

**ROOMS TO GO  
CUTLER BAY, FL**

**OWNER REVIEW: JUNE 6, 2022  
BID: NOVEMBER 9, 2023  
ADDENDUM ONE: NOVEMBER 20, 2023 (NO DRAWINGS)  
ADDENDUM TWO: NOVEMBER 29, 2023  
ADDENDUM THREE: DECEMBER 5, 2023  
ADDENDUM FOUR: JANUARY 2, 2024  
POST BID ADDENDUM FIVE: JANUARY 29, 2024**

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DIVISION 1 - GENERAL REQUIREMENTS

## PART 1: GENERAL

1. SUMMARY

(A) This Section includes administrative and procedural requirements governing Alternates.

2. DEFINITIONS

(A) Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

(1) The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

3. PROCEDURES

(A) Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

(1) Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

(B) Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

(C) Execute accepted alternates under the same conditions as other Work of this Contract.

(D) Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

## PART 2: PRODUCTS (NOT APPLICABLE)

## PART 3: EXECUTION

4. SCHEDULE OF ALTERNATES

(A) Other items as requested in the Pre-Bid Meeting.

(B) Provide an alternate price to re-roof the existing building including white 45 mil TPO, metal trim and utilizing 2" isocyanurate rigid insulation as underlayment.

(C) Provide an alternate price to re-roof the existing building including white 60 mil TPO, metal trim and utilizing 2" isocyanurate rigid insulation as underlayment.

(D) Provide an alternate price to utilize 60 mil TPO roofing in lieu of 45 mil for the addition.

(E) In lieu of 2 layers of rigid roof insulation provide same R-value in a single layer.

END OF SECTION

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DIVISION 3 - CONCRETE

## PART 1: GENERAL

1. RELATED DOCUMENTS

- (A) The provisions of Division 1 apply to the work specified in this Section.
- (B) Unless otherwise shown or specified, the work shall conform to the following standards of the American Concrete Institute.
- |                   |   |
|-------------------|---|
| ACI 117- (90)     | Standard Tolerances for Concrete Construction and Materials                           |
| ACI 211.1- (91)   | Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete |
| ACI 212.2R-81(91) | Guide for Use of Admixtures in Concrete   |
| ACI 214-77 (89)   | Recommended Practice for Evaluation of Strength Test Results of Concrete              |
| ACI 302.1R-96     | Guide for Concrete Floor and Slab Construction  |
| ACI 304R-89       | Guide for Measuring, Mixing, Transporting, and Placing Concrete                       |
| ACI 304.2R-71(96) | Placing Concrete by Pumping Methods   |
| ACI 305R-89 (99)  | Hot Weather Concreting  |
| ACI 306R-88 (97)  | Cold Weather Concreting   |
| ACI 306.1-87 (98) | Standard Specifications for Cold Weather Concreting                                   |
| ACI 308-81 (92)   | Standard Practice for Curing Concrete   |
| ACI 309R-87 (96)  | Guide for Consolidation of Concrete   |
| ACI 315-80 (95)   | Details and Detailing of Concrete Reinforcement                                       |
| ACI 318-99        | Building Code Requirements for Reinforced Concrete                                    |
| ACI 347R-88 (94)  | Guide to Formwork for Concrete  |
- (C) Unless otherwise shown or specified, the work shall conform to the following standards of the Concrete Reinforcing Steel Institute.
- |                                   |
|-----------------------------------|
| Manual of Standard Practice, 1986 |
| Placing Reinforcing Bars, 1997    |
- (D) Refer to drawings for extent and locations of all concrete work. Verify conditions and requirements of the job.

2. SCOPE OF WORK

- (A) Include all labor, materials and accessories, and perform all operations in connection with the installation of Concrete Work, and all related work incidental to the completion thereof, as shown on the drawings, complete, in strict accordance with the drawings and as specified herein. Concrete work includes:
- (1) Concrete and related reinforcing and formwork for foundations, pilasters, slabs, concrete pavement, exterior slabs, sidewalks around building, concrete curbs, all site work concrete, foundations for light poles and signs, foundation pads for equipment, etc. as shown on drawings.
  - (2) Installation of anchor bolts for steel columns, posts, and other anchored work as may be required.

- (3) Grouting of column bases.
- (4) All anchor slots, sleeves, and other inserts as required.
- (5) Shop drawings.
- (6) Vapor retarder under all interior concrete slabs on grade.
- (7) Granular subbase beneath slabs on grade as recommended by Geotechnical Report.
- (8) All dowels from concrete into masonry walls.
- (9) All other items required to make the work of this Section complete including staking for layout of footings, building layout, excavation, backfilling, etc.

### 3. SUBMITTALS

- (A) Shall be submitted for review only when required by and in accordance with the procedure set forth in these specifications.
- (B) Reinforcing steel shop drawings shall be provided showing all details of construction, bending and placing, completely dimensioned. Before proceeding with the work, review of all shop drawings must be secured from the Consultants.
- (C) Synthetic Fiber Reinforcement: Submit manufacturer's product data, including application rate and mixing instructions.
- (D) Fly ash: Submit laboratory test data indicating chemical composition compliance with ASTM C618 CLASS C.
- (E) Submit concrete mix designs for review by CASCO well in advance of concrete placement. Concrete mix design submittal with placement location clearly indicated shall include all strength data necessary to show compliance with the strength requirements of this specification for either the trial batch method or the field experience method.
- (F) Review of submittals will cover general design only. In no case shall this review relieve the Contractor of the responsibility for strength of concrete, general or detailed dimension, quality or quantity of materials, or any other conditions, functions, performance or guarantees required.
- (G) Refer to Section 04201 for submittal of masonry grout mix design.

### 4. QUALITY ASSURANCE

- (A) General
  - (1) The Owner will employ and pay for the services of an independent testing agency to provide testing and inspection of concrete work. The testing agency shall be licensed in the state where the structure is located and shall meet the requirements of "Recommended Practices for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction" (ASTM E329).
  - (2) Concrete materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Owner's Representative for final acceptance.
  - (3) The testing agency shall report all test and inspection results to CASCO, Owner and General Contractor immediately after they are performed. All test and inspection reports shall include the exact location in the work represented by the test.
  - (4) At the completion of all concrete work the testing agency shall submit a letter of certification stating that all concrete work has been constructed in accordance

- with the contract documents and all applicable code requirements.
- (5) The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, approve or accept any portion of the work, perform any duties of the Contractor, or be a party to scheduling of work.
  - (6) The General Contractor shall notify the testing agency a minimum of 24 hours in advance of all concrete work and all reasonable facilities shall be made available for technicians, to include providing and maintaining for the sole use of the testing agency adequate facilities for safe and proper curing of concrete test specimens on the job for initial curing.
  - (7) Records of inspection shall be kept available to the building official during progress of work for two years after completion of the project. Records shall be preserved by the independent testing agency.
- (B) The testing agency shall conduct strength tests of the concrete during construction in accordance with the following procedures:
- (1) Secure composite samples in accordance with "Method of Sampling Fresh Concrete" (ASTM C172). Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
  - (2) Mold and cure three specimens from each sample in accordance with "Method of Making and Curing Concrete Test Specimens in the Field" (ASTM C31). Any deviations from the requirements of this Standard shall be recorded in the test report.
  - (3) Test specimens in accordance with "Method of Test for Compressive Strength of Cylindrical Concrete Specimens" (ASTM C39). Two specimens shall be tested at 28 days and one shall be tested at 7 days. The acceptance test results shall be the average of the strengths of the two specimens tested at 28 days. If one specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded, and the strength of the remaining cylinder shall be considered the test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.
  - (4) Make at least one strength test (3 cylinders) for each 50 cu. yd., or fraction thereof, of each mix design of concrete placed in any 1 day.
  - (5) Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, using "Method of Test for Slump of Portland Cement Concrete" ASTM C143).
  - (6) Determine air content of normal weight concrete sample for each strength test in accordance with either "Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method" (ASTM C231), "Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method" (ASTM C173) or "Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete" (ASTM C138).
  - (7) Determine temperature of concrete sample for each strength test.

## PART 2: PRODUCTS

### 5. CONCRETE MATERIALS

- (A) Coarse Aggregate: ASTM C33.
- (B) Fine aggregate: ASTM C33.
- (C) ~~Portland~~ Cement: ASTM C150, Type II or ASTM C595, Type II.
- (D) Fly ash: ASTM C618, CLASS C.

**(E) Slag cement: ASTM C989.**

- (F) Water: Clear and free from injurious amounts of oil, acid, alkali, organic or other deleterious matter.
- (G) Admixtures:
- (1) When requested, a local qualified concrete technician employed by the admixture manufacturer shall be available to assist in proportioning admixture dosage for optimum use, proper use of the admixture and adjustment of concrete mis-proportions to meet jobsite and climatic conditions. Contractor shall give admixture manufacturer's representative a minimum of 48 hours notice when job service is required on the product.
  - (2) Consult fiber reinforcing manufacturer for water reducing admixture recommendation for fiber reinforcement material type, dosages and applications.
  - (3) Water reducing admixture; shall conform to ASTM C494 Type A. POZZOLIGH Normal Series of RLOYHEED Normal Series by Master Builders, Inc.
  - (4) Midrange Water Reducing Admixture: Shall conform to ASTM C494 Type A and Type F.
    - (a) POLYHEED Series by Master Builders, Inc.
    - (b) A minimum dosage of eight (8) ounces per 100 pounds (560 mi/100kg) of cementitious material shall provide a minimum of eight (8) percent water reduction and produce a concrete slump range of 6-8 inches (150-200 mm). Normal setting times shall be maintained throughout the dosage range of the midrange water-reducing admixture. Amount of admixture used shall be in accordance with manufacturer's recommendations.
  - (5) High Range Water Reducing Admixture: Shall conform to ASTM C494 Type F and G and ASTM C1017 Type I or II.
    - (a) RHEOBUILD by Master Builders, Inc.
  - (6) Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.
    - (a) Shall not contain more chloride ions that are present in municipal drinking water.
    - (b) Admixture manufacturer must have long term non-corrosive test data from an independent testing laboratory of at least one-year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  - (7) Air Entraining Admixture: ASTM C260.
    - (a) No air entrainment admixture shall be used for steel trowel finished concrete.
    - (b) Total entrapped air content shall be no greater than 2%.
  - (8) Maximum chloride ion due to admixtures shall not exceed 0.1% by weight.
  - (9) The addition of calcium chloride is not permitted.
  - (10) All admixtures shall be used in conformance with the manufacturer's recommendations.

**6. REINFORCEMENT MATERIALS**

- (A) Reinforcing Steel Bars: ASTM A615, Grade 60, unless noted otherwise.

- (B) Welded Wire Fabric: ASTM A185.
- (C) Steel Wire: ASTM A82.
- (D) Metal Accessories: Include all spacers, ties, chairs and other devices required to properly support and fasten reinforcing steel in place in accordance with the requirements of the ACI Manual of Standard Practice for Detailing Reinforcing Concrete Structures.
- (E) Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and design for use in concrete, complying with ASTM C 1116/C 1116M, Type III,  $\frac{3}{4}$ " long.
  - (1) Products: Subject to compliance with requirements, provide one of the following:
    - (a) Euclid Chemical Company, an RPM Company; Fiberstrand 100.
    - (b) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
    - (c) Propex Concrete Systems Corp.; Fibermesh 150.

#### 7. FORM MATERIALS

- (A) Removable forms shall be wood, metal or other approved material.
- (B) Forms for unexposed concrete surfaces may be No. 2 common boards of dimension lumber of uniform thickness.
- (C) Earth cuts may be used for forms for footings if soil conditions and local codes permit.

#### 8. RELATED MATERIALS

- (A) Vapor Retarder: **10** mil high density polyethylene meeting ASTM E1745 with a permeance of less than 0.3 perms as determined by ASTM E96.
- (B) Premolded Filler: Sealtight Ceramar filler at interior columns only, as manufactured by W.R. Meadows Inc. (no substitutions). At all locations other than interior columns use non-bituminous fiber type premolded filler as per ASTM D1741, Type III, Homasote "300" or approved equal all wood fiber board with the "Homex Plus" pull off strip for joints to be flash-patched.
- (C) Curing Compound: Dissipating water-based resin curing compound conforming to ASTM C 309, Type 1, Class B.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1. L&M Construction Chemicals, Inc.; L&M Cure R.
    - 2. Euclid Chemical Company, an RPM Company; Kurez DR-100.
    - 3. SpecChem; SpecRez.
    - 4. W.R. Meadows, Inc.; 1100.
- (D) Form Ties: Black iron snap ties with a minimum 1-inch breakback.
- (E) Form Releasing Agent: Non-staining.
- (F) Grout shall be "Crystex" grout by L & M Construction Chemical, Inc. **No Substitutions**
- (G) Acceptable system at all slab on grade construction joints (as an alternate to the "keyed" construction joint-see typical construction joint details on structural drawings): "Diamond Dowels" by PNA Construction Technologies (no substitutes); "Diamond Dowels" will be  $\frac{1}{4}$ " x  $4\frac{1}{2}$ " x  $4\frac{1}{2}$ ", spaced at 24" o.c., located at mid-depth of the slab.

### PART 3: EXECUTION

#### 9. CONCRETE PROPORTIONS

- (A) The specified compressive strength of the concrete  $f'_c$  shall be 3000 psi minimum or as shown on the drawings. Strength requirements shall be based on 28-day compressive strength.
- (B) Concrete exposed to weather shall be air entrained. Air content shall be between 4 and 8 percent.
- (C) Slump of concrete shall be 4"  $\pm$  1/2" unless a high range water-reducing admixture is used. The slump of concrete prior to addition of a high range water-reducing admixture shall not exceed 4". The slump of concrete containing a high range water-reducing admixture shall not exceed 10".
- (D) The maximum size of coarse aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between reinforcing bars, nor larger than 1-1/2".
- (E) The coarse aggregate size shall be number 57 or larger.
- (F) The minimum cement content shall be 470 pounds per cubic yard for non-air entrained concrete and 517 pounds per cubic yard for air-entrained concrete.
- (G) ~~The maximum Fly ash content by weight shall be 25% of the cementitious material.~~ Limit percentage, by weight, of cementitious materials as follows:
  - (1) Fly ash: 25 percent by mass.
  - (2) Slag cement: 50 percent by mass.
  - (3) Total of Fly ash and Slag cement: 50 percent by mass, with Fly ash not exceeding 25 percent by mass.
- (H) Concrete shall be proportioned by either the trial batch method or the field experience method.
  - (1) Where the trial batch method is used, make three test cylinders for each trial batch. Break one cylinder at 7 days and two at 28 days to verify strength requirements. Adjust proportions to produce a design mix at least 1200 psi greater than the specified strength,  $f'_c$ .
  - (2) Where the field experience method is used, the required average compressive strength shall be determined in accordance with paragraph 5.3.2 of ACI 318. Documentation that proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength shall consist of a field strength test record representing materials and proportions to be used for this project. A field strength test record shall consist of at least 10 consecutive tests encompassing a period of time of not less than 45 days and made within the past 18 months.

## 10. FORMWORK

- (A) Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.
- (B) The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
- (C) Forms shall be sufficiently tight to prevent loss of concrete.
- (D) All exposed concrete corners shall have a 3/4" x 3/4" chamfer, except as otherwise noted.
- (E) Form ties shall be broken off 1" or more back from concrete surfaces. No wire or strap

ties will be permitted. Ties shall be of sizes and weights as required for pressures developed and installed in accordance with manufacturer's recommendations. Form ties for exterior walls and grade beams shall be leakproof "waterseal type".

- (F) Forms for exposed surfaces shall be coated with non-staining releasing agent, applied before the reinforcing steel is placed.
- (G) Forms shall not be disturbed until the concrete has adequately hardened. Care shall be taken to avoid spalling the concrete surfaces.
- (H) All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed in them.

#### 11. STEEL REINFORCEMENT

##### (A) Fabrication:

- (1) Reinforcing steel shall be accurately fabricated to the dimensions shown.
  - (a) Bends shall conform to bend dimensions defined as standard in accordance with details in the ACI Detailing Manual - 1980 (SP-66) and/or CRSI Manual of Standard Practice, unless otherwise shown.
  - (b) Bars shall be bent cold and shall not be bent or straightened in a manner that will injure the material.
  - (c) Bars shall be fabricated within the tolerances shown in the ACI Detailing Manual - 1980 (SP-66) and/or CRSI Manual of Standard Practice.
- (2) Welding as an aid to fabrication and/or installation will not be permitted except as specifically shown on the drawings or as authorized by CASCO.

##### (B) Placing

- (1) Position reinforcement to 1/4" ± in accordance with placement plans.
- (2) Unless noted otherwise, reinforcing shall be placed so that the minimum concrete cover shown on the drawings is provided.
- (3) It shall be the Contractor's responsibility to ensure that the intended reinforcement location is maintained during concrete placement. Tie bars at intersections with soft steel wire.
- (4) Lap splices of reinforcing shall be as called for on the drawings.
- (5) Do no splicing at points of maximum stress. Lap all bars at all corners and abrupt changes in direction of walls. Provide steel dowels between footings and walls, pilasters, columns and elsewhere, as indicated on drawings and/or as conditions require.
- (6) Do not drive nails into wood forms to support reinforcement.
- (7) Provide two (2) No. 5 bars around all openings in concrete walls, and at all re-entrant corners in floor slabs.
- (8) Reinforcing bars partially embedded in concrete shall not be field bent.

##### (C) Cleaning and Protection:

- (1) Protect reinforcement from excessive rusting or mechanical injury. Store on skids or otherwise maintain at least 6 inches above ground.
- (2) After bars are tied in place take whatever precautions are necessary to protect bars from damage by construction equipment or careless workmen. Pay particular attention to bars projecting out of previously placed concrete.

Damaged steel shall be replaced at no cost to the Owner.

12. SYNTHETIC FIBER REINFORCEMENT

(A) Delivery, Storage, and Handling:

(1) Delivery:

- a. Deliver synthetic fiber reinforcement in manufacturer's original, unopened, undamaged containers and packaging, with labels clearly identifying product name, unique identification number, code approvals, and weight of fibers.

(2) Storage:

- a. Store synthetic fiber reinforcement in clean, dry area indoors in accordance with manufacturer's instructions.
- b. Keep packaging sealed until ready for use.

(B) Mixing:

- (1) Add synthetic fiber reinforcement to concrete mixture in accordance with manufacturer's instructions.
- (2) Add synthetic fiber reinforcement at a minimum application rate of 1.0 lbs./yd. of concrete.
- (3) Mix synthetic fiber reinforcement in concrete mixer in accordance with mixing time and speed of ASTM C 94 to ensure uniform distribution and random orientation of fibers throughout concrete.

13. JOINTS

(A) Construction Joints

- (1) Provide construction joints as required by the drawings, specifications, and job conditions. Provide deep key at joint per drawings.
- (2) Provide construction joints in walls at a maximum spacing of 50 feet unless otherwise indicated on the drawings.
- (3) Construction joints in slabs on grade are intended to function as formed control joints. See drawings for details. Locate construction joints in slabs on grade at locations shown on the drawings. For exterior slabs on grade the maximum spacing between construction joints shall be 20 feet.

(B) Control Joints

- (1) Locate control joints in interior slabs on grade as shown on the drawings not to exceed a maximum spacing of 15 feet.
- (2) Locate 1" deep tooled control joints in sidewalks as shown on the drawings. The maximum spacing of tooled joints shall be 8 feet.
- (3) All reinforcement shall be continued across joints. Remove all laitance from joints prior to placing adjoining concrete.

(C) Isolation Joints

- (1) Locate isolation joints at all columns and where exterior slabs or walks abut vertical surfaces and elsewhere, as shown on the plans or as job conditions require.
- (2) Locate isolation (expansion) joints in sidewalks at locations shown on the drawings. The maximum spacing between isolation joints in sidewalks shall be 32

- feet.
- (3) Locate isolation (expansion) joints in curbs at a maximum spacing of 20 feet.
- (4) Premolded filler for isolation joints shall be 1/2" thick.
- (5) Joint at sidewalk/building wall transition and sidewalk/decorative column pilaster base shall be caulked and sealed.

#### 14. PRODUCTION OF CONCRETE

- (A) Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C94. The ready-mixed concrete producer shall furnish duplicate delivery tickets, one for the Contractor and one given to the Owner's Representative, for each batch of concrete. The information provided on the delivery ticket shall include the quantities of all material batched including the amount of free water in the aggregate. The batch time as well as the quantity of water that can be added at the site without exceeding the maximum water cement ratio specified shall be noted on the delivery ticket.
- (B) The independent testing agency shall have access at all times to the batching and mixing plant for sampling of materials and inspection of all work performed for this job.
- (C) In cold weather, the temperature of the concrete at time of placement shall be at least 55 degrees F. The temperature of the surrounding materials must be greater than 32 degrees F.
- (D) In hot weather the ingredients shall be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered. When air temperature is between 80F and 90F, reduce maximum mixing and delivery time from 90 minutes to 75 minutes. When air temperature exceeds 90F, reduce maximum mixing and delivery time to 60 minutes.

#### 15. PLACING

- (A) Preparation for Placing Concrete
  - (1) **All bearing material shall be inspected by the independent testing agency prior to placement of concrete. The geotechnical engineer shall be the sole judge as to the suitability of the bearing material.**
  - (2) Before concrete is placed, all debris and ice shall be removed from the spaces to be occupied by the concrete. Remove surplus form releasing agent from the contact face of forms. Forms and the reinforcement shall be thoroughly cleaned of ice or other coatings.
  - (3) Water shall be removed from place of deposit before concrete is placed. Concrete shall not be placed on frozen ground.
  - (4) Notify all trades concerned and Owner's Representative sufficiently in advance of the scheduled time for concrete placement to permit installation of all required work by other trades.
  - (5) Before placing concrete, all required embedded items, including dovetail anchor slots, anchors, inserts, curb angles, metal frames, fixtures, sleeves, drains, stair nosings, accessory devices for Mechanical and Electrical installations shall be properly located, accurately positioned and built into the construction, and maintained securely in place.
  - (6) Build into construction all items furnished by the Owner and other trades. Provide all offsets, pockets, slabs, chases and recesses, as job conditions require including the safe location. Thicken slabs as required to maintain the intended slab thickness at embedded items.
  - (7) Set anchor bolts furnished under the Structural Steel Section of these specifications.

- (8) Place and properly support reinforcing steel.
- (B) Conveying
- (1) Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent separation or loss of material.
  - (2) Concrete for placement over prepared and certified pad shall be placed by means of a pump. Truck shall not tailgate.
  - (3) Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery without separation of material.
  - (4) Provide runways or other means for wheeled equipment to convey concrete to point of deposit. Construct runways so that supports will not bear upon reinforcement or fresh concrete.
- (C) Depositing
- (1) Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. No concrete shall have a free fall of over three feet from truck, mixer or buggies. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work, nor shall retempered concrete be used.
  - (2) When concreting is started, it shall be carried on as a continuous operation until the placing of the section is completed.
  - (3) All concrete shall be thoroughly consolidated by mechanical vibrators during the placing operation and shall be thoroughly worked around the reinforcement and embedded fixtures and into the corners of the forms. Mechanical vibrators shall be applied directly to the concrete and used only under experienced supervision. Vibrators shall not be secured to forms or reinforcement. Compaction shall be carried on continuously with the placing of concrete. Keep a minimum of two vibrators on the job during concreting operations.
  - (4) Protect adjacent surfaces from concrete drippings, spillage and splashes. Hardened or partially hardened splashes or accumulations of concrete on forms or reinforcement shall be removed before the work proceeds. Clean all damaged surfaces immediately.
  - (5) All conveyances shall be thoroughly cleaned at frequent intervals during the placing of the concrete, and before beginning a new run of concrete all hardened concrete and foreign materials shall be removed from the surfaces.
  - (6) The project superintendent shall mark on the drawings the time and date of the placing of the concrete in the different areas and members. Location of concrete batches from which concrete test cylinders are made shall also be recorded on these drawings. Such drawings shall be kept on file at the job until its completion and shall be subject to the inspection of the Owner's Representative at all times.

16. REPAIR OF SURFACE DEFECTS

- (A) Surface defects, including tie holes, shall be repaired immediately after form removal.
- (D) All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. No feathered edges will be permitted. The area to be patched and an area at least 6 in. wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1-part cement to 1-part fine sand passing a No. 300 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

- (C) The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted, and the mortar shall consist of not more than 1-part cement to 2-1/2 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the gray Portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
- (D) After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hr. before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall that will be exposed.
- (E) After being cleaned and thoroughly dampened, all tie holes shall be filled solid with patching mortar.

#### 17. FINISHING OF FORMED SURFACES

- (A) After removal of forms all concrete surfaces not exposed to view shall be finished with a rough form finish and all surfaces exposed to view shall be finished with a smooth form finish.
- (B) For a rough form finish, tie holes and defects shall be patched and fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces may be left with the texture imparted by the forms.
- (C) For a smooth form finish, the form facing material shall produce a smooth, hard, uniform texture on the concrete. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. Tie holes and defects shall be patched. All fins shall be completely removed.

#### 18. SLABS

- (A) Preparation of subgrade for slabs on grade.
  - (1) All bearing material shall be inspected by the independent testing agency prior to placement of all slabs on grade. The geotechnical engineer shall be the sole judge as to the suitability of the bearing material.
  - (2) Termite treatment is to be placed per manufacturer's recommendations during the slab preparation.
  - (3) The granular subgrade (if required) shall be well drained and of adequate and uniform loadbearing nature.
  - (4) Place granular subbase as recommended by the Geotechnical Report to thickness shown on the drawings and compact to a minimum of 98% of maximum density at optimum moisture per ASTM D698. Recompact immediately prior to placement of vapor retarder.
  - (5) Place vapor retarder over subgrade. Lap joints a minimum of twelve inches. All joints shall be continuously taped/sealed. Care shall be taken to prevent tears in the vapor retarder. Surface preparation, placement, joint sealing, protection and repair shall meet ASTM E1643.
  - (6) The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing it shall be raised and maintained above 50° F long enough to remove all frost from the subgrade.
- (B) Edge forms and intermediate screed strips shall be set accurately to produce the

designated elevations and contours of the finished surface and shall be sufficiently strong to support vibrating screeds or roller pipe screeds. The concrete surface shall be aligned to the contours of screed strips by the use of strike-off templates or acceptable compacting type screeds.

(C) Placement

- (1) Mixing and placing shall be carefully coordinated with finishing. Concrete shall not be placed on the subgrade or forms more rapidly than it can be spread, straightedged, and darbied or bull floated. These operations must be performed before bleeding water has an opportunity to collect on the surface. Placement of concrete for slabs shall be accomplished using a pump only.
- (2) To obtain good surfaces and avoid cold joints, the size of finishing crews shall be planned with due regard for the effects of concrete temperature and atmospheric conditions on the rate of hardening of the concrete.
- (3) Concrete floor slabs shall be placed by means of pumping and shall be thoroughly consolidated. Internal vibration shall be used along the bulkheads of slabs on grade. Consolidation of slabs shall be obtained with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

(D) Interior Concrete Floor Slab Surface Profile Tolerances

- (1) Slab on Grade Flatness and Levelness Tolerances:
  - (a) Floor Flatness Number:  $F_f$   
Specified Overall Value = 35  
Minimum Local Value = 24
  - (b) Floor Levelness Number:  $F_l$   
Specified Overall Value = 25  
Minimum Local Value = 18
  - (c) ACI Straightedge Level Tolerance of 1/8" in 10'-0" per ACI 117R-90
- (2) Suspended Slab Flatness Tolerances:
  - (a) Floor Flatness Number:  $F_f$   
Specified Overall Value = 30  
Minimum Local Value = 20
  - (b) ACI Straightedge Level Tolerance of 1/8" in 10'-0" per ACI 117R-90
- (3)  $F_f$  and  $F_l$  tolerances shall be tested in accordance with ASTM E 1155. Actual overall F-numbers shall be calculated using the inferior/superior area method.
- (4) All floor tolerance methods shall be made immediately prior to the flooring installer prepares to install the flooring. Coordinate with the Owner and General Contractor prior to testing. Results of all slab profile tests shall be provided to the General Contractor prior to the installation of the flooring.

19. FINISHES

- (1) General: All finishes must be adequate in all respects to receive material to be applied to it, true to line and free of defects or blemishes. No driers, dry cement, nor cement-sand mixture shall be used in connection with any finish surfaces to absorb water, stiffen mix or for any other purpose.
- (2) Finish
  - (a) Floated finish - After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when surface has stiffened

sufficiently to permit the operation. Adjustments shall be made during or after the first floating as required to meet or exceed the minimum specified floor flatness and levelness criteria. The slab shall then be refloated immediately to a uniform sandy texture.

- (b) Troweled finish - The surface shall first be float-finished as specified above. It shall next be power troweled. The first troweling after power floating shall produce a smooth surface, which is relatively free of defects, but which may still show some trowel marks. Additional trowelings shall be done by power trowel after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The finished surface shall be essentially free of trowel marks, uniform in texture and appearance and shall meet or exceed the minimum specified floor flatness and levelness criteria. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.
- (c) Light broom finish - The surface shall first be trowel-finished as specified above. Immediately after final troweling, it shall be given a light transverse texture by drawing a broom across the surface.
- (d) Rough broom finish - Immediately after the concrete has received a float finish as specified above, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

(3) Schedule of finishes:	
Interior floor slabs	Troweled/Light Broom (as required by the drawings)
Equipment Pads	Troweled
Exterior stairs and sidewalks	Light Broom
Exterior slabs except stairs and sidewalks	Rough Broom

20. CURING AND PROTECTION

- (A) Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.
- (B) Apply curing compound immediately after completion of placement and finishing. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. For any surface against which additional concrete or other material is to be bonded, unless it is proven that the curing compound will not prevent bond, positive measures shall be taken to remove it completely from areas to receive bonded applications.
- (C) Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal apply curing compound in accordance with the recommendations of the manufacturer. For any surface against which additional concrete or other material is to be bonded, unless it is proven that the curing compound will not prevent bond, positive measures shall be taken to remove it completely from areas to receive bonded applications.
- (D) Temperature, Wind, and Humidity
  - (1) Cold weather - When the mean daily outdoor temperature is less than 40° F., the temperature of the concrete shall be maintained between 50° and 70° F. for 7

days. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

- (2) Hot weather - When necessary, provisions for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
- (3) Rate of temperature change - Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5° F. in any 1 hour or 50° F. in any 24-hour period.
- (E) Protection from mechanical injury - The concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

## 21. EVALUATION AND ACCEPTANCE OF CONCRETE

- (A) Test results for standard molded and standard cured test cylinders shall be evaluated separately for each specified concrete mix design. Such evaluation shall be valid only if tests have been conducted in accordance with the specifications.
- (B) For evaluation, each specified mix design shall be represented by at least five sets of tests.
- (C) The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength, f'c, and no individual strength test result falls below the specified strength, f'c, by more than 500 psi. Should cylinder tests fail to meet these requirements or if deficient construction is suspected by the Owner's Representative, core tests may be required, and the cost of such tests shall be paid by the Contractor.
- (D) Testing by impact hammer, sonoscope, or other nondestructive device may be used to determine relative strengths at various locations in the structure as an aid for selecting areas to be cored. Such tests shall not be used as a basis for acceptance or rejection.
- (E) Where core tests are required, cores at least 2 in. in diameter shall be obtained and tested in accordance with "Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" (ASTM C42). The cores shall be air dried (temperature 60° to 80° F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry.
- (F) At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the Owner's Representative so as to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.
- (G) Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 85 percent of and if no single core is less than 75 percent of the specified strength, f'c.
- (H) Core holes shall be filled with low slump concrete or mortar.

## 22. ACCEPTANCE OF STRUCTURE

- (A) Completed concrete work which meets all applicable requirements will be accepted without qualification.
- (B) Completed concrete work which fails to meet one or more requirements, but which has been repaired to bring it into compliance will be accepted without qualification.

- (C) Completed concrete work which fails to meet one or more requirements, and which cannot be brought into compliance may be accepted or rejected by the Owner's Representative. In this event, modifications may be required to assure that remaining work complies with the requirements.
- (D) The cost of any additional tests or analysis, including additional architectural and engineering services, performed to prove the adequacy of the concrete work, shall be borne by the Contractor.

END OF SECTION

## DIVISION 4 - MASONRY

## PART 1: GENERAL

## 1. RELATED DOCUMENTS

- (A) The provisions of Division 1 apply to the work specified in this Section.
- (B) Unless otherwise shown or specified, the work shall conform to the most current version of ACI 530.1, "Specification for Concrete Masonry Structures".

## 2. SCOPE OF WORK

- (A) Furnish all labor, materials, tools, equipment and scaffolding required for completing masonry work, and related items indicated on the Drawings and specified herein.

## 3. RELATED WORK SPECIFIED ELSEWHERE

- (A) Sealants in masonry construction joints are specified in Section 07901 "Joint Sealants".
- (B) Steel lintels and miscellaneous steel frames are specified in Section 05500 "Miscellaneous Metals".
- (C) Wood nailers and blocking built into unit masonry are specified in Section 06100 "Carpentry".
- (D) Hollow metal frame anchors are specified in Section 08101 "Hollow Metal Work".
- (E) Water Repellent is specified in Section 09900 "Painting".
- (F) Dampproofing of concrete masonry units is specified in Section 07115 "Bituminous Dampproofing".

## 4. SUBMITTALS

- (A) Concrete Block Strength Certification: Submit manufacturer's certification, that all concrete block to be used for this project will be normal weight, complies with the requirements of ASTM C90, and has a minimum net area compressive strength of 1900 psi when tested in accordance with ASTM C140.
- (B) Standard Brick Strength Certification: Submit manufacturer's certification that all standard brick for this project complies with the requirements of ASTM C216, latest edition, Grade SW, type FBX or better.
  - (1) Unit Compressive Strength: 3,000 psi minimum average compressive strength.
- (2) Initial Rate of Absorption: Less than 20G/30 square inches per minute when tested per ASTM C67.
- (3) Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not efflorescenced".
  - (A) Maximum saturated coefficient 0.78.
  - (B) Minimum IRA 7g/30 sq. in. Maximum IRA 30g/30 sq. in.±.
  - (C) Submit product data for custom and standard concrete masonry units, standard brick, premolded joint filler, joint reinforcement, grout, and other accessories, for approval.
  - (D) Review of submittals will cover general design only. In no case shall this review relieve the Contractor of the responsibility for general or detailed dimension, quality or quantity of materials, or any other conditions, functions, performance or guarantees required.
  - (E) Submit samples of standard and custom concrete masonry units, standard face brick, precast sill materials and mortar colors to Owner for approval.

- (F) Construct a sample wall 4' x 4' minimum for review by the Owner, of unit masonry, mortar color and finish as specified. Provide with an expansion joint and colored sealant, if requested. Approved sample wall is to remain intact until all masonry work on project is accepted. Brace wall to avoid falling.
- (G) Submit masonry grout mix design.

## 5. REFERENCE STANDARDS

- (A) Unless otherwise indicated or specified, the work shall conform to the following Standards:
  - (1) American Concrete Institute (ACI)
    - (a) The most current version of ACI 530.1, "Specification for Concrete Masonry Structures".
  - (2) American Society for Testing and Materials (ASTM) (current version)
    - (a) ASTM A36, Standard Specification for Structural Steel.
    - (b) ASTM A82, Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement.
    - (c) ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    - (d) ASTM A167, Standard Specification for Stainless and Heat-Resisting Plates, Sheet and Strip.
    - (e) ASTM A307, Standard Specification for Low-Carbon Steel Externally and Internally Threaded Standard Fasteners.
    - (f) ASTM A366, Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
    - (g) ASTM A615, Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement.
    - (h) ASTM A641, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
    - (i) ASTM C90, Standard Specification for Hollow Load-Bearing Concrete Masonry Units.
    - (j) ASTM C140, Standard Methods of Sampling and Testing Concrete Masonry Units.
    - (k) ASTM C270, Standard Specifications for Mortar for Unit Masonry.
    - (l) ASTM C476, Standard Specifications for Grout for Reinforced Masonry.
    - (m) ASTM D2240, Standard Test Methods for Rubber Properties - Durometer Hardness.
    - (n) ASTM E447, Methods of Test for Compressive Strength of Masonry Prisms.
  - (3) National Concrete Masonry Association (NCMA)
    - (a) Technical Note No. 6, Estimating the Fire Resistance of Concrete Masonry.
    - (b) Technical Note No. 35, Fire Safety with Concrete Masonry.

## PART 2: PRODUCTS

## 6. CONCRETE MASONRY UNITS

- (A) Size: Manufacturer's standard sized split-face units with nominal face dimensions of 16" long by 4" or 8" high (15-5/8" by 11 5/8", 7 5/8", 5 5/8" or 3 5/8" actual), unless otherwise noted on the drawings. Thickness, finish and color to be as indicated on drawings.
- (B) Obtain masonry units from one manufacturer, of uniform texture, size and color for each kind required, for each continuous area and visually related areas.
- (C) Provide special shapes where shown and where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
- (D) Masonry Units exposed to the exterior shall have integral water repellent (Dryblock or Master Builder color cure XB, or approved equal). Wall systems employing standard gray masonry units as back-up to brick veneer, natural stone veneer or thinset stone panels or concrete masonry units which are to be painted shall not have integral waterproofing. Veneer systems with an air space shall have bituminous dampproofing applied to the surface of the concrete masonry back-up in the air space.
- (E) Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (4 hour, 3 hour and similar designations) comply with the requirements for materials and installation established by the National Concrete Masonry Association Tech #6 and #35 and other governing authorities for the construction shown.

## 7. CUSTOM UNITS (If indicated on the drawings)

- (A) Refer to drawings for color and location of integrally colored units (i.e., white, brown, gray, beige, etc.).
- (B) Refer to drawings for type and location of architectural or customized units (i.e., smooth, split-face, fluted, scored, rubbed, etc.).
- (C) Refer to the drawings for size, color, and location of precast concrete sills to match color of concrete masonry units. Precast units shall have uniform color and uniform fine aggregate surface texture. Provide sample to Owner for approval.
- (D) Minimum length to be 48". Color shall be white unless noted otherwise on the drawings. Sill bed joint mortar color to match precast sills.

8. STANDARD BRICK: ASTM C216 - if indicated on drawings

- (A) Obtain masonry units from one manufacturer; Manufacturer as noted on the drawings, or as otherwise approved by Owner's Representative. Brick shall be of uniform texture, size and color for each kind required, for each continuous area and visually related area.
- (B) Size: Manufactured to the following dimensions:
  - (1) Modular: 3-1/2" to 3-5/8" wide by 2-1/4" to 2-3/8" high by 7-1/2" to 7-5/8" long with standard voids. Solid brick shall be of same size without voids.
- (C) Surface Coloring: Brick shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in the applied finish when viewed from 10 feet.
- (D) Products: Submit to compliance with requirements, provided products as manufactured by company as indicated on the drawings or herein.
- (E) Special Shapes: Where shown on the drawings; manufacturer shall provide shop drawings for CASCO approval prior to manufacturing special shapes.
- (F) Bond: Shall be running bond with tooled joints unless otherwise shown on the drawings. Tooling shall conform to the guidelines provided in BIA Technical Notes

7B, revised.

- (G) Mortar: Conventional mortar shall conform to ASTM C-270 under guidelines provided in BIA Technical Notes Series 8.

9. NATURAL AND CULTURED STONE VENEER – if indicated on the drawings

- (A) Obtain natural and cultured stone from one manufacturer; Manufacturer as noted on the drawings.
- (B) Size: As noted on the drawings.
- (C) Color and Texture: As noted on the drawings.
- (D) Bond/Pattern: As noted on the drawings. Tooling shall conform to the guidelines provided in BIA Technical Notes 7B, revised.
- (E) Mortar: Conventional mortar shall conform to ASTM C-270 under guidelines provided in BIA Technical Notes Series 8.

10. MORTAR MATERIALS

- (A) Mortar shall conform to ASTM C270, Type S, Portland Cement-Lime. Minimum 28-day compressive strength shall be 1,800 psi.
- (1) Aggregate: Sand ASTM C144, Color White unless noted otherwise on the drawings.
- (B) For job site pigmented mortar use mineral pigments and, with exception of carbon black, limit to 10 percent of cement content, and carbon black to 1-1/2 percent of cement content. Color pigments shall be comparable in quality to material manufactured by Frank D. Davis Co., Beltsville, Maryland.
- (C) Premixed colored masonry mortar shall match adjacent masonry units unless noted otherwise on the drawings.
- (D) Mortar in masonry construction exposed to the exterior shall have a water repellent additive within mortar, including at concrete masonry units, natural stone veneer, brick veneer, cast stone, and precast concrete. Concrete masonry units which are to be painted, coated with bituminous dampproofing, or clad with thinset stone panels shall not have a water repellent additive in the mortar.

11. GROUT

- (A) Grout shall conform to ASTM C476. Minimum 28-day compressive strength shall be 1,800 psi.

12. REINFORCING BARS

- (A) Reinforcing bars shall conform to ASTM A615, Grade 60, unless noted otherwise.

13. JOINT REINFORCING

- (A) Continuous wire reinforcing (joint reinforcing) shall be truss type fabricated units (**no substitutions**) with a single pair of 9 gage side rods and 9 gage cross rods fabricated from cold-drawn steel wire complying with ASTM A82, and galvanized to conform to ASTM A153, Class B-2.
- (B) Manufacturers offering products to comply with requirements for joint reinforcing include the following:

Hohmann & Barnard  
Dur-O-Wall Company  
Wire-Bond  
AA Wire Products Company

## 14. ANCHORS, TIES, AND METAL ACCESSORIES

- (A) Anchors, ties, and metal accessories shall conform to the following requirements where applicable:
- Sheet Steel: ASTM A366, 16 gauge minimum, galvanized to conform to ASTM A153.
- Structural Steel: ASTM A36 galvanized to conform to ASTM A153.
- Anchor Bolts: ASTM A307 galvanized to conform to ASTM A153.
- Stainless Steel: ASTM A167, Type 304.
- (B) Adjustable Anchor System for Stone Veneer shall be fabricated from cold-drawn steel wire complying with ASTM A82, and hot dip galvanized to conform to ASTM A153, Class B-2 Hohmann & Barnard Tie-HVR-195V Anchor System – Truss Type with 9-gauge side and cross wire, 3/8" vertical J-hooks and 3/16" diameter ties, or equal as provided by the other listed anchor manufacturers **(NO SUBSTITUTIONS)**.
- (C) Stone or Brick Veneer Ties shall be fabricated from cold-drawn steel wire complying with ASTM A82, and hot dip galvanized to conform to ASTM A153, Class B-2 Hohmann & Barnard DW-10 with 12-gauge anchor, or equal as provided by the other listed anchor manufacturers **(NO SUBSTITUTIONS)**. Fasteners for attachment to concrete masonry shall be either Hilti Kwik-Con II+ Torx Head Masonry Screws or Powers Zamac Nailin Nail Anchor of appropriate length and diameter.
- (D) Manufacturers offering products to comply with requirements for anchors include the following:
- Hohmann & Barnard  
Dur-O-Wall Company  
Wire-Bond  
AA Wire Products Company

## 15. MASONRY ACCESSORIES, FINISHES, AND RELATED ITEMS

- (A) Masonry Cleaner: "Sure Klean Vanatrol" as manufactured by The Process Solvent Company.
- (B) Premolded Joint Filler: Premolded neoprene filler strip to comply with ASTM D 1056, RE41, compressible up to 35% thickness and width to suit joint in which used, minus depth necessary for caulking work. Joint filler must be compatible with sealant.
- (C) Control Joints: Provide PVC control joints as manufactured by Hohmann & Barnard or Dur-O-Wall **(NO SUBSTITUTIONS)**. Construct by using sash block units with preformed gaskets and continuous sealant on each side. Gasket shall be wide flange type, cross-shaped in section and designed to fit the full width of sash block less depth required for continuous caulk sealant on each side.
- (1) ~~For 8" block use Hohmann & Barnard RS Standard Rubber VS-8 PVC or Dur-O-Wal DA2006 PVC, NO SUBSTITUTIONS.~~
- (2) ~~For 12" block use Hohmann & Barnard VS-12 PVC or Dur-O-Wal DA2007 PVC, NO SUBSTITUTIONS.~~
- (D) Make building wall control joints and expansion joints weather tight on both the interior and exterior side of the wall joints.
- (E) Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 24'-0" o.c. for concrete masonry wythe. Locate control joints at points of natural weakness in the masonry work and/or as shown on the drawings.
- (F) Concealed Masonry Flashing (thru-wall or spandrel beam flashing): Minimum of 40 mil membrane consisting of 32 mils of pliable, highly adhesive rubberized asphalt, integrally

bonded to 8 mils high density, cross laminated polyethylene film. Adhere to stainless steel drip edge at exposed edges for door and window openings and foundation flashing.

(G) Exterior Weep Holes: provide the following:

- (1) Round plastic tubing: minimum density polyethylene, 3/8" outside diameter by 4" long.

~~(H) Rebar Positioners: Provide Type RB Rebar Positioners as manufactured by Hohmann & Barnard (NO SUBSTITUTIONS).~~

16. GLASS BLOCK UNITS - if indicated on drawings

(A) Standard units shall be nominal 4" x 8", 6" x 6", 8" x 8" or 12" x 12" x 4" width as indicated, SEVES Glass Block or Quality Glass Block. Refer to drawings for pattern. **NO SUBSTITUTIONS.**

- (1) Accessories: White Mortar, ASTM C270, Type N; expansion strips, reinforcing, anchors, sealants, etc. as indicated or required for a complete installation.

17. WALL DRAINAGE SYSTEMS

(A) Manufacturer: Mortar Net USA, Ltd. **NO SUBSTITUTIONS**

- (1) Contact: 326 Melton Road, Burns Harbor, IN 46304; Telephone: (880) 664-6638, (219) 939-3870; Fax: (219) 787-5088, E-mail: [info@mortar.net](mailto:info@mortar.net) Website: [www.mortarnet.com](http://www.mortarnet.com)

(2) Masonry Veneer over CMU

(a) Mortar Net MN 10-1: 10" (254mm) high x 1" (25.4 mm) thick material.

(b) Mortar Net MN 10-4: 10" (254mm) high x 0.4" (10.2 mm) thick material.

(c) Mortar Net MN 10-2: 10" (254mm) high x 2" (51 mm) thick material.

(3) Single Wythe CMU

- (a) Blok-Flash pans and cross bed webs (size to correspond with block size) with 7" x 16" mesh Drainage Matte at all non-grouted cores.

PART 3: EXECUTION

17. PRODUCT DELIVERY, STORAGE AND HANDLING

- (A) Masonry units shall be sound and free of chips and major cracks which would impair the strength of permanence of the construction.
- (B) Masonry units shall be kept dry during delivery and while stored at the site. Protect units with waterproof coverings to minimize moisture absorption.
- (C) Store masonry units on level platforms permitting air to circulate under stack.

18. PREPARATION

- (A) Make layout in accordance with project drawings.
- (B) Remove laitance, loose aggregate, and anything that may prevent mortar from bonding to foundation.
- (C) Do not proceed with masonry construction, until permitted, when the following foundation tolerances are not met:

Horizontal alignment	+1/4 in. in 10 ft.
(Variation from plan dimension)	1/2 in. max. variation

Vertical alignment (Variation from level)  $\frac{+1}{4}$  in. in 10 ft.  
 $\frac{1}{2}$  in. max. variation

- (D) Mortar (cold weather) - Use acceptable cold weather precautions when temperature is less than 40°F.
- (E) Mortar (hot weather) - Use acceptable hot weather precautions in placing and curing of the mortar when air temperature exceeds 100°F and when there is a drying wind at temperatures above 90°F.

19. PLACING MASONRY UNITS

- (A) Construct CMU and brick masonry with experienced personnel, using manufactured masonry units and materials necessary to hold units in desired position. There shall be an experienced foreman on the job at all times.
- (B) Thickness: Build walls and other masonry construction to the full thickness shown, except, build single-wythe walls to actual thickness of the masonry units, using units of nominal thickness shown or specified. Use concrete units that are sound, dry, clean and free from ice and frost when placed.
- (C) Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.
- (D) Dampening of concrete units before or during construction shall not be permitted unless made necessary by unusual conditions and approved by CASCO.
- (E) Adjust each unit to final position in wall while mortar is still soft and plastic. Remove any unit disturbed after mortar has stiffened and re-lay with fresh mortar.
- (F) Align vertical cells to be filled with grout to provide a continuous unobstructed opening not less than 3" x 4".
- (G) Pattern Bond: Lay all block in the bond pattern shown or if not shown or specified in a running bond pattern with vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners, unless otherwise shown. Do not use units with less than 4" horizontal face dimensions at corners or jambs.
- (H) Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement- type joints, returns and offsets. Avoid the use of less-than-half- size units at corners, jambs and wherever possible at other locations.
- (I) Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.
- (J) Stopping and Resuming Work: Rack back 1/2 masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry units and mortar prior to laying fresh masonry.
- (K) Built-in Work:
  - (1) As the work progresses, build-in items specified under this and other Sections of these Specifications. Fill in solidly with masonry around built-in items.
  - (2) Fill space between hollow metal frames and masonry solidly with mortar.
  - (3) Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
  - (4) Non-bearing Interior Partition Walls: Build full height of story to underside of structure above, unless otherwise shown.
- (L) Bracing and shoring: Exterior masonry walls have been designed to span vertically as

simple spans from floor to roof and are dependent upon the completed roof structure, metal roof deck, and completion of all masonry walls for stability and for resistance to wind and seismic forces. The Contractor is solely responsible for providing all necessary bracing as required for construction loads, for stability, and for resistance to wind and seismic forces until the entire structure is complete. The shoring shall not rely on any moment resistance capacity of the footings.

- (1) Interior brick on cmu masonry wall shall be reinforced as shown on the drawings and shall comply with all seismic and wind loads per governing Codes.

## 20. REINFORCEMENT

### (A) Preparation

- (1) Place all reinforcement for masonry in accordance with project documents.
- (2) Use metal reinforcement at time of placement, which is free of mud, oil, or other coatings that adversely affect bonding capacity.
- (3) Metal reinforcement with rust, mill scale or a combination of both may be used provided the minimum dimensions, including height of deformations, and weight of wire brushed specimens are not less than required by applicable ASTM specification.
- (4) Do not use metal reinforcement with kinks or unrequired bends. Do not straighten nor repair bars in a manner that will damage the bar or adjacent construction.

### (B) Fabrication

- (1) Fabricate bars without damaging the materials.
- (2) Bending of bars
  - (a) Perform bending on unheated bars, unless otherwise acceptable.
  - (b) Bars larger than #5 shall not be field bent unless acceptable to CASCO Project Manager.
  - (c) The diameter of bend measured on the inside of the bar, other than for stirrups, shall not be less than the values listed below except that for Grade 40 bars in sizes #3 to #11 inclusive, with turns not exceeding 180°, the minimum diameter shall be five bar diameters.

#### MINIMUM DIAMETERS OF BEND

Bar Size	Minimum Diameter
#3 through #8	6 bar diameters
#9, #10, and #11	8 bar diameters

- (d) Inside diameter of bend for stirrups shall not be less than four bar diameters.
- (3) Standard hooks - Use one of following:
  - (a) A 180° turn plus extension of at least four bar diameters but not less than 2-1/2 in. at free end of bar.
  - (b) A 90° turn plus extension of at least 12 bar diameters at free end of bar.
  - (c) For stirrup anchorage only, either a 90° or a 135° turn plus an extension of at least six bar diameters but not less than 2-1/2 in. at free end of bar.
- (4) Welding - Welding of reinforcing bars is not permitted.
- (5) Joint reinforcement

- (a) Reinforcement of two or more deformed longitudinal wires weld connected with cross wires, forming a truss design.
  - (b) Make out-to-out spacing of longitudinal wires 2 in. less than the nominal width of the wall or wythe.
  - (c) Space welded contacts or cross wires with each longitudinal wire not more than 16 in.
  - (d) Provide joint reinforcement in flat sections 10 to 20 ft. long, except that factory pre-fabricated corner reinforcements and other special shapes may be shorter.
- (6) Anchors and ties - Fabricate anchors and ties in one of the following ways:
- (a) Wire mesh ties shall be No. 16 gage minimum 1/2 in. mesh steel wire, 12 in. minimum length and 1-1/2 in. less than the nominal width of wall.
  - (b) Rigid steel anchors at intersecting walls shall be 1-1/2 x 1/4 x 24 in. minimum with ends turned up 2 in. minimum and shall conform to ASTM A36.
  - (c) Dovetail anchors shall be sheet steel 0.06 in. minimum thickness, 1 in. wide, and turned up 1/4 in. at outer end.
  - (d) Corrugated or crimped metal ties shall be sheet 0.03 in. minimum thickness, 7/8 in. wide, 6 in. long.
- (C) Placing reinforcing bars
- (1) Embed bars in grout and provide a minimum masonry cover not less than the following:
    - (a) Minimum 2" where exposed to earth or weather.
    - (b) Minimum 1-1/2" where not exposed to earth or weather.
  - (2) Make splices in bars as shown on project drawings unless otherwise acceptable to CASCO Project Manager.
  - (3) Provide clear distance between horizontal bars in layer not less than the diameter of the bars, nor 1", except that they may be bundled in pairs.
  - (4) Provide clear distance between vertical bars not less than one and one-half times the bar diameter, nor 1-1/2", except that they may be bundled in pairs.
  - (5) Provide clear distance between vertical bars not less than one and one-half times the bar diameter, nor 1-1/2", except that they may be bundled in pairs.
  - (6) Lay horizontal bars as work progresses.
  - (7) Hold vertical bars in hollow unit masonry in place at 200 bar diameters or 10 ft. maximum on center whichever is lesser.
- (D) Placing Joint Reinforcement
- (1) Place masonry joint reinforcement so that longitudinal wires are located over face-shell mortar beds and are embedded in mortar or grout for their entire length with minimum cover of 5/8" when exposed to weather or earth and 1/2" at other locations.
  - (2) Joint reinforcement sections for corners and other wall intersections, are to be factory prefabricated for placement at these locations.

- (3) Unless noted otherwise, joint reinforcement shall not be continuous through a control joint or an expansion joint.
  - (4) Lap the ends of joint reinforcement 6" for deformed wire and 12" for plain wire when spliced.
  - (5) Space continuous horizontal reinforcing as follows:
    - (a) For multi-wythe walls (solid or cavity) where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by Code but not more than 16" o.c. vertically.
    - (b) For single-wythe walls, space reinforcing at 16" o.c. vertically, unless otherwise shown.
  - (6) Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing place in 2 horizontal joints approximately 8" apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.
- (E) Placing anchors, ties, and metal accessories:
- (1) Install required anchors, ties, and metal accessories as the masonry construction progresses.
  - (2) Set bolts and inserts vertically in the top of the walls, pilasters, beams or columns 3" minimum from any face in masonry 7" or more in thickness, and at the center line in thinner masonry sections.
  - (3) Adjust shelf angles as required to keep the masonry level and at required elevation. Provide anchorage as detailed in the project documents.
  - (4) Hold all metal accessories to masonry by firmly embedding anchorage into grout or mortar 3" minimum.

## 21. MORTAR

- (A) Mixing mortar - Mix all cementitious materials and aggregate in mechanical mixers for a minimum period of 5 minutes, after all materials are placed in the mixer, with the amount of water required to produce the desired workability.
- (B) Make workability or consistency of mortar on the board such that it can be worked with the trowel. Water for tempering shall be available on scaffold at all times.
- (C) Do not permit mortar to stand more than 1 hr. without remixing.
- (D) Discard mortar which has begun to set or is not used within 2-1/2 hr. after initial mixing. Retemper mortar which has stiffened due to evaporation to restore its workability.

## 22. MORTAR BEDDING AND JOINTS

- (A) Place hollow units with full mortar bedment in all courses of piers, columns, pilaster, in starting courses on footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced or filled with grout or concrete. In other cases, provide cross web bedding when required. Split-face block shall be used for starter course on footings and above, to ensure that no smooth-face block is exposed.
- (B) Place hollow units with head joints tightly mortar bedded for a minimum depth from each face equal to the masonry unit face shell thickness.
- (C) Make horizontal and vertical face joints 3/8" thick unless otherwise required. Shove vertical mortar joints tight, to provide full head joints.
- (D) Tool mortar joints in exposed exterior surfaces when thumbprint hard with a round jointer unless otherwise required. Point joints tight in unparged masonry below grade.

- (E) Remove mortar protrusions extending more than 1/2" into cells or cavities to be grouted.
- (F) Fill horizontal joints between top of masonry partitions and underside of slabs or beams with mortar unless otherwise acceptable to CASCO Project Manager.
- (G) Provide joint sealant to depth of 1/4" unless otherwise required on both the exterior and interior surfaces at control joints and at other locations where sealed joints are indicated. Rake joints and tool sealant smooth and uniform.
- (H) In temperatures exceeding 100°F. do not lay out mortar beds ahead of placing of units. Use a very light fog spray, not sufficient to penetrate the masonry, on vertical surface of masonry to aid in mortar curing during first 24 hr. after placing units.
- (I) Do not insert through wall flashing or other elements which stop bond in masonry joints between mortar and masonry units, unless otherwise acceptable to CASCO.
- (J) Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.
- (K) Clean mortar spatters and drips from adjacent block work immediately.

### 23. ADJOINING CONSTRUCTION

- (A) Anchor or bond masonry and walls and partitions at points where they meet or intersect by one of the following methods:
  - (1) Lay 50 percent of units at the intersection in masonry bond with alternate units having a bearing of not less than 3" on the unit below.
  - (2) Anchor the intersection by metal ties, joint reinforcement, or anchors as acceptable to CASCO.
  - (3) Anchor interior non-load-bearing walls at intersection, at vertical intervals of not more than 2' on centers, with metal ties embedded at least 4" into the masonry, or as acceptable to CASCO.
  - (4) Where courses of meeting or intersecting walls are carried up separately, use acceptable method of bonding or keeping separate at the intersection.
- (B) Anchor masonry to structural members where masonry abuts or faces such members to comply with the following or as shown on the drawings.
  - (1) Provide an open space not less than 1/2" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
  - (2) Anchor masonry to structural steel members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown. Space anchors as shown, but not more than 16" o.c. vertically and 32" o.c. horizontally.
- (C) Anchor masonry facing to backing with anchors or ties by embedment at least 1-1/2" into facing and backing. Space ties not farther apart than 24" vertically, nor 36" horizontally.

### 24. BOND BEAMS

- (A) Construct bond beams of one or more courses of load-bearing units filled with concrete or grout and reinforced. Use continuous reinforcement unless otherwise indicated.
- (B) Provide custom unit bond beams to match adjacent block texture, if required, where shown on the drawings.

### 25. GROUT FOR MASONRY

- (A) General: (reference Part 2, paragraph 9 for grout strength)
- (1) Set reinforcing steel and anchors in required position and secure against displacement before grouting is started.
  - (2) Mix all cementitious materials and aggregates for a minimum period of 5 min. after all materials are placed in the mixer with the amount of water required to produce the desired consistency. Place in cores and/or collar joints while fluid and before initial set has taken place. Puddle or vibrate grout into place. Place grout in such a way as to prevent segregation of materials. Pour grout fluid enough to flow into all crevices of grout spaces leaving no voids.
  - (3) Grout beams over openings in one continuous operation.
  - (4) Grout vertical cores in maximum of 5' lifts. Stop grout pours 1- 1/2" below a mortar joint, except at top of wall. Where bond beams are used stop grout pour 1/2" below top.
  - (5) Use metal lath, mortar, or special units to confine grout to area required. Do not use materials which may inhibit bond or are combustible.
  - (6) Use acceptable cold weather precautions in placing and curing of grout when temperature is less than 40°F.
- (B) Low-lift grouting: In hollow unit masonry construction, limit low-lift grouting to maximum wall height of 5' per lift. Vertical cores to be grouted shall have minimum clear dimensions of 3" x 4".
- (C) High-lift grouting:
- (1) Grout hollow unit masonry in accordance with this section when erected to height in excess of 5' before grouting. Vertical cores to be grouted shall have minimum clear dimension of 3" and clear area of 10 sq. in.
  - (2) Provide cleanout openings at 12 sq. in. minimum area opposite each vertical bar at bottom course or in foundation wall.
  - (3) Clean cores and collar joints of mortar droppings and foreign material, position reinforcement, and close cleanout openings before grouting.
  - (4) Place vertical barriers consisting of masonry units and mortar in bond beam type hollow units and in collar joints to be grouted at 30' maximum to limit horizontal flow of grout.
  - (5) Pour grout in 5' lifts maximum allowing minimum of 30 minutes and maximum of 1 hr. before pouring next lift. Grout shall be consolidated by puddling or vibrating at time of pouring and then reconsolidated before plasticity is lost. Reconsolidation may occur as next lift is poured.
  - (6) Do not erect masonry to a height more than 80 times, minimum clear grout space before grouting with a maximum of 30' unless otherwise acceptable to CASCO.
- (D) Construction protection :
- (1) Do not use high-lift grouting method until masonry units have been in place 3 days minimum.
  - (2) Do not permit water or foreign material to fall in grout space while grout is being placed and curing.
- (E) Cleanup: Remove misplaced grout immediately and clean affected areas.

## 26. LINTELS

- (A) Install galvanized steel lintels as manufactured by Powers Steel and Wire Products over masonry openings of more than 1'-0" as per schedule on Structural drawings.

- (B) Install loose lintels of steel and other materials where shown.
- (C) Provide masonry lintels where shown. Formed-in-place masonry lintels are to be temporarily supported.
- (D) Unless otherwise shown, provide one reinforcing bar for each 4" of wall thickness and of a size number not less than the number of feet of opening width.
- (E) For hollow masonry unit walls, use specially formed "U"-shaped lintel units with reinforcing bars placed as shown and filled with concrete grout.
- (F) Provide minimum bearing of loose steel and formed –in-place masonry lintels of 8" at each jamb.

## 27. FLASHING OF CONCRETE MASONRY WORK

- (A) Wall Flashing
  - (1) Install flashing and weep holes in masonry at shelf angles, lintels, edges, cavity bases and other obstructions to downward flow of water in wall, and where indicated.
  - (2) Surfaces to receive flashing shall be smooth, dry and free from projections.
  - (3) Install flashings in walls where and as shown on drawings. Apply the material in one layer and fully adhere to substrate. Laps shall be not less 6". Where anchors, ties, or other materials penetrate flashings, seal penetrations in flashing with adhesive, sealant or tape as recommended by flashing manufacturer.
  - (4) Provide rubberized-asphalt flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.040 inch (1.0 mm). Adhere to stainless steel at exposed drip edge.
- (B) Install reglets and nailers for flashing and other related work shown to be built into masonry work.

## 28. MORTAR NET INSTALLATION

- (A) Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections are acceptable for product installation in accordance with manufacturer's instructions.
  - (1) Match product cavity size. Cavity should be no more than ¼" (6.4 mm) wider than 1" (25.4 mm) thick material and 2" (51 mm) thick material, and 0.4" (10.2 mm) thick material should touch both the outer wythe and the inner wall. For cavities larger than 2" (51 mm) place rigid insulation of sufficient height to extend at least 6" (152 mm) above the top of the Mortar Net against the outside of the inner wythe and of appropriate thickness to reduce the cavity to the appropriate size.
  - (2) Inspect for and repair holes in flashing immediately prior to installing Mortar Net.
- (B) Clean flashing and weep holes so they are free of mortar droppings and debris immediately prior to installing Mortar Net. Washing flashing with water or chemicals prior to installation is not necessary.
- (C) Install the Mortar Net product after flashing has been installed, the first 1 or 2 courses of brick have been laid, and weep holes have been created. Install product before third or higher courses of brick have been laid. Lay the first 1 or 2 courses of brick at flashing level, then install the Mortar Net continuously by placing it against the inside of the openings. No fasteners or adhesives are required, and mortar need not have set.
- (D) For most wall, install 1 continuous row of the Mortar Net at base of wall and over all wall openings directly on flashing.

- (E) To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the Mortar to at least 6" (152 mm) above the top of the Mortar Net.
  - (F) Multiple thicknesses of the Mortar Net may be installed to match cavity widths and if excessive dropping are expected. Inspection, preparation and installation procedure for multiple thicknesses is the same as for single thickness. When installing multiple thicknesses, align the dovetail sections with each other.
  - (G) To match cavity width with product thickness without using multiple thicknesses of the Mortar Net, place rigid insulation of appropriate thickness against outside face of inner wall.
  - (H) The Mortar Net shall not come in contact with wall ties standard wall tile installations, but if it does, it may be cut or torn to accommodate wall ties. Conduit, plumbing or other materials that bridge or intrude into cavity between inner and outer walls.
  - (I) Compress the Mortar Net horizontally so it can be forced into cavities slightly smaller than its nominal thickness without affecting Mortar Net or wall performance.
    - (1) When forcing the Mortar Net into a cavity, be sure mortar has set sufficiently to resist outward pressure from product.
29. REPAIR, POINTING, AND CLEANING
- (A) Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
  - (B) Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up joints at corner, openings and adjacent work to provide a neat, uniform appearance properly prepared for application of caulking or sealant compounds. Cut at defective joints and repoint.
  - (C) Clean exposed masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Clean wall surfaces with prepared masonry cleaner in accordance with the manufacturer's instructions.
  - (D) Remove mortar splatters and drips from adjacent block work immediately.
  - (E) After completion of all work, the Contractor shall remove all scaffolding and surplus masonry supplies from construction site.
30. CONSTRUCTION PROTECTION
- (A) Step back unfinished work for joining new work. Before laying new work, remove loose mortar and clean exposed joint.
  - (B) Protect sills, ledges, and offsets from mortar drippings and other damage during construction.
  - (C) Remove misplaced mortar and grout immediately and clean affected areas.
  - (D) Protect face materials from staining.
  - (E) Keep masonry units dry. Keep the top of masonry construction covered with a water-proof covering when work is not in progress.
  - (F) Temporarily brace masonry against horizontal loads until cured and permanently braced.

## 31. WARRANTY

- (A) Contractor shall, upon completion of work contained herein, issue a written warranty to the Owner covering workmanship and material. Said warranty shall become effective upon completion and acceptance of work under this Section by Owner's representative and shall cover workmanship for one year and include material manufacturer's warranty for a period of one year against failure due to product which did not conform to formula or meet manufacturer's quality control standards at time of its production.

## 32. ACCEPTANCE OF MASONRY CONSTRUCTION

- (A) Completed masonry work which meets all applicable requirements shall be accepted without qualifications.
- (B) Completed masonry work which fails to meet one or more requirements must be brought into compliance in an approved manner or may be rejected or accepted by the Owner.
- (C) The masonry work shall be clean and show a quality of workmanship and finish that is acceptable to the Owner.
- (D) Joints shall be tooled and tight, showing no separation between mortar and units.

- END OF SECTION -



DIVISION 7 - MOISTURE CONTROL

PART 1: GENERAL

1. RELATED DOCUMENTS

(A) The general provisions of Division 1 apply to the work specified in this section.

2. SCOPE OF WORK

(A) Apply single component water based, polymer-modified, cold applied, waterproof membrane to below grade concrete or masonry walls.

3. MATERIALS

(A) Apply MEL=ROL LM, manufactured by:

WR Meadows of Canada  
 70 Hannant Ct.  
 Milton, ON L9T 5C1  
 38 Rayborn Crescent  
 St. Albert, AB T84 481  
 (300) 342-5976

(B) MEL-ROL LM is a single component, water-based, polymer-modified, cold-applied, waterproofing membrane for application to the exterior surface of reinforced concrete walls.

(C) With MEL-ROL LM, installation time is reduced, utilizing either a spray or roller application.

(D) MEL-ROL LM can be used on new and remedial waterproofing applications on concrete substrates.

(E) Packaging:  
 5 Gallon (18.93) Pails  
 55 Gallon (208.20 liter) Drums (special order only)

(F) Shelf Life: Six months in unopened container. Do not store in temperatures over 90° F or below 40° F.

PART 2: PRODUCTS

4. MATERIALS

(A) Product Characteristics

(1)	Color	Black
(2)	Solids	70%
(3)	Total Cure Time	16-24 hrs
(4)	Application Temp	30° F Minimum
(5)	Coverage	20-25 sq. ft./gal
(6)	Shore "00" Hardness	Passes ASTM C-836

(7)	Adhesion to Concrete	Exceeds	ASTM C-836
(8)	Low Temp Flex & Crack Bridging	Passes	ASTM C-836
(9)	Stability	Exceeds	ASTM C-836
(10)	Elongation	1500%	ASTM D-412
(11)	Water Absorption	0.7%	ASTM D-1970
(12)	WVT	0.03 Perms	ASTM-E-96, B

## PART 3: EXECUTION

5. SURFACE PREPARATION

- (A) All surfaces must be clean (free of coatings), free of frost, relatively smooth and structurally sound. Patch any bug holes, tie holes, large gaps or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance on the substrates, such as dirt, dust, loose stones and debris, should be either swept or blown clean.
- (B) All shrinkage cracks less than 1/16" should be pre-treated with a 60-mil coat of MEL-ROL LM 6" (15 cm) wide. All cracks greater than 1/16" should be pre-treated with W. R. MEADOWS DETAIL STRIP prior to application of the membrane.

6. MIXING

- (A) MEL-ROL LM is designed to be used from the pail or drum with little or no mixing. However, if water appears on the surface of the unit, thoroughly mix with a low speed mechanical mixer prior to application.

7. PRIMING

- (A) To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM diluted with water may be required. (Approximate dilution ratio of MEL-ROL LM to water is 4:1.)
- (B) Thoroughly mechanically mix primer. Prime the entire concrete surface to be waterproofed by spraying or rolling on a single coat at a coverage rate of 100-150 sq. ft./gal. Allow primer to dry (approximately one hour, depending on climatic conditions).

8. DETAILING

- (A) After surface preparations are complete, detailing should be addressed. The desired thickness of membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations.

9. APPLICATIONS

- (A) ROLLER APPLICATION: MEL-ROL LM can be applied directly from the container using a ¾" nap roller. Apply in two coats, each 30 mils thick, allowing first coat to reach initial set prior to application of second coat.
- (B) SPRAY APPLICATION: MEL-ROL LM may be sprayed on vertical surfaces at the minimum coverage thickness of 60 mils wet (45 mils dry). A single coat may achieve desired coating thickness. However, if material slumps due to temperature or substrate conditions, two coats (30 mils wet) may be necessary. Apply the second coat after the first coat has dried (approximately one to two hours).

- (C) Approximate Coverage: Vertical: 20-25 sq. ft./gal. @ 60 mils

10. THICKNESS CONTROL

- (A) Frequently inspect surface area with a wet mil gauge to ensure desired consistent thickness is achieved. Porous substrates or masonry block walls may require additional coats to obtain desired thickness.

11. SPRAYING EQUIPMENT

- (A) MEL-ROL LM is most effectively applied by using the Graco HydraMax 350 or the Graco GH833 Big Rig.
- (B) The Graco heavy-duty texture gun is recommended for use with the following tips. For best results, use the 0.051" (Graco GHD551) heavy-duty switch tip. For spraying of primer coat, a smaller orifice tip such as the 0.035" (Graco GHD635) can be used. Tips should be reversible types for easy clean out.
- (C) CLEAN UP: Material should not be left in the pump, lines or gun when finished spraying. After spraying, promptly flush water through the system until pump and hose are clear (approx. five gallons). Aromatic solvents, such as xylene or toluene (approx. two gallons), should be used for final flushing after water is flushed through the pump and lines.
- (D) Mineral spirits, paint thinner, gasoline, etc., must not be used to flush system. **NOTE: Water must be flushed through the machine to remove any solvents prior to spraying of MEL-ROL LM.**

12. BACKFILLING

- (A) Allow 24 hours for complete cure of membrane prior to backfilling.

13. CAUTION

- (A) Do not freeze. Do not apply MEL-ROL LM on vertical projects if rainfall is forecast or imminent within 2-4 hours. Do not apply MEL-ROL LM on horizontal projects if rainfall is forecast or imminent within 24 hours. Do not apply MEL-ROL LM or primer when air, material and surface temperatures are expected to fall below 30° F within four hours of completed application.

- END OF SECTION -

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DIVISION 7 - MOISTURE CONTROL

## PART 1: GENERAL

1. RELATED DOCUMENTS

- (A) The general provisions of Division 1 apply to the work specified in this Section.
- (B) Other related Sections:
  - (1) Preservative treated nailers and blocking specified in Section 06100, Carpentry.
  - (2) Flashing and Sheet Metal specified in Section 07600.
  - (3) Roof accessories specified in Section 07701.
  - (4) Metal siding specified in Section 07402.
  - (5) Joint sealants specified in Section 07901.

2. SCOPE OF WORK

- (A) Furnish all labor, materials, tools, equipment and scaffolding required for completing single-ply TPO roofing, roof insulation, membrane flashing work and related items indicated on the drawings and specified herein.
- (B) Coordinate this work with other trades involved to avoid delays and to ensure a satisfactory and watertight installation.
- (C) Examine surfaces on or against which roofing is to be applied, check levels of roof for dips or hollows. Notify Owner's Representative in writing of any defects which, in the opinion of Roofer, would be detrimental to installation of his work. Do not proceed with any work until unsatisfactory conditions have been corrected in a manner acceptable to the Roofing Contractor. Laying of materials will be considered as acceptance of deck by Roofer.
- (D) Proceed with roofing work only after substrate construction and penetrating work have been completed and accepted by the Owner's independent testing and inspection agency.
- (E) Weather Conditions: Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

3. QUALITY ASSURANCE

- (A) The roofing and associated work shall be accomplished by a single qualified firm that is approved, authorized or licensed by the roofing system manufacturer to install manufacturer's product, meeting the highest quality rating available with the roofing system manufacturer and is eligible to receive manufacturer's warranty and has installed the approved system for at least five years on projects comparable to the work of this contract; and, upon written request of Owner, shall furnish the name and location of such roof installations.
- (B) Pre-Roofing Conference: Before the roofing work is scheduled to commence, after submittals have been reviewed by CASCO and Owner, and before any materials are ordered, a conference shall be called at the jobsite for the purpose of reviewing the drawings and specifications, the intent of which is to resolve roofing related questions before the work is started. The conference shall be attended by the General Contractor, Roofing Contractor and his foreman, the testing/inspection agency as well as Owner's Representative.
- (C) Source Limitations: obtain all roofing system components from a single roof system manufacturer.

- (D) Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below, by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
- (1) Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
  - (2) UL Listing: Roofing system shall meet requirements for U-L Class "A" fire hazard classification ratings.
  - (3) FM Listing: Roofing system application shall be in accordance with minimum the following, unless otherwise required by Code or the Authority having jurisdiction.
    - (a) Unless a higher wind speed is identified on the structural drawings a minimum wind speed of 90 mph shall be used for the roof system design.
    - (b) The FM Wind Uplift Rating shall be indicated on the drawings. Where no FM Wind Uplift Rating is specified on the drawings, the rating shall be calculated by the Contractor using the RoofNav Rating Calculator found on the FM website at <https://roofnav.fmglobal.com>.
    - (c) The Wind Uplift Rating calculated for this project's roof system design shall only apply to the roofing system (i.e.: membrane, insulation, etc.) and not supporting structural building components (i.e.: roof deck, roof joists, etc.).

#### 4. SUBMITTALS

- (A) Product's Data, Roofing: Submit copies of Product Data, specifications and installation instructions from the manufacturer for each major roofing product or system required. The material shall not be ordered until the submittals have been approved. One (1) copy shall be kept at the jobsite at all times for use during construction.
- (1) Any submittal that does not include the proposed Manufacturer's roofing system specification number will be rejected.
- (B) Shop Drawings: For roofing system; include plans, elevations, sections, details, and attachments to adjacent work.
- (1) Base flashings and membrane terminations.
  - (2) Tapered insulation, including slopes.
  - (3) Insulation fastening patterns.
- (C) Installer Certificates: Signed by roofing system manufacturer certifying that Roofing Contractor is approved, authorized, or licensed by Manufacturer to install the roofing system.
- (D) Maintenance Data: For roofing system; include in maintenance manuals.
- (E) Warranties: Special warranties specified in this Section.
- (F) Inspection Reports: Copy of roofing system manufacturer's inspection reports of interim and completed roofing installation.

#### 5. ROOFING SYSTEM GUARANTEE

- (A) Submit, in duplicate, a ~~twenty (20)~~ fifteen (15)-year no dollar limit guarantee on roofing and associated work specified in this Section, agreeing to repair or replace work that leaks water, deteriorates excessively or otherwise fails to perform as roofing due to failures of materials, installation or workmanship. Coverage of the guarantee shall include all materials and workmanship for the full time specified. Guarantee shall be issued and backed solely by the Roofing Materials Manufacturer.

- (B) General Contractor to submit to the Owners Representative copies of all Manufacturer's field inspection reports, including interim and final inspection reports, as well as the twenty (20) year guarantee as provided by Manufacturer.
- (C) The Roofing Contractor shall issue a "full system" warranty for a period of two (2) years from date of Certificate of Occupancy. Under this warranty, the Contractor shall remedy any defects resulting from workmanship in the roofing system. Repairs shall be made by the Roofing Contractor and the General Contractor at their own cost and expense, as may be necessary to maintain warranty and to keep roof in a watertight condition. The roofing system is defined as including all components from the roof deck up, including insulation, fasteners, membrane, flashings, adhesives, sealants, and any miscellaneous items required for a complete installation. The cost of repairs are the responsibility of the Roofing Contractor and the General Contractor.
- (D) When unit skylights are called for on the drawings, and an acceptable roofing manufacturer can provide a comparable product, the unit skylight may be submitted for consideration. If the roofing manufacturer's unit skylight is approved, it shall be included in a unitary full system warranty with the roofing system.

#### 6. DELIVERY, HANDLING, PROTECTION AND STORAGE

- (A) All materials provided by the Roofing System Manufacturer shall be delivered with appropriate packaging labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions.
- (B) All roofing materials shall be delivered dry in manufacturer's original, unopened package and be properly stored in a dry place, off the ground on raised pallets, minimum 4" high and off the roof. Membrane may be stored in standard packaging. Completely cover all material with canvas tarpaulins, inside or in closed vans, protected from Sun and weather and the intrusion of water. Plastic covers will not be acceptable.
- (C) Deliver roofing materials to Project site in unopened original containers with seals unbroken and labeled with Manufacturer's name, product brand name and type, appropriate packaging labels, indicating appropriate warnings, storage conditions, lot numbers, usage instruction, date of manufacture, and directions for storing and mixing with other components.
- (D) Stand all roll goods on end and store on clean floor to keep ends of rolls free from foreign matter.
- (E) Store all cartons and insulation on raised, level platforms in a dry clean location and protect them from the weather with waterproof canvas tarpaulins.
  - (1) Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- (F) Store solvents and coatings in a cool dry area.
- (G) Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by Roofing System Manufacturer. Protect stored liquid material from direct sunlight.
  - (1) Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- (H) Keep lids tightly sealed on all cut back adhesives, and flashing cements to keep volatiles from escaping.
- (I) Unload and handle all roofing materials insulation and accessories with care. Dropping membrane rolls, roof insulation, and roofing accessories can damage these components sufficiently to cause unsatisfactory application and performance.
- (J) Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of roof deck.

- (K) Plastic covers and shrink-wrap shall not be used for job storage, nor shall any other cover be used in which moisture can condense within or on the material stored therein.
- (L) Keep temperature of all roll materials above 40 degrees F for 24 hours prior to application. Coated rolls shall be given special care in proper temperature protection.
- (M) Cover all roofing materials remaining on the roof deck at the end of each work day.
- (N) PROJECT CONDITIONS:
  - (1) Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to Manufacturer's written instructions and warranty requirements.
- (O) WARRANTY:
  - (1) Special Warranty: Manufacturer's standard form, without monetary limitation, in which Manufacturer agrees to repair or replace all components of membrane roofing system that fail in materials, application or workmanship within specified warranty period. Failure includes roof leaks.
    - (a) Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners and other components of membrane roofing system.
    - (b) Warranty Period: 20 years minimum from date of Certificate of Occupancy.

#### 7. WORK SEQUENCE

- (A) Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
- (B) Do not disrupt activities in occupied spaces.
- (C) Provide preservative treated wood at perimeters to match insulation thickness as required by drawings and roofing system manufacturer.

#### 8. PRECAUTIONS

- (A) Adhesives, primer and caulks as indicated are extremely flammable and/or toxic. Follow precautions indicated on container labels.
- (B) Surface to be bonded shall be dry, clean and free of debris. Suitable surfaces shall be smooth, solid masonry, wood and metal and insulation board fastened according to the specific manufacturer's recommendations for receiving adhered roofing membranes and accepted by the Roofing System Manufacturer for adhered applications of the membrane.
- (C) All fasteners shall be installed with a depth-sensing screw gun to prevent over-driving or under driving. Adapter tools shall be used for the installation of specialized fasteners.
- (D) Verify, `coordinate and control the block off or shut down of positive pressure building ventilation systems of roofing materials to prevent sheets from billowing during applications.
  - (1) For stores, which are subject to positive pressurization from wind or from air handling systems below the deck during construction, consult Roofing System Manufacturer for suitability of application or required design enhancements.
- (E) Excessive patching as a result of damage to the membrane, or caused by faulty installation, may require total recover in those areas.
- (F) Job preparation shall include insuring positive drainage of the roofing system.

## PART 2: PRODUCTS

9. ACCEPTABLE SINGLE PLY TPO ROOFING MANUFACTURERS AND ROOFING SYSTEMS

- (A) Roof system manufacturers acceptable for use on the project: (ISO 9002 certified)
  - (1) Elevate, Ultra Ply TPO
  - (2) GAF Materials Corporation EverGuard TPO.
  - (3) Carlisle Syntec Incorporated. Sure-Weld TPO.
  - (4) Johns Manville, JM TPO ~~60 ST6RM-S~~.
- (B) In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - (1) Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
  - (2) Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, and are limited to, the manufacturers specified.

10. ROOFING INSULATION

- (A) Provide preformed, double layer roof insulation boards that comply with requirements and reference standards selected from Manufactures standard sized and in combined thicknesses attaining a "R" value of 26.0 minimum at the thinnest point and aged in accord with RIC/TIMA procedures. Place tapered insulation at bottom.
  - (1) Polyisocyanurate Board Insulation: ASTM C 1289, Type II, glass-fiber mat facer on both major surfaces.
    - (a) Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II-Class 1, UL class A rating and Factory Mutual (FM) class 1 approval, with the following additional characteristics:
      - (1) Thickness: As required to attain "R" = 26.00 minimum or greater.
      - (2) Size: 48 inches by 96 inches, nominal. 1.5 inch thickness minimum.
      - (3) Compressive Strength: 20 psi when tested in accordance with ASTM C 1289.
      - (4) Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
      - (5) Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
      - (6) Insulation Fasteners: Type and size as required by Roof Membrane Manufacturer for roofing system and warranty to be provided; use only fasteners acceptable to the Roof Membrane Manufacturer.
    - (b) Provide rigid insulation of proper thickness (1" minimum) at all preformed curbs without factory installed insulation.
- (B) Double Layer:
  - (1) Bottom Layer: Isocyanurate roof insulation with Non-Asphaltic Glass Fiber Facers, complying with Federal Specification HH-I-1972/2 and approved for use with guaranteed roofing assemblies.
  - (2) Top Layer: Isocyanurate roof insulation with Non-Asphaltic Glass Fiber Facers,

complying with Federal Specification HH-I-1972/2 and approved for use with guaranteed roofing assemblies with stagger joints each way.

- (C) Tapered Insulation: For cricket construction and where otherwise indicated, polyisocyanurate roof insulation meeting Federal specifications HH-1-1972/2 Class 1 and Factory Mutual (FM) Class 1 approval shall be used. Tapered insulation shall provide twice the slope of the roof system (1/4" per foot minimum) for slope on roof crickets on roof plan. Slope to drain as indicated on the drawings.
- (D) Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 11. SINGLE PLY TPO MEMBRANE ROOFING SYSTEM

### (A) MECHANICALLY FASTENED THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

- (1) Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, Single-ply, white, .060-.045-inch-thick (min.), mechanically fastened per manufacturer recommendations, flexible sheet formed from a thermoplastic polyolefin internally fabric or scrim reinforced with fabric and scrim over manufactures approved insulation and metal deck. Sheets shall conform to ASTM D6878.
  - (a) Provide energy compliant high reflectance and high emissivity roofing with initial reflectance of at least .65- and 3-year aged reflectance of at least .5 when tested in accordance with ASTM E903.
  - (b) Thickness of thermoplastic polyolefin over scrim shall be 21 mil minimum when tested in accordance with ASTM D7635.
- (2) Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- (3) Mechanically and adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- (4) Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
  - (a) Repair tears, voids and lapped seams in roofing membrane that does not meet requirements.
- (5) Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.
- (6) Physical Properties:
  - (a) Breaking Strength: 250 lbf (1108N); ASTM D 751, grab method.
  - (b) Elongation at Break: 15 percent; ASTM D 751.
  - (c) Tearing Strength: 55 lbf (245 N) minimum; ASTM D 751, Procedure B.
  - (d) Brittleness Point: Minus 40 deg F (-40 deg C). ASTM 2137.
  - (e) Ozone Resistance: No cracks after sample, wrapped around a 3-inch-(75 mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
  - (f) Resistance to Heat Aging: (White membrane); 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 32 weeks minimum at 240 deg F (116 deg C); ASTM D 573.

- (g) Water Absorption: Less than 4 percent mass change after 166 hours immersion at 158 deg F (70 deg C); ASTM D 471.
- (h) Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204.
- (7) Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges, as recommended by Roofing System Manufacturer.
- (8) Flashing Accessories: Types recommended by Roofing System Manufacturer, including adhesive tapes, flashing cements, and sealants.
- (9) Flashing Material: Manufacturer's standard system compatible with single-ply membrane.
- (10) Membrane Adhesive: As recommended by Roofing System Manufacturer for particular substrate and project conditions, formulated to withstand minimum uplift force per FM requirements.
  - (a) Provide adhesives that comply with local requirements limiting amounts of volatile organic compounds.
  - (b) All-Purpose Sealant: Provide-as a water cut-off mastic, a pitch-box sealer, and as a caulk to seal membrane to metal.
  - (c) Seam Caulk: Provide seam Caulk (white), solvent-based caulk to seal exposed cut edges of reinforced membrane.
  - (d) Seam Cleaner: Prior to heat welding seams, clean all seams and immediate areas with Seam Cleaner surface cleaner.
- (7) Provide a reinforced or non-reinforced fire-retardant sheet as recommended by manufacturer to achieve UL and FM listing.
- (8) At masonry roof parapets provide single-ply fully adhered flashing as indicated on drawings.
- (B) AUXILIARY MATERIALS
  - (1) General: Auxiliary materials recommended by Roofing System Manufacturer for intended use and compatible with membrane roofing.
    - (a) Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
  - (2) Sheet Flashing: Manufacturer's standard white, unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) minimum thickness.
  - (3) Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings. Bonding adhesives not acceptable in seams.
  - (4) Slip Sheet: Manufacturer's recommended slip sheet.
  - (5) Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 inch wide by 1/8 inch (25 by 3 mm) thick; with appropriate anchors.
  - (6) Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, pre-punched and fastened 8" o.c.
  - (7) Metal Accessories:
    - (a) Metal Roof Edging and Fascia: Factory formed continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof/parapet

- edge with nails.
- (b) Wind Performance:
  - (1) Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
  - (2) Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
  - (3) Provide product listed in current Factory Mutual Research Corporation Approval Guide, providing a rating satisfying the local requirements, but with minimum of FM 1-90 rating.
- (c) Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia.
- (d) Fascia Face Height: 5 inches.
- (e) Edge Member Height Above Nailer: 1-1/4 inches.
- (f) Length: 144 inches.
- (g) Functional Characteristics: Fascia retainer supports shall allow free thermal cycling of fascia.
- (h) Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded splices to allow thermal expansion.
- (i) Anchor Bar Cleat: 20-gauge, 0.036-inch G90 coated commercial type galvanized steel with pre-punched holes.
- (j) Curved Applications: Factory modified.
- (k) Special Shaped Components: Provide factory-fabricated pieces as required for complete installation, including miters, scuppers, and end caps with minimum 14-inch-long legs on corner pieces.
- (l) Scuppers: Weld watertight.
- (m) Accessories: Provide matching wall cap, downspout, extenders, and other special fabrications as shown on the drawings.
- (8) Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories. Unreinforced Ethylene Propylene-based membrane shall be supplied for field fabricated vent stacks, pipes, drains and corners.
- (E) INSULATION ACCESSORIES
  - (1) General: Roof insulation accessories shall be as recommended by insulation manufacturer for intended use and compatible with membrane roofing.
  - (2) Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to Roofing System Manufacturer.
  - (3) Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
- (F) WALKWAYS

- (1) Flexible Walkways: Factory-formed as provided by the membrane roofing system manufacturer. Color White. Refer to Roof Plan.

### PART 3: EXECUTION

#### 12. REFERENCE

- (A) The most current application guide published by the Manufacturer of the selected roofing system shall be considered part of this specification and shall be referred to for more specific application procedures regarding roofing insulation, membrane and base flashing.
- (B) Where this written specification differs from the Manufacturer's application guide, the more stringent specification shall be used.

#### 13. SUBSTRATE PREPARATION

- (A) The General Contractor shall be responsible for providing clean, rust primed, adequate, with deck welds painted, surfaces to receive insulation, roofing and flashing. Prior to the onset of work, the Roofing System Installer shall inspect the entire area to be roofed with the Owner's Independent Roof Inspector. Defects and improper conditions affecting roof installation shall be brought immediately to the attention of the General Contractor, in writing, for correction. All roof decking, walls, nailers, projections including curbs, pipes, etc. shall be in place prior to commencement of roofing.
- (B) The General Contractor shall provide documentation to the TPO Roofing System Installer and the owner that the deck and all related roof structures have been inspected and accepted by the Independent Roof Inspector prior to requesting the Roofing System Installer to begin work.
- (C) Ponded water shall be removed from the roof surface.
- (D) The Roofing System Installer shall coordinate with the General Contractor and/or directly with the Owner's Testing Agency to ensure timely inspection of the substrate and shall procure the written acceptance of that testing agency on the substrate surfaces prior to installation of roof insulation or membrane. All defects and improper installation shall be immediately brought, in writing, to the attention of the General Contractor for correction.
- (E) Roof deck substrate surface shall be clean, smooth, with all rust areas scraped and paint primed, free of sharp edges or any other irregularities detrimental to 100% adhesion of the flashing membrane. Any substrate repairs or modifications shall be done by others.
- (F) Plywood surfaces, where occurs, shall be minimum 5/8" thick (if indicated on the drawings furnished and installed by others) dry, clean, smooth, free of sharp edges, and suitable for acceptance of membrane. Plywood shall be exterior grade with an A or B finish side up and with no joints gapped greater than 1/4 inch. Install slip plates over all gapped or uneven joints where membrane seams will cross to minimize adhesion inconsistency.
- (G) Nailers: Pressure preservation treated wood nailers shall be installed at gravel stops or drip edges (furnished and installed by Others)
  - (1) Nailer shall be anchored with a suitable fastener for the application having a minimum withdrawal of 100 lbs., staggered 6 inches o.c. within 8 feet of an outside corner and 12 inches o.c. along other perimeter areas.
  - (2) Nailer thickness shall be chosen to match the top surface of adjacent construction  $\pm 1/4$  inch. This permissible variation shall not contribute to ponding.

#### 14. APPLICATION PROCEDURES

- (A) Insulation or protection board:
  - (1) Manufacturer's instruction: In regard to attachment, compatibility, and spanning of deck flutes, the Manufacturers' instructions or specifications shall determine the suitability for an application, subject to acceptance by the membrane Roofing System Manufacturer.

- (2) Precautions: Care shall be taken in handling insulation boards, as well as in their mechanical attachment, so no damage or rupture occurs to the surface. All damaged areas shall be cut out and replaced with structurally sound insulation, properly secured in place.
- (3) Attachment: Insulation shall be recommended by its Manufacturer for mechanical attachment. All boards shall be mechanically attached by FM approved plate and screw. Boards shall be fastened sufficiently to conform to the substrate surface geometry and FM uplift requirements.
- (4) Tapered insulation: Tapered insulation systems tapering down to a minimum 1/2-inch thickness shall have a tapered edge strip of high density fiber board and shall be used to provide a smooth positive transition to the flat areas.

15. INSTALLATION OF ROOF INSULATION

- (A) Insulation shall be installed in two layers per the recommendations of FM and the roof insulation manufacturer and the membrane Roofing System Manufacturer:
  - (1) The top layer shall be mechanically fastened through the bottom layer to the deck. Fastener quantities shall be per FM requirements:
    - (a) Additional fasteners shall be located as required to eliminate high spots in boards.
- (B) Insulation boards shall be laid in parallel courses with transverse joints staggered. Adjoining edges of board shall be brought into tight contact but shall not be forced into place in such manner as to damage boards. Where the roof meets vertical surfaces, boards shall be cut in a neat workmanlike manner, leaving approximately a 1/4" joint. Repair all joints greater than 1/4" with insulation. Score or cut boards as necessary to lay flat on deck where same is irregular. Broken corners shall be cut out and replaced with sections of insulation large enough to be supported on two or more deck flutes.
- (C) Roof insulations shall be cut to fit neatly around projections, pipes, and vents coming through roofing. Provide clearance per Manufacturer around heat conducting pipes.
- (D) Insulate deck area under parapet cant slopes.
- (E) Insulate deck area inside RTU curbs.
- (F) Install only as much roof insulation as can be completely covered with roofing the same day.

16. ROOFING CONSTRUCTION AT EDGES AND PENETRATIONS

- (A) Provide rigid insulation of proper thickness (1" minimum) at all preformed curbs for new roof penetrations (mech. units, exhaust fans, roof hatch, etc.)
- (B) Perimeter sheets: Install perimeter sheets in compliance with FM Windstorm resistance classification or per manufacturers' recommendation, the more stringent to apply.
- (C) At all areas where membrane flashings will be adhered to metal, the metal flange shall be primed on both sides and adhered to the field.
- (D) All sheet metal flanges to which membrane flashing will be adhered, shall be nailed 3" o.c. staggered, prior to the application of the flashings. Wood nailers equal in thickness to the roof insulation shall be installed below all sheet metal flanges prior to the application of the roofing plies.

17. TPO INSTALLATION

- (A) General: Start installation only in presence of the Owner's Independent Roofing Inspector and a qualified technical roof systems manufacturer's representative.
- (B) Begin application of roofing systems at the highest point of the project area and work to the lowest point to prevent water infiltration.

- (C) Mechanically Fastened Membrane:
- (1) A minimum of one-half width membrane sheets shall be installed at the perimeter of each roof level and the maximum practical width membrane sheets shall be installed over the field of roof. All membrane sheets shall be mechanically attached with manufacturer recommended fasteners and seam plates spaced 6, 12, or 18 inches maximum on center (depending on project criteria) within the membrane seam.
  - (2) Membrane shall extend from base of parapet up and over the top of the parapet wall and down to 1" below the wood blocking.
  - (3) Protect roofing system from waste products or direct steam venting as instructed by manufacturer.
  - (4) Do not expose membrane and accessories to temperature in excess of 180F.
  - (5) Avoid foot traffic on newly laid roofing system.
- (D) Membrane Perimeter sheets: Two or more sheets shall be installed at exposed perimeter areas unless located within ASCE Ground Roughness Categories A and B. Buildings located within ASCE Ground Roughness Categories C and D will have increased perimeter sheet requirements. Sheets shall be laid out in an approved pattern. Plates and screws shall be installed along the edge of the membrane through the insulation and into the roof deck. At perimeters that are to receive a gravel stop or metal edging, the membrane must be brought over the outside edge and secured at a minimum of 12 inches o.c. Follow FM requirements for wind uplift.
- (E) Lap splice: Membrane shall be overlapped a minimum of 5-1/2 inches along the length of the membrane sheet and 2 inches at end roll sections (width of membrane) and hot-air welded without any containments (adhesive, dirt, debris, etc.) prevalent in the seam.
- (1) The entire lap edge must be probed with an approved seam probing tool after it has cooled completely to verify seam consistency. No probing shall be done before the seam area has cooled to avoid damage to the membrane. In addition, a destructive test shall be performed daily on a 3-inch-wide area of seam weld to verify good peel strength. Properly welded seams will exhibit membrane delamination from scrim prior to weld failure. Destruction tests on welds shall be done for the first seam of the day, the first seam after the robot welder has been allowed to cool down, and after any extreme changes in weather conditions. Cut edges shall be caulked by applying seam/caulk. Destructured test areas shall be immediately repaired to specification required quality.
  - (2) The membrane, as with any material after exposure, shall be cleaned prior to seaming. The approved method for cleaning the membrane prior to hot-air welding shall be as follows:
    - (a) Remove any visible dirt and debris with a clean rag and water. Scrub heavily contaminated surfaces with a detergent cleaner followed by a water rinse.
    - (b) Aggressively agitate the seaming areas with a clean scrub pad saturated with Seam Cleaner followed by a thorough cleaning of the seamed area with a clean, dry rag. Care shall be taken not to redeposit any contaminants onto the cleaned sheet surface.
    - (c) Seam cleaner shall be allowed to completely flash off (i.e. membrane should be completely dry).
    - (d) The standard hot-air welding procedures shall be followed with an approximated 20% reduction in speed or as approved by Roofing System Manufacturer allowing several days to achieve final weld strength.
    - (e) Perimeter fastening: Wood nailers shall be installed at perimeter gravel stops or drip edges. Membrane shall be fastened at other terminations by use of plates and screws.

- (3) Base of parapet or curb: Membrane shall be mechanically fastened in compliance with the roofing system manufacturer's specifications meeting FM requirements (12 inches o.c. maximum spacing). through insulation into deck. Fastening shall be installed at parapet wall, curbs, fire and smoke vents, expansion joints, and any other roof penetrations that exceed 24 inches in any dimension.
- (F) Flashing: Perimeter, curbs, vents, expansion joints, drains, and other details shall be flashed as shown on Drawings.
- (1) Apply Bonding Adhesive to both underside of flashing membrane and surface to which it is bonded.
  - (a) Bonding adhesive shall not be applied to that portion of the flashing that overlaps onto itself.
  - (b) Hot-air welding shall be used throughout the system where membranes overlap.
- (2) Bonding Adhesive shall be allowed to dry to finger touch until it does not string or stick to a dry finger. Roll the flashing into the dry adhesive.
  - (a) Flashing shall not bridge at elevation or directional change.
- (3) All flashing shall be mechanically fastened at the top, under or through appropriate counter flashing with approved fasteners and with approved termination details.
- (4) Metal flashings at perimeter shall be made and installed as per Roofing System Manufacturer's recommendations.
- (5) Pipe flashings shall be installed in accordance with Roofing System Manufacturer's recommendations. Do not flash to lead.
- (6) Expansion joints shall be installed in accordance with details shown on drawings.
- (7) Roof drains if applicable, shall be installed in accordance with Drawings and Roofing System Manufacturer's recommendations. All bolts must be properly secured to supply 100% continuous compression of the clamping ring. Field seams shall not be run through drains.
- (G) Metal work: Metal work other than roof manufacturer's metal systems is not covered by Manufacturer's warranty.
  - (1) Metal work shall be installed to prevent damage from buckling or wind.
  - (2) All metal work shall be sealed and waterproofed in an acceptable manner.
- (H) Overnight seal/temporary water stop shall be made by a sealant method approved by the Membrane Manufacturer. Protect the insulation from inclement weather at the end of a day's work or if work is interrupted, the membrane shall be extended beyond the insulation and set into the approved overnight seal material. Roofing System Installer shall coordinate installation to ensure the system is made watertight at the end of each workday or at any interruption in the work.
- (I) Installation
  - (1) Approved insulation boards shall be installed with the longest dimension perpendicular to the direction of the membrane seams and with end joints staggered. Boards will be butted as closely as possible with no gaps over ¼ inch and mechanically attached.
  - (2) Perimeter sheets: Sheets shall be laid out in an approved pattern. Plates and Screws shall be installed along the edge of the membrane through the insulation and into the roof deck, per manufacturer's installation instructions. At perimeters that are to receive a gravel stop or metal edging, the membrane shall be brought over the outside edge and secured at a minimum of 12 inches o.c. Follow FM requirements for wind uplift. Buildings located within ASCE Ground Roughness

Categories C and D will have increased perimeter sheet requirements to be verified by Roofing Contractor.

- (3) Sheets fully adhered with manufacturer's membrane adhesive with no contamination of field seams, which must be heat welded.

18. WALKWAY INSTALLATION

- (A) Walkway Installation: See drawings for layout.
  - (1) Install walkway material over clean, dry surfaces.
  - (2) Layout areas where walkway material is to be installed with most of the material being oriented so that it is placed between the field seams with each adjacent and abutting section gapped according to manufacturer's recommendations.
  - (3) Weld or glue the perimeter of the properly positioned walkway material. Check seams for any voids or inconsistencies that might prevent water tightness. Provide ~~a double width (approximately 5'0") of protective~~ walkway around all HVAC and roof hatch.
  - (4) Apply seam sealant at all edges if required by Roofing System Manufacturer.

19. WATERSTOPS

- (A) Install temporary cutoffs around incomplete edges of the roofing assembly at end of each day's work and when work must be postponed because of inclement weather or other reasons. Straighten the insulation line using pieces of insulation loosely laid and seal the sheet membrane to the deck or existing membrane.

20. ROOFING APPLICATION QUALITY CONTROL

- (A) The General Contractor shall request the Roofing Manufacturer to provide a competent technical representative to provide one interim and one final inspection and to also inspect and direct the handling, methods, and application of the roofing materials. While it shall not be required that the Manufacturer's Representative remain constantly at the building during installation, he shall inspect all phases of the work in the application of the roofing as it progresses. Representatives should at all times be easily accessible during the execution of the work to properly attend to questioned items. The Manufacturer's Representative shall provide written certification that the workmanship and installation have been properly and correctly performed and that the Manufacturer's warranty is valid.
- (B) If this inspection and certification process is not provided by the General Contractor then the roof test cuts as specified below shall be performed by the General Contractor.
  - (1) General Contractor is to be responsible for obtaining roof test cuts and analysis as provided by a certified independent testing laboratory for all roof systems as specified by ASTM. All sampling procedures and documentation shall be in accordance with ASTM. Copies of the results shall be submitted to the Owner's Representative for review and approval.
  - (2) The cost of the required test and all subsequent roof repairs are the responsibility of the General Contractor and shall be included as part of the base bid proposal.

END OF SECTION

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DIVISION 8 - DOORS, WINDOWS & GLASS

## PART 1: GENERAL

1. RELATED DOCUMENTS

- (A) The general provisions of Division 1 apply to the work specified in this Section.

2. SCOPE OF WORK

- (A) The extent of aluminum work under this Section is indicated on the drawings and specified herein. Refer to drawings for location, details, etc. for the work which includes, but is not necessarily limited to:
- (1) Aluminum frames and framing.
  - (2) Aluminum closures.
  - (3) Aluminum clad structural or miscellaneous steel framing.
  - (4) Internal caulking specified for work of this Section.
- (B) Structural Design of curtainwall system including anchorage to the structure and internal stiffeners are part of the work of this Section.
- (1) See 4.(D) below.

3. QUALITY ASSURANCE

- (A) Drawings: Plans, elevations and details show spacing of members as well as profile and similar dimensional requirements of aluminum doors and framing work. Minor deviations will be accepted in order to utilize manufacturer's standard products when, in Project Manager's sole judgment, such deviations do not materially detract from design concept or intended performances.

4. SUBMITTALS

- (A) Shop Drawings: Submit shop drawings for fabrication and installation of aluminum entrances and curtainwalls, including elevations, detail sections of typical composite members, anchorages, reinforcement, expansion provisions, and glazing.
- (B) Samples: Submit samples of each type and color of aluminum finish on 6" long sections of extrusions or formed shapes and on 6" square sheets (if requested).
- (C) Submit product data for all items if requested.
- (D) Curtainwall System Design Certification: Submit a written certification, signed and sealed by an engineer registered in the state where the structure is located, stating that the curtainwall system and its anchorage to the structure has been designed to support the required design wind load as indicated in the "Building Design Data" found on the drawings without exceeding the allowable stresses of the material and without exceeding a deflection of ~~L/175 of the span or 3/4 inch, whichever is less~~ **L/175 for spans less than 13 feet 6 inches and L/240 + ¼ inch for spans 13'-6" or greater**. Submit design calculations and shop drawings signed and sealed by the curtainwall system's engineer who is registered in the state where the structure is located.
- (1) Test Reports: Submit certified test reports for framing products (if requested) showing compliance with specified performance characteristics and physical properties.
- (E) Submit documentation (if requested) which verifies that curtainwall system has been approved for use by local authorities having jurisdiction and complies with all applicable state or federal codes or regulations.
- (F) Submit mockup of mitered sill cover end cap to Owner's representative for review and approval.

5. RELATED WORK SPECIFIED UNDER OTHER SECTIONS

- (A) Glass and Glazing: Section 08812.
- (B) The G.C.C. shall prepare all masonry openings required for the installation of work of this Section.
- (C) Masterkeyed Cylinders: Section 08711.
- (D) Sealants and joint fillers for joints at perimeter of entrance and curtainwall systems specified in Joint Sealants Section 07901

## PART 2: PRODUCTS

6. ALUMINUM CURTAINWALL WORK

- (A) Drawings are based on Kawneer 1600. Use System-1 (captured) and/or System-2 (silicone glazed) as detailed on the drawings for vertical aluminum framing. Use System-2 (silicone glazed) for sloped aluminum framing. ~~and~~ Use 350 IR Swing Entrances for doors. Similar and equivalent system by Old Castle Building Envelope, YKK, and U.S. Aluminum will be acceptable for use unless otherwise indicated or specified.
- (B) Materials: Aluminum shall be free from streaking and die marks. Extrusions : Alloy 6063-T5 or 6063-T6. Exposed fasteners shall be aluminum, stainless steel or zinc plated steel ASTM A164.
- (C) Finish: (Refer to Drawings for Color Required).
  - (1) A Fluoropolymer Paint Coating, based on 70% KYNAR 500, conforming with the requirements of AAMA 605.2 (American Architectural Manufacturers Association). Color: Custom Colors as indicated or as selected. On doors, provide (over the finish) manufacturer's standard clear protective topcoat.
    - (a) The finish coating on the aluminum work shall be a factory-applied oven baked finish. This finish, Valspar's Floropan coating or as approved equal, shall be a dispersion coating based on Autochem's 70% KYNAR 500 resin (polyvinylidene fluoride) as formulated by a licensed coating formulator. The finish and application and application shall be in strict accord with the formulator's specifications and applied by an approved applicator.
  - (2) Mild steel framing operations shall conform to ASTM A283 Grade "C". All steel to receive one coat of zinc chromate primer after fabrication. Field welds and scratches shall receive one touch-up coat after installation.
- (D) Fasteners: Aluminum alloy 245-T4, bronze, or 300 stainless steel. Do not use exposed fasteners except where unavoidable. Match, including KYNAR 500, finish of adjoining metal or exposed fastener parts. Provide phillips head countersunk head machine screws for exposed fasteners.
- (E) Flashing: 20-gauge aluminum.
- (F) Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- (G) Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot rolled sheet and strip.
- (H) Workmanship:
  - (1) All work shall be straight and true, free from warpage, and of highest standard of material and workmanship. As far as possible, all work shall be performed in the shop. Any departure from indicated details shall be submitted for approval to the Owner's Representative. Joints, corners, copes and miters shall be accurately cut, filed, and fitted and framed together at contact points. All surfaces of joints and

- connections shall match the finish of adjacent metal and be approved by the Owner's Representative. Provide all clips, fastenings and reinforcements required for installation of all work. Removable members shall be carefully formed and fitted. So far as possible, all fastenings and shims shall be concealed. Those which are not shall match finish of adjoining metal. All joints shall be watertight. Provide approved type bituminous insulation between aluminum and dissimilar metals or cement mortar.
- (2) All frames, transoms, and mullions, etc., shall be constructed, sized, dimensioned, and reinforced as required to provide rigid construction. Joints shall be of the hairline type. Reinforce with steel plate for all hardware and accessories, including surface applied items. Include all sealing and caulking between metal to metal contacts, between frames, mullions, etc., to provide airtight and weathertight joints.
- (I) Curtainwall System: This Contractor shall furnish all necessary material, labor and equipment for the complete installation of the following:
- (1) Glass framing, vertical and horizontal; transition members connecting these components, adapters and mountings for trim moldings and facing materials. Provide aluminum tube members to be installed over steel channel framing as indicated.
- (2) Framing members, transition members, mullions, adapters and mountings shall be extruded of aluminum with alloy and temper consistent with the method of manufacture. These members shall be of 6063-T5 or 6063-T6 extruded aluminum alloy (ASTM B221 alloy G.S. 10A-T5).
- (3) All screws, miscellaneous fastening devices and internal components shall be of stainless steel or plated or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.
- (4) All mullions shall have glazing gaskets of elastomeric extrusions and sealant to be structural type silicone as recommended by the sealant manufacturer. Horizontals shall have flexible (PVC) thermal break material located on exterior side of glass plane. Exterior glazing shall be EPDM secured by extended aluminum pressure plates fastened to main horizontal grid members. Provisions shall be made at all sealed horizontals to lead moisture accumulation to exterior.
- (5) Where indicated, provide for butt-glazed construction. See Details.
- (a) Joints, water stops, sealants as recommended by the manufacturer. Joints between framing members and adjoining metals made watertight by caulking with caulking compounds, or other approved sealant material.
- (6) All anchorage required to transmit live and dead loads to building structure at all locations necessary.
- (J) Protection: Provide required protection to prevent damage to finished work. Provide protective barriers as required to prevent damage, after erection, resulting from work of other trades. Use strippable rubber paint on erected work and gummed paper on shop fabricated work.
- (K) Aluminum Swing Doors: Door to be installed complete with frames, horizontal mullions, stops, trim, anchors and hardware. Weather-strip exterior door at sill, jamb, and head with manufacturer's standard devices.
- (L) Door accessories and finish hardware; color and finish shall be US26D surfaces unless otherwise indicated or specified.
- (1) Supplier to verify if codes require hardware other than specified within drawings.

## 7. PERFORMANCE

- (A) Framing furnished under this Section shall meet or exceed the following performance requirements.
  - (1) Resistance to Water Infiltration: The framing system, shall not leak when tested in accordance with ASTM E331 at a minimum static air-pressure difference of 20 percent of positive wind load design pressure, but not less than 15 P.S.F.
  - (2) Performance Under Uniform Loading: When tested in accordance with ASTM E330 and when the load is removed there shall be no evidence of permanent deformation or damage when tested under a load of 150 percent of the inward and outward acting design pressures as calculated using the appropriate building code.
  - (3) Allow for expansion and contraction resulting from ambient temperature range of 120°F (49°C) and material surfaces range of 180°F (83°C).
  - (4) Air filtration of not more than 0.06 cfm per square foot of a fixed area per ASTM E 283.

## PART 3: EXECUTION

### 8. PREPARATION

- (A) Field Measurement: Wherever possible, take field measurements prior to preparation of shop drawings, and fabrication, to ensure proper fitting of work. However, proceed with fabrication and coordinate installation tolerances as necessary when field measurements might delay work.

### 9. ERECTION

- (A) All items under this heading shall be set in their correct locations as shown in the details and shall be level, square, plumb, and at proper elevations and in alignment with other work.
- (B) All joints between interior metal, masonry and between interior glass framing and mullion members shall be tightly caulked in order to secure a watertight job. All materials shall be screwed in place using backing, masonry plugs, or anchor straps as required. Where moldings are joined, they shall be accurately cut and fitted to result in a tightly closed joint.
- (C) After erection, the General Contractor shall adequately protect exposed portions of the framing from damage by welding, grinding and polishing machines, plaster, lime, acid, cement, or other harmful compounds.
- (D) All framing, accessories, etc. shall be installed in strict accordance with the manufacturer's recommendations.
- (E) Remove and replace members that are marred or show evidence of deterioration of finish.

### 10. CURTAINWALL INSTALLATION QUALITY CONTROL

- (A) The Owner will employ and pay for the services of an Independent Testing Agency to provide testing and inspection of the Curtainwall System installation.
- (B) The extent of the curtainwall quality assurance inspections shall include but not be limited to the following:
  - (1) Verify structural steel located within the curtainwall aluminum mullions and transverse beam sills and headers.
  - (2) Verify connections to curtainwall steel member supports and concrete sill at several locations. Remove cover plates to observe bolt and screw connections at several locations as required.
  - (3) Verify that the installation complies with signed & sealed shop drawings reviewed by the Architect.

11. PROTECTION AND CLEANING

- (A) Protect all glass and aluminum frames from welding damage.
- (B) After installation, metal and glass surfaces of the walls shall be cleaned on both interior and exterior, of all mortar, plaster, paint and other contaminants.
- (C) This contractor shall be responsible for removal of protective materials and cleaning with plain water, or water with soap or household detergent. This Subcontractor shall be held responsible for damages resulting from the use of other cleaning materials.
- (D) After being cleaned, all work shall be protected against damage until it is accepted by the General Contractor. Thereafter, it shall be the responsibility of the General Contractor to maintain protection and provide final cleaning.
  - (1) Cleaning of all frames to be complete a minimum of one (1) week before store opening.

12. GUARANTEE

- (A) For all work of this Section provide guarantee that all workmanship, materials, and the completed installations are first class in every respect, and that Contractor will make good at his own expense any and all defects of any nature whatsoever that may develop within one year from date of acceptance of the building.

13. FIELD QUALITY CONTROL

- (A) Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- (B) Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously complete areas show compliance with requirements.
  - (1) Field Water Testing: Testing of curtain walls for water resistance shall be performed according to ASTM E1105 and AAMA 501.2, applying same test pressures (where applicable) and requirements as listed under Section 1.2. Modified such that uncontrolled water is defined as water infiltrating the system or appearing on any interior surface from sources other than condensation.
  - (2) Testing Extent: Six test areas, three per ASTM E 1105 and three per AAMA 501.2, are to be performed at areas as selected by Owner.
  - (3) Curtain wall and window wall test to incorporate at least two bays wide by 1 floor high including the edge of slab conditions.
  - (4) Any failed test will require an additional two areas to be tested in addition to retesting of the remediated failed specimen.
  - (5) Construction sequence shall include provisions for timely completion of test areas.
  - (6) Remedial measures shall maintain standards of quality and durability and are subject to approval.
  - (7) Test Reports: Shall be prepared according to AAMA 503.
  - (8) Provide powered scaffold, water supply, power supply, manpower and necessary equipment.
- (C) Contractor is to repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- (D) Contractor is responsible for ensuring adequate water supply and pressure to meet the specified requirements.

- (E) Additional testing and inspection due to failed tests will be performed to determine compliance of remediated or additional work with specified requirements. All costs for remediation and retesting shall be at the Contractor's expense. Additional expense shall include those of the testing agency, Owner, Architect and Consultant.

END OF SECTION

DIVISION 9 - FINISHES

## PART 1: GENERAL

1. RELATED/DOCUMENTS

- (A) The general provisions of Division 1 apply to the work specified in this Section.
- (B) Unless otherwise shown or specified, this work shall conform to the following standard:  
AISI Specification for the Design of Cold-Formed Steel Structural Members (1986).

2. SCOPE OF WORK

- (A) This Section includes all labor, materials, tools and equipment necessary for and incidental to the execution and completion of Gypsum Drywall work, as shown on the drawings and specified herein. Work shall include cold rolled structural metal ceiling framing as indicated on the drawings and as specified herein.
- (B) Maintain minimum temperature of 55 degrees F. in building prior to drywall application for a period of 24 hours. The temperature shall be maintained for the entire wallboard and joint treatment application. Ventilation should be provided to eliminate excessive moisture, and control drying time of joint compound. Avoid drafts to prevent too rapid drying of joint compounds.
- (C) The extent of the gypsum drywall work is shown on the drawings and in Finish Schedules.
- (D) Refer to Carpentry Section for wood wall studs.
- (E) Refer to Section 05500, Miscellaneous Metals, for steel angle partition supports.
- (F) Requirements for furnishing and installation of screw-type metal framing for support of gypsum drywall are included in this Section.
- (G) Refer to Section 15301, Fire Protection Systems, for requirement to conceal the inspector's test connection pipe drop in a gypsum drywall chase with access panel if it occurs on the Sales floor.

3. QUALITY ASSURANCE

- (A) Tolerances for Drywall Work: Do not exceed a variation of 1/8" in 8'-0" from plumb, level and flat (all directions); and do not exceed 1/16" offset of planes at joints between panels, shim panels as necessary to comply with tolerances.

4. JOB CONDITIONS

- (A) In cold weather, the building shall be heated during the application of the gypsum wallboard and joint treatment to maintain a uniform temperature in the range of 50 degrees F. to 75 degrees F., and ventilation shall be provided to eliminate excessive moisture.

5. SUBMITTALS

- (A) Submit sample for review of texture.
  - (1) On actual drywall surfaces, provide two 12" x 12" texture finish samples or field sample to Owner for approval.
- (B) Submit Product Data for access panel.

## PART 2: PRODUCTS

6. MATERIALS

- (A) Steel Drywall Framing: Studs and Runners - Screw-type complying with ASTM C645. Provide studs of the size indicated with runners of compatible size. **Unless otherwise indicated, fabricate from 20 25-gauge electro-galvanized steel with zinc coating.**

- (B) Z-Furring Channels: 25-gauge electro-galvanized steel, size indicated.
- (C) Rigid and Resilient Furring Channels: Screw type furring channels complying with ASTM C645, fabricate from 25-gauge electro-galvanized steel with manufacturer's standard zinc protective coating. Sizes as shown on drawings.
- (D) Vertical Deflection Connection: Provide VertiTrack VTX or VertiClip SLD deflection accommodating device, by the Steel Network, Inc., Tel: (888) 474-4876. Products shall conform to the following properties and performance criteria:
  - (1) Code Criteria
    - (a) Meet required head of wall connection criteria as required by applicable code of cyclic wall movement.
  - (2) Material Composition: meeting ASTM A653/A, SS Grade 50, lass 1, 50 ksi minimum yield strength, 65 ksi minimum tensile strength, G-60 hot-dipped galvanized coating.
  - (3) Material Thickness: 0.036 inch for VertiTrack VTD series (interior wall), 0.068 inches for VertiTrack VTX series (exterior walls).
  - (4) Clips shall be designed for positive attachment to structure and stud web using step bushing technology to provide frictionless vertical movement.
  - (5) Provide clips with attached bushings and screws of the series, size and configuration as recommended by the manufacturer.
- (E) Ceiling Furring Channels shall be 3/4" standard galvanized cold rolled lathing channels.
- (F) Ceiling Runner Channels shall be 1-1/2" (0.475 lbs. per ft.) standard galvanized channel runners for suspended ceiling work.
- (G) Ceiling Hangers for runners shall be No 8-gauge steel galvanized annealed wire.
- (H) Ceiling Tie Wire shall be 18 gauge galvanized annealed wire.
- (I) Manufacturer: Same as gypsum wallboard manufacturer or approved equal.
- (J) Gypsum Drywall Board
  - (1) Exposed Drywall Surfaces: Provide gypsum wallboard (48" wide) complying with ASTM C1396 with paperface surface suitable to receive decorated finish and with long edges tapered to receive manufacturer's standard joint treatment, unless otherwise shown.
  - (2) Moisture-Resistant Applications: At toilet room walls, janitor's closet, behind the FRP, behind the drinking fountain in the hall and other areas as noted on the drawings, provide moisture-resistant gypsum backing board and/or face board with core and paper acings treated to resist moisture to comply with ASTM C1396.
  - (3) Manufacturers: Provide gypsum wallboard produced by one of the following or approved equal.
    - Georgia Pacific Corporation
    - National Gypsum Company
    - U.S. Gypsum Company
- (K) Drywall Accessory Materials
  - (1) Fasteners: Provide 1" and up to 1-1/2", Type S drywall screws.
  - (2) Drywall Control Joints: For long continuous runs of drywall systems, provide one-piece joint assembly of non-corrosive metal with continuous un-perforated expansion strip for insertion into joint and perforated flanges for attachment to face of wallboard. Material shall be U.S.G. Control Joint #093 or similar if by another manufacturer. Space joints to correspond with masonry joints at 26'-0"

- maximum.
- (3) Metal Trim Accessories: Provide trim accessories of the sizes required for the drywall applications shown and specified, fabricated from galvanized steel. At external corners, provide 1-1/4" mechanically fastened metal corner bead with smooth rigid nose and perforated and knurled metal flanges. USG Dur-A-Bead or similar if by another manufacturer.
  - (4) For protection of exposed wallboard edge openings and where drywall abuts or intersects dissimilar construction, provide metal casing bead trim. Beaded nose with exposed flange knurled for joint treatment. Where kerfed jambs are shown, provide trim with special leg designed for insertion into jamb slot. U.S.G. 200B Metal Trim or similar if by another manufacturer.
  - (5) Joint Tapes: Paper type complying with ASTM C475, USG sheetrock joint tape or equal by another manufacturer.
  - (6) Joint Compound: Adhesive with or without fillers complying with ASTM C475. Provide in dry powder form or pre-mixed ready for application.
  - (7) Textured Finish: Unaggregated texture coating equal to U.S.G. "Sheetrock Wall and Ceiling Spray Texture (Tuf-Tex)" in Orange Peel finish, medium texture.
- (L) Isolate steel framing from building structure at location indicted to prevent transfer of loading imposed by structure movement.
- (1) Isolate ceiling assemblies where they abut or are penetrated by building structure.
  - (2) Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - (a) Use proprietary deflection where indicated.
    - (b) Use proprietary firestop deflection track where indicated.
- (M) Flexible Steel Track: Curved steel stud framed interior partitions shall be constructed using on of the following products:
- (1) FLEX-ABILITY CONCEPTS, Flex-C Trac, (866) 443-3539.
  - (2) The Steel Network, Inc., CircleTrak, (888) 474-4876.
  - (3) ClarkDietrich, Contour Track, (800) 543-7140.
  - (4) Approval Equal.

### PART 3: EXECUTION

#### 7. INSTALLATION OF STEEL DRYWALL FRAMING

Manufacturer's Instructions: Unless otherwise shown or specified, install metal framing and accessories in accordance with manufacturer's printed instructions.

- (A) Floor and Ceiling Runner Tracks: Provide Continuous tracks sized to match studs. Align runner tracks accurately to the partition layout at both floor and ceiling. Secure runner tracks as recommended by the stud manufacturer for the floor and ceiling construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners. Provide fasteners at all corners and ends of runner. Use continuous gasket sealers at floor, ceilings, columns and walls of dissimilar materials.
- (B) Height of Partitions: Terminate top of partitions as shown on drawings.
- (C) Provide additional studs to support inside corners and partition intersections, and to support outside corners, terminations of partitions, both side of control joints and adjacent to all openings.

- (D) Use full length studs between runner tracks.
- (E) Friction fit studs to runner tracks by positioning and rotating into place. Provide positive attachment to runner tracks for studs located at partition corners and intersections, and adjacent to openings using 3/8" self-tapping screws on both flanges of studs.
- (F) Provide rough framing at openings using full-length studs adjacent to jambs and horizontal header and sill tracks. Cut horizontal tracks to length and split flanges and bend webs at ends for flange overlap and screw attachment to jamb studs. Install cut to length intermediate studs between jamb studs at head and sill sections at same spacing as full-length studs.
- (G) Where vertical control joints are shown at jamb lines, provide additional vertical studs located on opening side of jambs and not less than 1/2" from jamb studs. Do not fasten studs to tracks or jamb studs.
- (H) For all interior doors wrap door opening (jambs and head) with 2 x 4 wood studs and provide two (2) studs of the same gauge as the wall studs at each jamb and one additional stud not more than 6" from jamb studs.
- (I) Metal Furring Framing
  - (1) General: Provide metal furring where shown, as specified, and as required to provide support for drywall. Where size and spacing of furring members is not shown for support, do not exceed the minimum requirements of GA201. Install z-furring channels vertically.
  - (2) Where control or expansion joints are shown, provide separate supports on each side of joint. Do not bridge joints.

## 8. INSTALLATION OF GYPSUM DRYWALL BOARD

- (A) General
  - (1) Standards: Comply with the requirements of ANSI C840 "Standard Specification For Application and Finishing of Gypsum Board", except comply with manufacturer's instructions and recommendations where more stringent.
  - (2) Provide drywall of the thickness shown.
  - (3) Form control joints in drywall construction as specified. Allow 1/2" continuous opening between edges of adjacent drywall boards to allow for insertion of control joint trim accessory.
- (B) Single Layer Applications
  - (1) Partition/Walls: Apply gypsum board vertically using floor-to-ceiling length boards with vertical joints located over supports, but offset at least one stud space on opposite faces of partition/walls. Use type S drywall screws in compliance with manufacturer's instructions for fastening, but do not exceed screw spacing of 8" o.c.
  - (2) Wood Supports: Fasten gypsum wallboard with annular ring nails or screws at the Contractor's option. Comply with manufacturer's instructions for fastening, but do not exceed nail, or screw spacings of 8" o.c. (wall and ceilings).
  - (3) Metal Supports: Fasten gypsum wallboard with screws. Comply with manufacturer's instructions for fastening, but do not exceed 8" o.c. spacing. Screws shall be power-driven and screw heads shall provide slight depression below the surface of the board.
- (C) Drywall Finishing
  - (1) Finish exposed drywall surfaces with joints, corners and exposed edges reinforced or trimmed as specified, and with all joints, fastener heads, trim accessory flanges and surface defects filled with joint compound as specified in accordance with manufacturer's recommendations for a smooth, flush surface. Form true, level or

- plumb lines, without joints, fastener heads, flanges of trim accessories or defects visible after application of field-applied decoration.
- (2) Use joint tape to reinforce joints formed by tapered edges or butt ends of drywall units and at interior corners and angles. Set tape in joint compound then apply skim coat over tape in one application.
  - (3) Where open spaces of more than 1/16" width occur between abutting drywall units, (except at control joints), prefill joints with joint compound and allow prefill to dry before application of joint tape.
  - (4) Reinforce external corners of drywall work with corner beads.
  - (5) Securely fasten metal corner beads as recommended by the manufacturer. Use fasteners which will be fully concealed by joint compound fully applied over flanges.
  - (6) Edge Trim: Provide specified type of metal casing bead trim. Install in single unjointed lengths.
  - (7) Insert control joints strips into open joint and staple flanges to drywall in accordance with manufacturer's instructions.
  - (8) In all areas other than Janitor's Closet, Electrical room, Storage Rooms and back lighting chases, provide orange peel medium textured finish.
  - (9) Application of Joint Compounds: After mixing, do not use joint compounds if recommended pot-lifetime has expired. Allow drying time between applications of joint compound in accordance with manufacturer's recommendations for the relative humidity and temperature levels at the time of application. In no case, allow less than 24 hours drying time between applications of joint compound. Apply not less than 2 separate coats of joint compound over joints, fastener heads and metal flanges. (2 coats are in addition to set and skim coat mentioned above.) Sand between coats as necessary. Final coat and subsequent sanding shall leave gypsum wallboard ready for decorator finish.
  - (10) Joint compound treatment is not required above suspended ceilings where partition/walls are shown or specified to extend to structural deck or ceiling above suspended ceiling, unless partition is visible through ceiling grille.
- (D) For Sales Area, spray joint compound on drywall surfaces to match texture of approved submitted samples. Coordinate work with Owner to assure that the final finish, color and texture is achieved.
- (E) Completion and Protection of Finished Work: Installer shall advise Contractor of proper procedures for the protection of completed drywall work from damage or deterioration until acceptance of the work. At the completion of this contractor's work, all unused materials, tools, scaffolds, and equipment shall be removed from the structure. All work installed by others, which is dirty due to the drywall installation, shall be cleaned and restored to its original condition. Clean up all texture overspray. All drywall construction shall be guaranteed against defective materials and workmanship for a period of one year as called for in the General Provisions.

- END OF SECTION -

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DIVISION 9 - FINISHES

## PART 1: GENERAL

1. RELATED DOCUMENTS

(A) The general provisions of Division 1 apply to the work specified in this Section.

2. SCOPE OF WORK

(A) Furnish all labor, materials, tools and equipment required for completing tile work and related items indicated on the drawings and herein specified.

(B) The extent of the work is indicated on the drawings and specified herein.

## PART 2: PRODUCTS

3. CERAMIC AND PORCELAIN TILE

(A) Standard grade meeting ANSI A137.1

(B) Tile: Refer to Room Finish Schedule and Floor and Wall Finish selections on the drawings for all tile materials and grout.

(C) Mortar Mix for Thin Setting Bed Method: Materials shall be Portland Cement Powdered mortar product of one of the following, manufactured under license to the Tile Council of America, Inc., and all containers shall bear their Hallmark. Use product(s) as appropriate for the substrate.

(1) "Ultraflex 2" as manufactured by Mapei.

(a) Mixed with water, exceeds ANSI A118.4 & A118.11

(2) "Ultraflex LHT" for large and heavy tile, as manufactured by Mapei. (No substitutions)

(a) Mixed with water, exceeds ANSI A118.4TE & A118.11

(D) Sand: ASTM C144 washed clean and graded; use fine sand for grout; use white sand with white cement. Gradation: 100% passing No. 8 sieve, not more than 5% passing No. 100 sieve.

(E) Water: Clean, potable free from deleterious substances.

(F) Marble saddles shall be white vermont marble, even color and rubbed finish of profile and length shown on drawings. Set snugly between door jambs. Set saddles in thin bed of Portland cement mixture and grout.

(G) Metal Transitions: As specified on the drawings. **NO SUBSTITUTIONS**

(1) Klein and Company, Inc., Holly Springs, GA. Phone 1-800-241-0681. 16-gauge zinc angle, metal type, finish, and width as indicated on the drawings and depth as required for flush installation with top surface of tile

(2) Schluter Systems, Inc., Plattsburg, NY 12901, will be acceptable. Phone 1-800-472-4588.

(H) Anti-Fracture tile underlayment: ECB anti-fracture system.

(1) Membrane: SBS modified bitumen, self-adhering formula, reinforcing with stress flex fiber sheet.

(2) Thickness: 40 mil.

- (3) Physical properties of membrane, meet or exceed the following:

<u>Property</u>	<u>Test Value</u>	<u>Test Method</u>
FHA 4900.1	Pass 3' head	ASTM D-583
Tensile MD	880 psi	ASTM D-146
Tensile CD	550 psi	ASTM D-146
Crack bridging	1/4"	NAC Model
Shear/Bond	Pass	A118.1-1985
Impact Resistance	Pass	Mil-D-3134

- (3) Manufacturer: N.A.C. Products, Inc. 3200 S. Main Street, Akron, OH 44319, Tel: 330-644-3117 or 1-800-633-4622 FAX: 330/644-3557

- (4) Install the 36" wide anti-fracture tile underlayment membrane centered on and only at concrete floor slab joints under areas covered with ceramic or porcelain tile.

- (I) Grout: Manufacturer: H.B. Fuller Construction Products, Inc., [www.tecspecialty.com](http://www.tecspecialty.com). Product: For floor and wall applications use TEC AccuColor EFX Epoxy Special Effects Grout 440 (or approved equal). Refer to drawings for grout color.
- (J) Provide Owner with five (5) tiles from each tile type used on this project for Owner's stock.
- (K) Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- (1) MAPEI Corporation "Mapecem Quickpatch", or approved equal.

### PART 3: EXECUTION

#### 4. INSTALLATION OF TILE

- (A) Concrete or Masonry Base: All wall and floor tile to be installed over a base material consisting of concrete or masonry shall be installed by the thin-set mortar bed method. Thin-set mortar shall be mixed thoroughly and applied in strict accordance with manufacturer's printed instruction. Minimum thickness of setting bed shall be 1/8". Install with best practice of the trade in accordance with the procedure set forth in the Tile Council of North America Basic Specifications F 113.
- (B) Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards: 1/8 inch in 10 feet or 1/16 inch in 2 feet for large format tile defined as greater than 15 inch on any side. 1/4 inch in 10 feet or 1/16 inch in 1 foot for tile less than 15 inch.
- (1) Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
- (2) Remove protrusions, bumps and ridges by sanding or grinding.
- (C) Floor tile to be installed with 3/16" joints (unless noted otherwise on the drawings), wall tile to be installed with 1/16" joints.
- (D) Wall tile on gypsum board shall be installed per Tile Council of North America Specification No. W243 for Dry Set Mortar. Wall tile on cement board shall be installed per Tile Council of North America Specification No. W244 for Dry Set Mortar.
- (E) Wood floor base shall be set on top of tile floor and trimmed with shoe molding as detailed on the drawings.
- (F) Grout: Force grout into joints, avoiding air traps or voids, strike or tool joints of tile to depth of cushion. Remove excess grout, check for gaps or air holes.
- (G) Anti-Fracture tile underlayment: Base layer is made of a polymer modified elastomeric sheet capable of heavy-duty service per ASTM C-627 laminated to a stress-flex fiber sheet.

Joints shall be on a butt-seaming designed, not to be overlapped.

- (1) For joints exceeding 3/16", use manufacturer's recommended backer rod and sealant.
- (H) Adhesives: Amtico SF or epoxy adhesive as recommended by manufacturer and to be applied following manufacturer's directions for trowel notching, coverage, open time and safety precautions.

5. WORKMANSHIP

- (A) Work: Performed by qualified workmen in a manner conforming to best current practice of the trade.
- (B) Cut and drill where necessary, without marring tile. Grind and carefully joint any cut edges against other work.
- (C) Remove loose mortar, laitance, or materials detrimental to bond before applying setting beds.
- (D) Carefully lay out work to ensure straight joints of uniform width. Avoid tile cut less than half size, unless specifically approved by Owner's Representative.

6. CLEANING AND PROTECTION

- (A) At completion of installation, thoroughly clean all surfaces. Use of acid will not be permitted. Use clean water in initial cleaning. Remove all stains, mortar, etc.
- (B) Before traffic is permitted over finished tile floors, cover with waterproof building paper with all joints taped.
- (C) Remove crooked, broken, or damaged tile, replace with new (and apply sealer, if floor tile) before completion of building.

END OF SECTION

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DIVISION 10 - SPECIALTIES

## PART 1: GENERAL

1. RELATED DOCUMENTS

(A) The general provisions of Division 1 apply to the work specified in this Section.

2. SCOPE OF WORK

(A) Furnish all materials, inserts, anchors, etc. required for a complete installation.

(B) Refer to Section 10811 for toilet room accessories.

(C) The extent of the work is indicated on the drawings and specified herein.

(D) Comply with local Codes or handicap provisions of local agencies, if no local codes are applicable comply with the requirements of the latest edition of all applicable Codes for handicap use of toilet rooms.

3. SUBMITTALS

(A) Shop Drawings

(1) Show fabrication and installation of toilet compartment and screen assemblies, include plans showing room layout, dimensions, elevations, sections and details.

(2) Show anchorage, panel and stile core construction, accessory items and finishes.

(3) Provide location drawings for bolt hole locations in supporting members for attachment of partitions.

(4) Manufacturer's Data Sheets

4. PRODUCT DELIVERY, STORAGE AND HANDLING

(A) Deliver items in manufacturer's original unopened protective packaging.

(B) Store materials in original protective packaging to prevent soiling, physical damage or wetting.

(C) Handle so as to prevent damage to finished surfaces.

5. WARRANTY

(A) Furnish one-year warranty against defective materials and workmanship, including delamination of panels and corrosion of hardware.

## PART 2: PRODUCTS

6. MANUFACTURER

(A) Subject to compliance with requirements, provide products by the following:

(1) Bobrick

~~(2) NO-SUBSTITUTIONS-ALLOWED.~~

(2) Bradley

(3) Global Industrial

7. MATERIALS

- (A) General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- (B) Stile core material: Resin-impregnated, 45 lb. density particle board bonded to each side of 11 gage steel sheet.
- (C) Panel and door core material: Resin-impregnated, 45 lb. density particle board.
- (D) Screen posts: tubing, 1-1/4" square, 18-8S Type 304, stainless steel with satin finish.
  - (1) Floor and ceiling connections: Type 304 stainless steel.
- (E) Compartment headrail: Extruded anodized aluminum with satin finish, sloping top and grip-resistant edge.
- (F) Plastic laminate: High pressure laminated plastic NEMA LD-1, minimum thickness 0.050 inches.
- (G) Hardware: Hinges, slide latches, door keepers, pulls/handles, coat hooks and mounting brackets shall be 18-8S, Type 304 stainless steel with satin finish.
  - (1) Door hardware: Stainless steel one-way sheet metal screws.
- (H) Leveling device: Steel bar 3/8" x 1" with 3/8" diameter threaded rod, nuts and sleeve.
- (I) Stile shoes: One piece, 4" high, Type 304, stainless steel with number 4 satin finish.
- (J) Fasteners – stainless steel tamper resistant.
- (K) Door Pulls: All handicap accessible toilet stall doors (in- swinging and out-swinging) shall have a door pull on both sides of the door, located near the latch and 34" minimum and 48" maximum above the floor.

8. FABRICATION

- (A) Toilet Compartments
  - (1) Toilet compartments shall be overhead-braced type, Bobrick Series 1042. – **NO SUBSTITUTIONS.**
  - (2) Bond plastic laminate to core material with adhesive specifically formulated to prevent delamination in moist, warm areas of public washrooms. Bond edges prior to bonding face sheets. No splices or joints allowed in faces or edges.
  - (3) Finished thickness: 1 inch.
  - (4) Leveling device: Continuously weld anchoring and leveling, device to steel reinforcing core of stiles.
  - (5) Hardware: Self-lubricating balanced hinge with adjustable hold open feature, combination slide latch and bumper, and coat hook.
    - (a) Door hardware or mounting brackets shall not be exposed on exterior toilet compartments.
- (B) Urinal Screens
  - (1) Urinal screens shall be Post-to-Ceiling type, Series 1043, with top of screen mounted 70 inches above finish floor.
- (C) Laminate color: D354-60 Designer White, Matte Finish (Wilsonart)

## PART 3: EXECUTION

9. INSPECTION

- (A) Check areas scheduled to receive partitions for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of holding brackets.
- (B) Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
- (C) Do not begin installation of partitions until conditions are satisfactory.

10. ERECTION

- (A) General:
  - (1) Install partition rigidly, straight, plumb and level.
  - (2) Installation methods shall conform to manufacturer's recommendations for backing and proper support.
  - (3) Conceal evidence of drilling, cutting and fitting to room finish.
- (B) Overhead Braced Partitions:
  - (1) Attach stile to supporting floor, anchored with minimum 2 in. penetration into supporting floor system. Partition shall not be in contact with floor, only shoe.
  - (2) Level, plumb and tighten installation.
  - (3) Secure stile shoes in position.
  - (4) Set tops of doors parallel with overhead brace when doors are in closed position.

11. ADJUSTMENT AND CLEANING

- (A) Adjust hardware for proper operation after installation.
- (B) Set hinges on inward swing doors to hold doors open approximately 15 degrees from closed position when unlatched.
- (C) Set hinges on outward swing doors for physically handicapped compartments to hold doors in closed position when unlatched.
- (D) Clean exposed surfaces of partitions, hardware, fittings and accessories.

- END OF SECTION -

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DIVISION 15 - MECHANICAL WORK1. GENERAL

- (A) All work under this Section shall be governed by and subject to the provisions of the following:

## SECTION 15051 - BASIC MATERIALS, METHODS AND REQUIREMENTS

- (B) This Section is intended to establish the basic requirements for piping work common to all mechanical and plumbing systems. This Section shall govern all piping work except as otherwise modified in other Sections and/or as required to comply with governing Codes and/or regulations of Utilities.
- (C) Fire Protection Systems: Refer to Section 15301. The installation of all fire protection systems and piping shall comply with the requirements of governing Codes. The provisions of the National Fire Codes (latest edition) published by the National Fire Protection Association (NFPA) shall govern as minimum requirements in the absence of requirements from governing Codes.

2. PIPING MATERIALS

- (A) The piping materials for each type of mechanical system are specified in the respective sections of these specifications. The specified materials shall be used to establish the base bid by each contractor, unless otherwise specified and/or allowed by addendum.
- (B) Substitute Piping Materials
- (1) At the time of bidding, Contractors are encouraged and invited to propose as substitutes any piping materials and/or systems potentially suitable for the services involved in lieu of the specified materials. NOTE: Schedule 5 or 10 piping is not allowed.
  - (2) Contractor's proposal for substitute materials shall be accompanied by the respective add or deduct to the contract amount. Any substitute piping material accepted by the Owner's Representative shall be subject to approval by the Engineer. Contractor shall submit data on the substitute in sufficient detail to permit the Engineer to evaluate joining and installation methods, expansion and contraction, corrosion resistance, flow performance, and other pertinent features. Contractor shall be responsible to assure that the substitute materials can be installed properly with the restraints imposed by the geometry and construction features of this project.
- (C) Provide chrome plated escutcheon plates to finish and conceal pipe penetrations through walls in all locations where exposed to view.

3. VALVES

## (A) General

- (1) All valve catalog numbers specified herein refer to Jenkins valves, except as otherwise noted.
- (2) Equivalent valves as manufactured by Stockham, Fairbanks, Kennedy, Hammond, or Nibco are acceptable for base bid.
- (3) At the time of bidding, Contractors are encouraged and invited to propose as substitutes any valves of other manufacturers and/or designs potentially suitable for the applications and services involved in lieu of the specified valves. Contractor's proposal for substitute valves shall be accompanied by the respective add or deduct to the contract amount. Any substitute valves shall be approved by the Engineer prior to award of the contract by the Owner's Representative. Contractor shall, when requested, submit complete and detailed data on the substitute valves to the Engineer. The data shall include an identification of the proposed service and application of each valve.
- (4) Hose-end valves (H.E.V.) shall be provided as gate valves with hose-thread adaptor having 3/4" hose thread, except as otherwise noted or specified.
- (5) Valves for special applications or systems which are not specified in this section

shall be specified in the appropriate section of Division 15.

- (B) Gate Valves
  - (1) Domestic Hot and Cold Water
    - (a) 2-1/2" and larger - Fig. 651-A, 125 lb., IBBM (iron body, bronze mounted), solid wedge, OS&Y, flanged.
    - (b) 2" and smaller - Fig. 47-U, 125 lb., bronze, rising stem, solid wedge disc, union bonnet, screwed.
- (C) Globe Valves
  - (1) Domestic Hot and Cold Water
    - (a) 2-1/2" and larger - Fig. 613, 125 lb., IBBM, OS&Y, bolted bonnet, regrind-renew beveled bronze disc and seat ring, flanged.
    - (b) 2" and smaller - Fig. 106-A, 150 lb., bronze, composition disc, disc holder, screw-over bonnet, screwed.
- (D) Check Valves
  - (1) Domestic Hot and Cold Water
    - (a) 2-1/2" and larger - Fig. 624, 125 lb., IBBM, swing check, bolted cap, regrind-renew bronze seat and disc, flanged.
    - (b) 2" and smaller - Fig. 92-A, 125 lb., bronze, swing check, regrinding bronze disc, screwed.
- (E) Shut-off and Isolation Valves; Open-end Valves
  - (1) Required shut-off and isolation valves are shown on the drawings and/or specified in Division 15 of these specifications.
  - (2) In general, a shut-off valve will be required at the mains and at each piece of equipment so that the system and equipment may be isolated for service or repairs. Valves shall be line size, unless otherwise shown on the drawings.
  - (3) Each Contractor is requested to notify the GC prior to any piping installation, if, in the opinion of the Contractor, any additional shut-off valves might be desired. If approved by Owner's Representative, a change order will be issued.
- (F) Drain Valves
  - (1) The installation of all liquid piping shall be such that the contents may be easily drained at the end or at the beginning of each run. Provide 1/2" drain valves with 3/4" hose-end connections for all drainage, unless larger size is shown on the drawings or required by Code or regulation.
  - (2) When a sudden change of piping elevation is unavoidable due to construction obstructions, a drain valve must be installed at the low point for draining.

#### 4. JOINING OF PIPING SYSTEMS

- (A) Threaded Joints
  - (1) All steel or wrought iron pipes with threaded joints shall have full cut, taper threads and the interior of the pipe shall be reamed out clean and to full size of pipe.
  - (2) Factory threaded pipe shall be furnished with thread protector during shipment and until pipe is installed.
  - (3) Threaded pipe joints shall be made with an approved pipe thread compound, applied to male threads only.
- (B) Sweat Joints

- (1) All copper piping shall have sweat joints, except at screwed valves and devices where sweat-to-threaded adaptors shall be provided.
  - (2) Solders for Sweat Joints - For domestic hot and cold water and DWV services, a good grade of 95/5 antimony solder with a compatible flux with a lead content not greater than .2% for refrigeration service, silver solder, 35 or 45% alloy.
- (C) Welded Joints
- (1) Welded joints shall be made by the shielded metal-arc process. Welders shall be currently qualified by tests in accordance with the Standards for Qualification of the American Welding Society or the ASME Boiler and Pressure Vessel Code. For portions of the work falling within the jurisdiction of ASME Code, welders shall be qualified in accordance with ASME Standards. The level and type of welder qualification shall be consistent with the pressures, temperatures, hazards of the respective systems, and as required by governing Codes.
  - (2) As minimum requirements, welding work shall be in accordance with the applicable provisions of AWS and/or ASME Specifications to assure proper procedures for joint preparation, joint alignment, electrode selection, and welding techniques.
- (D) Use of Fittings and Unions
- (1) All changes in direction and size of pipe shall be made with fittings. No mitering, saddling, or welding of smaller pipe into larger will be permitted. Run-outs in steel or wrought iron piping (except galvanized), one-half the size of the main or smaller may be made by use of "Weld-O-Lets"; runouts larger than one-half the main size shall be made with tees.
  - (2) Unions shall be provided at the connections to all equipment unless the connections are made with flanged fittings or mechanical couplings.
- (E) Connection Between Dissimilar Metals
- (1) No direct connection between dissimilar metals is permitted.
  - (2) For screwed connections, use insulating "dielectric" unions.
  - (3) For flanged connections (including bronze or copper to cast iron or steel; cast iron to steel; or stainless steel to cast iron or steel) the raised face shall be removed, or flat face flange provided. A full face, non-metallic, gasket suitable for the service shall separate flange faces. Flange bolts shall be isolated from the dissimilar material by means of insulating sleeves or bushings and washers.
- (F) Gaskets - Gaskets for flanged connections shall be of suitable materials and thicknesses for the service involved. For natural gas and water systems, "CC Rubber" by Crane, or equal shall be used. For fuel oil systems, cork-fiber or neoprene compressed asbestos shall be used.
- (G) Joints for Sewer Piping Systems - Refer to Section 15401, Plumbing Systems.
- (H) Mechanical Couplings
- (1) At the Contractor's option, mechanical couplings and fittings may be used for applications as specified herein. Mechanical couplings shall be considered for other systems provided the Contractor submits a proposed substitution and receives approval from the Owner's Representative.
  - (2) Couplings and fittings shall be Victaulic, Gustin-Bacon, or approved equal. Couplings shall be Victaulic Style 77 and/or Style 75. Gaskets shall be grade "H" synthetic and bolts shall be oval neck track-type with hexagonal nuts. Galvanized couplings with cadmium-plated bolts and nuts shall be used with galvanized pipe. Where malleable fitting pattern is not available, standard seamless welding fittings may be used in conjunction with the grooved fittings.
  - (3) Before assembly of couplings, lightly coat pipe ends and outside of gaskets with manufacturer's recommended lubricant to facilitate installation. Pipe shall be grooved in accordance with manufacturer's specifications and instructions. Manufacturer's field instructions shall be provided.

- (I) Joints for other piping systems, if applicable, shall be as specified in the appropriate Section of Division 15.

5. ROUTING OF PIPING SYSTEMS

- (A) All piping shall be run parallel to and perpendicular to walls, floors, joists and ceilings with due allowance for pitch.
- (B) All horizontal piping above ground shall be run above the bottom cord of the bar joists in Sales areas. All vertical above ground piping in sales to be concealed.
- (C) All piping above ground shall be run concealed in finished areas, including offices and office areas, finished toilet rooms, and similar finished areas. An area shall be considered "finished" whenever a ceiling is required to conceal structural framing. Concealed piping shall be installed within ceiling plenums or spaces, within wall construction, enclosed in furred columns, etc. Piping to be concealed in unfinished areas shall be so noted on the drawings.
- (D) In general, all horizontal piping shall be run as high above finished floors as possible, with proper allowance for pitch. Elevations and routings of piping shown on the drawings are reasonably accurate and are intended as a guide, not as a restriction, for proper piping installation. Contractors shall verify elevations and routings to minimize offsets and to assure proper coordination prior to installation of piping work.

6. SLOPE FOR PIPING SYSTEMS

- (A) All piping shall be sloped to permit draining of the respective piping system. The following minimum slopes shall apply except as otherwise specified or noted on the drawings. The direction (of slope) given below is the direction of piping fall with respect to the primary fluid conveyed.

<u>SYSTEM</u>	<u>COMPONENT OR SIZE</u>	<u>SLOPE RATE</u>	<u>DIRECTION</u>
Domestic Water	All interior piping	1" in 40ft.	against flow
Sewers, Ind. & San.	3" and smaller	1" in 4ft.	with flow
Sewers, Ind. & San.	4" and larger	1" in 8ft.	with flow
Sewers, Ind. & San.	Vents	1" in 4ft.	from stacks
Sewers, Storm Interior		1" in 8ft.	with flow
Natural Gas	Mains and branches	1" in 50ft.	with flow

- (B) When governing Codes or utility regulations require slopes greater than those specified above or prohibit slopes as great as those specified above, the Code or regulation shall apply.
- (C) The direction and magnitude of the slope may be varied from the above specifications for special or unavoidable conditions when approved in writing by the Engineer or Owner's Representative.

7. PIPE HANGERS, SUPPORTS, AND ANCHORS

- (A) All piping and related devices and equipment shall be securely supported to avoid sagging, vibration, and excessive strain or forces on the piping or related devices and equipment. Proper allowances shall be made for expansion, contraction, slope, and anchorage.
- (B) Piping shall be supported from structural framing, concrete floor slabs or walls, or masonry walls as the strength of the supporting construction safely permits.
- (C) No piping shall be supported from roof decks, metal side wall, precast concrete side walls, lateral bracing for structural members, or web members of bar joists without prior written approval from CASCO.
- (D) Each Contractor shall provide all beams, channels, angles, Uni-Strut, and similar members, including brackets, braces, stanchions, saddles, clips, etc., as required to support piping from building framing, platforms, or floor. Column-type supports and stanchions anchored to floor or concrete pad (exterior) shall be permitted only where shown on the drawings, specified herein, or approved by CASCO. All steel supporting elements for piping shall be painted with rust inhibiting primer, white or light grey in color except as otherwise specified. Sections of pipe shall not be used to support piping systems or pipe hangers in

any way.

- (E) Piping supported from field-placed concrete floors or walls shall be attached by means of appropriate inserts installed at the time concrete is poured. Each contractor shall provide all inserts for his portion of the work and shall be responsible for the location of same.
- (F) No cutting or drilling of structural members shall be permitted without prior written approval from the Engineer.
- (G) Hangers and supports shall be trapeze, split or solid ring, clamp or clevis type on adjustable hanger rods. Hanger rods shall be attached to beam clamps or other suitable brackets or supports. Welding of hanger rods to steel framing will not be permitted. The use of piping as trapeze members will not be allowed on any Rooms To Go project (no exceptions). The use of steel angles or unistruts ~~(no-hols)~~ as trapeze members only shall be allowed.
- (H) Pipe hooks, strap iron, or chains will not be permitted for supporting piping.
- (I) Hangers and supports in direct contact with copper tubing shall be copper plated and suitably isolated from tube to prevent contact between dissimilar metals. All hangers, rods, and supporting devices shall be primed with light grey rust inhibiting primer, cadmium plated, galvanized, or equivalent non-corrosive finishes or materials.
- (J) Piping shall be supported and/or anchored at each change in pipe direction, at branch connections to mains and runouts to equipment, at valves 3" and larger, and at heavy devices.
- (K) Vertical piping shall be supported with riser clamps placed at each floor or ceiling and at each coupling and fitting. Clamps shall not be exposed where exposed piping passes through finished areas. Clamps shall be securely supported by brackets or similar structural members which are in turn supported from suitable building construction.
- (L) The maximum center-to-center spacing of pipe hangers and supports, in feet, shall comply with the following schedule for hard drawn copper tubing, for steel pipe, Schedule 40, and for Schedule 40 PVC.

PIPE SIZE	COPPER	PVC	STEEL	PIPE SIZE	COPPER	PVC	STEEL
1/2"	4	4	5	3"	6	4	10
3/4"	4	4	6	3-1/2"	-	-	10
1"	4-1/2	4	7	4"	6-1/2	4	10
1-1/4"	5	4	8	5"	-	-	10
1-1/2"	5	4	9	6"	7-1/2	4	10
2"	5	4	10	8"	8	4	10
2-1/2"	6	4	10	10"	8-1/2	4	10
				12"	9-1/2	4	10

- (M) Hanger and support spacing for other types of piping shall comply with the following, except as otherwise specified or noted on the drawings.
  - (1) Cast Iron Soil Pipe: 10-feet (maximum) with supports and hangers located at the joints, but not less than one (1) hanger or support for each length of pipe. When 5-foot sections of pipe are used or when piping is not supported at joints, hanger and support spacing shall not exceed 5-feet.
  - (2) Cast Iron or Asbestos-Cement Pressure Pipe: 12-feet (maximum) with supports and hangers located at the joints, but not less than one (1) hanger or support for each length of pipe.
  - (3) Plastic or Fiberglass Piping: The maximum spacing of supports and hangers for specified plastic or fiberglass piping shall be as specified in the appropriate section of these specifications.
  - (4) Substitute Piping Materials or Systems: Contractors offering substitute piping shall submit proposed hanger spacing, preferably the manufacturer's printed recommendations, to the Engineer for approval.
- (N) Refer to separate paragraph covering thermal insulation for additional requirements for hanging and supporting insulated piping.

8. UNDERGROUND PIPING

- (A) Underground piping shall not be laid in contact with rocks, boulders, cinder fill, frozen earth, or any other materials or objects which could cause physical damage to the piping or unusual corrosion action.
  - (B) All underground cast iron, vitrified clay, and concrete piping shall be laid with the bottom quadrant (90 degrees) of the piping fully and uniformly supported on a shaped trench bottom, including bell or hub ends, except as otherwise specified or noted on the drawings.
  - (C) Vitrified clay pipe shall be installed in accordance with the applicable provisions of ASTM C-12 as minimum requirements.
  - (D) Vitrified clay pipe under exterior paved areas shall be installed with the following bedding conditions, unless more stringent conditions are noted on the drawings or required by site conditions.
    - (1) Total cover over top of pipe 18" or less: Lay pipe with bottom half (180 degrees) in a concrete cradle not less than 4' thick below pipe barrel.
    - (2) Total cover over top of pipe 30" to 19": Lay pipe with bottom quadrant in a concrete cradle not less than 4" thick below pipe barrel.
  - (E) Underground piping subject to thrusts or "pull-apart" forces due to pressure testing, shock loads, or other potential movements shall be anchored with clamps and rods and/or with concrete thrust blocks as required to resist such forces or potential movements. Clamps, rods, or similar metal anchors shall be painted or coated to prevent corrosive action.
9. THERMAL INSULATION - Applications to Piping
- (A) Refer to Section 15051 for basic requirements for thermal insulation work and materials. Refer to each Section of Division 15 for the types and thicknesses of insulation and other requirements for insulation of specific systems and equipment.
  - (B) The following specifications are for the methods of application of thermal insulation common to all piping systems. Special and/or additional requirements (if any) for particular systems shall be as specified in the respective Section of Division 15.
  - (C) Fittings - Insulate with equal insulating value and vapor barrier as the respective pipe insulation with built-up covering, with pre-molded (such as Insul-Sure as manufactured by Insul-Coustic, Corp.) or with one-piece pre-molded PVC insulated fittings such as manufactured by Zeston. Fittings insulated with built-up and mitered segments shall have cement, mastic, and wrap applied in accordance with the manufacturer's recommendations for proper ratings and for a smooth, even, finished appearance.
  - (D) Valves
    - (1) Valve bodies on low temperature systems shall be insulated with built-up and mitered segments of fiberglass, asbestos cement, or pre-molded insulation as required to equal the insulating and vapor permeability values of the respective pipe insulation. Valves shall be covered with a glass fab jacket.
    - (2) Valve bodies on high temperature systems (above 250 degrees F.) shall be insulated with asbestos cement and glass fab jacket as required to equal the insulating value of the respective pipe insulation. Valve bodies on hot systems (below 250 degrees F.) shall be insulated similar to valves on low temperature systems.
    - (3) Exposed portions of valves shall be insulated as much as practical, except the hand wheel and exposed portions of the stem.
    - (4) Apply cements, mastics, and straps in accordance with the manufacturer's recommendations for proper ratings and for a smooth, even, finished appearance.

## (E) Flanges

- (1) On hot systems (below 250 degrees F.) insulation may stop at flanges so as to allow access to bolts. Ends of insulation shall be finished.
- (2) On high temperature systems (250 degrees F. or higher) flanges shall be insulated same as piping.
- (3) On low temperature systems insulation shall stop at flanges and shall be sealed. Cover flanges with 1/2" flexible foam plastic "slip cover" which shall be stretched over the flanges and shall be fitted snugly against the piping insulation forming tight vapor seal. Slipcover shall be removable.

## (F) Pipe Saddles

- (1) No insulation shall rest directly on pipe supports. Provide heavy gauge galvanized steel or aluminum protector saddles on the bottom half of the piping at each support of sufficient length and stiffness to prevent noticeable deformation of insulation.
- (2) "Hot" Piping (hot water, etc.)
  - (a) Piping may be supported by pipe hangers directly, with insulation fitted around the hangers and finished in a similar manner as fittings, or insulation may pass through hangers.
- (3) "Cold" Piping (cold water, internal roof drain lines, RTU condensate drain lines, etc.)
  - (a) All insulation of "cold" piping shall pass uninterrupted through pipe hangers.
  - (b) Insulation saddles on which pipe is supported shall be of sufficient density to safely support the weight of piping and contents without noticeable deformation. Bottom portion of the pipe cover shall be provided with galvanized steel or aluminum protectors.
  - (c) Prefabricated pipe saddles shall be "Insul-Shield", as manufactured by Insul-Coustic Corp., or similar shop fabricated saddles. Sample of shop fabricated saddles shall be submitted to the Engineer for approval prior to installation.

## (G) Accessories

- (1) All accessories, specialties, and thermal conducting components on low temperature piping systems shall be insulated with 3/8" thick flexible foam plastic material or insulation and vapor barrier equivalent to adjacent piping.
- (2) All accessories, specialties, and thermal conducting components on high temperature piping systems shall be insulated equivalent to adjacent piping.
- (3) Insulation for removable components shall be easily removable without disturbing the main piping insulation.

10. CLEANING AND PRESSURE TESTING

## (A) General

- (1) Refer to Section 15401 for additional requirements relating to Plumbing Systems.
- (2) Definition: Cleaning as used herein shall be taken to mean the removal of all materials foreign to the respective piping system, which is or could be contaminating, obstructing, or unsightly.

## (B) Cleaning

- (1) The interior of all piping work shall be thoroughly cleaned of foreign materials as the work is installed.
- (2) After installation, the interior of all piping shall be cleaned and flushed in

accordance with the specifications governing the respective systems.

- (3) The exterior of all above grade piping shall be cleaned of mud, dirt, grease, rust and other foreign materials by brushing and/or washing with suitable solvents or detergents as required to leave the piping clean in general appearance and suitable to receive thermal insulation. Further cleaning and preparation of piping to receive painting, when required, shall be performed by the Painting Contractor. Prime any remaining rust prior to painting or installing thermal insulation.
- (C) Pressure Testing
- (1) All piping shall be pressure tested in accordance with the following specifications and as required by other Sections of Division 15.
  - (2) Testing work shall be successfully completed prior to application of any thermal insulation or pipe covering, prior to backfilling any buried piping, and prior to enclosure of any concealed piping.
  - (3) Testing shall be in the presence of CASCO and/or the Owner's Representative and all authorities having approval jurisdiction over the installed work. Each contractor shall perform and conduct the testing at times mutually agreed upon with the Owner's Representative.
  - (4) Isolate or remove any and all devices and equipment from the piping prior to the pressure testing if the devices or equipment are not designed to withstand the test pressures. If the maximum pressure rating is not marked on the device or equipment or is otherwise not known to the Contractor, the Engineer shall be notified prior to testing for directions.
  - (5) Testing shall be repeated or continued until all piping is proven leak-free. All defects shall be repaired or replaced to the satisfaction of the Owner's Representative. Defective welds in welded piping shall be ground off and the piping shall be rewelded. Defective pipe or fittings shall be replaced, not patched or repaired.
  - (6) Gaseous Fuel Piping shall be pneumatically tested with compressed air at a minimum of 25 psig and in no case less than 50% above the operating pressure of the system. Pressure in the section of piping under test shall hold constant for a period of 24 hours after applying correction factors for temperature changes. Where required by code or utility company, a certificate of compliance shall be obtained from the utility company or code enforcing authority.

- END OF SECTION -

DIVISION 15 - MECHANICAL WORK1. GENERAL

- (A) All work under this Section shall be governed by and subject to the provisions of the following:

Division 1	GENERAL REQUIREMENTS (All Sections)
Division 2	SITE WORK (Section 02668 WATER PIPING)
Section 15051	BASIC MATERIALS, METHODS, AND REQUIREMENTS
Section 15061	BASIC REQUIREMENTS FOR PIPING SYSTEMS

- (B) All work under this Section shall be the responsibility of the Fire Protection Contractor (FPC), except as otherwise specified herein, noted on the drawings, or modified by the Contract Documents.

2. RESPONSIBILITY AND SCOPE

- (A) These specifications for the Fire Protection Systems are "Performance" specifications and are intended to establish minimum design criteria and basic guidelines for the work. The FPC shall assume full responsibility for the criteria, design, layout, and details of all fire protection work to meet the requirements of governing Codes or regulations. The FPC shall be responsible to establish, retain and identify the "Engineer of Record" for the fire protection sprinkler work.
- (B) As minimum requirements, all fire protection work shall comply with the latest applicable provisions of the National Fire Codes published by the National Fire Protection Association (NFPA).
- (C) The scope of work shall include all labor, materials, equipment, and accessories necessary for the complete fire protection systems including, but not limited to the following major items.
- (1) Modification of existing sprinkler riser and accessories at the general location indicated on the drawings, as required by local jurisdiction, including alarm check, retard chamber, water motor gong, flow detector, and accessories.
  - (2) Modification of existing siamese fire department connection as required by local conditions and code requirements.
  - (3) Sprinkler systems in all parts of the building based upon the criteria indicated on the drawings and/or specified herein.
  - (4) Preparation of detailed shop drawings for the fire protection systems to meet the approval of State and local authorities having jurisdiction on this project and as required by the Engineer. FPC shall provide the seal and signature of a licensed Professional Engineer on shop drawings, calculations, and other related documents if required to obtain State and local approvals and/or Certificate of Occupancy.
  - (5) Payment of all costs relating to fees, permits, inspections, tests, and plan reviews required for the fire protection work and systems.
  - (6) All signs and labels required by NFPA Standards and/or local authorities.
  - (7) Perform all testing. Provide Contractor's Material and Test Certifications for interior and exterior work in accordance with NFPA 13 and other certifications required by local Codes.

3. SHOP DRAWINGS

- (A) All shop drawings and submittal data shall be furnished and submitted in accordance with the provisions of Section 01021 of these specifications and the following requirements.
- (1) GC to provide a copy of Fire Protection submittal for Owner specified consultant review.

- (B) The FPC shall prepare a set of construction shop drawings, immediately after the award of the contract, showing the complete system and have same approved by local authorities, State agencies as required by codes and regulations. After the above approvals have been obtained, the FPC shall submit the drawings to CASCO for review. Materials shall not be ordered, nor shall any work be installed until all the approvals have been obtained.
- (C) To avoid interference and clear all obstructions, any piping layouts shall be coordinated in the field with contractors of other trades, prior to the submission of shop drawings for approval. On projects with a skylight, show skylight and routing of branch and main piping around the skylight on the shop drawings. Provide sprinkler protection beneath the skylight as required by NFPA Pamphlet 13. Coordinate routing of branch piping to sprinkler heads beneath skylight with the Owner's representative before installation.

#### 4. WATER SUPPLIES

- (A) FPC shall make modifications to the water supply connections to the water system as required by design criteria herein and the Water Utility and local regulations or authorities.
- (B) The FPC shall be responsible to determine all requirements relative to water supplies for the sprinkler system. The FPC shall furnish and install backflow prevention devices and all other specialty valves, tamper switches, metering, detectors and accessories as well as valve enclosures as required to comply with local codes and the requirements of the water utility. Backflow prevention device shall be provided with means for full forward flow testing. Test outlet to be screened for rodent protection.
- (C) In the event local codes and regulations require a backflow prevention device on the sprinkler riser, the FPC shall provide a vertical type whenever possible (subject to approval by local authority) in order to minimize the floor space required for piping and backflow device layout.
- (D) During construction, the FPC shall make all necessary notifications and coordinate the fire protection and water supplies on a timely and proper basis.
- (E) Fire Pump:
  - (1) Unless approved water flow data is indicated on the drawing or in the specifications, the FPC shall, prior to submission of bid, investigate and determine the water flow characteristics for this project.
  - (2) In the event the water supplies are inadequate or considered marginal to support the required design density, the FPC shall provide an ALTERNATE BID, identified as Alternate FP-1, to provide an electric driven fire or booster pump and jockey pump package.
  - (3) The ALTERNATE BID shall be furnished to cover the fire pump/jockey pump complete with all necessary valves, fittings and including, but not limited to, the following:
    - (a) Full service/across the line controllers
    - (b) Bypass piping and fittings
    - (c) Test header and accessories and/or flow meter as required by authority having jurisdiction.
    - (d) Eccentric reducers and concentric increasers as required.
    - (e) Sensing lines and accessories to fire and jockey pumps. All wiring and power to pumps/controllers to be completed by EC. GC shall be required to obtain an ALTERNATE BID for electrical work involved for this installation.
  - (4) In the event the FPC does not submit an ALTERNATE BID or otherwise suitably qualify his bid clearly to the GC, this shall be taken to mean that the FPC accepts the water supplies as suitable. Any subsequent claims for additional compensation due to inadequate water supplies will not be considered.
  - (5) In addition to notifying the GC, each FPC bidder is requested to notify CASCO and

Owner's Representative of their intention to submit an ALTERNATE BID for a fire or booster pump. This will ensure that the ALTERNATE BID is not overlooked by the GC.

5. PIPING MATERIALS

(A) Above Ground Interior Piping

~~(1) Black steel schedule 40 pipe conforming to ASTM A120 or ASTM A53. Schedule 30~~

(1) Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 plain end. Unions in "Malleable- or Ductile-Iron Unions" Paragraph below are generally available in NPS 1/4 to NPS 3 (DN 8 to DN 80), but NFPA limits them to NPS 2 (DN 50) and smaller.

(2) Malleable- or Ductile-Iron Unions: UL 860.

(3) Grooved-Joint, Steel-Pipe Appurtenances:

(a) Pressure Rating: 175-psig minimum.

(b) Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.

(c) Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

~~or welding shall be used to join piping 2-1/2 inches and larger, except where mechanical couplings are allowed as specified herein.~~

(4) Mechanical couplings and fittings as manufactured by Victaulic, or equal, which are UL listed for fire protection service and meeting with the approval of the insurance underwriting agency and governing Codes may be used to join above ground piping.

(5) Fitting from a single manufacturer shall be provided for a complete installation on this project. A combination of more than one single manufacturer shall not be acceptable.

(B) Above ground exterior piping:

(1) Piping penetrating exterior walls shall be galvanized and painted to match wall.

(C) Refer to Section 15061 for provisions relating to the use of other piping materials, piping systems, or methods of joining.

6. WET PIPE SPRINKLER SYSTEMS

(A) Except as otherwise required, provide wet pipe sprinkler systems for all areas of the building in accordance with a minimum coverage of Ordinary Hazard, Group 2 per NFPA Pamphlet 13. Water test data and calculations shall be submitted with the shop drawings. Sprinkler system design criteria and all work shall meet the requirements of local Codes, Building Officials, and Fire Protection Officials. Verify requirements and criteria during bidding.

For stockroom, storage up to 16'-0" high, of Class III commodity on racks, non-encapsulated (without solid shelving) with 4'-0" minimum aisle width shall be allowed. A density of 0.28 gpm/s.f. over the most remote 2000 sq. ft. shall be required. Utilizing high temperature sprinklers without in-rack sprinklers. 500 gpm combined hose allowance shall be required.

(B) Sprinkler Heads

(1) Ceiling sprinklers in finished areas shall be TYCO TY-FRB or equivalent or Viking "flush type" of the flush mounted or recessed mounting type to minimize the projection of the sprinkler head below the ceiling plane. Sprinkler heads shall be centered in ceiling tiles.

(2) Except as otherwise noted, sprinkler heads shall be rated for 155 degrees F. Temperature ratings, locations, and clearances for sprinkler heads near hot equipment or piping, etc., shall comply with NFPA Pamphlet 13.

(C) Spare Sprinklers

(1) Provide not less than the minimum number of spare sprinkler heads, for each type

and rating used on the job, in accordance with NFPA Pamphlet 13.

- (2) Provide metal cabinet or cabinets for storage of spare sprinklers. Cabinets shall be provided with hinged door and latch and shall be finished with red enamel paint. Provide engraved plastic sign on each cabinet front to read: SPARE SPRINKLERS. Provide a sprinkler wrench in each cabinet.
  - (3) Cabinets shall be securely mounted to the wall in locations where the space ambient temperature will not exceed 100 degrees F. Verify and coordinate cabinet locations with the Owner's Representative.
- (D) Hangers:
- (1) Hangers and supports, drains, test connections, sleeves, chrome escutcheons, spare sprinkler heads with cabinet, and other necessary appurtenances.
  - (2) Trapeze hangers shall be provided as outlined in NFPA 13, 2007 Edition, Chapter 9 "Hanging, Bracing, and Restraint of System Piping", except the use of piping as trapeze members which **will not** be allowed on any Rooms To Go project (no exceptions). The use of steel angles or unistruts (no holes) as trapeze members **only** shall be allowed.
- (E) Installation
- (1) Modification of existing sprinkler system piping network, as required for compliance with design criteria herein and for maximum clearances as required by design criteria herein. Relocate piping to within joist space or remove and install new piping. Whatever is feasible and deemed appropriate for the condition. Unused piping will not be abandoned in place.
  - (2) The entire installation shall comply with NFPA Pamphlet 13, as minimum requirements, and with applicable portions of Section 15061 of these specifications.
  - (3) FPC shall coordinate the installation of all fire protection systems with the work of all other trades. Provide all necessary offsets in piping to avoid interference with other equipment and systems and provide additional sprinkler heads due to offsets and/or interference as required to achieve design coverage.
  - (4) All horizontal piping shall be installed above the bottom chord of the roof joists with due allowance for clearances for sprinklers as required by NFPA Pamphlet 13. All piping shall be concealed in areas where hung ceilings are applied. All effort should be made to avoid beam penetrations. Routing should be established, in such a manner, to avoid beam locations. No penetrations will be accepted without the written approval of the Structural Engineer of Record.
  - (5) Coordinate routing of piping with lighting fixtures, HVAC systems, and other piping to minimize offsets and interferences. Where pipe must be routed past a structural steel beam and cannot pass beneath the beam without providing an offset, penetrate and pass through the beam rather than provide an offset below the beam. Penetrations must be approved in writing by the Structural Engineer. Reinforcing of the beam shall be performed per the Structural Engineer's requirements at no additional cost to the Owner. Where necessary and unavoidable, provide offsets in the piping as required to accommodate the space and structural limitations set by the building geometry. Shop drawings shall demonstrate that coordination is being properly considered by showing lighting and HVAC systems in the background form to the extent required.
  - (6) Provide drain valves and piping as required to permit all sprinkler piping to be completely drained. Provide inspector's test connections in accordance with NFPA Pamphlet 13 and as required by governing Codes. Locate inspector's test in non-public area (e.g. utility room) if possible. Otherwise, coordinate location with Owner. If located in the sales area, the drop will need to be concealed in a drywall chase and the valve will require a metal access panel.
  - (7) All drains and test connections shall be discharged into the building storm drainage system through an approved indirect waste connection or shall be piped to discharge to the building exterior at 6" above finished grade. The FPC shall provide precast concrete splash blocks at all drains and test connections discharging to the

building exterior at unpaved points. Discharge points shall not be higher than 0'-6" above finished grade.

- (8) All piping shall be concealed in finished rooms and areas. Refer to Section 15061 for clarification. Drains and/or test connections shall not be terminated exposed in finished rooms or areas or toilet rooms.
  - (9) All piping through interior walls and partitions shall be sleeved and closed off with chrome escutcheons where visible. Penetrations through fire rated walls shall be sleeved, packed, and grouted as required to maintain the fire rating of the wall. Piping through floors and exterior walls, including foundation walls, shall be sleeved, packed, and grouted with non-shrinking cement as required to make watertight.
  - (10) The use of roof decks as point of attachment to pipe hanger is absolutely prohibited.
  - (11) Piping shall not penetrate steel beams. When it becomes absolutely necessary to penetrate steel beams the Structural Engineer shall be consulted for confirmation of the size, location and number of allowed beam penetrations.
- (F) Risers and Alarms
- (1) Flanged connections shall be used at the base of all risers. Steel pipe shall not be extended into the ground at the base of risers. Provide cast iron flange and spigot piece at the floor penetration for connection to the steel pipe riser.
  - (2) Risers penetrating floors shall be sleeved, packed with oakum, and made watertight with non-shrinking grout.
  - (3) Each riser shall be equipped with an alarm check valve assembly, retarding chamber, water motor alarm (if electric alarm is used, General Contractor is responsible for power wiring), drains, gauges, and related piping, valves and accessories. Water motor alarm gong shall be mounted on the exterior face of the building wall near the riser. Pressure gauges, complying with NFPA Pamphlet 13, complete with stop cock and draining provisions shall be provided on the supply and discharge side of each alarm check valve.
  - (4) Provide where indicated on the drawings a siamese fire department connection with two - 2-1/2" hose connections, caps and chains. Hose threads to meet local Fire Department requirements. Additional siamese connection shall be furnished if required by the reviewing authorities.

## 7. CORROSION MANAGEMENT

- (A) Corrosion Monitoring Stations
- (1) Provide CorrView monitor with 1-1/2 inch National Pipe Thread, 0.035 inch wear dimension and flat front surface; 3,000 psi pressure rating and 11,000 proof burst test.
- (B) Monitoring Stations shall be located as follows: one (1) in the fire sprinkler riser downstream of the check valve; one (1) in the lower side of the horizontal main fire sprinkler piping trunk line; one (1) in the fire department sprinkler test line. Monitoring Stations shall be mounted in accordance with the manufacturer's instructions and at non-concealed locations. Coordinate exact locations with the Owner's construction manager prior to installation.

8. TESTS

- (A) In the absence of current and reliable water test data, the FPC shall arrange and pay for a flow test in the area of the proposed water supply connection prior to beginning the installation. The FPC shall submit to CASCO proof of adequate pressure and flow to serve the project facility.
- (B) The entire Sprinkler System shall be tested as required by NFPA and any agencies having jurisdiction.
- (C) No part of the system to be concealed shall be covered up or closed in until such portions have been tested and approved.
- (D) The FPC shall notify the various agencies and bureaus in advance of the time that the tests are to be made.
- (E) An operating test of sufficient duration shall be made for the equipment, fixtures and accessories to the satisfaction of the Owner's Representative.
- (F) All defective parts shall be replaced or corrected by the FPC and an extra test or tests shall be made until the operation is satisfactory. All arrangements and expenses necessary to conduct all tests required by these specifications and the various bureaus and agencies having jurisdiction over the work installed under this contract, shall be made by this FPC. No extra compensation will be allowed for these tests, the cost thereof being included in the lump sum bid for this contract.
- (G) Where any evidence of stoppage and/or leakage is found in piping or equipment, the FPC shall disconnect, clean, repair and reconnect all obstructed piping or equipment and shall also pay for all necessary cutting and repairs to adjoining work. The FPC shall be responsible for repairing all damage caused by leaks in the piping system, including, but not limited to, touch ups of rust with prime paint, at no cost to the Owner.
- (H) All piping and equipment shall be thoroughly cleaned inside and out, of dirt, cutting, oils, and other foreign substances and shall be left clean.

END OF SECTION

DIVISION 15 - MECHANICAL WORK1. GENERAL

- (A) All work under this Section shall be governed by and subject to the provisions of the following:

Section 15051 - BASIC MATERIALS, METHODS, AND REQUIREMENTS

- (B) All work under this Section shall be the responsibility of the Heating and Air Conditioning Contractor (HAC), except as otherwise specified herein, noted on the drawings, or modified by the Contract Documents.

- (C) Shop Drawings

- (1) Prepare shop drawing submittals for the following:

- Ductwork Materials
- Diffusers and Grilles
- Dampers, Fittings, Flexible Duct, Duct Liner

- (2) Clearly mark the particular make, model number, accessories and options on all submittals. Capacities, rating and characteristics of the proposed equipment shall be based on conditions indicated or specified herein. Review of shop drawings is for general conformance with the design concept and contract documents.

- (3) All submittals required by this section shall be submitted in one package. Submittals shall be prepared in accordance with the requirements of Section 01021 of the specifications.

2. SHEET METAL WORK

- (A) General

- (1) Sheet metal work shall be performed by the HAC's own sheet metal shop, or at the HAC's option, may be subcontracted to a qualified Sheet Metal Subcontractor, hereinafter referred to as the SMS. If SMS is to be used, the HAC shall submit the name of the proposed SMS to the Owner's Representative.

- (2) Reference Manuals - Quality of workmanship, metal gauges, fabrication, construction and installation of sheet metal work shall comply with HVAC DUCT CONSTRUCTION STANDARDS - METAL & FLEXIBLE published by Sheet Metal and Air Conditioning Contractor's National Association, Inc. (herein referred to as SMACNA). All work and materials shall comply with NFPA Pamphlet 90A, latest edition.

- (B) Materials, Fabrication, and Installation

- (1) Ducts for heating, cooling, and exhaust systems shall be galvanized steel of commercial lock forming quality having a minimum galvanized coating of 1-1/4 ounces per square foot of sheet metal (total coating for both sides), unless otherwise noted on the drawings or specified herein.

- (2) Round spiral ductwork and fittings shall be provided in accordance with specifications on the drawings and the following:

Provide single wall, galvanized steel, spiral lockseam round ductwork. Fittings shall be single wall galvanized steel, standing seam or solid welded construction. Elbows shall be standing seam, gored elbows. Grille collars shall have 4-sided saddle taps and be attached to the ductwork with self-tapping sheet metal screws at 6" on center maximum and Ductmate neoprene gasket tape around full perimeter of collar: No substitutions. Duct-to-duct joints shall be made with the spiral seam rotated so that the standing seam forms a continuous helical pattern across the joint. Seal perimeter of duct-to-duct connections with

Ductmate neoprene gasket tape: No substitutions. Caulk is not allowed at any location along ductwork, take-offs, or grille connections. All ductwork and fittings shall be manufactured and installed in accordance with SMACNA's "HVAC Duct Construction Standards", latest edition.

Spiral ductwork shall be fabricated on machines which do not employ oil-based lubricants in the manufacturing process. All ductwork shall be cleaned prior to delivery per the manufacturer's instructions. If on-site cleaning is required, the ductwork shall be stood vertically with the open side of the lock seam facing down to dry. The ductwork shall be installed completely dry.

- (3) All exposed rectangular and round ductwork and fittings in the showroom shall be provided with a mill phosphitized finish ("paint grip", "zinc grip" or similar mill surface etch treatment) to allow the ductwork to be painted. Ductwork shall be painted by the General Contractor after installation.
- (4) Sheet metal work as shown on the drawings is, in general, schematic and based on the specified manufacturer's equipment and material dimensions. HAC shall make accurate measurements in the field prior to ductwork fabrication and shall provide all necessary offsets and transition pieces required to accommodate the actual structural and equipment variations and as required to clear piping and recessed lighting fixtures.
- (5) Duct Dimensions - Unless otherwise specified or noted on the drawings, duct sizes shown are OUTSIDE DIMENSIONS of the ducts. Contractor need not increase duct size to allow for the thickness of duct lining.
- (6) All rectangular ductwork shall be cross broken.
- (7) All ducts and ductwork shall be supported by hangers of the types and at the spacings as recommended by SMACNA. HAC shall provide additional steel angles, channels, Unistrut (~~no holes~~), etc., as required to span between bar joints or structural members in order to hang ducts at proper intervals and at necessary points. Hangers shall be provided at all elbows and at branch takeoffs on the main ducts.
- (8) No ducts shall be supported from the roof deck. No cutting or drilling of structural members is permitted unless written permission is obtained from CASCO. No ducts shall be supported from or rigidly attached to any interior partitions, except those of masonry or concrete construction.

(C) Turning Vanes and Radius Elbows

- (1) All changes in direction of supply, return, and exhaust ductwork made with square elbows shall have turning vanes. Turning vanes shall be provided in all square elbows whether shown on the drawings or not.
- (2) Turning vanes shall be single wall type as manufactured by Aero/Dyne Company or Tuttle & Bailey or may be shop fabricated in accordance with SMACNA. The number and spacing of vanes shall comply with the manufacturer's recommendations or, if shop fabricated, in accordance with SMACNA. In ducts with internal liner, the vanes shall be installed over the liner; the liner shall not be interrupted for vane installation.
- (3) At the Contractor's option, elbows may be "Standard Radius" type in accordance with SMACNA with the throat radius equal to the width of the duct in the plane of the radius. When space does not permit the use of "Standard Radius" elbows, a short radius elbow with turning vane complying with SMACNA may be used.

(D) Flexible Connections

- (1) Provide sound and vibration isolating flexible connections on all motorized equipment to which duct connections are made, at locations noted on the drawings, and as specified.

- (2) Connections on interior work shall be made with Ventglas Neoprene - coated glass fabric as furnished by Ventfabrics, Inc. Connections made on work exposed to weather and/or sunlight shall be made with Vention Hypalon - coated glass fabric as furnished by Ventfabrics, Inc.
- (3) An allowance of at least one-inch slack shall be made at each connection. The fabric shall be attached at equipment with metal collar frames and to ductwork by folding in with the sheet metal or with bands or frames as required to make leak proof joints.

### 3. VOLUME CONTROLS

- (A) Provide volume control dampers (do not provide air extractors) at all branch take-offs and other locations as shown on the drawings and as otherwise required for the proper balancing of the air distribution systems. The HAC and ITC shall be responsible for the proper balancing and volume control of all air distribution systems.

### 4. AIR DISTRIBUTION DEVICES

- (A) Provide air distribution devices complete with accessories in accordance with the Schedule on the drawings and the following.
- (B) The HAC shall verify ceiling construction to assure the suitability of each device, frame, and hardware for the respective application. Provide all mounting hardware required whether specified on the drawing schedule or not.
- (C) Air devices shall be as manufactured by Titus, Barber-Colman, Metal-aire, Tuttle and Bailey, Kueger, Carnes or Anemostat.

### 5. DUCT LINER

- (A) Low velocity rectangular duct systems shall be internally lined with acoustical liner in accordance with the following.
  - (1) Supply and return rectangular ducts concealed by hung ceilings shall have one-inch-thick liner.
  - (2) Return air ducts for units serving the general Sales Area shall have 1" thick liner.
  - (3) Supply spiral duct liner as indicated on drawings.
- (B) Duct liner shall be made of glass fiber material bonded with an inactive resin and having a density of not less than 2 pounds per cubic foot. The surface in contact with the air stream shall be factory coated with a suitable coating to prevent erosion and to meet the requirements of NFPA Pamphlet 90A. The surface in contact with the air stream shall be fire-resistant and contain an EPA registered anti-microbial agent that meets the requirements of ASTM C 1338, ASTM G21 (fungi test) and ASTM G22 (bacteria test). The material shall have the following ratings and characteristics.
  - (1) Thermal conductivity (k-factor) of 0.24 at 75 degrees F. mean.
  - (2) Flame spread - 25; Smoke developed - 50.
  - (3) Maximum air velocity of 4000 FPM in accordance with UL Standard 181.
  - (4) Maximum temperature of 250 degrees F.
  - (5) Noise reduction coefficient of 0.08. (Average of sound absorption coefficients at 250, 500, 1000 and 2000 cps)
- (C) All duct lining shall be installed in accordance with the manufacturer's recommendations and SMACNA Standards. Mechanical fasteners and adhesives shall be as recommended by the manufacturer.

- (D) Duct liner shall be as manufactured by Certainteed CGS Group-ToughGard R Duct Liner or Owens- Corning-QuietR AcousticR Duct Liner or product of equivalent quality, appearance and performance.

6. DUCT WRAP

- (A) Round ducts serving the office/ breakroom utility shall receive 1-1/2" of Owens-Corning vapor barrier faced duct wrap FRK-25, series ED-150, with a thermal conductivity of 0.24 at 75 degrees F. mean temperature, or equivalent by J-M or Certainteed. Insulation shall be adhered to metal at 8" o.c. with Foster's 85-15 bonding adhesive. Longitudinal and circumferential joints shall be secured with 9/16" flare-door staples at 6" o.c. and taped with 3" wide (min.) foil reinforced kraft tape. All penetrations of facing shall also be taped. Comply with manufacturer's recommendations for installation.

7. FLEXIBLE INSULATED DUCTS

- (A) Provide flexible ducts as manufactured by Certainteed CGS Group, Flexible Tubing Division of Automation Industries, Johns-Manville, or Wiremold as indicated on the drawings and in accordance with the following specifications.
- (B) Flexible ducts shall consist of an inner of helical wound spring steel coated with vinyl and covered with a vinyl coated fiberglass mesh permanently fused to form a continuous inner sleeve. The inner line shall be covered with fiberglass insulation jacketed with a reinforced, metalized plastic vapor barrier casing.
- (C) Flexible ducts shall be UL listed in accordance with UL Standard 181, Class 1 and shall have the following ratings and characteristics.
  - (1) Maximum thermal conductance (C) of 0.23 BTUH per square foot degree F. at 75 degrees F.
  - (2) Temperature range of 0 to 250 degrees F.
  - (3) Maximum vapor transmission rating of jacket of 0.03 Perm.
  - (4) Maximum internal pressures of 2" w.c. positive and 1-1/2" w.c. negative.
  - (5) Maximum velocity of 2400 FPM.
- (D) Duct sizes noted on the drawings refer to the inside duct diameter. Flexible ducts shall be installed to provide sweeping configurations without undue restrictions, but not creating unnecessary sags or curves. Flat banding material not less than 1-1/2" wide shall be used to suspend flexible ducting. Ducting furnished with factory installed grommets shall be suspended by wires attached to grommets.
- (E) Where ceiling plenum space is not sufficient to permit top connection to ceiling diffuser with proper bend radius for flexible duct, HAC shall fabricate and/or provide an adaptor box for diffuser to permit side connection of flexible duct.

8. PREFABRICATION ROOF CURBS AND EQUIPMENT SUPPORTS

- (A) Roof curbs for Rooftop Units (RTU's) shall be manufacturer's standard curbs. All other roof curbs shall comply with the following paragraphs.
- (B) Provide factory prefabricated roof curbs and equipment supports as indicated on the drawings and in accordance with the following specifications.
- (C) When available, roof curbs and equipment supports shall be furnished by the manufacturer of the respective equipment or item to be supported to assure a close and proper fit. All other curbs and supports shall be as manufactured by Vent Products Co., Inc., Louvers and Dampers, Inc., Penn Ventilator, The Pate Company, or Thybar Corporation, in accordance with the following:
- (D) Materials and Construction

- (1) Curbs and supports shall be constructed of not less than 18-gauge galvanized steel or 14-gauge (.064") aluminum. Material of curb shall match the equipment or item to be supported when required to prevent direct contact of dissimilar metals.
- (2) Curbs and supports shall be reinforced and/or constructed of heavier gauge materials as required to properly support the applied loads, including wind, snow, and dynamic with safety factor of 2 or greater.
- (3) All joints and seams shall be continuously welded to assure leak proof and weather tight construction.
- (4) All curbs shall be insulated with rigid fiberglass board, 3 lbs. per cubic foot minimum density. The thickness of insulation board shall be equal to the required nominal curb thickness: 1- 1/2 inches, minimum.
- (5) All curbs and supports installed on insulated roofs shall have an integral cant strip, 3" minimum. The cant shall be raised by an amount equal to the thickness of the roof insulation. The top of all curbs shall be not less than 11 inches above finished roof. The top of all equipment supports shall be not less than 9 inches above finished roof. The top of all curbs and supports shall be installed level with factory built-in pitch matching roof slope.
- (6) Top of all curbs and supports shall have a wood nailer of nominal 2-inch lumber, except where self-flashing curbs are approved. Provide cap flashing for all applications where the wood nailer would be exposed.

- END OF SECTION -

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DIVISION 16 - ELECTRICAL WORK1. GENERAL

- (A) This Section covers materials, methods and requirements common to all electrical work.
- (B) All electrical work shall be governed by and subject to the provisions of this Section and all Sections of Division 1.
- (C) Refer to Section 00011 for requirements relating to Base Bid Products, Substitutions and Alternates.
- (D) The General Contractor shall be responsible for providing a copy of Division 1 specifications to each subcontractor and for coordinating the work accordingly.
- (E) Submittal data, shop drawings and samples:
  - (1) Shall be submitted for review for the following equipment in accordance with the procedure set forth in Section 01021 of these specifications.
    - (a) Light Fixtures
    - (b) Site Lighting poles (if applicable).
    - (c) Electric Panels (if applicable)
    - (d) Distribution Equipment including Lighting Contactors
- (F) Contractor to provide select unit prices (See Section 00301 Proposal Form).

2. WORK INCLUDED

- (A) The work covered by this Section of the Specifications consists of providing all equipment, materials and labor, and performing all work as required for the complete execution of the Electrical Work as shown on the Drawings, herein specified, or both, and which without restricting the generality of the foregoing, shall include the following:
  - (1) General Requirements.
  - (2) Conduit and Fittings. Wire and Cable.
  - (3) Any primary and secondary service work as required by the Utility Company, or as shown on the drawings.
  - (4) Service entrance equipment and switchgear.
  - (5) Provision of lighting fixtures and lamps, including all hangers and supports.
  - (6) Site Lighting.
  - (7) Light and Power Panelboards.
  - (8) Light and Power Systems
  - (9) Mounting of starters and controls.
  - (10) Grounding.
  - (11) Telephone System: Work as required by the Telephone Company including service conduit requirements and grounding system.
  - (12) Power wiring for HVAC and Plumbing work.
  - (13) Provision of emergency lighting units and exit signs.

- (14) Temporary light and power as required by the General Contractor.
- (15) Excavation, trenching and backfill. Comply with applicable provisions of Division 2, Excavating, Grading and Backfilling.
- (16) Conduit and wire for automatic temperature controls as indicated on the drawings. (Low voltage wiring by HAC).

### 3. WORK SPECIFIED UNDER OTHER SECTIONS

- (A) The following items of work will be done in accordance with the appropriate Sections of the Specifications, or by the Utility Companies.
  - (1) Finished painting.
  - (2) Patching.
  - (3) Concrete work.
  - (4) Foundations.
  - (5) Furnishing and installing of all telephone equipment and low voltage wiring.
  - (6) Furnishing of automatic temperature controls (except as noted on the drawings), and electric heaters.
  - (7) Coordinate with utility company as to provision, setting and connection of transformer.

### 4. CONDUIT AND FITTINGS

- (A) Materials
  - (1) Except as otherwise noted, specified, or required, provide all conductors in rigid conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT), flexible conduit or schedule 40 PVC complying with the standards of the latest edition of the National Electrical Code (NEC) and the requirements of local authorities. Rigid conduit, or EMT shall be of the best quality hot-dipped galvanized or sherardized steel tubing, and of standard trade dimensions, smooth inside and out. Each length of conduit shall bear the marker's trademark or stamp. All conduit shall be approved by the Underwriter's Laboratories (UL).
  - (2) Conduit fittings and conduits shall be zinc-coated, threaded type for rigid conduit or intermediate metal conduit, set-screw or compression type below slab for EMT or match the conduit for plastic.
  - (3) Conduits shall be as manufactured by Southwire Co., Wheatland Tube Co., Allied Tube, Johns-Manville, Carlon, Triangle, or Robroy; fittings: Southwire Co., Johns-Manville, Carlon, Steel City, Thomas & Betts, Robroy, or Appleton, except as otherwise noted.
- (B) Applications
  - (1) Rigid conduit or IMC shall be used for all feeders and sub-feeders where exposed to possible physical damage. EMT shall be permitted for feeders in protected areas.
  - (2) Conduit embedded in concrete, which is in contact with earth, and conduit installed outside building below grade shall be rigid steel conduit, or schedule 40 PVC. Conduit elsewhere shall be EMT unless specified or noted otherwise. Schedule 40 PVC shall have rigid steel elbows at all bends. PVC conduit above grade (inside or outside the building) is not acceptable.
  - (3) Secondary electrical service duct banks shall be concrete encased galvanized rigid steel conduit, IMC or schedule 40 PVC.

- (4) Conduit run above grade, outside the building, not under solid canopy or structure shall be rigid steel.
  - (5) All PVC rigid conduit, fittings and cement shall be produced by the same manufacturer. All joints shall be solvent welded in accordance with manufacturer's recommendations. All PVC conduit shall be schedule 40.
  - (6) Where non-metallic conduit is used, install green grounding conductor.
  - (7) Conduits installed in concrete or in direct contact with earth, or in areas subject to acid soils, high ground water, or other severely corrosive influences, shall be protected with anti-corrosive compounds, which are UL approved for that particular application.
  - (8) Flexible steel conduit may be used in making short flexible connections from outlet boxes to recessed lighting fixtures, or other equipment or light fixtures that are concealed behind partition walls with access doors. Flexible steel conduit shall be as short as possible but shall have a minimum length of 12".
- (C) Installation
- (1) Conduits shall be continuous from outlet to outlet, from outlet to cabinets, pull or junction boxes and shall be secured to all boxes with locknuts and bushings in such manner that each system shall be electrically continuous throughout.
  - (2) Where conduits enter or leave all outlet boxes, cabinets, safety switches, tap boxes, motor controllers, etc., other than those having threaded hubs, a standard locknut shall be used on the outside of the box, and a locknut and bushing used on the inside. Bushings shall be of an approved insulated type.
  - (3) Under no circumstances shall conduits or fitting be supported from or anchored to the roof deck.
  - (4) All conduits shall be fastened securely in place with approved straps and hangers in sufficient number to prevent movement of any part of the conduit. This includes conduit installed in forms before concrete is poured. Where exposed conduits are suspended, the hangers shall be Caddy (Erico), Gateway, or Grinnell, steel band, adjustable hangers with rod suspension, having nut fitted in malleable iron or steel inserts. Inserts for hanger rods shall be installed in the slabs, and all hangers shall be installed at not more than 9'-0" centers.
  - (5) All concealed conduits installed above suspended ceiling shall be run above bottom of joists, or otherwise coordinated with the HAC and PBC so as to allow room for running ducts and piping.
  - (6) Expansion fittings shall be provided at all conduits across a building expansion joint. Fittings shall be type "AX", "EX" or "TX" as made by O.Z. Electrical Company. Provide copper bonding jumper at each expansion fitting.
  - (7) All conduit shall be run at right angles to and/or parallel to floors, perimeter walls and steel joist.
  - (8) Connection to Motorized Equipment - Connection to motorized equipment shall be made with flexible conduits having sufficient slack between rigid conduit and motor terminal in order to minimize vibration transmission. No rigid conduit shall be anchored to equipment which is subject to vibration transmission. Fittings shall be of the metallic ferrule, compression type. Minimum length of flexible conduit shall be 18 inches. Flexible metal conduit shall be Anaconda "Sealtite".
  - (9) Open ends of conduits shall be capped with plastic cap or corked during roughing-in so as to prevent the accumulation of dust and moisture condensation in conduit.
  - (10) When rigid metal conduit is joined, all conduit joints shall be made up tight and no running threads will be permitted.

- (11) All conduit shall have powered soapstone or wire pulling lubricant blown through them before pulling of wires or wires shall be lubricated with soapstone paste or wire pulling lubricant.
- (12) When metal conduit is installed in direct contact with the earth, use "hot dipped" galvanized type and coat the conduit and the joints with asphaltum.
- (13) Conduits in hazardous areas, as identified on the drawings, shall be installed with seal fittings between hazardous and non-hazardous areas in compliance with NEC Class 1 installation. All fittings, etc., shall be specifically approved by the Underwriter's Laboratories for use in such areas.
- (14) All exposed horizontal conduit runs in Sales Area shall be attached to the underside of the top chord of the bar joist.
- (15) All conduit in finished areas shall be concealed.
- (16) Conduit runs shall be installed to avoid proximity to hot water pipes. Conduit shall be kept a minimum of 3" from such pipes, except where crossings are unavoidable. In such instances the conduit shall be kept at least 1" from the covering of the pipe.
- (17) Where conduit is to remain empty, install polypropylene (or nylon) pull-line from end to end with tag at each end designating opposite terminus.
- (18) **Conduit serving roof mounted equipment shall be routed up through roof curb to avoid roof penetration. Conduit serving receptacles mounted on rooftop HVAC units shall also be routed through roof curbs. If equipment curb is not available for conduit penetration through roof, the contractor shall provide pipe curb as manufactured by Pate, RPS or Thycurb.**
- (19) Conduits emerging from PVC runs below slab or grade to a panel, switchboard, or other device shall be rigid steel.

5. WIRE AND CABLE

(A) Types

- (1) Unless otherwise noted or specified, all power wiring shall be NEC approved type for 600 volt and shall be UL listed.
- (2) All wire #8 AWG and larger shall be stranded copper. All wire #10 AWG and smaller shall be solid, unless otherwise specified. **Use of aluminum wire shall be allowed for feeders rated 200A or more, if permitted by local authority.**
- (3) All stranded conductors shall be furnished with copper connecting lugs drilled or reamed the full diameter of the bar conductors. Main and feeders shall be run their entire length in continuous pieces without joints or splices.
- (4) Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with pressure type connectors, "SCOTCHLOK" or approved equal. Tape shall be "Scotch" No. 33+ for indoor and No. 88 for outdoor or approved equal. Where connection is made to any terminal, copper terminal lugs shall be bolted or compression fitted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.
- (5) Conductors shall have insulating rating complying with the following:

<u>Application</u>	<u>Type or Letter (NEC)</u>	<u>Max. Operating Temp. Deg. C</u>
Branch Circuits (No. 12 thru No. 10 AWG)	THHN OR THWN	60

Feeder Circuits (No. 8 AWG and larger)	THHN THWN OR XHHW	75
Branch Circuits (within 3" of ballasts in fixtures)	THHN OR XHHW	90

Unless a circuit breaker, switch, contractor, motor starter, etc., is marked otherwise, circuit conductors connected to the terminals must not operate at more than a 60-degree C. ampacity for a breaker, switch, etc., rated 100 amps or less and must not operate at more than a 75 degree C. ampacity for a breaker, switch, etc., rated over 100 amps.

(B) Wire Sizes

- (1) Minimum wire size for branch circuits shall be #12 AWG except that home runs longer than 100 feet in actual wire length from panel to load shall be minimum #10 AWG.
- (2) Size of wires larger than #12 AWG shall be as specified on plans or riser diagram.

(C) Color Coding

- (1) All branch circuit wire shall be color coded as follows:

<u>Lines (Phase)</u>	<u>208Y/120 Volt</u>
A	Black
B	Red
C	Blue
Neutral	White
Grounding Wire	Green
Neutral (for I.G. circuit)	White with Yellow stripe
Isolated Ground Wire	Green with Yellow stripe

- (2) Feeder cables need not be color coded throughout the length but may instead be identified by colored tapes at each end corresponding to the colors scheduled above.
- (3) Wiring for auxiliary systems and control wires shall be color coded by means of colored stripes or tracers.

(D) Direct burial cable shall be unreeled into trench (not dragged) after all course stones have been removed from base of trench and sand fill laid down. Cables should be snaked slightly to allow for movement and settlement.

(E) Romex, and/or BX cables not permitted to be used in the facility.

(F) MC (Metal Clad) Cable: NEC standard, UL approved may be only used for wiring above suspended ceiling, behind partition walls, crawl spaces, etc., if allowable by the local jurisdiction. Minimum wire size conductor #12 AWG copper, including green insulated equipment ground, galvanized steel or aluminum interlocking cladding, sized in accordance with the NEC. Verify/confirm use of MC cable with Owner Representative prior to any work. Use of MC cable for other specific applications shall be approved by Owner only.

(G) Installment of SJ or SO cord will be allowed for vertical drops from sales ceiling space only, if acceptable by the local code authority. SJ/SO cord length shall be limited to the vertical drop only from the j-box into the luminaire or track fixture, be minimum #12 AWG, and installed in accordance with applicable NEC articles. All terminations at luminaire or track fixture shall be UL listed and labeled for the termination of SJ/SO cord with proper strain relief.

(H) Manufacturers - All wires and cables shall be the products of American, Southwire Co, General Cable, Okonite or General Electric Company.

6. OUTLET AND SWITCH BOXES

(A) All outlet and switch boxes shall be NEC approved type and shall be sized to provide ample

space for wiring devices and conductors. Where the number of conductors and connections exceeds NEC limitations, box extensions shall be used. All boxes shall be standard galvanized or sherardized sheet steel as manufactured by Steel City Electric Company or National Electrical Products Corporation.

- (B) All ceiling outlet boxes for exposed work, acoustical tile ceilings, and furred plaster ceilings shall be 4-inch octagonal, 2-1/8" deep. Provide plaster rings and/or fixture studs as required.
- (C) All boxes for concrete work shall be especially designed for this construction and shall be 3" deep for concrete thickness of 4" or more. Minimum concrete cover shall be 3/4".
- (D) Flush mounted wall outlets shall be 4-inch square boxes or gang boxes, 1-1/2" deep, and shall be provided with suitable extension rings and covers. Outlets shall be carefully aligned so that cover plates will be truly vertical and horizontal.
- (E) Exposed wall or column mounted outlet boxes for convenience receptacles and lighting switches shall be standard, single gang (minimum) utility conduit boxes.
- (F) All boxes shall be rigidly mounted and shall be equipped with suitable screw fastened covers. All raceways entering boxes shall be mechanically and electrically secure. Open knockouts or holes in boxes will not be tolerated but shall be plugged with suitable blanking devices. Boxes shall be cleared of all plaster, dirt, trash, etc. before the installation of any wiring devices and/or before the installation of cover plates.
- (G) All boxes for conduit system shall be installed flush with finished surface with allowable recess for adaptors so that coverplates may be pulled tight against the finished surface.
- (H) Outlet boxes or switch boxes in finished areas shall be mounted flush with wall surface.
- (I) All exposed boxes for conduit system in Sales Area shall be installed above bottom chord of the bar joist as close to the roof deck as possible, unless otherwise noted in plans.

#### 7. TAP OR PULL BOXES

- (A) Pull boxes shall be constructed of code gauge, welded and galvanized sheet steel. Boxes shall be sized in accordance with NEC requirements, and shall be furnished without knockouts; holes for raceways shall be drilled on the job. Where necessary for boxes to be supported away from ceilings or beams, structural steel members shall be provided for supports.
- (B) Where weatherproof sheet steel boxes as called for, the ELC shall furnish and installed code gauge, welded and galvanized sheet steel boxes with cover and all flanges designed to resist the entrance of rainwater. Conduit entrances shall be made by means of threaded hubs mounted by continuous weld on the boxes before galvanizing. Boxes in or below grade or ground floor shall be cast type boxes.

#### 8. WIREWAYS AND TROUGHS

- (A) Underwriters approved metal raceways shall be furnished and installed complete with necessary complement of fittings, connectors and accessory parts. Wireway shall be of the "lay-in" type without standard knockouts and with screw covers for full channel access as manufactured by Square D, Cutler Hammer, Hoffman or Columbia.
- (B) Wireways shall be securely supported by approved methods at 4 ft. intervals. Number of conductors per wireway shall conform to the latest NEC requirements.

#### 9. WIRING DEVICES

- (A) General - All wiring devices shall be of the type indicated below. Color of devices shall be white.
- (B) Switches

- (1) Toggle, single pole, Hubbell 1221-WHI.
  - (2) Toggle, 3-way, Hubbell 1223-WHI.
  - (3) Pilot Light - Neon lights and red jewel, Hubbell 1221PLC.
  - (4) SPST, SPDT, DPST, & DPDT switches as required for special applications shall be of the corresponding model switches as specified above.
- (C) Convenience Outlets
- (1) Duplex Hubbell HBL5352W, 125 volt, NEMA 5-20R.
- (D) Special Purpose Outlets
- As scheduled on drawings.
- (E) Coverplates
- All coverplates in finished areas shall be white colored nylon unless otherwise noted in plans. Coverplates in unfinished areas shall be galvanized steel. Coverplates for outlets in mirrored walls shall be glass mirror type. Coverplates for outlets in simulated stone veneer walls, wood stained surfaces and brick walls shall be brown.
- (F) All wiring devices shall be as specified by Hubbell or equal by Arrow-Hart, Eagle, GE, Leviton, Pass & Seymour or Woodhead.

#### 10. FUSES

- (A) When the feeders or equipment are to be protected with fusible devices, the fuses shall be furnished and installed by the ELC.
- (B) Type of fuses to be used shall comply with the following except as otherwise noted:
- (1) 601 Ampere and Above - Bussmann Type KRP-C, Class L (600V).
  - (2) 0 to 600A - Type LPN-RK (250V) or LPS-RK (600V) Class RK1, or Type LPJ (600V) Class J.
- (C) Ten percent (10%) or a minimum of three (3) spare fuses shall be supplied for each type and ampere rating used for this project. Fuses shall be placed on a fuse clip board or in a fuse box (Bussmann #SFC or equal) to be mounted at the main service panel as directed by Owner's Representative.
- (D) All fuses for the distribution system shall be of the same manufacturer to ensure selective coordination and shall be made by Bussmann Manufacturing Company, GEC-Alsthom, Gould-Shawmut or Littlefuse.

#### 11. MAGNETIC MOTOR STARTERS AND COMBINATION SWITCH-STARTERS

- (A) Except as otherwise noted on the drawings, or specified herein, all magnetic motor starters and combination switch-starters shall be provided by the ELC. The ELC shall install all power wiring from the panel or disconnect switch, through the starter and including final connections at the motor.
- (B) Magnetic starters shall be made by Square D, ITE or Cutler Hammer.
- (1) Type - Full-voltage, non-reversing, across-the-line type, unless otherwise noted.
  - (2) Overload Relays - Three (3) overload protection on all 3-phase motors.
  - (3) Voltage of Holding Coils - Unless factory pre-wired for internal controls and interlock, all motor starters furnished by contractor shall have 120 volt or less holding coils with individual control transformer built within each starter.
- (C) Enclosure - Of the proper type for indoor, outdoor, hazardous, dust tight, watertight

- (D) applications.  
For accessory motor control devices see control diagrams on the drawings.
  - (E) All starters shall be furnished with hand-off-auto control station and pilot light. If not indicated as being remote from the starter, control station and pilot light shall be furnished with starter, mounted in starter cover.
  - (F) Fused and non-fused disconnect switches for combination switch-starters shall comply with specifications below.
  - (G) Auxiliary contacts and devices required for interlock and temperature control work shall be provided by the ELC in accordance with the control requirements. Coordinate with HAC.
12. STARTER AND CONTROLLER PROTECTION
- (A) Starters or controllers, whether furnished with the equipment or by ELC, specifically requiring a certain type or size of overcurrent protection device shall be so furnished with such protection by the ELC.
13. PUSH BUTTON STATIONS
- (A) Push button stations for control of motors shall be heavy-duty industrial type in NEMA type 1 surface enclosure. Pilot lights shall be complete with suitable jewels and, where control voltage requires, shall be equipped with transformer. Push button stations shall be Square D, ITE or Cutler Hammer.
  - (B) Push buttons shall be either momentary, maintained contact, or selector switch type as required. ELC shall verify with HAC for the proper type desired prior to installation for these push buttons.
  - (C) Unless otherwise noted or specified, all push button stations shall be provided by the ELC.
14. FUSIBLE AND NON-FUSIBLE DISCONNECT SWITCHES
- (A) Unless otherwise indicated, all manual operating and disconnect switches for motors and power equipment installed for this project shall be furnished and installed by the ELC.
  - (B) For single phase, 1 HP or smaller motor, use Square D ITE Class 2510, or Cutler Hammer 9101, manual motor switch with pilot light where indicated.
  - (C) For motor load larger than 1 HP, use Square D, ITE or Cutler Hammer horsepower rated switch. Switches shall be heavy duty, industrial type in NEMA type 1 general purpose enclosure, except as otherwise noted or required. Cover shall be interlocked with mechanism to prevent opening unless switch is in "off" position. Switches exposed to weather shall be raintight type.
  - (D) For power load other than motor load, use 15A, AC switch up to 1000 watts, and safety switch, thereafter, made by same manufacturer as in subparagraph (C).
  - (E) Refer to control diagrams on the drawings for accessory devices and additional data.
15. DEVICE AND EQUIPMENT MOUNTING
- (A) Location of Outlets - Unless otherwise specifically dimensioned on the drawings, the location for lighting fixtures and outlets shown on drawings is only schematic. ELC shall exercise great care in locating the outlets during roughing-in period. When the locations of outlets are shown in the detailed drawings on architectural elevations and details, these shall be followed. Device locations in showroom/sales area to be confirmed with owner representative prior to installation. When in doubt, check with Owner's Representative for instructions prior to roughing-in.
  - (B) Mounting
    - (1) Unless otherwise indicated, protective devices shall be mounted with top of power panel or enclosure 94 inches above finished floor, shall be properly aligned, and shall be adequately supported independently of the connecting raceways.

- (2) Flush mounted switch outlets shall be mounted 4'-0" above floor. Flush mounted receptacle shall be mounted 1'-6" above the finished floor except as otherwise indicated on drawings. Flush mounted telephone and computer outlets heights vary. Refer to drawings for exact mounting heights.
  - (3) RTU sensor J-boxes shall be mounted at 7'-0" above floor, 1'-0" off end of partitions. RTU duct smoke detector remote test switches shall be mounted at fire alarm panel in Electrical room.
  - (4) Motor controllers shall be mounted with centerline of operating lever 6'-6" maximum above floor.
  - (5) All devices or equipment mounted on steel columns shall be mounted on the column web (between flanges) for protection.
  - (6) Lighting and receptacle panelboards shall be mounted with center of panel 4'-6" above finished floor, except that topmost circuit operating handle shall not be more than 6'-6" above floor. Adjust as required.
  - (7) All wiring devices, electrical enclosures and panels in finished areas shall be flush mounted.
- (C) Perform following tests and inspections and prepare test reports:
- (1) Upon completion of the ground rod installation, the Electrical Contractor shall perform test by fall-of-potential method according to IEEE 81. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within forty-eight hours of rainfall and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other means of reducing natural ground resistance.
  - (2) If the resistance to ground exceeds 6 ohms, additional rods shall be driven and bonded together, until a reading of 6 ohms or less to ground is obtained. Submit directly to the Project Manager two (2) copies of each test report certified by the testing Technician and the Electrical Contractor.
- (D) All applicable codes, regulations, etc. shall take precedent over the above mounting heights in the event of a conflict. Mount per applicable requirements.
- (E) Access to and workspace around panels and equipment shall be in accordance with the latest edition of the NEC.

## 16. VIBRATION CONTROLS

- (A) General - It shall be the responsibility of the ELC to install all conduits and boxes avoiding direct contact with any piping or mechanical equipment which is the source of vibration or the cause of vibration transmission. Any installation by ELC which does not comply with this general principle shall be corrected at Contractor's expense.
- (B) Transformers
- (1) When connection is made with conduits and wires a minimum of 18 inches of flexible conduit shall be used.
  - (2) All floor-mounted transformers shall be supported on rubber-in-shear mounts capable of providing approximately 0.25 inch of static deflection when loaded.
  - (3) Small column or wall mounted power transformers shall be bolted to steel channels through rubber grommets.
- (C) Conduit Connection to Equipment
- (1) In general, all conduit connections to air conditioning, plumbing or building, or any

rotating or oscillating equipment requiring electric motors, shall be made with flexible conduits. All flexible conduits shall be Anaconda "Sealtite".

- (2) The length of flexible conduit required for each motor shall be based upon the requirements for a 360-degree loop in the conduit between the electrical motor and electrical box. When flexible conduit is not use, a neoprene or rubber bushing between the conduit and the electric motor to break the metal-to-metal contact shall be installed. A flexible ground strap shall be provided to complete the electrical ground where required.
- (D) Holes and Openings - Openings around conduits, wireways, etc., where walls or floors are pierced shall be wrapped with fiberglass insulation and shall be grouted on both sides of the opening. Grouting shall be made flush with finished surfaces.
- (E) Isolator Description and Manufacturers
  - (1) Type of Isolators
    - (a) To be used for isolation of transformers.

Molded neoprene units equipped with leveling bolts. Units shall be Mason Industries Type "ND", Amber Booth or Consolidated Kinetics Corporation sized for .35-inch static deflection.
    - (b) Type W - To be used for isolation of switchboards or control cabinets.

Loading of molded neoprene pads shall be limited to a static deflection of 0.03 to 0.06 inch. The area of pad shall be selected to match the load with manufacturer's recommended unit loading. An auxiliary steel plate may be required to distribute the load uniformly over the pad area.

#### 17. EQUIPMENT, RACEWAY AND WIRING IDENTIFICATION

- (A) General - All interior exposed raceways, wiring and equipment shall be suitably identified by the ELC. The ELC shall provide access to and shall open boxes, etc., as required, at time of final inspection to satisfy Owner's Representative that the proper identification procedures for conductors, etc., have been adhered to.
- (B) Conductors
  - (1) All conductors on circuits 600 volts and below shall be color coded as specified hereinafter. Color coding shall be by means of colored insulating material, colored braid or jacket over the insulation, or by means of suitable colored permanent, non-aging, insulating tape equal to Scotch #471 to "Texcel 98" applied to conductors at each outlet, cabinet or junction point.
  - (2) Wire markers shall be applied to each conductor or cable within panelboards, motor starter enclosures, circuit breaker enclosures, disconnect switches, cabinets, junction boxes, pull boxes, and other similar equipment identifying the serving equipment and feeder or branch circuit from which the conductors originate.
- (C) Equipment
  - (1) The ELC shall furnish and install engraved laminated micarta nameplates for electrical equipment as specified hereinafter. Lettering shall be approximately 1/8 to 3/16 inch in size. Plates shall be black surface and white core to produce white letters. Where equipment is not suitable for mounting the nameplate thereon, by bolting or riveting, the Contractor shall furnish a No. 14 gauge steel plate, painted black, to which the nameplate shall be bolted or riveted and which shall be suitably fastened to the equipment or mounted immediately adjacent thereto.
  - (2) All push button stations, control switches, selector switches, motor controllers, air circuit breakers or safety switches, etc., shall be provided with nameplates as described in the previous paragraph. Such nameplates shall clearly identify by name the equipment controlled and shall state any special operating instructions

which may be indicated on the drawings. All nameplate designations shall be subject to the approval of Owner's Representative.

- (3) All switchboard equipment, factory-built control panels, breaker panels, etc., shall be equipped with suitable nameplates as specified under these individual headings.

18. TEST

- (A) Prior to the start-up of any systems, ELC shall carefully check all devices and manufacturer's instructions for the proper procedure of start-up.
- (B) Check service entrance voltages and inform electric utility of any over-voltage or under-voltage conditions. Check ground conditions and grounding resistance. Check system for proper phasing.
- (C) Balance all single-phase loads at panelboards. The total connected load on each leg of the panel shall not vary more than 10 percent. If they vary more than 10 percent, the branch circuit connections shall be redistributed at the panels by exchanging the circuit wires from the branch circuit protective devices until the above conditions are satisfied.
- (D) Replace all burned out lamps at the completion of work.
- (E) Check all auxiliary systems in accordance with manufacturers' instructions prior to operating in systems.
- (F) Make all necessary field adjustments and set all protective relays and devices in accordance with instructions provided by the Owner. Fully coordinate all external connections to the equipment with the equipment manufacturer.
- (G) ELC shall megger each motor winding before energizing the motor. The insulation resistance shall be recorded based on winding temperatures and voltage information furnished by Owner. ELC shall submit recorded insulation resistance and notify Owner of all motors with low insulation resistance in order that these motors may be replaced.
- (H) ELC shall perform such test as are required by utility on service entrance cables.

19. OPERATING TESTS

- (A) In addition to any other tests herein specified, the systems, after completion, shall be tested in operation for at least fifteen (15) days and shown to be in satisfactory operating condition.
- (B) Should any of the equipment or apparatus, furnished by the Contractor, require the service of a Factory Representative for installation or placing in proper service and/or adjustment, the Contractor shall provide same without additional cost to the Owner. Refer to Division 1 of these specifications.
- (C) The Contractor shall furnish to the Owner two (2) sets of instruction books and spare parts lists, bound in brochure form, covering each item of equipment furnished under the contract.

20. CLEANING

- (A) During construction, for all work furnished and/or installed under his contract, ELC shall clean and/or protect interiors of all equipment devices, raceways, etc., from dust, dirt, cuttings or other foreign matter before closing of finished work.

21. TEMPORARY LIGHT AND POWER

- (A) If required, the GC shall arrange with the utility company to provide a temporary construction service for temporary light and power. Location to be at the GC's field office remote from the building.
- (B) The GC shall furnish and install a temporary panel at the above location. Temporary light stringers with double pigtail sockets and temporary power stringers and outlets shall be

installed by the ELC as required by the GC for the various trades.

- (C) The ELC shall lamp all sockets originally and shall maintain system during working of all trades. Subsequent lamping and fuses shall be furnished by the GC.
- (D) The GC shall pay for all energy consumed and any other charges by the Utility Company.
- (E) The ELC shall remove all temporary equipment and wiring when it is no longer required and when directed to do so by the GC.

22. PROTECTION AND INSTALLATION

- (A) All electrical equipment and materials stored on the site shall be suitably sheltered from the elements. All materials and items subject to moisture damage shall be stored in dry, heated spaces. All equipment shall be protected against dirt, water, and corrosive or mechanical damage and theft.
- (B) All electrical systems and equipment shall be stored, protected, installed, tested, adjusted and started up in strict accordance with the manufacturer's directions and instructions. Each Contractor shall promptly notify the Engineer of any conflict between any requirement of the Contract Documents and the manufacturer's instructions and shall receive the Engineer's written instructions before proceeding with the work. Any work that does not comply with the manufacturer's instructions or such written instructions from the Engineer shall be corrected by the Contractor at no increase in the contract amount of additional cost to other trades.
- (C) If the size of any conduit, conductor, switch, breaker, enclosure or related accessories or the location of any fixture or device is not clearly evident on the Drawings, the Contractor shall request clarification from the Engineer prior to proceeding with the work.
- (D) All electrical equipment shall be installed in a rigid and secure manner and shall be installed plumb, level, and square with the building, unless otherwise indicated on the drawings or specified herein.
- (E) All penetrations through fire rated walls, ceilings, floors, etc. shall be sealed with an approved material which is listed for the application and fire rating.

-END OF SECTION