systems are started and operating in safe and normal condition.
 - 3. Temperature control systems are installed complete and operating. Testing and programming of all system components and the overall system has been completed and test reports accepted by the Santa Fe County Construction Inspector.
 - 4. Proper thermal overload protection is in place for electrical equipment.
 - 5. Construction filters have been replaced and the final filters are clean and in place.
 - 6. Duct systems are clean of debris.
 - 7. Fans are rotating correctly.
 - 8. Volume dampers are in place and open.
 - 9. Air coil fins are cleaned and combed.
 - 10. Access doors are closed and duct end caps are in place.
 - 11. Air outlets and inlets are installed and connected.
 - 12. Duct and piping supports are installed.
 - 13. Duct systems are leak and pressure tested and test reports accepted by Santa Fe County Construction Inspector.
 - 14. Hydronic systems are leak tested and test reports accepted by Santa Fe County Construction Inspector.
 - 15. Hydronic systems are flushed, filled and vented.
 - 16. Refrigerant systems are leak tested and test reports accepted by Santa Fe County Construction Inspector.
 - 17. Pumps are rotating correctly.
 - 18. Start-up screens from pump suction diffusers are removed.
 - 19. Proper strainer baskets are clean and in place.
 - 20. Service and balance valves are open.
 - 21. Pressure gauges, temperature gauges, test fittings, etc., are installed.
- D. Put HVAC systems and equipment into full operation and continue operation during times of testing and balancing.
 - 1. Do not operate equipment until properly lubricated and brought into manufacturer's specified operating conditions.
- E. Provide labor and materials to make any change in sheaves, belts, and dampers, required for correct balance as requested by the TAB Agency.

Testing, Adjusting and Balancing

- F. Provide labor, i.e., remove and reinstall ceiling tiles, etc., to access concealed equipment as requested by TAB Agency.
- G. After TAB Agency is notified and TAB work started, should system(s) be found to not be in readiness or a dispute occurs as to readiness of system(s), the Contract Administrator may require a joint inspection be made by representatives of Santa Fe City, the TAB Agency and the Contractor.
 - 1. Should inspection reveal TAB services notification to have been premature, costs of work previously accomplished by TAB Agency to be paid for by the Contractor.
 - 2. Such items as are not ready for TAB services to be completed and placed in operational readiness by Contractor, and TAB services again be scheduled.

PART 3.2 SANTA FE CITY RESPONSIBILITIES

- A. Provide TAB Agency with Contract Drawings, approved submittal data, specifications and supplements required for TAB Agency to accomplish review, inspection and TAB services outlined in this specification.
- B. Notify TAB Agency within 48 hours of receipt of written notification from Contractor that system(s) will be ready for testing, adjusting and balancing.

PART 3.3 TAB AGENCY RESPONSIBILITIES

- A. Review, inspect, test, adjust and balance systems, as outlined in this Section.
- B. Promptly report to Santa Fe City Construction Inspector any conditions that prevent system balancing.
- C. Cooperate with Contractor but do not instruct or direct Contractor in any of the work, but make such reports as are necessary directly to Santa Fe City Construction Inspector.
- D. Do not provide any construction labor or materials to modify systems.

PART 3.4 TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design flow rates.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design flow rates to space. Adjusts outlets and inlets in space to within plus or minus 10 percent of design flow rates.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design flow rates.

PART 3.5 ADJUSTING

- A. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- B. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- C. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

PART 3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distributions systems to obtain required or design supply, return and exhaust airflow rates.
- B. Make airflow rate measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure airflow rates at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

- E. Use volume control devices to regulate airflow rates only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system airflow rates by adjustment of fan speeds. Vary branch airflow rates by damper regulation
- G. Provide system schematic with design and actual airflow rates 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 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. Check dampers for proper operation.
- J. Check leakage across outside air, return air, and exhaust dampers.
- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately [0.05] inches positive static pressure near building entries.
- M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- N. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.
- O. On fan powered VAV boxes, adjust airflow switches for proper operation.

PART 3.7 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design flow rates.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rate for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain 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 or in normal position 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 simulate full flow in one part by temporary restriction of flow to other parts.

PART 3.8 TEST REPORT FORMS

- A. Final report forms to contain the following minimum data.
- B. Report Forms
 - 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency

- c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Manager
 - g. Project Inspector
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
2. Summary Comments:
- a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
3. Instrument List:
- a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
4. Electric Motors:
- a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - 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. Air Cooled Condenser:
- a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual

- h. Number of compressors
7. 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
8. Return Air/Outside Air Data:
- a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
9. 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
10. Duct Traverse:
- a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow

- f. Test velocity
- g. Test air flow
- h. Duct static pressure
- i. Air temperature
- j. Air correction factor

END OF SECTION

SECTION 16010

GENERAL 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 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 16 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:

- 16010 GENERAL PROVISIONS
- 16110 RACEWAYS, BOXES AND FITTINGS
- 16120 CONDUCTORS

1.04 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 (5) five copies of each certificate to the Owner.
- 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 following specifications and standards shall form a part of these specifications:

1. National Fire Protection Association Standards
2. National Electrical Code (Current Edition), NFPA 70 (NEC)
3. Life Safety Code (Current Edition), NFPA 101
4. NFPA 72
5. Occupational Safety and Health Act (OSHA)
6. National Electrical Safety Code (NESC)
7. Underwriter's Laboratories, Inc. (Standards)
8. American National Standards Institute (ANSI)
9. American Society of Testing and Materials (ASTM)
10. Institute of Electrical and Electronic Engineers (IEEE)
11. Insulated Cable Engineer's Association (ICEA)
12. National Electrical Manufacturer's Association (NEMA)

1.05 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, 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 in writing not 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.

1.07 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. The Contractor shall furnish (5) five copies to the Owner.

1.08 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 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. The Contractor shall furnish (5) five copies to the Owner.
- C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

1.09 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.

1.10 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.

1.11 PERFORMANCE TESTS:

- A. Thoroughly test all fixtures, services and all circuits for proper operating condition 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 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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 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 by the use of 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 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. Letters must be in the Architect's office no later than 10 days prior to the bid date and shall be considered as authorized only upon written confirmation from the 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 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 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. The Contractor shall furnish (5) five copies to the Owner.
- 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. Lamps
 6. Special Systems equipment (Fire Alarm, PA., etc.).
- B. Electrical System Controls: Refer to Section 16900 - Equipment Connections and Controls, 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.
- B. All equipment 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 Engineer. Branch circuit numbers are mandatory and shall be changed only on written permission from the 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 Engineer.
- B. Verify with 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 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 Government. Warrant all equipment, materials and workmanship for one year in

accordance with the terms of this Contract. The Contractor shall furnish (5) five copies to the Owner.

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 16110

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 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.

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: Ells 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 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 condulet 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 1-1/2 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.

2.04 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.

2.05 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, 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 Contracting Officer. No conduit shall be run on roof or exposed face of building unless specifically shown on plans or approved by Contracting Officer.
- 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 for conduits up to 1-1/4 inch, three bends for 1-1/2 to 2-1/2 inch conduits and two bends for 3 to 4 inch conduits. 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 feeder conduits shall be long radius.
- 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 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

termination's, adjacent to all change in directions and where conduits pass through walls or floors. In general, use yellow color.

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 1-1/2 inch or smaller. Install individual pipe hangers for conduits larger than 1-1/2 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 Contracting Officer.
- 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. All conduits run under floor shall be stubbed up to a coupling set flush with floor. This includes 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 masonry and machine screws 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.

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 16010, General Provisions for identification requirements for raceways and boxes.

END OF SECTION

SECTION 16120

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 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.

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.
- F. 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 Contracting Officer 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 Contracting Officer 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 Contracting Officer. Submit (5) five written reports of the tests and results to the Government.

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.

END OF SECTION