

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes masonry required to complete the Work
- B. Options
 - 1. Where “stone” is indicated built into masonry, provide either cast stone as specified or limestone as specified at contractor’s option.

1.2 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's specifications and instructions for reinforcing and accessory materials and proprietary materials.
- B. Shop Drawings:
 - 1. Submit Shop Drawings for stone in the form of cutting and setting drawings showing size, profiles, locations and anchoring.
 - 2. Submit shop drawings for reinforcing detailing, fabrication, bending and placement of reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, control joints and arrangement of masonry reinforcement.
- C. Samples - Mortar:
 - 1. Submit samples of colored mortar, showing the range of color which can be expected in the finished Work.
- D. Samples - Concrete Masonry Units (CMU):
 - 1. Submit 3 samples of each type of CMU unit. Select units to show the range of color and texture which can be expected in the finished Work.
 - a. Submit test reports conducted within last 6 months in accordance with ASTM C 140 demonstrating specification compliance.
- E. Samples - Brick:
 - 1. Submit 3 samples of exposed brick to Architects. Include the full range of exposed color and texture to be expected in the completed Work.

- a. Submit test reports for test conducted on the brick proposed for use not more than twelve (12) months before submittal in accordance with ASTM C 67 demonstrating specification compliance. Include initial rate of absorption.
 2. Submit sufficient samples of each brick and other masonry unit to be utilized to the mortar batch plant, representing the full range of exposed color to be expected in the completed Work to construct prisms consisting of not more than 7 bricks for each different brick and brick combinations as they occur in the Work.
- F. Samples - Stone: Submit three samples, approximately 4-inch by 6-inch by 1-inch thick having proposed finish and color. Include the full range of exposed color and texture to be expected in the completed Work.
- G. Test Reports: Submit material test reports from a qualified independent testing laboratory complying with ASTM C 1093 to be employed and paid by Contractor with affidavits/certifications indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
1. Mortar to comply with physical properties requirements set forth in ASTM C 270.
 2. Clay masonry to comply with the physical properties requirement set forth in ASTM C 216. Test report shall include compressive strength, 24 hour soak, 5 hour boil, saturation coefficient, efflorescence, and IRA (suction) tests.
 3. Concrete masonry units to comply with physical properties requirement set forth in ASTM C 90.
- H. Certification: Plant mixed mortar and plant mixed grout: Submit statement from provider for each different cement product, name of manufacturer, brand, type and weight slips at the time of delivery for each 20 tons of mortar and grout.
- I. Certification; Ground-Face CMU: Submit certification from the producer of the Ground-Face CMU stating that the units to be provided meet the soiling and cleanability requirements of ASTM C 744.
- J. Insulation Certification: Submit a certification signed and dated by the insulation installer listing the type of insulation installed, the manufacturer, and R-value.
- K. Certification, Reinforcing Bar: submit certification indicating each material and grade.
- L. Certification, Joint Reinforcing: submit certification indicating type and size of joint reinforcement.
- M. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content
 2. Product Data for Credit MR 5: For products and materials required to comply with requirements for regional materials, documentation indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 QUALITY ASSURANCE

A. Materials:

1. Do not change source or brands of masonry mortar materials during the Work.
2. Obtain concrete masonry units (CMU) from one manufacturer, cured by one process and of uniform texture and color, for each type required for each continuous area and visually related areas.

B. Fire-Resistive ratings: Provide materials and construction identical to those of assemblies with fire-resistive ratings determined per ASTM E 119 by a testing and inspection agency, by equivalent concrete masonry thickness, or other means, as acceptable to authorities having jurisdiction.

C. Regulatory Requirements: Comply with the applicable requirements of governing authorities and codes.

D. Unit Masonry Standard: Comply with TMS602/ACI530.1/ASCE6 current edition "Specifications for Masonry Structures," except as otherwise specified.

E. Coordination: Review installation procedures and coordinate with other Work that must be integrated with masonry.

F. Job Mock-Up: Prior to installation of masonry work, contribute to the project mock up shown or specified in 01410 Preconstruction Mock Up. Build mock-up at the site, where directed, of full thickness unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed Work..

1. For cavity wall construction, construct the entire wall profile showing face brick, cavity, cavity wall insulation, concrete masonry unit backup, a grouted concrete masonry cell with reinforcing bar simulating a grout key, horizontal joint reinforcing, ties, base flashing, along base at corner condition, weep hole ventilators, and a typical lintel and sill showing flashing with end dams.

G. Preinstallation Conference: Conduct preconstruction conference at the project site.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

A. Masonry Protections:

1. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - a. Where one wythe of multi wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
2. Do not apply uniform floor or roof loads or concentrated loads for at least 3 days after constructing masonry walls or columns.
3. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry.
4. Protect base of walls from rain-splashed mud and mortar splatter.
5. Protect sills, ledges, and projections from grout and mortar droppings.
6. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from grout and mortar droppings.

B. Frozen Materials: Do not use frozen materials or materials mixed or coated with ice or frost.

C. Frozen Work: Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.

D. Cold Weather Construction: Comply with the cold weather requirements indicated in TMS 602/ACI 530.1/ASCE 6 and the following when the ambient temperature falls below 40 deg F or the temperature of masonry units is below 40° F, comply with the following:

1. Temperature of masonry units shall not be less than 20 deg F when laid in the assembly. Remove visible ice on masonry units before using the unit.
2. Heat mortar sand or mixing water to produce mortar temperatures between 40 deg F and 120° F at the time of mixing. Maintain mortar above freezing until used in masonry.
3. Use heat sources where ambient temperatures are between 20 deg F and 25 deg F, on both sides of the masonry under construction and install wind breaks when wind velocity is in excess of 15 mph.
4. Where ambient temperatures are below 20 deg F, provide an enclosure for the masonry under construction and use heat sources to maintain temperatures above 32 deg F within the enclosure.
5. Where mean daily temperatures are between 32 deg F and 40 deg F protect completed masonry from rain or snow by covering with a weather resistive membrane for 24 hours after construction.
6. Where mean daily temperatures are between 25 deg F, and 32 deg F completely cover completed masonry with a weather resistive membrane for 24 hours after construction.
7. Where mean daily temperatures are between 20 deg F and 25 deg F, completely cover completed masonry with insulating blankets or equal protection for 24 hours after construction.

8. Where mean daily temperatures are below 20 deg F, maintain masonry temperature above 32 deg F for 24 hours after construction by enclosure with supplementary heat, by electric heating blankets, by infrared heat lamps, or by other acceptable methods.
- E. Hot Weather Construction: When the ambient air temperature exceeds 90° F with a wind velocity greater than 8 mph, do not spread mortar beds more than 4 feet ahead of laying masonry units and set units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Brick:

1. Face brick: Conforming to ASTM C 216, Grade SW, Type FBX having a maximum IRA of 30g/min-30 square inches. (See drawings or designations of Brick Types.)
 - a. Brick Type "A": (light Colored), Stacked Bond
 - 1) 280-284 A. The Belden Brick Company or #855I/S smooth utility size from Harmar Brick"
 - 2) Size: Utility Brick
 - 3) Brick shall be manufactured within 500 miles from the Project site from raw materials harvested within 500 miles of the Project site.
 - b. Brick Type "B": (dark colored), Running Bond
 - 1) Sienna Ironspot Smooth, Endicott Clay Products, or Fine Art smooth vintage brown smooth utility size, Sioux City Brick
 - 2) Size: Utility Brick.
 - 3) Where feasible, Brick shall be manufactured within 500 miles from the Project site from raw materials harvested within 500 miles of the Project site.
 - c. Brick Type "C": To match existing brick being repaired.
 - 1) Modular Sunburst Blend A 11-32 by The Belden Brick Company, or Gas Burn #224/220 Modular Size by the Sioux City..
 - 2) Brick shall be manufactured within 500 miles from the Project site from raw materials harvested within 500 miles of the Project site.
2. Match color and texture of samples on file, obtain acceptance of Architect.
3. Provide special shapes required to avoid exposing coring or where exposed faces do not match uncut faces.
4. Minimum net area compressive strength 1900psi per ASTM C 90.

B. Concrete Masonry Units (CMU):

1. Size: Nominal face dimensions of 16 inches long by 8 inches high (15-5/8 inches by 7-5/8 inches actual), unless otherwise indicated.

2. Special Shapes: Provide for lintels, corners, jambs, sash, control joints, headers, bonding, scored units and other special conditions.
 - a. Provide bullnose block for outside corners, unless otherwise indicated.
 - b. Provide squared edge block for other areas indicated.
 - c. Special Scored face block. Provide scored units for "Double Half" appearance, with concave joint in face of unit to match installed mortar joint. See drawings for locations
3. Hollow and Solid CMU: ASTM C 90 minimum net area compressive strength of 1900 PSI.
 - a. Medium weight: provide units having dry weight not exceeding 125 pounds per cubic feet.
4. LEED Requirements: Provide each product meeting the following minimum requirements:
 - a. Replacement of a minimum 10 percent of the Portland Cement with Fly Ash and other pozzolans manufactured within 500 miles of the Project.
 - b. The product has been manufactured within 500 miles of the Project from raw materials harvested or extracted within 500 miles of the Project.

C. Materials - Mortar and Grout:

1. Portland Cement: ASTM C 150, Type I.
2. Masonry Cement: Not acceptable.
3. Lime: ASTM C 207, Type S.
4. Aggregate for Mortar: Sand, ASTM C 144, except for joints 1/4 inch and less (if any) use aggregate graded with 100 percent passing the No. 16 sieve.
5. Water: Clean, free of deleterious materials which would impair strength or bond.
6. Aggregate for Grout: ASTM C 404.
7. Pointing Mortar: Bagged Ceramic Tile Grout (sanded), to be mixed with an acrylic latex additive and manufactured by one of the following:
 - a. Hydroment by Bostik.
 - b. Laticrete International.
 - c. Custom Building Products.

D. Mortar Pigment: Compounded for use in mortar mixes by one of the following:

1. Bayer Corporation, Industrial Chemicals Div.: Bay ferrox Iron Oxide Pigments.
2. Davis Colors; True Tone Mortar Colors.
3. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
 - a. For use with Type B brick: Color 37, or similar to match Architect's sample.
 - b. For use with Type C brick: where necessary to match adjacent, existing mortar.

E. Reinforcing Bars: ASTM A 615, Grade 60.

1. Where reinforcing bars are used, provide rebar positioners.
2. Where indicated on drawings, use epoxy coated reinforcing.

F. Continuous Wire Reinforcing:

1. Provide welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner ("L") and intersection ("T") units. Fabricate from steel wire complying with ASTM A 82, with deformed continuous side rods and plain cross rods, with unit width of 1-1/2 inches to 2 inches less than thickness of wall or partition.
2. For single wythe masonry, provide units fabricated as follows:
 - a. Ladder type fabricated with single pair of side rods and perpendicular cross rods spaced not more than 16 inches O.C.
3. For multi-wythe masonry, provide units fabricated as follows:
 - a. Use tab design with single pair of side rods and rectangular box eye-type cross tie of lengths required to extend through insulation and drainage material spaced not more than 16 inches O.C.; with side rods spaced for embedment within each face shell of backup wythe with loose pintle type ties extended to engage the outer wythe by at least 1 ½ inches. Similar to Dur-o Wall Lular-eye. Anchors portion shall have a maximum offset not to exceed 1-1/4 inch.
4. Wire: Fabricate with 9-gauge side and cross rods, unless otherwise indicated.
 - a. Provide zinc-coated (galvanized) wire ASTM A 641 for interior partitions.
 - b. Provide hot-dipped galvanized finish after fabrication, ASTM A 153, Class B-2, (1.5 ounce per square foot) for exterior walls.
 - c. Provide Stainless Steel wire where indicated on the drawings.

G. Anchoring Devices:

1. Adjustable Anchors: Provide adjustable anchors which will permit horizontal and vertical movement of masonry but will provide lateral restraint, and as follows:
 - a. For anchorage to steel framework, provide V-shaped 3/16 inch wire tie sections sized to extend to within 1 inch of face of masonry, hot-dipped galvanized finish conforming to ASTM A 153, Class B-2, (1.5 ounce per square foot).
 - b. Furnish to steel fabricator for installation on web of steel members where masonry anchors are indicated on the drawing, and where masonry passes or abuts the member 1/8 inch (3.19mm) 7 inch high receptor angle having slotted flange, 5 inch slotted hole in one leg located 3/4inch from edge of angle to receive wire tie section similar to Dur-O-Wall D/A 700 series triangular ties or equivalent.
 - c. Furnish to steel fabricator for installation on flange of steel member where masonry anchors are indicated on the drawings and where masonry passes or abuts the member. Provide ¼ inch crimped wire anchor in 8-foot lengths for welding to steel flange to receive wire tie section similar to Dur-O-Wall D/A 700 Series triangular ties or equivalent.
 - d. For anchorage of concrete masonry to concrete masonry at control joints provide joint stabilizing anchor similar to Dur-O-Wall D/A 2200 or equivalent. For anchorage of concrete masonry wall to non-load bearing concrete masonry walls, provide wire mesh hardware cloth masonry ties complying with ASTM A185.

2. Stone Anchors: Fabricate cramp anchors and dowels of stainless steel. Provide minimum 3/16 inch thick cramp anchors and minimum 3/8 inch diameter dowels. Pre-drill dowel locations to prevent cracking.

H. Accessory Materials:

1. Bond Breaker Strips: 15 lb. asphalt impregnated building felt.
2. Pre-Molded Control Joint Strips: Solid rubber or PVC strips with a minimum Shore A durometer hardness of 70, designed to maintain lateral stability in masonry wall.
3. Compressible Filler: Expanded polyethylene.
4. Expansion Joint Filler: Closed cell neoprene 3/8 inch thick with peel off pressure sensitive adhesive on one side similar to Dur-O-Wall D/A 2010, rapid-soft joint or Hohmann & Barnard # NS Joint.
5. Weep-hole Ventilator: Continuous cellular flexible, ultraviolet resistant polypropylene. Dur-O-Wall Cell Vent, D/A 1006 or Hohmann & Barnard # QV vent width and height the same as brick head dimension. Color selected by Architect.
6. Precompressed Expansion for Sealant: Emseal 25
7. Mortar Collection Device: Free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings, thickness required to fill cavity.
 - a. Mortar Break; Advanced Building Products.
 - b. CavClear Masonry Mat; CavClear.
 - c. Mortar Net; Mortar Net.
 - d. Mortar Stop; Polytite.
8. Loose fitting 3/8" cavity drainage material to fit between vertical leg of the loose-angle veneer lintel and back of brick to prevent clogging of thru-wall flashing.

I. Through-Wall Flashing:

1. Rubberized Asphalt Sheet Flashing: Manufacturer's standard composite flashing product consisting of minimum 26-mil-thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 4-mil-thick, high-density, cross-laminated polyethylene film to produce an overall thickness of 30 mils. Manufactured by Carlisle, W. R. Grace, Illinois Products Corp. or Polyguard.
 - a. At drips, provide minimum 2 inches wide by 0.015 inch thick continuous stainless steel with one side hemmed edged and bent down 1/4 inch (at 45°) to form a drip. Stainless steel to be 304 or 316 grade.
 - b. Provide stainless steel edge for construction adhesive on top of foundation walls.
 - c. Provide prefabricated pre-formed corner boots of rubberized asphalt flashing material for outside corners and flashing end dams at lintels, sills, inner corners and all other types of end terminations.
 - d. Provide mastic and primer recommended by the flashing manufacturer

J. Cavity Wall Insulation:

1. Foil-faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2 or having the R-value stamped on the board faces. Minimum R Value: 6.7 per inch.

- K. Limestone: Kansas Wheat, or Kansas Silverdale limestone, or Indiana oolitic limestone as quarried in Lawrence, Monroe, and Owen counties, Indiana. Stone to comply with ASTM C 568, Category II (medium density); and matching standards of the Indiana Limestone Institute of America's "Indiana Limestone Handbook" for the following:
 - 1. Grade: (Select)
 - 2. Color: to match Illinois Brick Company: Kansas Limestone Wheat
 - 3. Finish: (Smooth)
 - 4. Cut: standard.

- L. Cavity Insulation with Integral Drainage Matting
 - 1. Insulation: Polyisocyanurate rigid board insulation as specified.
 - 2. Drainage Matting: fluid conducting-non-absorptive mold resistant high impact dimpled styrene drainage panel with permeable-face or polymer mesh consisting of woven textile product in random pattern having voids no greater than 1/4 inch in diameter bonded to the entire face of the insulation board by the manufacturer. Matting shall be integrally bonded to the entire face of the rigid board insulation by the manufacturer and shall be suitable for substantially continuous installation within the full height of the wall cavity.
 - a. Drainage mat thickness: 3/8 inch or 1/2".
 - 3. Masonry mat thickness shall allow no more than 5/8 inch tolerance between masonry mat and the masonry wythe.
 - 4. Products:
 - a. Thermadrain; Thermadrain, Inc.
 - b. CavClear Insulation System: Archovations, Inc.
 - 5. Adhesive: Type recommended by insulation board manufacturer and air barrier for application indicated.

2.2 MORTAR MIXES

- A. General in areas of work at existing building masonry wall and for areas of Brick only: Mortar for Unit Brick Masonry, comply with ASTM C 270, Proportion Specifications for Type "N" portland lime mortar (1:1:6) except where indicated otherwise
 - 1. Provide only plant mixed mortar as specified.

- B. Mortar for Unit Brick Masonry: Provide only premixed, pre-bagged mortar supplied from plant.
 - 1. Comply with ASTM C 270, proportion specification for type "N" indicated in table 1.
 - 2. Minimum compressive strength of mortar 750 psi.
 - 3. Provide only plant mixed mortar as specified. Mortar manufacturer must provide test results indicating the mortar's compliance with this specification.
 - 4. When used in brick, colored mortars are to be selected by the architect to match masonry units.

- C. Mortar for Concrete Unit Masonry:

1. Portland Cement: ASTM C 150, Type I.
2. Masonry Cement: ASTM C 91.
3. Lime: ASTM C 207, Type S.
4. Aggregate for Mortar: Sand, ASTM C 144 or ASTM C 404, Size No. 2, except for joints 1/4" and less (if any) use aggregate graded with 100% passing the No. 16 sieve.
5. Water: Clean, free of deleterious materials which would impair strength or bond.
6. Aggregate for Grout: ASTM C 404.

D. Grout: Portland cement, sand, gravel and water, proportioned as required ASTM C 476 to provide a 28-day minimum compressive strength of 2000 psi. Mix grout to obtain on 8 inches to 10 inches slump unless otherwise indicated.

1. At the contractors option, Self Consolidating Grout (SCG) can be used and must meet ASTM C 476 and the following requirements:
 - a. T20 between 2 to 5 seconds.
 - b. Visual Stability Index (VSI) to be zero.
 - c. A total spread range between 22 inches to 30 inches when mixed with the appropriate amount of water.

E. Plant Mixing Mortar and Grout:

1. Proportion mortar to comply with required type per ASTM C 270.
 - a. Have tests conducted by independent laboratory for compressive strength and bond strength for each masonry composite and submit results.
 - b. If specified compressive strength cannot be obtained by adjusting mortar mix within specified range of the mortar type specified, immediately notify the Architect and provide recommendations.
 - c. Conduct separate tests for each brick and separate tests utilizing different brick or other masonry units as combination occurs on the job.
2. Dry mix materials utilizing equipment designed to insure uniform blending and precision measuring devices to insure uniformity from batch to batch.
3. Deliver and maintain at site bulk dry blended ingredients in enclosed container.
4. Add only clean water at the site.
5. Provide required certificates.

2.3 STONE FABRICATION

- A. Fabricate to profiles. Provide holes and sinkages as required.
- B. Fabricate in lengths shown, or if not shown, in approximately 4 foot sections. Allow for 3/8 inch joints. Provide drips and wash surfaces on all projecting portions.
- C. Provide minimum two cramp anchors at top and bottom between panel units and minimum 2 dowels per coping and sill unit.
- D. Provide mitered corners.

2.4 FIELD QUALITY CONTROL

- A. Owner will employ a testing laboratory experienced in performing types of masonry field quality control tests for engineered masonry indicated.
 - 1. Perform the following field tests, a minimum of 3 sample each, per 5000 square feet of wall area.
 - a. Mortar compression test per ASTM C 780.
 - b. Grout prism test per ASTM C 1019.
 - c. Concrete masonry prism test per ASTM C 1314.
 - d. Flexural bond strength of brick when brick are structural test per ASTM C 1072.
 - e. Cone slump test for grout as required.
- B. Evaluation of Quality Control Tests: Masonry work, in absence of other indications of noncompliance with requirements, will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- C. Start of work will evidence acceptance of conditions.

3.2 PREPARATION

- A. Lay out partitions on floors and locate door frames.
- B. Reinforcing: Remove loose rust, ice and contaminates before placing units.

3.3 INSTALLATION

- A. Tolerances: Erect masonry within the following tolerances from the specified dimensions:
 - 1. Dimension of elements.
 - a. In cross section or elevation -1/4 in., +1/2 in.
 - b. Mortar joint thickness
 - Bed ±1/8 in.
 - Head -1/8 in., +1/4 in.
 - Collar -1/4 in., +3/8 in.
 - c. Grout space or cavity width -1/4 in., +3/8 in.

2. Elements

- a. Variation from level:
 - Bed joints $\pm 1/4$ in. per 10 ft.
 $\pm 1/2$ in. maximum
 - Top surface of bearing walls $\pm 1/4$ in. per 10 ft.
 $\pm 1/2$ in. maximum
- b. Variation from plumb $\pm 1/4$ in. per 10 ft.
 $\pm 3/8$ in. per 20 ft.
 $\pm 1/2$ in. maximum
- c. True to a line $\pm 1/4$ in. per 10 ft.
 $\pm 3/8$ in. per 20 ft.
 $\pm 1/2$ in. maximum
- d. Alignment of columns and walls (bottom versus top)
 - $\pm 1/2$ in. for bearing walls
 - $\pm 3/4$ in. for non-bearing walls

3. Location of elements

- a. Indicated in plan $\pm 1/2$ in. per 20 ft.
 $\pm 3/4$ in. maximum
- b. Indicated in elevation $\pm 1/4$ in. per story height
 $\pm 3/4$ n. maximum

4. In placing of reinforcement (See Article 3.4E of ACT 530.1)

B. Installation, General:

1. Comply with TMS 602/ACI 530.1/ASCE 6 Current Edition and this Specification.
2. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match Work immediately adjacent to the opening.
3. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide required pattern and to fit adjoining Work neatly. Use full-size units without cutting wherever possible.
4. Lay out 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.
5. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
6. Where shown or scheduled, provide special units and bond.
7. Lay all other exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below (except in one - third running bond where required by unit size).

8. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than 4 inches horizontal face dimensions at corners or jambs.
9. Discard units with cracked faces, chipped edges, or corners or other defects that affect appearance or performance.

C. Mortar Bedding and Jointing:

1. Lay brick and other solid masonry units with solidly filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
2. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed cross webs in mortar in starting course and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced and filled with grout.
3. Maintain joint widths except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8 inch joints.
4. Tool exposed joints as a Weathered Joint (according to The Brick Industry Association), except as otherwise shown.
5. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
6. Remove masonry units disturbed after laying; clean and reset 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.
7. Remove mortar protruding into cells of CMU, which are to be grouted.

D. Stone Work: Set units in full bed of mortar with all vertical joints full. Fill dowel, anchor and similar holes solid. Wet joint surface thoroughly before setting; for surfaces which are soiled, clean bedding and exposed surfaces with fiber brush and soap powder followed by thoroughly rinsing with clear water.

1. At copings and sills and where stone joints are shown to be sealed or caulked, install head joints free of mortar.

E. Composite Walls:

1. Fill the collar joint solidly with mortar by parging the in-place wythe and laying units into the parging.
2. Provide weephole ventilator in head joints of exterior wythe of composite wall located immediately above ledges and flashing, spaced maximum 2 feet O.C. and recess 1/8 inch from face of masonry.
3. Install weephole ventilation so that the back of the ventilation comes into contact with the interior wythe surface

F. Cavity Walls:

1. Keep cavity clean of mortar droppings and other materials during construction.
2. Tie exterior wythe to back up with continuous horizontal joint reinforcing as specified.
3. Provide weephole ventilator in head joints of exterior wythe of cavity wall; locate immediately above flashing, space maximum 2 feet O.C. and recess 1/8 inch from face of masonry.

4. Install weep hole ventilation so that the back of the ventilation comes into contact with cavity drainage material surface.
5. Cut units of insulation to fit tight to each other, reinforcing and abutting construction, install small pads of adhesive spaced approximately 1 foot O.C. both ways on inside face or attach to inside face with plastic fasteners secured to wire ties. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
6. Install mortar collection device at all through wall flashing locations. Provide units the full width of the cavity with ends butted to provide continuous coverage and provide paths for moisture to reach weeps.

G. Stopping and Resuming Work:

1. Rake back 1/2 unit length for one half running bond or 1/3 unit length for one-third running bond in each course; do not tooth, stop and resume brickwork and CMU at control or expansion joints. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

H. Built-In Work:

1. As the Work progresses, build in items specified under this and other Sections and as required to complete the Project. Fill in masonry solidly 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. Fill cores in hollow units with grout minimum 3 courses (24-inches) under bearing plates, beams, lintels, posts and similar items unless otherwise indicated.

I. General:

1. Place all anchors and ties, for secure anchorage and bonding of masonry.
2. Install anchors, ties and joint reinforcement to achieve full mortar encapsulation. Lap joint reinforcement minimum of 6 inch at end of 10 feet sections.
3. Embed anchors and ties at least 1/2 inch in mortar of outer face shell of hollow units and 1-1/2 inch in mortar of solid masonry.
4. Provide minimum of 5/8 inch mortar cover for anchors, ties, and longitudinal wires of joint reinforcement when exposed to earth or weather and 1/2 inch mortar cover when not exposed to earth or weather.
5. Do not disturb or bend ties or anchors after embedding in grout or mortar.
6. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
7. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections for single wythe CMU walls.

J. Anchors:

1. Anchor masonry to structural members as detailed on drawings, such members to comply with the following:

- a. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
- b. Anchor masonry to structural members with metal anchors embedded in masonry joints and attached to structure.
- c. Space anchors as indicated, but not more than 16 inches O.C. vertically and 32 inch O.C. horizontally.

K. Ties and Joint Reinforcement:

1. For stacked and Running Bond: Bond masonry wythes to back up with specified continuous wire reinforcing at 16 inch O.C. vertically and 36" o.c. horizontal. Alternate courses staggered.
2. For Stacked Bond: Bed Joint reinforcement to provide a minimum area of horizontal reinforcement of 0.0003 times the vertical cross-sectional area of the wall.
 - a. Achieve by either of the following:
 - 1) Using bond beams spaced not more than 48 in. on center,
OR
 - 2) Using joint reinforcement of at least one wire size W1.7 (9 gauge) (MW11) or larger, spaced at a maximum of 18in. on center vertically.

L. Control and Expansion Joints:

1. General: Provide horizontal and vertical expansion, control and isolation joints in masonry where shown. Provide related masonry accessory items as the masonry work progresses. Do not span joint reinforcement or other obstructions through movement joints unless provisions are made to prevent in-plane restraint of wall movement.
2. Vertical and Horizontal Expansion Joints in Brick: Leave joints open for installation of joint filler, backer rod and sealant.
3. Control Joints in concrete block: Install preformed control joint gaskets designed to fit standard sash block where indicated on drawing or form a continuous vertical joint in CMU and rake mortar joint back 3/4 inch and provide backer rod and sealant.

M. Lintels:

1. Install steel lintels. Plumb and level.
2. Provide masonry lintels where shown and wherever openings of more than 1 foot are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
 - a. Unless otherwise shown, provide one horizontal reinforcing bar for each 4-inch of wall thickness, of size number not less than the number of feet of opening width.
 - b. For hollow masonry unit walls, use U-shaped lintel units with reinforcing bars and filled with grout.
 - c. Provide 8 inches minimum bearing at each jamb for 8 inches wide units.
 - d. Provide 12 inches minimum bearing at each jamb for 12 inches wide units.
 - e. Coordinate with cavity drainage material at loose lintels.

N. Flashing:

1. Provide flashing in masonry work at, or above, all shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Seal penetrations in flashing with material recommended by flashing manufacturer before covering with mortar.
2. Prepare surfaces to be smooth and free from projections which might puncture flashing.
3. Where horizontal surfaces of cast in place concrete are irregular or not level, provide a thin leveling bed of mortar before installing flashing.
4. At lintels and shelf angles, install flashing on steel surface with no mortar above or below.
5. At masonry and concrete surfaces, install flashing with a full bed of mortar between flashing and course above. Seal flashing penetrations with manufacturer recommended mastic before covering with mortar
6. Install rubberized asphalt flashing to comply with manufacturer's instructions and as follows:
 - a. Where indicated, install stainless steel drip edge to extend the drip strip a minimum of 1/4 inch beyond the face plane of the brick wall, unless otherwise indicated. Install the drip edge on top of the lintel or shelf angle set into a continuous bed of adhesive. Lap end joints of drip edge by overlapping not less than 2 inches and sealing lap with elastic sealant.
 - b. Apply primer to all material in contact with flashing to maximize adhesion of through-wall flashing.
 - c. Verify the width of flashing pieces to be installed by field measurement.
 - d. Flashing should extend, uninterrupted, from outer wythe of masonry into the concrete masonry back-up. Terminate interior leg of flashing by extending flashing 1/2 the width of CMU into CMU backing wythe.
 - e. Carefully fit flashing around projections, columns, walls, etc. Install flashing continuous around inside and outside corners using prefabricated corner boots. Form membrane to correct profile without wrinkles or buckles, and protect from entering the wall to the outside.
 - f. Extend flashing to within 1/2 1/2 inch of the outside face of wall and adhere to drip edge or terminate as detailed on the drawings.
 - g. Extend drip edge past opening to furthest end dam and make it symmetrical.
 - h. Provide prefabricated end dams at termination of all flashing at columns, ends of lintels, inner corners or similar end conditions.
 - i. Lap flashing joints a minimum of 6 inches, set in mastic recommended by manufacturer and press tightly to seal.

3.4 INSTALLATION OF REINFORCED UNIT MASONRY

- A. Install reinforced unit masonry to comply with requirements of TMS 602/ACI 530.1/ASCE 6 Current Edition.
- B. Construct formwork and shores to support reinforced masonry elements during construction. Construction formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

- C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
- D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- E. Terminate all grout lifts 1-1/2 inches above the mortar joint at the bottom of the concrete masonry unit to form a grout key.

3.5 REPAIR, POINTING

- 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. During the tooling of joints, enlarge voids or holes, except weepholes, and completely fill with mortar.
- C. Point up all joints at corners, openings and adjacent Work to provide a neat, uniform appearance, prepared for application of sealants.

3.6 CLEANING

- A. Cleaning exposed, concrete masonry, including SGT surfaces: Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's Work.
- B. Final Cleaning of Brick Work:
 - 1. After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as follows. Obtain Architect's acceptance of sample cleaning before proceeding to clean rest of masonry work.
 - 2. Protect stone and non-masonry surfaces from contact with cleaner.
 - 3. Protect landscape and soil from contact with masonry cleaner. Provide neutralizing solution application if contact occurs.
 - 4. Mix and apply the cleaning agent as recommended by the manufacturer.
 - 5. Working areas not larger than 150 square feet at a time, thoroughly wet the masonry surface.
 - 6. Apply the cleaning solution liberally with a natural fiber brush.
 - 7. Allow cleaning solution to remain on the wall for approximately 5 minutes. Do not allow the cleaning solution to dry on the wall.
 - 8. Scrape off excess mortar deposits. Use of metal scrapers is discouraged. Use of wire brushes is forbidden.
 - 9. Reapply cleaning solution.
 - 10. Rinse thoroughly with fresh water at a pressure not to exceed 300psi with fan tipped nozzle.
 - 11. When working from staging, keep area below surface wet.

END OF SECTION

SECTION 07 72 73

MEMBRANE INTEGRITY TEST SYSTEMS

PART 1 - GENERAL

A. SUMMARY

- a. Alternate to the Base Bid Section Includes: provide and install components of the Membrane Integrity Test System, or Electronic Moisture Detection and infrastructure for a permanent monitoring system (monitoring system is NOT part of the base scope of work) for Roofs A and B including:
 - a. Leak detection conductor cable and accessories in the concealed spaces of a Roof Assembly. Including Electronic vector mapping grid
 - b. Leak detection testing of installed membrane.
 1. Perform electronic integrity water-tightness leak detection test using low voltage electronic field mapping on installed roof after a period of at least eight weeks has passed since roofing installation completion. Repair all leaks in accordance with Sections describing roof membrane systems. Repeat test until no leaks are detected.
 2. Perform electronic integrity water-tightness leak detection test using low voltage electronic field mapping on installed roof for the entire period of the two year warranty should the need arise to detect leaks.
 3. Provide coordination among the Roofing installing company, and Integrity Test System installer for roofing system repairs.

B. RELATED WORK

1. Specified elsewhere:
 - a. 07 52 00 Modified Bituminous Membrane Roofing
 - b. 07 62 00 Flashing and Sheet Metal.
 - c. 07 72 00 Roof Accessories.
 - d. 07 92 00 Joint Sealants

C. DEFINITIONS

1. Roofing System Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers" in the associated sections describing Roofing Membrane Systems, hereinafter called "manufacturer."

D. SYSTEM DESCRIPTION

1. Coordination:
 - a. Integrate layout of membrane integrity test system with rooftop structures and equipment and roof penetrations for building utilities and services.
 - b. Coordinate membrane integrity test system with work of other Sections
2. Pre-installation Meetings: Conduct pre-installation meeting in coordination with the waterproofing pre-installation conference to verify project requirements, manufacturer's

installation instructions, and coordination with installation requirements for membrane and vegetative roof modules.

E. QUALITY ASSURANCE

1. Manufacturer's Qualifications: Manufacturer of membrane integrity test systems with minimum five-year record of satisfactory manufacturing and support of installed systems comparable to system required as Work of this Section.
2. Water Tightness Leak Detection Testing Agency's Qualifications:
 - a. Engage Installation and Testing Firm to perform low voltage electronic integrity membrane leak testing. Perform testing in accordance with leak detection system manufacturer's recommendations
 - b. The testing contractor shall be approved by manufacturer of the testing system, and shall be trained in such.
 - c. The testing contractor shall have performed a test of similar type and scale within the last three years.

F. REFERENCES

1. Cited Standards and specified manufacturers' catalogs, current at the date of bidding documents, unless otherwise specified, are incorporated herein by reference and govern the work. If conflict is discovered between referenced Standards or catalogs and the project specifications, request written clarification from the A/E. Do not proceed with the work until receiving clarification.
2. Standards:
 - a. American Society for Testing and Materials (ASTM).
 - b. Factory Mutual Laboratories (FM).
 - c. Underwriters Laboratories (UL)
 - d. Sheet Metal and Air Conditioning Contractors National Assoc. (SMACNA)

G. SUBMITTALS

1. Make all submittals in accord with the Standard Documents for Construction, Section 01 33 23.
2. Shop Drawings:
 - a. Diagram of proposed system showing complete monitored area, rooftop structures and equipment, and roof penetrations for building utilities and services. Show location of membrane integrity test system conductor cable.
3. Product Data: For each type of product required for a complete membrane leak detection system including, but not limited to:
 - a. Manufacturer's specifications for roofing system.
 - b. Grid cables
 - c. Connector plates
 - d. Fasteners.
 - e. Other Electronic Vector Mapping Grid components

4. Water-tightness testing agency qualifications:
 - a. Testing agency's list of completed projects of like size and type.
 - b. Testing agency's personnel qualifications, resume and project experience indicating experience in like projects of similar type and scale.
5. Water-Integrity Test Results and Report:
 - a. Testing agency's summary and analysis of the water-tightness test with plan showing locations of electrical field and wires on a drawing.
 - b. Drawing indicating locations of repairs (if any) to comply with water-tightness.
 - c. Digital drawings, photographic documentation, and written report detailing installed location of components of membrane leak detection system and connection boxes.

H. DELIVERY, STORAGE AND HANDLING

1. General: Deliver materials in manufacturer's original packaging with label indicating pertinent information identifying the item. Store materials in accordance with manufacturer's instructions in a protected dry location and off of the ground. Do not open packaging nor remove labels until time of installation.
2. Follow Manufacturer's instructions.
3. Special Instructions: Protect electronic equipment and sensing and detection devices against damage from dust and moisture.

I. PROJECT CONDITIONS

1. Environmental Requirements: Proceed with the Work in accordance with manufacturer's requirements and instructions and any agreements or restrictions of the Pre-Construction Conference, including the following:
 - a. Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

J. SEQUENCING

1. Sequence Work of this section with other sections and installers as follows:
 - a. Install wiring and moisture detection devices and other sensing devices in dry conditions following installation of system components noted in the details, and before the installation of cover board.
 - b. Perform initial connectivity tests.
 - c. Install recovery board.
 - d. Retest system connectivity.
 - e. Install protection board material.
 - f. Retest system connectivity.

K. WARRANTY

1. General Contractor: Two years in accord with the Standard Documents for Construction, Section 01 78 36.
 - a. Installation Warranty: Warrant against defects in workmanship for a period of not less than five years.
 - b. As part of this warranty, General Contractor is responsible to provide Leak Detection service and test of the system by the Membrane Integrity Testing Agency per the

requirements of this section at a point two years after substantial Completion, or as otherwise determined or requested by the Using Agency.

- c. Manufacturer's Warranty: Warrant against defective equipment and components for a period of not less than one year.

2. PRODUCTS

- A. MATERIALS For the Membrane Integrity Test System, as required and recommended by the following acceptable Manufacturers.

1. International Leak Detection (ILD), (866) 282-LEAK, ((866)282-5325), info@leak-detection.com
2. IR Analyzers, (800) 879-1964, www.iranalyzers.com
3. Detec Systems, 253.272.3252, www.detecsystems.com

- B. Membrane Integrity Test System Components, per the manufacture of the system to be comprised of:

- a. Conductor cable:
 - a. Nine strands of 0.06 inch (1.5 mm) diameter highly-conductive stainless steel wire interwoven with braided polyethylene strands
 - b. Tensile strength of not less than 180 lbs.
- b. Vector Mapping Grid: Highly conductive, corrosion resistant, geometrically stable mesh placed between membrane and protected building components
 - a. Stainless steel grid: 2 by 2 inch (50 by 50 mm) screen mesh in 47 inch by 160 foot (1.2 by 50 m) rolls.
- c. Conductor Wire Assembly: Provide grounding plate for connection to Vector Mapping Grid, suitable for connection to terminals at connection box.
- d. Connection plates
- e. Connection Box: to be mounted at the interior of the building. (Location to be determined by User). Run in exterior grade code compliant electrical conduit from top of roof surface, over coping and through outside wall to the interior with permanent terminal connections for connecting diagnostic and testing equipment, NEMA [4X] with the following characteristics:
 - a. Permanent connections for attachment of diagnostic and testing equipment without opening contact box.
 - b. Weatherproof connections to ensure weather-tight seal terminals when membrane integrity test system is not in use.
 - c. Conduit, anchors, Hardware, brackets, and fittings required to permanently mount contact box to building structure.

C. ACCESSORIES

1. Fasteners: Provide corrosion-resistant fasteners and hardware, electrical terminations, sealants, and other items required to provide complete installation
2. Lap Joint Tape: Provide self adhesive aluminum tape, minimum 2 inch (50 mm) wide

3. EXECUTION

A. INSPECTION

1. Verify that substrate complies with roofing manufacturer's and integrity test manufacturer's requirements. Proceed with installation once substrate complies with requirements.

B. Vector Mapping Grid: Install Vector Mapping Grid on membrane substrate immediately under membrane and immediately prior to installation of membrane.

1. Verify that location of Vector Mapping Grid fasteners does not interfere with or cause damage to membrane.
2. Install Vector Mapping Grid directly below the roof/waterproofing membrane and fasten Vector Mapping Grid in accordance with leak detection system manufacturer's requirements.
 - a. Two connection plates and attached connection wire is to be placed in two opposite corners of the roof area. Two connection plates per maximum 25,000 square feet.
 - b. The connection plate(s) is to be placed directly on the substrate, below the Vector Mapping Grid.
 - c. The prefabricated cable, connected to the connection plate, is to be brought through the membrane into a flashing sleeve.
 - d. Vector Mapping Grid to cover total waterproofing/roofing field area, from inside of perimeter to inside of perimeter, directly below the roof membrane.
 - e. Cut grid as close as possible to the perpendicular strand at both end and side edges.
 - f. Terminate approximately ½ inch from all projections and interior drain bodies.
 - g. Provide minimum 2 inch (50 mm) overlap where adjacent sheets meet, including side laps and end laps.
 - h. Vector Mapping Grid is to be cut as close as possible to the perpendicular strand at both end and side edges
 - i. Secure the wire to prevent movement or damage
3. Do not penetrate the Acoustic Steel Deck at Roof A.
4. Do not place Vector Mapping Grid where it will be in continuous direct contact with structural components.

C. Conductor Wire: Install conductor wire on top of membrane at spacing and layout indicated on approved shop drawings.

1. Secure conductor wire using method recommended by manufacturer.

D. Installation Testing: Verify continuity and functioning of conductor wire and measurement grid upon completion of installation.

E. Testing and Field Quality Control

1. Engage Installation and Testing Firm to perform membrane integrity testing. Perform testing in accordance with membrane integrity test system manufacturer's recommendations.
 - a. Perform testing following adequate precipitation or wet membrane and membrane overburden adequately to enable accurate testing.

- b. Identify locations of membrane leaks; record locations and document with photographs. Submit test reports to Architect.
 - c. Confirm completed repair of identified leaks and retest to verify water tightness of membrane.
2. Perform leak detection of the entire roofed areas indicated using low voltage electronic field mapping. Perform test only after a “resting period” of a minimum of 8 weeks after the completion of the membrane roofing installation. Perform just prior to the time of substantial completion review.
 - a. Ensure that the area to be tested is adequately wet to enable accurate testing.
 - b. Install conductor wire on top of membrane at spacing and layout indicated on approved shop drawings. Secure conductor wire using method recommended by manufacturer.
 - c. Verify continuity and functioning of conductor wire upon completion of installation.
 - d. Perform Integrity test to identify locations of membrane leaks; record locations and document with photographs. Submit test reports to Architect
 - e. Confirm completed repair of identified leaks and retest to verify water tightness of membrane.
3. Perform test in the presence of the AOR, Commissions Representative, CPS School Personnel (engineer), and Roofing System Installer. Give 72 hours advance notice for the coordination of all attendees.

F. System Repairs

1. Coordinate with Roofing System Installer to quickly and accurately repair all detected leaks.
2. Re-perform tests to ensure that repairs have been effective, and no leaks persist.
3. Submit all necessary reports

END 07 72 73

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum window wall as indicated and as specified.

1.2 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's data, recommendations and standard details, including fabrication, finishing, hardware, accessories and other components of the Work.
- B. Shop Drawings: Submit Shop Drawings for the fabrication and installation and associated components of the Work signed and sealed by a structural engineer licensed in the State of Illinois. Attesting that the system conforms to "Quality Assurance" requirements of this Section. Include wall elevations at 1/2" scale, and half-size detail sections of every typical composite member. Show anchors, joint system, expansion provisions and other components not included in manufacturer's standard data. Include glazing details.
- C. Samples: Submit a set of two (2) samples of required aluminum finish, showing extremes of color and appearance, on minimum 4" long extrusions of the alloys to be used for the Work.
 - 1. The right is reserved to require samples of typical fabricated sections, showing joints, exposed fastenings (if any), quality of workmanship, hardware and accessory items, before fabrication of the Work proceeds.
- D. Certification: Submit written certifications, signed by window wall manufacturer, attesting that system conforms to each of the "Quality Assurance" requirements of this Specification where the manufacturer's standard system has been tested in accordance with specified tests and meets performance requirements specified. Where such testing has not been accomplished, perform required tests through a recognized testing laboratory or agency and provide certified test results.
- E. LEED Submittal:
 - 1. LEED Credit EQ 4: Submit manufacturers' product data proving that adhesives and sealants used inside the weatherproofing system meets the testing and product requirements of the California Department of Health Services *Standard Practice for the Testing of Volatile Organic Emissions from Various sources Using Small Scale Environmental Chambers*, including 2004 addenda.
 - 2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content.
 - 3. Product Data for Credit MR 5: For products and materials required to comply with requirements for regional materials, documentation indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each

raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 QUALITY ASSURANCE

- A. Standards: Comply with the requirements and recommendations in applicable specifications and standards by NAAMM, AAMA and AA, including the terminology definitions, and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated. Conform to 16 CFR 1201.
- B. Manufacturer: Provide systems by manufacturers regularly engaged in providing systems of the type required for a minimum of three (3) years and conforming to profiles and dimensions shown and this specification.
- C. Installer: Regularly engaged in installation of the types of Work required and acceptable to the system manufacturer.
- D. Wind Loading: Fabricate exterior units to withstand the wind pressure loading of 30 lbs. per sq. ft. on the gross area of the system, acting inward and also acting outward except 40 lbs. per sq. ft. at corners when tested in accordance with ASTM E 330.
- E. Deflections and Thermal Movements: Design work and internally reinforce component members to withstand wind pressures, building deflections, construction shrinkage, thermal movements and erection tolerances, within the following deflection limitations and temperature variations without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects. Fabricate, assemble and erect the work to maintain these limitations.
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m), and to 1/240 of clear span plus 1/4 inch (6.35 mm), for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).
- F. Story Drift: Provide glazed aluminum curtain-wall systems that accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: $H/400$.
- G. Structural steel elements supporting window wall component have been designed in accordance with AAMA TIR-A11 "maximum allowable deflection of framing systems for building cladding components at design wind load."
- H. Water and Air Leakage: Design, fabricate, assemble and erect work and system of sealed joints with other work, to be permanently free of significant leakage of both water and air. Significant leakage is defined as follows, based on a differential test pressure amounting to 20% of specified strength performance pressure required, testing a complete module of window wall work.

1. Air Infiltration (Framing): More than 0.06 cu. ft. per minute per sq. ft. (projected area of module), determined by ASTM E 283 at an inward test pressure of 6.24 PSF.
 2. Air Infiltration (Doors): Provide doors with an air infiltration rate of not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.567 PSF.
 3. Water Penetration: Provide framing systems with no water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.
- I. Condensation Requirements: Provide thermal-break construction which provides a condensation resistance factor (CRF) of at least 55 per the requirements of AAMA 1503.
- J. Glass Statistical Factor (Safety Factor): Glass thicknesses when shown on the Drawings are for convenience of detailing only and are to be confirmed by the Contractor and/or glass manufacturer. All glass for the size openings shown will be provided in thicknesses such that the probability of breakage at the "Design Wind Pressure" will not exceed 8 lights per 1000 lights (S.F. 2.5)
- K. Thermal Performance: Provide window wall system and doors having maximum U-factor of **0.36** for fixed units and **0.41** for operable units as determined in accordance with NFRC 100 by a laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and labeled and certified by the manufacturer; and assembly maximum solar heat gain coefficient (SHGC) of **0.49** for north orientation and **0.38** for all other orientations for overall glazed area as determined in accordance with NFRC 200 by a laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and shall be labeled and certified by the manufacturer. Shading coefficient of the center of glass multiplied by 0.86 shall be an acceptable alternate for determining compliance with the SHGC required for the overall glazed area. Shading coefficient shall be determined using special data file determined in accordance with NFRC 300. Shading coefficient shall be verified and certified by the glass unit manufacturer.
1. U-Factors from 8.1 of ASHRAE IESHA Standard 90.1-2007 shall be an acceptable alternate for determining compliance with the U-factor criteria. Where credit is being taken for a low-emissivity coating, the emissivity of the coating shall be determined in accordance with NFRC 301. Emissivity shall be verified and certified by the window wall manufacturer.
- L. Perimeter Fire-resistive Joint System: For joints between edges of fire -resistive rated floor assemblies and window wall system, provide a system of type and rating below as determined by NFPA 285 and UL 2079.
1. UL-listed Perimeter Fire Containment system: Integrity rating equal or exceeding the fire-resistive rating of the floor or floor/ceiling assembly forming one side of the joint having the required joint width and movement classification and an L number rating.
- M. Job Mock-Up: Prior to their installation of the work, contribute to the project mock-up shown in the Construction Drawings and as specified in Section 01410 "Preconstruction Project Mock-up". Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects, attachment and performance and set quality standards for fabrication and installation.

PART 2 - PRODUCTS

2.1 MATERIALS AND ACCESSORIES

- A. Aluminum Extrusions: Provide alloy and temper as recommended by manufacturer for strength, corrosion resistance, application of required finish and control of color, but not less than 22,000 psi ultimate tensile strength. Provide main extrusions of not less than 0.125" wall thickness.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other non-corrosive metal fasteners guaranteed by the manufacturer to be compatible with the doors, frames, stops, hardware, anchors and other items being fastened. For exposed fasteners (if any), provide Phillips flat-head screws with finish matching the item fastened.
 - 1. Do not use exposed fasteners except where unavoidable for the assembly of units, and unavoidable for the application of hardware. Provide only concealed screws in glazing stops.
- C. Steel Reinforcement and Brackets: Manufacturer's standard formed or fabricated steel units, of shapes, plates or bars; with 2.0 oz. hot-dip zinc coating complying with ASTM A 123, applied after fabrication to brackets and rust inhibitive paint applied to reinforcing elements.
- D. Concealed Flashing: Dead soft stainless steel, minimum 26 gauge.
- E. Inserts: For required anchorage into concrete or masonry work, furnish inserts of cast iron, malleable iron or 12 gauge steel hot-dip galvanized after fabrication.
- F. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- G. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PAINT 12, compounded for 30 mil thickness per coat.
- H. Sealants and Gaskets: Provide sealants and gaskets in the fabrication, assembly and installation of the Work, which are recommended by the manufacturer to remain permanently elastic, non-shrinking, non-migrating and weatherproof for the life of the building.
 - 1. LEED Requirement: Provide adhesives and sealants used inside the weatherproofing system meet the testing and product requirements of the California Department of Health Services *Standard Practice for the Testing of Volatile Organic emissions from Various Sources Using Small Scale Environmental Chambers*. Including 2004 addenda.
- I. Glazing Gaskets: For glazing glass, and for gaskets which are factory-installed in a "captive" assembly of glazing stops, provide manufacturer's standard stripping of molded neoprene.
- J. Glazing:
 - 1. Include a minimum 15% pre-consumer recycled glass in the prime glass (before coating). Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1. (clear), quality q3 (glazing select), kind FT (fully tempered); free of visible tong marks.
 - 2. Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent glass, flat), Class 1. (clear), quality q3 (glazing select), with

- ceramic coating applied to second surface free of pin holes, kind HS (heat strengthened) or kind FT (fully tempered).
3. Laminated Glass: Two pieces of 1/8" tempered glass as specified with inner layer of 1/8" colored polycarbonate laminated with polyurethane to allow for differential movement such as Guardvue by Viracon or equal.
 4. Insulating Glass Units: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space complying with ASTM E 774, Performance Classification "A", manufacturer's ten (10) year warranty against failure of hermetic seal of air space.
 5. Refer to Drawings for composition of various glazing applications and minimum performance requirements.

2.2 GLAZING SCHEDULE

1. Glazing types and locations as indicated on drawings.
2. Glass Type "G1": 1/4" thick clear tempered glass (Safety Rated, UL 10C).
3. Glass Type "G2" – not pertinent here.
4. Glass Type "G3": 1-inch thick Insulated Exterior Glass Assembly: Unit shall consist of a 1/4" thick clear low-E outboard lite with PPG Solarban 60 on the #2 surface, 1/2" gas cavity and a 1/4" thick clear inboard lite. Other manufacturer's products will be considered subject to meeting the performance criteria specified herein. Unit shall have the following performance characteristics:
 - a. Visible Light Transmittance: 71% minimum
 - b. Solar Energy Transmittance: 33% maximum
 - c. Ultraviolet Transmittance: 19% maximum
 - d. Visible Light Reflectance – Exterior: 11%
 - e. Visible Light Reflectance – Interior: 13%
 - f. Solar Energy Reflectance: 29%
 - g. U-Value (Winter Nighttime): 0.30 Btu/(hr x sq.ft. x °F) maximum
 - h. U-Value (Summer Daytime): 0.28 Btu/(hr x sq.ft. x °F) maximum
 - i. Shading Coefficient: 0.44
 - j. Relative Heat Gain: 91 Btu/hr x sq.ft.
 - k. Solar Heat Gain Coefficient: 0.38 maximum.
7. Glass Type "G4-L": 1-inch Thick Insulated Laminated Exterior Glass Assembly: Unit shall consist of 1/4-inch thick clear low-E tempered outboard lite with PPG Solarban 60 on the #2 surface, 1/2" gas cavity, 1/8" clear lite, a 0.060 colored PVB interlayer, and a 1/8" clear lite. Other manufacturer's products will be considered subject to meeting the performance criteria specified herein.
 - a. Visible Light Transmittance: 71% minimum
 - b. Solar Energy Transmittance: 32% maximum
 - c. Ultra-Violet Transmittance: < 1% maximum
 - d. Visible Light Reflectance – Exterior: 11%
 - e. Visible Light Reflectance – Interior: 12%
 - f. Solar Energy Reflectance: 29%
 - g. U-Value (Winter Nighttime): 0.29 Btu/(hr x sq.ft. x °F) maximum
 - h. U-Value (Summer Daytime): 0.28 Btu/(hr x sq.ft. x °F) maximum
 - i. Shading Coefficient: 0.43
 - j. Relative Heat Gain: 91 Btu/hr x sq. ft.
 - k. Solar Heat Gain Coefficient: 0.38 maximum.

8. **Glass Type "G4-LC"**: 1-inch Thick Insulated Laminated Exterior Glass Assembly: Unit shall consist of 1/4-inch thick clear low-E tempered outboard lite with PPG Solarban 60 on the #2 surface, 1/2" gas cavity, 1/8" clear lite, a 0.060 colored PVB interlayer, and a 1/8" clear lite. Other manufacturer's products will be considered subject to meeting the performance criteria specified herein.

1. Visible Light Transmittance: 71% minimum
2. Solar Energy Transmittance: 32% maximum
3. Ultra-Violet Transmittance: < 1% maximum
4. Visible Light Reflectance – Exterior: 11%
5. Visible Light Reflectance – Interior: 12%
6. Solar Energy Reflectance: 29%
7. U-Value (Winter Nighttime): 0.29 Btu/(hr x sq.ft. x °F) maximum
8. U-Value (Summer Daytime): 0.28 Btu/(hr x sq.ft. x °F) maximum
9. Shading Coefficient: 0.43
10. Relative Heat Gain: 91 Btu/hr x sq. ft.
11. Solar Heat Gain Coefficient: 0.38 maximum.

2.3 HARDWARE

- A. Except as indicated otherwise herein, refer to Division 09 Section "Door Hardware" for the furnishing of hardware items. Hardware templates will be furnished to the manufacturer for the fabrication of door and frames to receive hardware. Receive the hardware and coordinate with the hardware requirements of this Section. Report discrepancies (in writing) to the Contractor.
- B. Cut, reinforce, drill and tap frames and doors as required to receive hardware, except do not drill and tap for surface-mounted items until the time of installation at the Project Site. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- C. Install all hardware, except surface-mounted hardware, at the fabrication plant. Remove only as required for final finishing operations, and for delivery and installation of the Work at the Project Site
- D. Projected Sash: Operable sashes are specified under Section 08 56 13 Aluminum Windows – Accessible.

2.4 FABRICATION

- A. Coordination of Fabrication: Wherever possible, check the actual openings in the construction work by accurate field measurement before fabrication, and show recorded measurements on final Shop Drawings.
- B. Prefabrication: Provide each door as a "packaged entrance" unit. Complete the fabrication, assembly, finishing, application of hardware and all other Work, before shipment to the Project Site, to the greatest extent possible. Disassemble only to the extent necessary for shipment and installation.
- C. Basic Fabrication:

1. Complete the cutting, fitting, forming, drilling and grinding of all metal at the shop to the extent possible. Remove arrises from cut edges and ease edges and corners to a radius of approximately 1/64".
 2. Conceal fasteners, wherever possible, except as otherwise shown.
 3. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.
 4. Internally reinforce the Work as necessary for performance requirements, and for support to the structure. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion. Separate metal surfaces at moving joints with nonmetallic separators to prevent "freeze-up" of joints.
- D. Weather Stripping: Where exterior door stiles or head rails do not close against fixed stops equipped with compression weather stripping, provide sliding weather stripping, retained in an adjustable strip in a mortise centered in the edge of the door. Provide heavy-duty, hollow, compression weather stripping in the bottom-rail, adjustable for contact with the threshold.
- E. Stile-and-Rail Type Aluminum Doors:
1. Provide tubular frame members, fabricated with mechanical joints of heavy inserted reinforcing plates and concealed tie-rods or j-bolts, in accordance with manufacturer's standard fabrication methods; or fabricate with structurally welded joints, at manufacturer's option.
 2. Except as otherwise shown or scheduled, provide door units 1-3/4" thick.
 - a. Provide wide stile doors.
- F. Aluminum Framing:
1. Fabricate tubular and channel frame assemblies with either welded or mechanical joints using shear blocks with concealed fasteners wherever possible.
 2. Provide non-removable door stops extruded integrally with frame to extent possible.
 - a. Provide compression weather stripping on the door-contact face of door stop for exterior door frames, and on other frames where indicated.
 - b. Where weather stripping is not provided, install neoprene silencers on door stops to prevent metal-to-metal contact between doors and stops.
 3. Provide glazing system for frames to receive lights. Design system for replacement of glass, but for non-removal of glass from the exterior.
 4. Fabricate frame assemblies for exterior walls with flashing and weeps to drain penetrating moisture to exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
 5. Provide all elements with thermal breaks to positively eliminate outside to inside metal contact. Provide thermal break materials certified to comply with Performance Requirements of the unit in each case (window or window wall).
 - a. Interior framing need not be thermal break construction.
- G. Fabrication of Supporting Steel Elements:

1. Fabricate in accordance with AISC - Manual of Standard Practice.
2. Certify welders in accordance with requirements of AWS.
3. Fabricate and assemble in the shop to the greatest extent possible. Shear, flame cut and chip accurately and carefully.
4. Degrease, hand tool clean and apply one coat of rust-inhibitive metal primer to all elements after fabrication.

2.5 ALUMINUM FINISHES

- A. Prepare the surfaces for finishing in accordance with recommendations of the aluminum producer and the finisher or processor.
- B. Finish all components of each assembly simultaneously so as to attain complete uniformity of color. Adjust and control the direction of mechanical finishes (as specified) to achieve the best overall visual effect in the Work, as determined in consultation with the Architect.
- C. Sequence the finishing and processing of materials in a predetermined bay-bay-bay plan, which will minimize color and texture differences between adjacent components.
- D. Color and Texture Tolerance:
 1. The right is reserved to reject the Work because of color or texture variations, which are visually objectionable, but only where the variation exceeds the range of variations established by the manufacturer prior to the Work, by means of range samples which have been accepted by the Architect.
 2. Prepare range samples on extrusions of profiles and shapes of the actual members of the Work. Establish range samples to maintain a total range of 2 degrees on the green reflectance scale.
- E. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- F. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- G. High Performance Organic Finish: Two Coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not install component parts which are observed to be defective in any way, including warped, bowed, dented, abraided and broken members, including glass and edge damage. Remove and replace members which have been damaged during installation.\
- B. Deliver base plates for mullion anchorage in time to allow for installation. Provide setting drawings.

3.2 ERECTION TOLERANCES

- A. Limit variations from plumb, and level to the following:
 - 1. 1/8" maximum deviation.
- B. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:
 - 1. 3/8" total maximum deviation for any member at any location.
 - 2. 1/8" maximum change in deviation for any member at any 10' run, any direction.
- C. Limit offsets in the end-to-end and edge-to-edge alignments of adjoining and consecutive members, which form planes, continuous runs and profiles to the following:
 - 1. 1/16" maximum offset in any flush alignment, including any which are to be 1/2" or less out-of-flush, and including any which are separated 2" or less by a reveal or protrusion in the plane of the wall.
 - 2. 1/8" maximum offset in alignments which are to be out-of-flush by more than 1/2", or separated by a reveal or protrusion of more than 2" width.
- D. Provide sliding connections at top of mullions to accommodate deflections of L/360 of the floor above.

3.3 ERECTION

- A. Erect steel elements in accordance with AISC - Manual of Standard Practice.
- B. Certify welders in accordance with requirements of AWS.
- C. Do not cut, trim, weld or braze components during erection in any manner which would damage the finish, decrease the strength, or result in a visual imperfection or a failure in performance of the window wall. Return component parts which require alteration to the shop for re-fabrication, if possible, or for replacement by new parts, if not possible.
- D. Install components level, plumb, true to line and with uniform joints and reveals. Use erection equipment which will not mark or stain finished surfaces, and will not damage the component parts in any way.
- E. Anchor component parts securely in place by bolting, welding or other permanent mechanical attachment system, which will comply with performance requirements and permit movements which are intended or necessary. Install slip-joints wherever necessary to ensure movement as intended or necessary.
- F. Apply bituminous paint of approximately 30-mil dry film thickness, or other suitable permanent separator, on concealed contact surfaces of dissimilar materials, before assembly or installation.
- G. Wire brush and touch-up prime welded and shop un-primed steel.
- H. Provide close fitting sleeves at joints to insure alignment and no open joints.

- I. Provide all closures, panels, sill and stool covers and all other accessory items required for a complete installation. Form accessories of minimum 0.063" aluminum.
- J. Install fire stopping in accordance with requirements to obtain fire rating.

3.4 GLAZING

- A. Protect glass units from edge damage at all times during handling and installation.
- B. Inspect for edge or surface damage and do not install defective units. The glazer is responsible for correct glass size for each opening, within the tolerances and necessary dimensions established.
- C. The glazer must examine the framing or glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed, and notify the Construction Manager in writing of any conditions detrimental to the proper and timely completion of the Work. Start of Work will evidence acceptance of conditions.
- D. Do not install glazing sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
- E. Comply with combined recommendations of glass manufacturer and manufacturer of glazing sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.
- F. Comply with "Glazing Manual" and "Glazing Sealing Systems Manual" by Flat Glass Marketing Association, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
- G. Before glazing begins, the Contractor shall conduct a meeting with the glass manufacturer, glazing materials manufacturer, glazer, and Construction Manager to review details of installation.
- H. Glazing Methods:
 - 1. Glaze in exact accordance with requirements necessary to obtain "quality assurance" specified hereinbefore.
 - 2. Immediately upon installation, protect glass from breakage by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surface of glass.
 - 3. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in any other way during the installation period.
 - 4. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other surfaces.

3.5 PERIMETER FIRE CONTAINMENT SYSTEM

- A. Perimeter fire resistive joint by system: Install perimeter fire stopping system in exact accordance with manufacturer requirements.

1. Owner will engage qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
2. Inspecting of completed installation of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint system proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 - a. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
3. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
4. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
5. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.6 FIELD TESTING

- A. Field Tests: Contractor shall perform and pay for onsite tests of selected newly installed curtain wall system components. Test newly installed curtain wall products as directed by Commission's Authorized Representative for air leakage and water penetration resistance.
 1. All new curtain wall products shall be field tested in accordance with AAMA 502 by an AAMA accredited laboratory as selected by the Commission's Authorized Representative and engaged by the responsible Contractor. Independent testing laboratory engaged to perform tests will meet all requirements of AAMA 204.
 2. Costs for all tests, both original and retests shall be paid for by the responsible Contractor. All unsuccessful tests, both original and retest, shall be paid for by the responsible Contractor.
 3. All testing work in accordance to AAMA 502 of newly installed curtain wall products shall commence at initial installation and shall be completed prior to issuance of a certificate of Preliminary Acceptance for window wall work; and in no case more than six months after the date of Preliminary Acceptance of the installation. Any field testing required six months beyond the date of Final Acceptance of the curtain wall installation will be done in accordance with AAMA 511.
 4. Testing Quantity: Erect test chambers for each window product type identified on plans. Test three (3) curtain wall products of each type, or three (3%) percent of each type of curtain wall product installations; whichever is greater, for air infiltration and water penetration as specified in accordance to AAMA 502 after the curtain wall products have been completely installed.
 5. Test Parameters:
 - a. Air infiltration field tests shall be conducted at the same uniform static test pressure as the laboratory test unit. The Maximum allowable rate of air leakage shall not exceed 1.5 times the laboratory test unit for glazing types consistent with the laboratory test unit. The field test air leakage rate shall not exceed 1.5 times the maximum allowable laboratory performance specified in the testing criteria listed in Section 1.3 H above for any configuration.
 - b. Water penetration field tests shall be conducted at a static test pressure of 4/5 of the laboratory test performance values for hardware and glazing types consistent

with the laboratory test unit. The field test water test pressure shall not be less than 4/5 of the minimum allowable laboratory performance specified in the testing criteria listed in Section 1.3 H above for any configuration.

6. All work on curtain wall products that fail the field tests shall be re-executed until the installation passes the field testing. Modify methods of installation of subsequent work to incorporate required corrections identified by the testing process.

3.7 PROTECTION AND CLEANING

- A. Protect exposed aluminum work from damage by construction and. Use lacquer coating only if totally removed without damage to finish. Use strippable covering only if totally removed without damage to finish. Remove protection and clean surfaces and glass immediately before acceptance of building.

END OF SECTION

SECTION 11 14 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. The plans and specifications as written are inclusive of known quantities, and quality standards that meet the minimum performance standards of the school lunch program for the city of Chicago public schools, the architectural limitations of the new building and the enrollment capacity of the new school.
- B. All equipment shall be provided in strict accordance with the plans and specifications. All contractors, subcontractors, and sub-tier subcontractors shall be bound to the specifications as well as the general contract conditions, supplemental conditions and section one of the contract documents.
- C. The naming of manufacturers in the specifications or on the drawings shall not be construed as an intention to eliminate the products of other manufacturers having equivalent products that meet or exceed the performance and quality standards of the named manufacturer.
- D. Other manufacturer's products will be considered subject to meeting the performance criteria specified herein.
- E. Any necessary modifications of the equipment, building, piping, ductwork, electrical or any other work including architectural costs resulting from the use of substituted equipment or material shall be at the sole costs of the contractor and specifically not the building owner.
- F. The approval of substituted material or equipment by owner or the architect will not relieve the contractor from sole responsibility for the proper installation and original performance requirements nor will the approval and or review by the owner or architect be considered as a basis for any additional monies or an extension of time in the performance of the contract work.

1.2 DESCRIPTION

- A. Furnish and install all food service equipment indicated on the drawings and as specified herein. The work includes but is not necessarily limited to the following:
 - 1. Custom fabricated equipment.
 - 2. Prefabricated equipment.
 - a. Where more than one manufacturers name is listed you may select one of the named manufacturers as long as all options and accessories are included to meet the performance criteria.
 - 3. Necessary appurtenances and accessories.
- B. It is the intention of these specifications to designate an inclusive job, complete, ready for use, except plumbing rough-in, electrical rough-in, (all ductwork and fans up stream from the hood collars) and final connections which will be made by other contractors as noted equipment shall be set in place, leveled, ready for use except for the final connections by the respective building trades.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. The following sections contain requirements that relate to this section.
 - 1. Division 22
 - a. Waste, water and vent piping rough in for and make all final connections to all equipment.
 - b. Pressure reducing valves, "P" traps, floor drains and grease traps.
 - c. All indirect connected waste lines and condensate drainlines.

2. Division 26
 - a. All wiring, conduit and fittings shown on the electrical drawings and final connection to the equipment.
 - b. Receptacles for all equipment furnished with cords and plugs.
 - c. Any miscellaneous disconnects, transformers, switches and other related equipment, which are required for a complete operating assembly.

1.4 QUALITY ASSURANCE

A. General Provisions

1. The Food Service Equipment Contractor will be referred to in the specifications and on the drawings as the "K.E.C." or the Kitchen Equipment Contractor, or the Food Service Equipment Contractor.
2. Kitchen Equipment Contractor shall carefully read all the Contract Documents and furnish the equipment to conform to the construction limitations of the building as set forth in all of the Contract Documents.

B. Uniformity of Construction

1. All custom-fabricated equipment shall be made by one manufacturer and shall be uniform throughout as to method and type of construction used. All equipment shall carry a nameplate identifying the manufacturer.

C. Contractor Qualifications

1. The Food Service Equipment Contractor shall have been regularly engaged in this work for the past five years, and use only skilled craftsmen completely familiar with the methods and materials called for herein.
2. The Contractor, upon demand, shall submit to Architect written evidence of having executed contracts of a comparable size and evidence of sufficient financial resources, which will enable him to perform the work in an expeditious manner, without delay to the project or to other trades.
3. Fabrication of items other than standard catalog items shall be fabricated by a food service equipment fabricator, which has the plant, personnel, and engineering facilities to properly design, detail, and fabricate high quality equipment. The fabricator shall be acceptable to the Architect and the Owner. Furthermore, all work in above category shall be standard unit assembly manufactured by one manufacturer and of uniform design, material, and finish equal to the specification as written.

D. Deviations of Specifications and Substitutions

1. The Contractor shall furnish equipment in strict accordance with the Specifications.
2. Any and all substitutes shall be in strict accordance with the conditions and procedures of the section one contract documents. Any requests not meeting the qualification and procedures as written will be cause for rejection by the Owner and or the Architect.

E. Standard Manufactured Equipment

1. All standard catalog items shall be furnished as specified in regard to brand name, item type, accessories, scheduled options and quantities.
2. All equipment shall be new and of the latest current model.
3. All equipment shall be delivered to the job site in the manufacturer's original shipping container or packaging, sealed and unopened.
4. All equipment shall be N.S.F. labeled.

F. Codes, Regulations and Standards

1. All equipment shall be constructed in strict conformance with the standards of the National Sanitation Foundation as outlined in its bulletin on food service equipment entitled "Standard No. 2" dated July and October, 1952 with its most current revision. Each piece of equipment shall have a "seal of approval" label of the National Sanitation Foundation.

2. Installation of all food service equipment shall comply fully with Illinois State Department of Public Health Regulations and with other current applicable City, County, State and Federal regulations and code requirements.
3. The Contractor shall submit all notices required by law to authorities having jurisdiction and shall obtain and pay for all required permits or certificates of inspection. Submit to the Owner permits and certificates of inspection prior to the request for final payment.
4. All refrigeration shall meet the requirements of the City of Chicago Refrigeration Department and meet or exceed the requirements of the 1995 Montreal Convention.

G. Field Dimensions

1. The K.E.C. shall take all field dimensions as required to fit its equipment to the building conditions and shall coordinate with the other building trades in locating the utility service connections.
2. Trim will not be acceptable to fit the equipment to the building where the K.E.C. has failed to verify all field dimensions.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings in compliance with section one documents.

B. Equipment Data

1. Submit catalog sheets of standard manufactured equipment in compliance with section one documents.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials and equipment shall be delivered and handled on the job site in a manner to prevent damage or loss, and stored in a place protected from damage, moisture and exposure to elements.
- B. In the event of damage, immediately make all repairs and replacements necessary to meet the approval of the Architect and at no additional cost to the owner.
- C. No equipment shall be delivered to the job site until the site is ready to receive the equipment.

1.7 JOB CONDITIONS

- A. Coordinate work with the work of other contractors to insure proper roughing-in and final connections to equipment and that adequate openings and bases for equipment are provided.
- B. Establish the exact size of openings to be left for all built-in work, and verify all measurements at the job site and be responsible for same.
- C. Kitchen Equipment Contractor shall provide a representative at the job site during the installation of his equipment, who shall supervise the installation of the equipment and coordinate the connection of the equipment.
- D. Protect all surfaces and structure in the area of installation from damage during the execution of work.
- E. Schedule delivery of food service equipment so that areas to receive it are ready for installation.

- F. Final tests of all equipment and demonstration of use shall be made in compliance with section one documents.

1.8 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Furnish complete portfolios in compliance with section one documents.

1.9 GUARANTEE

- A. The contractor is required to place all equipment in perfect operating order inclusive of each particular system or parts thereof, which are part of his work, ready for continuous use and satisfactory operation, in a manner acceptable to the Architect and Owner.
- B. The contractor shall guarantee all furnished work and materials and equipment are in compliance with section one documents.
- C. This guarantee shall not be constitute to abrogate other specified guarantees or usual guarantees against work that has been defective when supplied or that has been improperly cared for or protected during the construction period.
- D. In addition to the normal testing and repair, which are required for the completion of his work during the guarantee period, the Contractor shall visit the building at the Owner's request to clarify any questions for the operating personnel concerning the proper operation and maintenance of the equipment.
- E. All compressors furnished as part of the food service equipment shall have a five (5) year warranty commencing from date as stipulated above. This warranty shall be as provided by the manufacturer of the compressor.
- F. Provide extended warranties where specified.

PART 2 - PRODUCTS

2.1 QUALITY AND CONDITION OF MATERIALS

- A. All materials shall be new, first quality, and without flaws. Equipment shall be delivered upon completion in an undamaged condition. The K.E.C. shall protect from damage, clean, and put into operating condition before acceptance by Owner.

2.2 MATERIALS AND GAUGES

- A. Unless otherwise specified or shown on drawings, all surfaces shall be fabricated of stainless steel, including exposed underbracing below tops of dish tables and open base tables and sinks. The gauges used shall be as follows:
 - 1. 12 ga. (Special construction where specified) Wide tops, sinks, underbracing, drip pans and floor troughs.
 - 2. 14 ga. (Standard construction unless otherwise noted) Table tops, sinks, underbracing and special overshelves.
 - 3. 16 ga. (Standard construction, unless otherwise noted) Undershelves, interior shelves, overshelves, wall shelves, body panels for base cabinets and counters.
 - 4. 18 ga. (Standard construction, unless otherwise noted) Body panels for wall cabinets, partitions, back wall panels, drawer and door fronts and canopies.

5. 20 ga. (Standard construction, unless otherwise noted) Liners for refrigerators, interior panels for drawers and doors.

2.3 MATERIALS

A. Non-Corrodible Alloy

1. Non-corrodible alloy, or stainless steel, specified hereinafter shall be Type 304 stainless steel, having a standard analysis of 18% chromium and 8% nickel. Sheets shall be stretcher leveled, free of buckles, warps and surface imperfections.
2. All gauges, where specified United States Standard gauges. All exposed surfaces shall be given a finish equal to #4 or 180 grit. Where manufacturing process and welding disturb the original finish, it shall be carefully reground, polished and restored to match balance of surface.

- B. Galvanized Iron: Where galvanized iron is specified, furnish hot-dip galvanized, copper bearing steel. Use in largest possible sheets with as few joints as necessary. All sheets shall be commercial quality, stretcher leveled, and re-rolled to insure a smooth surface.

- C. Faucets, Valves, Fittings: Sinks fitted with faucets as called for under each or as a separate item listed as faucets. All basin type faucets, Chicago #51, T&S #B202, or Fisher #3110. All splash mount faucets, Chicago #445, T&S #B237, or Fisher #3210. All special faucets for kettles, pre-wash, etc., shall be listed under Item Specifications.

- D. Motors: Up to and including 1/2 HP shall be wired for 120 volts, single phase. Motors over 1/2 HP shall be wired for 208 volts, coordinate with electrical contractor.

- E. Switches and Controls: The equipment contractor shall supply each motor-driven appliance or electrically heated unit a suitable control switch or starter of proper type in accordance with Underwriter's Laboratories and code requirements. Controls that are mounted on vertical surfaces of fabricated fixtures shall be set into recessed die stamped stainless steel cups or otherwise indented to prevent damage.

F. Electrical Elements:

1. Fabricated items requiring dry heat, such as plate warmers, urn stands shall be fitted with strip or ring heaters of sufficient wattage to provide specified heat. Unless otherwise specified, these heaters shall be installed directly below bottom shelf. Mount in suitable channels and interconnect with hard copper wire in accordance with Electrical Code. Provide each fixture with one or more thermostatic controls, each with pilot light indicator(s).
2. Properly protect all wiring in metal enclosures in accordance with the National Electrical Code, the Chicago Electrical Code and UL Standards.

2.4 FABRICATION

A. Open Type Bases

1. Pipe standards and frames: All pipe stands for open base tables or dish tables shall be constructed of 1-5/8 OD stainless steel tubing, with stringers and cross braces of the same material. All joints between legs and cross braces shall be welded and ground smooth. Legs shall not be spaced more than 5'6" on center.
2. Feet: Fit all pipe legs with sanitary, die-stamped stainless steel bullet shaped feet, fully enclosed, with a slightly rounded bottom to protect the floor. Fit top of these feet with a male threaded stem to fit into the end of the pipe legs specified and provide a total adjustment of 1". Stem shall be extra long so threads are not exposed. Finish off bottom on pipe leg smoothly and overlap stem to provide sanitary fitting and prevent accumulation of grease or other debris at this joint.

3. Undershelves: Unless otherwise specified in item Specifications, undershelves shall be constructed of 16 gauge stainless, turned down front, sides and back 1-1/2" with edges deburred. Shelf shall have rounded corners and be provided with die-stamped raised ferrules to receive legs. Reinforce shelf with 14 gauge stainless steel closed inverted hat type channels. Dish table shelves shall be removable.

B. Enclosed and Semi-Enclosed Bases:

1. Body: Body shall be constructed of fronts, and ends and backs of 18 gauge stainless steel formed and reinforced to create a rigid, welded structure.
2. Tops: When metal tops are specified, reinforced with 14 gauge stainless steel closed inverted hat-type channel bracing.
3. Shelves: intermediate shelves shall be welded in place, unless otherwise specified. Bottom shelves shall be made removable in sections. Both types of shelves shall be constructed of 16 gauge stainless steel turned down fronts, sides and back 1-1/2" with deburred edges. Shelves shall be braced with 12 gauge stainless steel closed inverted hat-type channels. Provide pipe chase openings for utility lines when required. Intermediate shelves shall be turned up 1-1/2" in back and sides and feathered along wall surfaces of base.
4. Legs: Unless otherwise specified, or detailed, bases shall be mounted on 6" high, 1-5/8" OD stainless steel seamless tubular legs, each fitted with a stainless steel closed bottom, vermin-proof, adjustable bullet shaped foot. Legs shall be welded to 14 gauge stainless steel closed inverted hat-type channel welded to body under lower shelf.
5. Drawers: Drawers, unless otherwise specified, shall be 20" x 20" x 5" deep. Drawer front shall be pan-type, fabricated of 14 gauge stainless steel, fitted with a S.S. recessed pull and shall be flush with enclosure. Drawer insert shall be fabricated of 28 gauge stainless steel with all interior coved 1/2" radius. Insert shall be removable and shall be at least three-quarter exposed when drawer is opened fully. Drawer shall operate on heavy-duty stainless steel extension slides with stainless steel ball-bearing rollers. Drawer shall be enclosed fully and shall be self-closing except when fully extended. Provide stainless steel hasp fully welded to all drawers.

C. Table Tops (Metal):

1. Metal table tops of 14 gauge stainless steel with all horizontal and vertical corners coved on 5/8" radius. Shop seams and corners welded, ground smooth and polished. Working tops enclosed base fixtures reinforced on the underside with a framework of 1-1/2" x 4" x 1-1/2" inverted closed hat channel. Cross angle members placed at each pair of legs. Additional cross angle members between legs on not less than 48" centers. One angle runner, running lengthwise, provided on top so here will not be any noticeable deflection. Studweld reinforcements to underside of top. Do not use rivets or bolts through top.
2. Provide field joints in top where necessary and locate for practical construction, consistent with sizes convenient for shipping and accessibility into building. See paragraph entitled "Field Joints" for description of these joints.
3. Turn metal tops down 1-3/4" in a bullnose roll except where adjacent to walls or other pieces of equipment. Turn wall side up and back 2" unless otherwise specified in schedule.

D. Dish Table Tops:

1. Construct tops of dish tables of 14 gauge stainless steel with all free edges turned up 3" and finished with die-formed sanitary rolled rim. Flange sides adjacent to walls or higher fixtures up 6" and back 2" at up 45 degrees then down 3/4". All interior horizontal and vertical corners shall be coved on 5/8" radius. Outside radius of rolled rim corners shall be concentric with side cove.
2. Mount dish table tops on stainless steel tubing legs and connecting rails same as specified for open base tables.
3. Ends of splash shall be closed. Free corners of tops shall be spherical.

E. Sinks, Drainboards and Sink Insets:

1. Unless otherwise specified in Item Specifications shall be fabricated of 14 gauge stainless steel with 1-1/2" rim of front and sides and shall be of one-piece welded construction. All interior corners shall be coved a minimum of 3/4" radius, horizontally and vertically, with all intersections meeting in a spherical section. Solder filling shall not be acceptable. All exposed corners shall be bullnosed. Unless otherwise specified, backsplash shall be turned up 8", back on a 45 degree angle and down 3/4" with exposed ends closed. Bottom shall be pitched and fitted with 1-1/2" waste outlet with stainless steel removable strainer plate, lever handle valve and connected overflow. The use of die drawn bowls will not be accepted.
2. Multiple Compartments: All sinks having two or more compartments adjacent shall be of double thickness continuously welded to form a continuous front. Each compartment shall be pitched and fitted with a 1-1/2" I.P.S. waste outlet with stainless steel removable strainer plate, lever handle valve and connected overflow.
3. Drainboards: Where drainboards with sink compartments are specified they shall be fabricated of the same material as sink and shall be welded integrally with sink to form one-piece welded construction. Drainboards shall be pitched 1/8" per foot minimum. However, drainboards rim shall be kept level with sink. The front end shall be turned up 3" and finished with a 1-1/2" channel rim, with edges deburred. All exposed corners shall be rounded. Unless otherwise specified, backsplash shall be turned up 8", back on a 45 degree angle and down 3/4" with all exposed ends closed. Drainboards shall be reinforced with a 14 gauge stainless steel closed inverted hat-type channel bracing. Undersides of sinks and drainboards shall be coated with 1/8" thick hard-drying, sound-deadening mastic material and sprayed with aluminum paint.
4. Sink Insets: Sinks built into tops of fixtures, unless otherwise specified in Item Specifications, shall be fabricated of 14 gauge stainless steel. All interior corners shall be coved a minimum of 3/4" radius, horizontally and vertically with all intersections meeting in a spherical section. Sinks shall be welded integral to table tops. Riveted, spot-welded, and soldered joints between sink and top of table or in sink proper shall not be acceptable. Bottom shall be pitched and fitted with 1-1/2" I.P.S. waste outlet with stainless steel crumb strainer waste outlet. All sizes of sinks specified are inside dimensions.

F. Field Joints:

1. All field joints shall be welded.
2. All welded parts shall be non-porous and free of imperfections, free of pits, cracks, or discoloration. All welds of galvanized metal on dish tables and sinks shall be ground smooth, sandblasted, and sprayed with molten zinc at 1,200 degrees F to a minimum thickness of .004". Tinning of welds shall not be acceptable. All welds of stainless steel shall be ground and polished to original finish.

G. Sound Deadening:

1. Underside of all tops at contact of body and bracing shall be sound deadened with high quality asphalt mastic: Philip Cary "Hush Mush", Daubert Chemical "Quiet Tape", or approved equal.
2. Underside of drawers and shall be sound deadened.
3. Double walled sliding and swing doors shall be fitted with sound deadening insulation between the walls.

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish to the architect a purchase order log with the following information.
1. Line item equipment number
 2. Quantity of each line item
 3. Manufacturer name

4. Model number of line item
5. Date ordered
6. Scheduled delivery date
7. Purchase order number

B. Furnish the general contractor with the following items.

1. A delivery schedule compatible with their construction schedule.
2. All items of equipment that would require early installation dates, i.e. hoods, floor troughs, etc.
3. Copies of all delivery receipts and bill of lading for all items delivered to the job site. Copy shall bare the written name and signature of receiving person.
4. All loose, small component items shall be clearly taped with the corresponding item number.
5. The general contractor shall distribute all components that are scheduled for installation by others to each respective trade.

C. Trash and crating

1. Remove all debris generated by k.e.c. to job site dumpsters on a daily basis.
2. Do not allow any debris to accumulate in any work area that would impede the work of others or would in any way create a hazard.

3.2 SITE INSPECTIONS

- A. Report to the general contractor in writing verification of all rough locations that are not located per the drawing or the requirements of the specified equipment.
- B. Field verify actual as built dimensions of all walls, rough-ins, structurals, etc. That effect your work.
- C. Field verify that all areas are ready to receive equipment prior to delivery to site.

3.3 INSTALLATION

- A. Deliver all equipment in strict accordance with the specifications.
- B. Deliver, uncrate, assemble, set in place, and level all equipment to be ready for final m.e.p. connections.
- C. Cover all equipment work surfaces with, a thickness equal to the original packaging material, a cover to protect the equipment until the job site is ready for final clean up. All covers shall be securely fastened to the equipment.
- D. Silicone seal all equipment to walls where equipment abuts walls. Seal shall be neat, clean and coved so as to create an easily cleanable surface.
- E. Securely fasten with concealed fastener all scheduled trim after all final connections are completed.
- F. Field verify that all exposed edges of all equipment is free of all burrs, sharp edges and all exposed surfaces are free of any and all fabrication irregularities. Where necessary repair, grind and polish irregularities to a quality finish consistent with the specification standards.
- G. Remove all protective covering from all equipment and clean all equipment ready for final sanitizing when the job site is ready for final inspection by the architect.

3.4 TESTING

- A. Verify that all equipment is connected as per the manufacturer requirements.
- B. Lubricate, start-up, test and adjust all equipment prior to the architect's and owner's inspection.

- C. Notify the architect in writing that all equipment is ready for inspection and demonstration.

3.5 CONTRACT CLOSE OUT

- A. Deliver to the architect all required copies of owner's manuals, operating instructions and warranty documents prior to scheduling architect acceptance review.
- B. Demonstrate all items of equipment to architect and owner.
- C. Deliver all keys clearly tagged, miscellaneous loose accessories to the owner via schedules bill of lading and secure signature for same.

PART 4 - LINE ITEM SPECIFICATION

KEC contractor shall install all equipment level and plumb. All necessary field modifications to equipment to achieve a level and plumb installation shall comply with all applicable codes and (NSF) sanitation requirements.

ITEM 1 STOREROOM SHELVING

Quantity and size as shown on the drawings.

CAMBRO MFG. CO. 7601 CLAY AVE. HUNTINGTON BEACH, CALIFORNIA 92648-2219 800-854-7631 FAX 714-842-3430 MODEL: CAMSHELVING	INTERMETRO INDUSTRIES CORP. NORTH WASHINGTON ST. WILKES-BARRE, PENNSYLVANIA 18705 717-825-2741 FAX 717-825-2852 MODEL: METROMAX	AMCO INDUSTRIES 901 N. KILPATRICK AVE CHICAGO, IL 60651 800-621-4023 FAX 312-379-5183 MODEL: PLASTIC PLUS
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Steel core posts and traverse supports polypropylene coated. Open grid, removable shelf mats capable of being washed in a commercial dishwasher. A 48" shelf section shall support 800 lbs. Each unit to be sized per plan and adjusted per field conditions and to be approximately 84" – 87" high and to have three (3) tiers equally spaced, top tier 72" a.f.f. Each section to be fitted with 5" high premium swivel casters with brakes suitable for corrosion resistant applications.

NOTE: ALL SHELVING FOR ITEMS 1 - 3 SHALL BE BY THE SAME MANUFACTURER

ITEM 2 FREEZER LOCKER

Quantity and size as shown on drawings.

KOLPAK/McCALL 641 N. McCORKLE PARK PARSONS, TN 38363 901-847-5306 901-847-9013 (FAX) Model #P6-066-FT	LEER MANUFACTURING 206 LEER STREET NEW LISBON, WI 53950 888-766-5337 608-562-3166 (FAX) Model #G5-6X6	NOR-LAKE 727 SECOND ST. HUDSON, WI 54016 800-955-5253 715-386-6149 (FAX) MODEL #KL-66
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Cooler shall be exterior sized per the drawing for nominal 6'-0" x 6'-0" width and length, and shall be 6'-6" high. Failure of the Kitchen Equipment Contractor to provide the correct size, as specified that results in changes to the building architectural and mechanical electrical and plumbing system shall pay all costs to alter same.

Walls panels, interior and exterior shall be a minimum 26 gauge, pebble pattern finish aluminum, with 4" thick closed-cell foamed-in-place polyurethane construction, standard cam-lock connection system, to insure a sealed enclosure when erected. Ceilings to be white baked enamel. Provide stucco aluminum trim angles at all wall intersections with the building wall. Flame spread rating to be 25 or less.

Stainless steel insulated floor set in building slab depression. KEC to provide trim angles at building wall junctions.

Doors and door panel sections shall be positioned as shown on the drawings. Each door shall fit flush with box exterior; shall be equipped with a minimum of 2 cam-lift, self-closing hinges securely fastened to door frame; magnetic sealing door gasket, recessed light switch with pilot light, door frame heater, 14 gauge stainless steel threshold plate, 2" dial thermometer, cam-action locking handle with interior safety release, heated pressure relief port and audio alarm. Door to be a nominal 26" wide and stainless steel finished with 24" high aluminum treadplate kickplate on both sides.

Interior lighting shall include one (1) standard 100 watt shielded vaporproof light fixture provided at the door opening, installation and for inter-connection to door light switch. Refrigeration system shall consist of self-contained, top mounted air-cooled unit; refer to drawings for operation voltage and amperage.

Refrigeration systems shall be provided by same manufacturer as the walk-in cooler. Furnish a letter of certification that the compressor and coil system is sized correctly to operate and hold product at 0 degrees F. with a maximum run time of 80% and as a working cooler. Assume that product load will be room ambient; door open thermal loss of 10% for 4 hours per day, five out of seven days.

Refrigeration system shall consist of furnishing and installing complete refrigeration system. Furnish complete with permits, hook-ups, valves, building coves, controls, disconnects, start-up, and 1 year service after Final Acceptance. All work shall be performed in accordance with the City of Chicago Refrigeration Code and meet the minimum standards as set by the 1995 Montreal Convention.

1. Coils shall be flush, ceiling mounted.
2. Provide unit with sight glass, drier and liquid line assembly, and pressure relief valve. Pressure relief valve and all piping shall meet the Chicago Mechanical Code.
3. Condensate evaporator.
4. Electric defrost heater on drain line from the freezer coil.
5. Hi/low temperature alarm system.

Submit complete shop drawings and details for review prior to fabrication and installation.

NOTE: ITEMS 2 AND 3 SHALL BE THE SAME MANUFACTURER

ITEM 3 REFRIGERATOR LOCKER

Quantity and size as shown on drawings.

KOLPAK/McCALL
641 N. McCORKLE PARK
PARSONS, TN 38363
901-847-5306
901-847-9013 (FAX)
MODEL #P6-066-CT

LEER MAUFACTURING
206 LEER STREET
NEW LISBON, WI 53950
888-766-5337
608-562-3166 (FAX)
MODEL #G5-6X6

NOR-LAKE
727 SECOND ST.
HUDSON, WI 54016
800-955-5253
715-386-6149 (FAX)
MODEL #KL-66

Same as specified for Item #2 except provide refrigeration to maintain +38 degrees Fahrenheit.

ITEM 4 HAND SINK

Quantity as shown on the drawings.

EAGLE GROUP
100 INDUSTRIAL BLVD.

CLAYTON, DE 19930
800-441-8440
FAX 302-653-2065
MODEL HSA-10-F

ADVANCE TABCO
200 HEARTLAND BLVD.
SUITE T
EDGEWOOD, NY 11747
1-800-645-3166
FAX 1-516-242-6900
MODEL 7-PS-60

UNIVERSAL STAINLESS
2801 HUTCHINSON-MCDONALD

CHARLOTTE, NC 28269
1-800-925-1909
FAX 1-704-599-1909
MODEL CHS-1

Handsink shall be complete with faucet/strainer and wall mounting bracket. Handsink bowl shall measure nominal 12" x 10" x 5-1/2" overall with marine edge, made of 20 gauge, type 300 series stainless steel. Corner shall be minimum 1-3/4" coved; ends shall be turned back for safe, no-cut edges. Backsplash shall be 8" high with 2-3/4" turnback at 45 degree angle, with all welded end caps. Welded areas shall be blended to match adjacent surfaces, then polished to No. 4 finish. Hand sink shall include splash-mounted, chrome-plated Chicago, T&S or Fisher faucet with wrist handles and swivel gooseneck spout with .5 GPM aerator.

ITEM 5 ROLL-THRU REFRIGERATOR

Quantity as shown on the drawings.

TRAULSEN
11-402 15TH AVE.
COLLEGE POINT, NY
1-800-825-8220
FAX 1-718-961-1390
MODEL ARI (1) 32-LUTFHS

VICTORY
110 WOODCREST RD.
CHERRY HILL, N.J. 08003
856-428-4200
FAX 856-428-7299
MODEL RISA RISA-1D-S1-PT

TRUE MFG
PO BOX 970
O'FALLON, MO 63366
800-325-6152
FAX 314-272-2408
MODEL #TA1-RRT-1S1S

- Provide stainless steel trim and enclosure panels as shown on detail 11.
- Item #5 and #8 to be the same manufacturer.

ITEM 6 OVEN CARTS

Mfg: Blodgett or approved equal
Quantity as shown on drawings.

- Two (2) #CTRE-2 transport carts for each oven (four total).
- Four (4) #DBR-1L roll-in basket dollies for each oven (eight total).
- Porcelain finish for oven interiors.

BASKET REQUIREMENTS, each basket dolly shall be provided with fourteen (14) #136-12 wire baskets as manufactured by Marlin Steel Wire Products (#410-644-7456). Baskets shall be constructed of nickel chrome plated cold rolled steel wire. Basket top and bottom frame to be ¼" diameter cold rolled steel. Crosswires of #11 gauge cold rolled steel shall be welded for form a 2" grid pattern and corner Vs for extra strength. The entire basket assembly is then to be nickel chrome plated. Basket shall measure 13-3/8" x 25-7/8" x 2-5/8". Total quantity baskets required is one hundred twelve (112).

ITEM 7 UTILITY CARTS

Quantity and size as shown on drawings.

LAKESIDE	PIPER PRODUCTS
1977 S. ALLIS ST.	300 S. 84 TH AVENUE
MILWAUKEE, WI 53207	WAUSAU, WI
1-414-481-3900	800-544-3057
FAX 1-414-481-9313	FAX 715-842-3125
MODEL #243	MODEL #6-UCM-2

- Corner bumpers

ITEM 8 ROLL-THRU FOOD WARMER

Quantity as shown on the drawings.

TRAULSEN	VICTORY	TRUE MFG.
11-402 15TH AVE.	110 WOODCREST RD.	P.O. BOX 970
COLLEGE POINT, NY	CHERRY HILL, N.J. 08003	O'FALLON, MO 63366
1-800-825-8220	856-428-4200	800-325-6152
FAX 1-718-961-1390	FAX 856-428-7299	FAX 314-272-2408
MODEL #AIH-132-L-FHS	MODEL #HISA-1D-S1-PT	MODEL #TA1HRT-1S1S

- Provide stainless steel trim and enclosure panels as shown on detail 11.
- Items 5 & 8 to be the same manufacturer.

ITEM 9 MOBILE WORKTABLE

Quantity and size as shown on the drawings.

Custom Fabricated, NSF, general construction per standard details

TOP, 14 gauge stainless steel, type 304 (18/8) with edge per detail 5d.

UNDERSTRUCTURE, 14 gauge galvanized channeling rigidly braced to top with studs and dome caps.

UNDERSHELF, 16 gauge stainless steel, type 304 (18/8) with edge to match top welded to legs.

LEGS, 1-5/8" diameter S/S, type 304 (18/8) (8) legs required.

GUSSETS, stainless steel conical type with inner sleeve and set screw.

CASTERS, 5" diameter polyurethane tires, all swivel, two (2) w/brakes.

DRAWERS, 20" x 20" x 5" deep, stainless steel drawer and housing.

ITEM 10 THREE COMPARTMENT SINK

Quantity and size as shown on drawings.

Custom fabricated, NSF, general construction per standard details.

SINK, 14 gauge stainless steel, type 304 (18/8) with 3/4" radius corners. Backsplash per details 3b and 4a against walls. Rim per detail 5b on free sides. Include lever wastes.

PARTITIONS, 14 gauge S/S, 5/8" thick double wall construction totally flush welded to sink body.

DRAINBOARDS, 14 gauge S/S integrally welded and of same construction as sink, sized per plan to have built in pitch to sink compartments.

UNDERSTRUCTURE, 14 gauge S/S triangular channeling welded to bottom.

LEGS, 1-5/8" diameter S/S, type 304 (18/8).

GUSSETS, stainless steel conical type with inner sleeve and set screw.

FEET, stainless steel adjustable bullet type.

FAUCETS - Two (2) required

- Chicago or T&S 15" minimum double jointed nozzle with 2.2 GPM aerator.

ITEM 11 ROLL-IN CONVECTION OVEN

BLODGETT OVEN CO. (OR APPROVED EQUAL)

50 LAKESIDE AVE.

P.O. BOX 586

BURLINGTON, VT 05402

802-860-3700

802-864-0183 (FAX)

MODEL #ZEPHAIRE, DOUBLE (ELECTRIC)

STANDARD EXTERIOR FINISH, shall consist of #430 stainless steel front, #3 finish and a dull heat resistant black enamel finish on the top, sides and back of oven.

CONTROL PANEL, shall be of stainless steel with independent controls. Control panel shall be completely removable for servicing.

STANDARD BAKING COMPARTMENT INTERIOR, including baffle to be of steel. Dimensions 29" wide x 20" high x 28-1/4" deep to front of baffle.

INSULATION, top, back and sides to be insulated with 1" thick, high temperature mineral fiber sheet.

DOORS AND HANDLES, a single handle mounted on each door to operate each door individually.

TRACKS, shall consist of stainless steel-formed guides mounted on the liner bottom.

DOCKING AND LOCKING ASSEMBLY, to be mounted on oven base to facilitate alignment for docking and locking of transport cart.

VENTING, oven baking chamber is continuously vented to oven exterior.

THERMOSTATS, each section shall be equipped with an electric, direct acting thermostat, which shall have a snap action mechanism and integral off-on switch. Range shall be 200 degrees F to 500 degrees F.

TIMER, 60-minute mechanical timer with bell.

LISTING, ovens are listed Underwriters Laboratories and National Sanitation Foundation. Each Convection Oven shall be provided with the following optional features:

- 6" stainless steel legs, solid doors in lieu of doors with windows.
- Safety restraining cable.

ITEM 12 EXHAUST HOOD(S)

Quantity and size as shown on drawing.

AVTEC INDUSTRIES 120 KENDALL POINT DR. OSWEGO, IL 60543 708-851-4800 FAX 708-851-5777 MODEL #VDW – TYPE II	CAPTIVE-AIRE 245 W. ROOSEVELT RD. W. CHICAGO, IL 60185 630-231-3380 FAX 630-231-8721 MODEL #VHB-6 – TYPE II	CADDY 509 SHARPSTOWN RD. BRIDGEPORT, NJ 609-467-4222 FAX 609-467-5511 MODEL CHW – TYPE II
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The exhaust hood[s] construction and specifications shall meet or exceed the minimum standards as set forth by the following agents and authorities:

1. The City of Chicago Building Code
2. Underwriter's Laboratories
3. The National Sanitation Foundation
4. The National Fire Protection Agency
5. Illinois Department of Public Health

The exhaust hood[s] shall be sized as per the Food Service and architectural drawings and the mechanical drawings; both of which allow for a minimum overhang of 6" in rear for the mechanical connection of the equipment under the hood, 12" in front of equipment, and the length by 6" at each side beyond the equipment as it is spaced under the exhaust canopy, except against a building wall. Install bottom at 80" a.f.f.

The exhaust air shall be sized as per the mechanical drawings.

Where the mechanical requirements of the exhaust hood[s] provided by the Food Service Equipment Contractor do not meet the values as set forth by the Contract Documents, all costs for altering the duct and fan system, altering the H.V.A.C. system of the room, general construction modification, including any required architectural and/or engineering review shall be borne by the Kitchen Equipment Contractor.

The entire hood shall be constructed of a minimum of number 18 gauge, Type 304 stainless steel, No. 4 finish on all exposed areas. Single wall vent hood for non-grease applications for the removal of heat, vapor, etc. Hood shall have a full perimeter gutter with a ½" OD Bolt thread drain connection.

1. Exhaust duct collar to be 4" high with 1" flanges. Duct sizes, CFM and static pressure requirements shall be as shown on the drawings. Hood shall be recognized by NSF.
2. Incandescent light fixtures, quantity as follows. Light fixtures shall be interconnected to a single point connection within hood sections.
 - a. Hood under 8'-0" long to include (1) fixture.

- b. Hood between 8'-0" and 10'-0" long to include (2) fixtures.
- c. Hood between 10'-0" and 16'-0" long to include (3) fixtures.
3. 20 gauge, Type 304 stainless steel enclosure panel to enclose area above the canopy from the top of the canopy to the building ceiling.
4. Provide 18 gauge, Type 304 stainless steel wall flashing with a No. 4 finish to wall or walls under exhaust canopy. Wall flashing shall extend from the cove base to the underside of hood. Provide clean, tight knockouts for all utility rough-ins.
5. Provide light and fan switches on the face of the hood.

ITEM 13 MILK CASE COOLERS

Quantity and size as shown on the drawings.

MOD-U-SERVE	BEVERAGE-AIR	NOR-LAKE
2320 PEYTON	P.O. BOX 5932	727 SECOND ST.
HOUSTON, TX 77032	SPARTANBURG, SC 29304	HUDSON, WI 54016
888-955-5463	800-845-9800	800-955-5253
FAX 281-442-3351	FAX 864-582-5083	FAX 715-386-6149
MODEL #MCT-DM2	MODEL #ST49N	MODEL #AR-124

ITEM 14 FROST TOP SERVING COUNTER

Quantity as shown on the drawings.

All serving line components to be by the same manufacturer. 32" working counter top height all units.

DELFIELD	DUKE MFG. CO.	MOD-U-SERVE
P.O. BOX 470	2305 N. BROADWAY	2320 PEYTON
MT. PLEASANT, IL	ST. LOUIS, MO 63102	HOUSTON, TX 77032
1-800-733-8821	800-735-3853	888-955-5463
FAX 1-800-669-0619	FAX 314-231-5074	FAX 281-442-3351
MODEL #SCFT-74-NU	MODEL #TFT-74-SS	MODEL #MCT-FR5

TOP, fabricated of 16 ga., type 302 polished stainless steel, turned down 2" on edges, with all corners welded and perimeter marine edge. Frost top to be approximately 2" below the counter top.

APRON, full length x 10" high stainless steel apron.

CASTERS, mount on four (4) 5" diameter, heavy-duty, double ball bearing swivel casters with non-marking rubber tires. Two casters fitted with brakes adjust height to accommodate 32" work top.

LOCKING DEVICE, Cam-action latches with trigger releases to join multiple units together at the top to form a unitized serving line.

Include the following accessories:

1. Full length x 12" wide, solid, stainless steel, ribbed type tray slide set on stainless steel folding brackets.
2. Full length minimum 6" wide stainless steel work shelf on stainless steel folding brackets.
3. Full front panel and end enclosure panels with laminate or stainless steel finish.
4. Full length x full width stainless steel undershelf.
5. Full length double-deck display stand with plexiglas sneeze guards and end panels and stainless steel shelves. Each shelf to be fitted with a fluorescent light intertwined with compressor cordset
6. Full length stainless steel kickplate across the front.

ITEM 15 HOT FOOD SERVING COUNTER

Quantity as shown on the drawings.

DELFIELD	DUKE MFG. CO.	MOD-U-SERVE
P.O. BOX 470	2305 N. BROADWAY	2320 PEYTON
MT. PLEASANT, IL	ST. LOUIS, MO 63102	HOUSTON, TX 77032
1-800-733-8821	800-735-3853	888-955-5463
FAX 1-800-669-0619	FAX 314-231-5074	FAX 281-442-3351
MODEL #SC-74	MODEL #TST-74-SS	MODEL #MCT-FT5

Same general materials, accessories, specifications and details to match Item #14, except delete the display stand specified under point 5. No display stand or sneeze guard is required.

ITEM 16 CHECKER STAND

Quantity as shown on the drawings.

DELFIELD	DUKE MFG. CO.	MOD-U-SERVE
P.O. BOX 470	2305 N. BROADWAY	2320 PEYTON
MT. PLEASANT, IL	ST. LOUIS, MO 63102	HOUSTON, TX 77032
1-800-733-8821	800-735-3853	888-955-5463
FAX 1-800-669-0619	FAX 314-231-5074	FAX 281-442-3351
MODEL #SCS-30	MODEL #TCS-30-SS	MODEL #MCT-CRSG

Same general materials, specifications and details to match Item #14.

1. Full length x 12" wide, solid, stainless steel, ribbed type tray slide set on stainless steel folding brackets.

ITEM 17 TRAY DRYING RACK

Quantity and size as shown on the drawings.

INTERMETRO INDUSTRIES CORP.	AMCO INDUSTRIES
NORTH WASHINGTON ST.	901 N. KILPATRICK AVE
WILKES-BARRE,	CHICAGO, IL 60651
PENNSYLVANIA 18705	800-621-4023
717-825-2741	FAX 312-379-5183
FAX 717-825-2852	MODEL: PP4824
MODEL: PR48VX	

Four (4) tiers high, all shelves equipped with removable shelf mats, tray drying inserts, and 5" diameter polyurethane tired casters, two (2) swivel with brakes. Include donut bumpers.

ITEM 18 ANGLE RACKS

Quantity as shown on the drawings.

NEW AGE
P.O. BOX 384
NORTON, KS 67654
800-255-0104
FAX 913-817-2616
MODEL #1337

CRES-COR
5925 HEISLEY ROAD
MENTOR, OH 44060
877-273-7267
FAX 440-350-7267
MODEL #207-1811C

CHANNEL
55 CHANNEL DRIVE
PORT WASHINGTON, NY 11050
866-712-7283
FAX 516-944-6271
MODEL #417-A-SL

Frame and cross supports shall be of 1" square tubing, extruded aluminum alloy, all welded construction with corner bumpers. Bottom shall be of solid aluminum alloy with aluminum hat channels welded underneath for recessing of casters. Tray slides shall be of extruded aluminum angles 5"± O.C. welded to the frame. Units shall be furnished with 5" diameter heavy duty, plate type casters two supplied with brakes and to be sized to fit into Items #5 and #8.

ITEM 19 REACH-IN REFRIGERATOR

Quantity: One (1)

TRUE MFG.
P.O. BOX 970
O'FALLEN, MO 63366
MODEL: T-49

TRAULSEN
11-402 15TH AVE.
COLLEGE POINT, NY 11356
MODEL: G20010

CONTINENTAL
539 DUNKSFERRY ROAD
BENSALEM, PA 19020
MODEL: 2R

Include the following features and options:

1. Minimum of 49 cubic feet capacity.
2. Aluminum interior and exterior with stainless steel doors.
3. 9'-0" long UL listed attached cord and plug.
4. Casters, two (2) with brakes.
5. Minimum 1/3 HP, 115 volt, condensing unit.
6. Hot gas condensate evaporator.

ITEM 20 TRAY CARTS

Quantity as shown on the drawings.

PIPER PRODUCTS	CADDY
300 S. 8 TH AVE.	711 CADDY DRIVE
WAUSAU, WI 54401	PITMAN, NJ 08071
800-544-3057	609-589-1550
FAX 715-842-3125	FAX 609-589-0220
MODEL D-160-23	MODEL T-135

FRAME, constructed of 1" O.D. 16 ga. stainless steel tubing, with 3/4" O.D. integrally welded cross rails.
CABINET, constructed of all-welded 18 ga. stainless steel, with edges flanged. Include a canted shelf with enclosed ends and full height back at an angle to support trays, with all interior corners coved to a 1/2" radius. Shelf to be set 14" above the floor and provide a 1/2" diameter hole to permit drainage.
CASTERS, mounted on four (4) 4" diameter heavy-duty, double ball bearing swivel casters, two [2] with brakes.

Unit may be custom fabricated per the specifications.

ITEM 21 FLOOR TROUGHS

Quantity as shown on the drawing.

ADVANCE TABCO	IMC TEDDY	BRASSMITH INC.
200 HEARTLAND BLVD	PO BOX 206	16133 W. 45 TH ST.
EDGEWOOD, NY 11747	COPIAGUE, NY 11726	GOLDEN, CO 80403
800-645-3166	631-789-8881	800-779-4203
FAX 516-242-6900	FAX 631-789-3633	FAX 303-271-3645
MODEL #FFTG-1236	MODEL #FT-1236	MODEL #FT-12-36

Stainless steel subway style grate.
Unit may be custom fabricated to comply with the specifications of the above.

ITEM 22 RECYCLING COUNTER

Custom fabricated, size and quantity per plan x 36" O.A. high.

- General construction per details 1, 2, 6, and 7
- Backsplash per details 3e and 4a against building walls.
- Rim per detail 5f
- Integral sink approximately 40" x 20" x 12" deep fitted with T&S or Chicago deck mounted faucet with 12" nozzle with loose keyed stops and 2.2 GPM aerator spout, and crumb cup basket drain. Provide hinged double pan solid door per detail 7. Omit bottom shelf in the cabinet base.
- Support top with Walsh-Simmons seating #BAS 30WL cantilevered table brackets spaced to accommodate the recycling bins, Item #23. Tops to be set at 30" a.f.f.
- Provide cutout in top with 1" turn-down at rear and ends and 1" turn-up at front with radiused corners. Cutouts to be centered over recycling bins between top supports.

ITEM 23 RECYCLING BINS

Quantity and size as shown on the drawings.

RUBBERMAID COMMERCIAL PRODUCTS
3124 VALLEY AVENUE
WINCHESTER, VA 22601
540-667-8700
FAX 540-542-8821
MODEL #3958

ITEM 24 DUNNAGE RACKS

Quantity and size as shown on drawings.

INTERMETRO INDUSTRIES CORP.
NORTH WASHINGTON ST.
WILKES-BARRE,
PENNSYLVANIA 18705
717-825-2741
FAX 717-825-2852
MODEL: A1460NK3/13PK3

AMCO INDUSTRIES
901 N. KILPATRICK AVE
CHICAGO, IL 60651
800-621-4023
FAX 312-379-5183
MODEL: A1260/P08 Polygard

Steel core posts and traverse supports polypropylene coated. Open grid, removable shelf mats capable of being washed in a commercial dishwasher. Each unit to be sized per plan and adjusted per field conditions and to be 8" – 12" high.

ITEM 25 FREEZER SHELVING

Quantity and size as shown on drawings.

CAMBRO MFG. CO.
7601 CLAY AVE.
HUNTINGTON BEACH,
CALIFORNIA 92648-2219
800-854-7631
FAX 714-842-3430
MODEL: CAMSHELVING

INTERMETRO INDUSTRIES CORP.
NORTH WASHINGTON ST.
WILKES-BARRE,
PENNSYLVANIA 18705
717-825-2741
FAX 717-825-2852
MODEL: METROMAX

AMCO INDUSTRIES
901 N. KILPATRICK AVE
CHICAGO, IL 60651
800-621-4023
FAX 312-379-5183
MODEL: PLASTIC PLUS

Provide shelving sections same as specified for Item #1. Sections to be sized per plan x approximately 64" high, with three (3) tiers. Delete casters.

ITEM 26 REFRIGERATOR SHELVING

Quantity and size as shown on drawings.

CAMBRO MFG. CO. 7601 CLAY AVE. HUNTINGTON BEACH, CALIFORNIA 92648-2219 800-854-7631 FAX 714-842-3430 MODEL: CAMSHELVING	INTERMETRO INDUSTRIES CORP. NORTH WASHINGTON ST. WILKES-BARRE, PENNSYLVANIA 18705 717-825-2741 FAX 717-825-2852 MODEL: METROMAX	AMCO INDUSTRIES 901 N. KILPATRICK AVE CHICAGO, IL 60651 800-621-4023 FAX 312-379-5183 MODEL: PLASTIC PLUS
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Provide shelving sections same as specified for Item #1. Sections to be sized per plan x approximately 64" high, with three (3) tiers. Delete casters.

ITEM 27 TRASH CONTAINERS

Quantity and size as shown on the drawings.

RUBBERMAID COMMERCIAL PRODUCTS
3124 VALLEY AVENUE
WINCHESTER, VA 22601
540-667-8700
FAX 540-542-8821
MODEL #2655/2654

ITEM 28 OPEN NUMBER

ITEM 29 DISH WASHER

Quantity as shown on the drawings.

CHAMPION INDUSTRIES P.O. BOX 4149 WINSTON-SALEM, NC 27115 336-661-1556 FAX 336-661-1979 MODEL #UH-170B	CMA 12700 KNOTT AVE. GARDEN GROVE, CA 92841 800-854-6417 FAX 714-895-2141 MODEL #180U.C	HOBART 701 S. RIDGE TROY, OHIO 45374 888-4HOBART FAX MODEL: LXi
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- Detergent and rinse aid pumps
- Hot water sanitizing

ITEM 30 DISH TABLE

Quantity as shown on the drawings.

ADVANCE TABCO
200 HEARTLAND BLVD.
EDGEWOOD, NY 11719
800-498-6634
FAX 631-586-2933
MODEL #DTU-U60-48L

EAGLE
100 INDUSTRIAL BLVD.
CLAYTON, DE 19938
800-441-8440
FAX 302-653-2065
MODEL #UDT-4R-16/3

SELECT STAINLESS
11145 MONROE ROAD
MATTHEWS, NC 28105
888-843-2345
FAX 704-841-1590
MODEL #52UD-L STANDARD

- 16 gauge, #304 stainless steel construction
- T&S, Chicago Faucet or Fisher backsplash mounted pre-rinse spray.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus four (4)- inch wg to plus ten (10)-inch wg. Metal ducts include the following:
1. Rectangular ducts and fittings.
 2. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.
 3. Double-wall, rectangular, round, and flat-oval spiral-seam ducts and formed fittings.

1.2 DEFINITIONS

- A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
 2. Joints: Joints include girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Hanger and Support Design: Hangers and supports shall comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

1.4 SUBMITTALS

- A. Shop Drawings: Drawn at a scale of not less than 1/4" = 1'-0". Show fabrication and installation details for metal ducts.
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Duct layout indicating sizes and pressure classes.
 3. Elevations of top and bottom of ducts.
 4. Dimensions of main duct runs from building grid lines.
 5. Fittings.
 6. Reinforcement and spacing.
 7. Seam and joint construction.
 8. Penetrations through fire-rated and other partitions.
 9. Equipment installation based on equipment being used on Project.
 10. Duct accessories, including access doors and panels.

11. Hangers and supports, including methods for duct and building attachment and vibration isolation.

B. Delegated-Design Submittal:

1. Spacing of hangers and supports.
2. Design calculations: Calculations, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Submit certification stating all adhesives and sealants installed in the building interior (defined as inside of the weatherproofing system and applied on-site) shall meet testing and product requirements of the California Department of Health Services *Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*, including 2004 Addenda.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be stored in a designated area and protected from inclement weather.

B. All materials shall be secured so as not to be a hazard during the construction process.

C. Store ductwork with tight-fitting seals on open ends to ensure ductwork is free of all dirt, debris and moisture during the installation process.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. PVC-Coated Galvanized Steel: Acceptable by authorities having jurisdiction for use in fabricating ducts with UL 181, Class 1 listing. Lock-forming-quality, galvanized sheet steel complying with ASTM A 653/A 653M and having G90 coating designation. Factory-applied PVC coatings shall be 4 mils thick on sheet metal surfaces of ducts and fittings exposed to corrosive conditions and 2 mils thick on opposite surfaces.
- D. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- E. Stainless Steel: ASTM A 480/A 480M, Type 304 & 316.
- F. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- G. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- I. Insulated Flexible Ducts: Flexible ducts wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.

2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes combinations of open-weave fabric strips and mastics. Duct Sealants classified as "Other Sealants" shall have a maximum VOC content of 420 g/L. Duct Sealants classified as "Architectural Sealants" shall have a maximum VOC content of 250 g/L.
- B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- C. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- D. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: All-thread rods used in pool areas, pool equipment rooms, and pool supporting spaces shall be aluminum if the ducts are aluminum and stainless steel if the ducts are stainless steel.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
 - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 - 3. Supports for Aluminum Ducts: Aluminum support materials..

2.4 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 - 1. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
 - 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.5 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Manufacturers: applicable to factory-fabricated duct and fittings:
- B. Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Ductmate Industries, Inc.
 - 2. Lindab.
 - 3. Lockformer.
 - 4. McGill Airflow.
 - 5. Nexus Inc.
 - 6. Semco, Inc.
 - 7. Ward Industries.
- C. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- D. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- E. Flat-Oval, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible. Fabricate ducts larger than 72 inches in diameter with butt-welded longitudinal seams.
- F. Duct Joints:
 - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
 - 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - 5. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
- G. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- H. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

- I. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
 - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
 - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
 - b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
 - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
 - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
 4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
 5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 6. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
 9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
 10. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
 11. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.
- J. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:
 1. Round Elbows 4 to 8 Inches in Diameter: Two piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
 2. Round Elbows 9 to 26 Inches in Diameter: Standing-seam construction.

3. Round Elbows 28 to 60 Inches in Diameter: Standard gored construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slip-joint construction with a minimum 2-inch insertion length.

2.6 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: applicable to factory-fabricated duct and fittings.: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. McGill AirFlow LLC.
 2. Sheet Metal Connectors, Inc.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: 304 stainless steel (outdoor application) / G90 galvanized steel (indoor application) complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Maximum "R" Value: R = 5.0 for interior ducts, R = 8.0 for exterior ducts.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
- G. Inner Duct: **Minimum 0.028-inch perforated sheet steel**
- H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.7 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Manufacturers: applicable to factory-fabricated duct and fittings.: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Lindab Inc.
 2. McGill AirFlow LLC.
 3. SEMCO Incorporated.
 4. Sheet Metal Connectors, Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: 304 stainless steel (outdoor application) / G90 galvanized steel (indoor application) complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
 3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch solid sheet steel.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum "R" Value: R = 5.0 for interior ducts., R = 8.0 for exterior ducts.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts (constant volume units): +2".
2. Supply Ducts (before Air Terminal Units): +4".
3. Supply Ducts (after Air Terminal Units): +2".
4. Supply Ducts (between fan and first system fire damper): +8".
5. Return Ducts (Negative Pressure): -2".
6. Return Ducts (between nearest fire damper and return fan inlet): -4".
7. Return Ducts (return fan discharge and AHU intake / exhaust damper): -4".
8. Exhaust Ducts (Negative Pressure): -2".

B. All ducts shall be galvanized steel except as follows:

1. Dishwasher Hood Exhaust Ducts:
 - a. Aluminum or type 304, stainless steel with finish to match dishwasher equipment and hood. Welded/flanged seams and joints.
2. Exposed Supply Ducts In Occupied Spaces (Gymnasiums / Wrestling / Fitness / Multipurpose / Cafetorium / Library / etc.):
 - a. Spiral round/oval galvanized sheet steel with paint grip finish.
3. Double Wall Ductwork:
 - a. Double wall ductwork type 304 SS outer, solid sheet steel inner with fibrous glass insulation.

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.3 PVC-COATED DUCT, SPECIAL INSTALLATION REQUIREMENTS

- A. Repair damage to PVC coating with manufacturer's recommended materials.

3.4 UNDERSLAB DUCTS, SPECIAL INSTALLATION REQUIREMENTS

- A. Verify undamaged condition of ducts before enclosure with fill or encasement.
- B. Protect ducts from damage by equipment used in placing fill materials and concrete on or around ducts.
- C. Protect duct openings from damage and prevent entrance of foreign materials.

3.5 SEAM AND JOINT SEALING

- A. Seal all duct seams and joints to the most severe requirement between the latest Chicago Building Code and SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

- B. Utilize sealant designed for outdoor use with ductwork exposed to the outdoors.
- C. Seal ducts before external insulation is applied.

3.6 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. For concrete structure installations: Install concrete inserts before placing concrete.
- E. For concrete structure installations: Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.7 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
 - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 - 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
 - 4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

END OF SECTION

SECTION 27 51 00

DISTRIBUTED AUDIO-VIDEO COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
1. Coaxial and Category 6 UTP wiring for media-management television distribution.
 2. Cable connecting hardware, termination panels, and cross-connects.
 3. Signal transmission active and passive components.
 4. Signal transmission of a Locally Originated Video Channel.
- B. The MMTV cabling system will be a star topology two-way coaxial video cabling system capable of passing reverse channels from 5 MHz to 36 MHz and forward channels for 54 MHz to 860 MHz. The MMTV cabling system is comprised of, but not limited to coaxial, splitters, faceplates, and connectors. Each MMTV outlet will have a dedicated coaxial cable and a 4-pair, UTP Category 6 cable run from the outlet to the MDF.

1.2 DEFINITIONS

- A. Broadband: For the purposes of this Section, wide bandwidth equipment or systems that can carry signals occupying in the frequency range of 5 to 1000 MHz.
- B. Carrier: An RF signal that is modulated to carry information. In the process of modulation, it is spread out over a wider band.
- C. CATV: Community antenna television; a communication system that simultaneously distributes several different channels of broadcast programs and other information to customers via a coaxial cable.
- D. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. $\text{dBmV} = 20 \log_{10}(V_1/V_2)$ where V_1 is the measurement of voltage at a point having identical impedance to V_2 (0.001 V across 75 ohms).
- E. Headend: The control center of the master antenna television system, where incoming signals are amplified, converted, processed, and combined into a common cable along with any locally originated television signals, for transmission to user-interface points.
- F. IDF: Intermediate Distribution Facility
- G. MDF: Main Distribution Facility
- H. MMTV: Media Management Television
- I. Modulator: An active device that modulates a baseband audio and video source onto an NTSC 6 MHz wide channel. This device shall employ a custom SAW filter to provide true vestigial

sideband selectivity with built-in FCC group delay pre-distortion. This will allow for adjacent channel operation without any interference. This device shall also comply with FCC Docket 21006.

- J. RF: Radio frequency.
- K. User Interface: End point of Contractor's responsibility for Work of this Section. User interfaces are the 75-ohm terminals on device plates.
- L. UTP: Unshielded Twisted Pair

1.3 SUBMITTALS

- A. Product Data: For each component specified, including detailed manufacturer's specifications. Include data on features, ratings, and performance.
- B. Shop drawings: Show fabrication and installation details, including:
 - 1. Floor plans prepared at 1/8" scale indicating the following:
 - a. Location of all MMTV outlets with identification numbers.
 - b. Location of termination racks and backboards.
 - c. Point-to-point raceway routing, identifying number and type of cables in each raceway. Include pullbox locations and sizes.
 - d. Conduit fill calculations, indicating cross-section area percent fill for each raceway.
 - 2. Detailed layout drawings of MDF racks, including front-view details identifying all components, cabling connections, and cable identification numbers.
 - 3. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
 - 4. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system to user-interface points. Show cable types and sizes.
 - 5. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to specification. Contact Blonder Tongue Laboratories, Inc. for a survey form and recommended design considerations.
- C. Source quality-control test reports on coaxial cable sweep tests.
- D. Field quality-control test reports, as indicated in Part 3 Article "Contractor Startup and Reporting."
- E. Maintenance data for products to include in the operation and maintenance manual specified in Division 01. Include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Engage firms experienced in manufacturing systems and equipment similar to those indicated for this Project and that have a record of successful in-service performance.
- B. Comply with City of Chicago Building Code (CCBC).
- C. Comply with all parts of the FCC part 76 rules and regulations for CATV systems.
- D. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in City of Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE AND HANDLING

- A. **Environmental Limitations:** Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Receive, handle, and store MMTV system items and materials at the project site. Materials and items shall be placed so that they are protected from damage and deterioration.
- C. Stage materials in a secure area of the project site until installation.

1.6 SYSTEM DESCRIPTION

- A. System shall consist of a coaxial and UTP cable distribution system for delivery of two-way video channels and control signals.
- B. Headend equipment shall consist of signal amplification devices. Coordinate with Owner to obtain signal levels, and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
- C. Cable distribution system consisting of Category 6 UTP cables, UTP termination hardware, coaxial cables, user interfaces, signal taps and splitters, RF amplifiers, signal equalizers, power supplies, and required hardware complying with IEEE 802.7 and resulting in performance parameters specified in this Section.
- D. **Hardware Requirements:** Use modular, plug-in, solid-state electronic components. Mount amplifiers and other powered equipment in standard 19-inch cabinet complying with EIA 310.

1.7 PERFORMANCE REQUIREMENTS

- A. Minimum acceptable distribution system performance at all user-interface points shall be as follows:

1. RF Video Carrier Level: 8 dBmV nominally, with -5/+7 dB tolerance range.
2. Relative Video Carrier Level: Within 3 dB to adjacent channel.
3. Slope: No more than 1 dB between 54- and 860-Mhz.
4. Tilt: + 8 dBmV maximum over the 54- to 860-Mhz frequency range.
5. Carrier Level Stability, Short Term: Level shall not change more than 0.5 dB during a 60-minute period.
6. Carrier Level Stability, Long Term: Level shall not change more than 2 dB during a 24-hour period.
7. Channel Frequency Response: Across any 6-MHz channel in 54- to 860-MHz frequency range, referenced to video, signal amplitude shall be plus or minus 1 dB, maximum.
8. Carrier-to-Noise Ratio: 45 dB or more.
9. RF Visual Signal-to-Noise Ratio: 43 dB or more.

1.8 WARRANTY

- A. The Contractor shall unconditionally warrant all equipment and systems provided under this Section to be free from defects in materials and workmanship for a period of at least thirty-six (36) months from the date of final acceptance of all work of this Section.

PART 2 - PRODUCTS

2.1 MMTV CATEGORY 6 UTP CABLE AND CONNECTING HARDWARE

- A. MMTV UTP Cable: 100-ohm, 4-pair Category 6 UTP.
 1. Comply with requirements of Division 27 Section "Data Communications Horizontal Cabling" for Category 6 UTP cable.
 2. Jacket Color: Grey.
- B. MMTV UTP Patch Panel: Category-6 rated modular rack-mounted panel, 24 or 48 ports per patch panel.
 1. Comply with requirements of Division 27 Section "Data Communications Horizontal Cabling" for Category 6 UTP patch panel.
- C. MMTV UTP Jacks and Jack Assemblies: Category 6-rated modular, color-coded, non-keyed eight-position RJ45 modular receptacle units with integral IDC-type terminals.
 1. Comply with requirements of Division 27 Section "Data Communications Horizontal Cabling" for Category 6 UTP jacks and jack assemblies.
 2. Jack Color: Grey.

2.2 MMTV COAXIAL CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Belden CDT, Electronics Division.
 2. CommScope Properties, LLC.
 3. West Penn Wire/CDT; a division of Cable Design Technologies, Inc.

- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband CATV applications. Coaxial cable and accessories shall have 75-ohm nominal impedance. Listed to comply with City of Chicago Electrical Code.
- C. Source Quality Control: Cable products shall be 100 percent sweep tested at the factory before shipping at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- D. RG-11/U, Indoor Trunk Cable: No. 14 AWG, solid, bare-copper conductor; cellular polyethylene dielectric insulation. Bare-copper braid shield with 95 percent minimum shielding factor. Jacketed with black PVC. Suitable for indoor installations; City of Chicago Electrical Code, Type CATVR.
 - 1. Utilized for all runs of 135 feet and over in length.
- E. RG-6/U, Indoor Branch Cable: No. 18 AWG, solid, copper-covered steel conductor; cellular polyethylene dielectric insulation. Double shielded with 100 percent aluminum-foil shield, 60 percent aluminum braid. Jacketed with black PVC. Suitable for indoor installations; City of Chicago Electrical Code, Type CATVR.
 - 1. Utilized for branch drops up to 135 feet in length.

2.3 MMTV COAXIAL CABLE CONNECTORS AND TERMINATION HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Amphenol Corporation.
 - 2. B&L Coaxial Connections, Ltd.
 - 3. Connect-Tech Products.
 - 4. Hubbell Inc., Hubbell Premise Wiring.
 - 5. Leviton Manufacturing Co., Inc., Leviton Voice & Data Division.
 - 6. Ortronics Inc.
 - 7. Panduit Corporation.
 - 8. Siemon Company.
 - 9. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 - 10. Blonder Tongue Laboratories, Inc., CATV/MATV Hardware, active and passive
- B. Coaxial Cable Connectors: Type F, 75 ohms. Connectors shall be properly sized for the cable outside diameter. Connectors shall be axial press-terminated to create a radial interference fit with the cable. Connector shall not pull-off by an axial pull force of 70 pounds. Other connector types, such as screw-on and hex crimp connectors are not acceptable.
- C. Coax Patch Panels: Modular rack-mounted panel housing multiple, numbered coax bulkheads and Type F connectors for splicing and patching coaxial cable.
- D. Coax Jacks: Female-type modular bulkhead connector, housing Type F mating adapter. Metallic parts of anodized brass, beryllium copper or phosphor bronze.
 - 1. Attenuation: Less than 0.1 dB.

2. Voltage Standing-Wave Ratio: Less than 1.15 to 1.

2.4 MMTV FACEPLATE

- A. Workstation Outlets: Three port-connector assemblies mounted in single-gang faceplate. Coordinate with Contract Drawings.
 1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices."
 2. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
 3. Coordinate manufacturer to match communications horizontal wiring.
 4. Coordinate color and finish selection with Architect.
 5. For use with snap-in jacks accommodating UTP and coaxial work area cords. Jacks shall snap firmly into faceplate frame and be flush with outer plate surface.
 - a. Provide with one MMTV coax jack and one MMTV Category 6 UTP RJ45 jack.
 - b. Provide with one data Category 6 UTP RJ45 jack for future wireless device.
 6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.5 SIGNAL TRANSMISSION ACTIVE AND PASSIVE COMPONENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Blonder Tongue Laboratories, Inc.
 2. Or equal.
- B. Bi-Directional Amplifiers (Blonder Tongue, RMDA-86A-30P stk#5200P83) Rack Mounted Broadband Amplifier): Furnish and install broadband amplifiers as necessary by design. Quantities as required to maintain specified signal strength at all outlets. Provide all proper internal attenuators and equalizers, (Blonder Tongue BIDA-FA. Stk#5411a and BIDA-CE8, stk#5478.)
 1. Splitters (Blonder -Tongue SCVS Series, DFCS-24 (stk#5798), and DFCS-32 (stk#5799): Furnish and install splitters with solder back, 120 dB radiation RFI shielding or better, ports as required. Bandwidth of 5-1000 MHz. Quantities as required by design.
- C. Directional Taps (Blonder Tongue SCW, SRT Series): Furnish and install directional taps with solder back, 120 dB RFI shielding or better. Bandwidth of 5-1000 MHz. Quantities as required by design.
- D. Terminators (Blonder -Tongue BTF-TP Series): Terminators shall be 75 ohm F-type. Provide terminators on all unused ports including test ports located on amplifiers and MMTV coax outlets. Quantities as required by design.
- E. Channel Elimination Filter: (Blonder Tongue CEF series, stk# 4446) This filter is designed to remove one 6 MHz wide television channel. Attenuation shall be a minimum of 52 db. Its insertion loss shall not be greater than 3.1db. Channel to be deleted shall be in the 54-312 MHz range. (Channel 99 may be considered as a standard)

F. Sub Band Diplexer (Blonder Tongue DSV-42, stk# 4376) The sub-band diplexers shall be manufactured in a die-cast housing with a soldered back plate to ensure high RFI shielding. Sub-band diplexers shall be employed for isolating and separating VHF/UHF/CATV signals (50 to 1000 MHz) from sub-channel signals (DC to 42 MHz). They shall permit two-way transmission of RF signals on a single coaxial cable. The sub-band diplexers shall be equal to Blonder Tongue DSV-42 and shall meet or exceed the following specifications:

1. Impedance: 75 Ohms
2. Passband:
 - a. Combined: DC-42 and 50-1000 MHz
 - b. High: 50-1000 MHz
 - c. Low: DC-42 MHz
3. Insertion Loss: 0.5 dB
4. Return Loss: 14 dB Minimum
5. Isolation:
6. DC-42 MHz:
7. 50-860 MHz: 55 dB Minimum
8. 860-1000 MHz: 45 dB Minimum
9. 50-1000 MHz:
10. DC-42 MHz: 45 dB Minimum
11. Power Passing Capability: 500 mA

G. Single Channel Modulator, (Blonder Tongue MAVM-861 series, stk#7992)

H. The modulator shall be channelized agile channel, solid state heterodyne audio/video modulator. The modulator shall modulate a 0.7-2.8 volt peak to peak sync negative video source and a 140 mV RMS audio source to output CATV channels 2 to 135 by changing field changeable output filter modules. The modulator shall have front panel controls for video and audio modulation levels, aural to visual ratio and RF output level. The modulator shall be BTSC compatible via field-defeatable audio pre-emphasis. The modulator shall be equal to Blonder Tongue MAVM-861-** and shall meet or exceed the following specifications:

1. Frequency Range: 54-860 MHz
2. Output Level: 40 dBmV Minimum
3. Output Level Control: 15 dB
4. Spurious Outputs: -66 dBc
5. C/N In Channel: 65 dB
6. Output Return Loss: 15 dB Minimum
7. Broadband Noise: -95 dBc

2.6 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Ladder Rack Runway: Comply with requirements of Division 27 Section "Communications Cabinets, Racks, and Enclosures."
 1. Used for routing of MMTV UTP and coaxial cabling within MDF.

- C. Conduit, Surface Raceway and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller than 4 inch square by 2-1/2 inches deep, fitted with single-gang trim plate to accommodate single-gang MMTV faceplate.
 - 2. Provide all necessary fittings and adapters for installing MMTV outlet in surface raceway, where indicated in Contract Drawings.

PART 3 - EXECUTION

3.1 COMMUNICATIONS DEMOLITION

- A. Comply with requirements of Division 27 Section "General Requirements for Communications" for demolition of communications systems.

3.2 WIRING METHODS AND INSTALLATION OF PATHWAYS

- A. Wiring Method: Install cables in raceways. Conceal raceway except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes and their installation specified in Division 26 Section "Raceways and Boxes for Electrical Systems."
 - 2. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
 - a. Utilize wide radius bends and elbows.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Provide service loop per requirements of this Section.
- C. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- D. Wiring within MDF and IDFs: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Provide service loop per requirements of this Section. Utilize overhead ladder rack runway for cable routing within room(s).
- E. Comply with requirements for ladder rack runway, cabinets, and racks specified in Division 27 Section "Communications Cabinets, Racks, and Enclosures." Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Examination: Examine pathway elements intended for MMTV UTP and coaxial cable installation. Check raceways, ladder rack, and other elements for compliance with accessibility for installation and maintenance, and other conditions affecting installation.

- C. Install all equipment and components in accordance with manufacturer's written instructions, in compliance with City of Chicago Electrical Code and with recognized industry practices, to ensure that all items comply with specifications and service intended purposes.
- D. For UTP cabling: Comply with requirements of Division 27 Section "Data Communications Horizontal Cabling" for installation of horizontal UTP cables.
 - 1. Terminate MMTV UTP outlets on dedicated Category 6 patch panel mounted to floor-standing rack in MDF and IDFs. Terminate to Category 6 modular jack at user interface faceplate.
- E. For MMTV coaxial cabling:
 - 1. Terminations: Terminate coaxial cables on dedicated coax patch panel mounted to floor-standing rack in MDF and IDFs. Terminate to female Type F mating connector at user interface faceplate.
 - 2. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between indicated termination, tap, or junction points. Remove and discard cable where damaged during installation and replace it with new cable.
 - 3. Do not exceed manufacturer's recommended minimum bending radiuses
 - 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.
 - 5. Cable may not be installed in same raceway with power cable.
 - 6. Coaxial cable shall not be spliced except on plywood backboards in wire closets, or in cabinets designated for the purpose.
 - 7. Do not use water-based cable pulling lubricants with PVC-jacketed cable.
 - 8. Install passive circuit devices, such as splitters and attenuators, in wire closets or cabinets. Do not install attenuators as part of user-interface device outlets.
- F. Service Loops: Provide the following minimum extra length of cable, dressed and routed neatly:
 - 1. At MDF/IDF frames: 60 inches, neatly installed in vertical wire manager or accommodated by additional routing around overhead ladder rack runway.
 - 2. At Concentrator Enclosures – Pass-through Cabling: 24 inches, neatly installed inside housing for MMTV UTP and coaxial cables that pass through enclosure.
- G. All items must be complete as specified prior to final acceptance. It will be the responsibility of the Contractor to ensure all cabling meets all specifications and standards defined herein.

3.4 IDENTIFICATION

- A. Comply with requirements of Division 27 Section "Identification for Communications Systems" for identification of MMTV system cabling.
- B. Identify system components, wiring, cabling, and terminals:
 - 1. System: Use a unique 3-syllable alphanumeric designation for each cable, and label the cable and the jacks, connectors, and terminals to which it connects with the same designations. Use logical and systematic designations related to the architectural arrangements of the facility.

- a. First syllable is to identify and locate the wiring closet or equipment room where the cable originates.
 - b. Second syllable is to identify and locate the cross-connect or patch panel field in which the cable terminates.
 - c. Third syllable is to designate the type of medial (copper or fiber) and the position occupied by the cable pairs or fibers in the field.
2. Outlets: Label cables within outlet boxes.
 3. Distribution Racks and Frames: Label each unit and field within that unit.
 4. Within Connectors Fields, in MDF and IDF Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.
 5. Cables, Generally: Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 6. Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
- C. Cable Schedule: Post at a prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Provide a diskette copy of final comprehensive schedules for the project in the software and format selected by the Owner.
- D. Record serial numbers of all items furnished that are serialized. Serial numbers to be included in warranty manual.

3.5 CLEANING

- A. On completion of installation inspect exposed finishes. Remove burrs, dirt, paint spots, and construction debris. Repair damaged finish(es), including chips, scratches, and abrasions.
- B. All equipment, hardware and finishes shall be cleaned prior to final acceptance. Unless otherwise indicated, clean shall mean free of dust, dirt, mud, debris, oil, grease, residues, and contamination.
- C. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion. Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. Cover fixtures, materials, equipment and devices furnished or installed under this Section or otherwise protect against damage, both before and after installation. Hardware, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced.
- D. During the course of MMTV installation work, provide for on-going proper disposal of all debris, including but not limited to: equipment packaging and shipping materials, shipping pallets, empty cable reels/boxes, cable cuttings, etc. The Contractor shall, at all times, keep the site free from accumulations of waste material or rubbish caused by its employees or work. Remove all crates, cartons, and other waste materials or trash from the working areas at the end of each working day. Flammable waste material must be removed from the working areas at the time of generation. All rubbish and debris, combustible or not, shall be discarded in covered metal containers daily and removed from the premises at least weekly and legally disposed of.

3.6 CONTRACTOR STARTUP AND REPORTING

A. MMTV Coax – Adjusting / Testing:

1. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 860 MHz, minimum. Provide documentation of recent calibration against recognized standards.
2. Adjust Amplifier(s) and Cabling System to meet the following:
 - a. Measure the input signal to each amplifier to determine the correct value(s) of plug-in attenuators and equalizers for amplifier. Use amplifier plug-ins to equalize the input signal to obtain a flat input with no more than 1dB of slope between 54 MHz and 860 MHz. In cases where the input slope is positive, which may occur if IDF's are a short cable distance from the MDF's launch amplifier, no input equalization will be necessary.
 - b. Measure signal levels at all MMTV faceplate jacks at 54 MHz and at 860 MHz. After all adjustments are made, record measured signal levels at these two frequencies.
 - c. Acceptance Criteria: The Signal level range at any outlet shall be between +3 to +15 dBmV (54-860 MHz).
3. After all adjustments are made, measure and record signal level at input to amplifier.
4. Results from testing described above shall be submitted to Architect/Engineer for review and approval prior to Final Acceptance.

B. MMTV UTP Cable Testing Procedure:

1. Comply with requirements in Division 27 Section "Commissioning of Communications" for Category 6 UTP performance tests, inspections, correction of deficiencies, and preparation of test and inspection reports.
2. Inspect for physical damage.
3. Test all permanent links in accordance with TIA/EIA-568-B.2-1. Correct malfunctioning links and retest to demonstrate compliance. Test report must indicate circuit ID as indicated on cable schedule.

END OF SECTION

SECTION 27 53 13

MASTER CLOCK SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section specifies a master clock and program control system including the following components:
 - 1. Master clock and program control unit.
 - 2. Secondary indicating clocks.
 - 3. Program signal devices.
 - 4. Clock circuit power boosters.
 - 5. Interface with intercom public-address system.
 - 6. System wire and cable.

1.2 DEFINITIONS

- A. GPS: Global Positioning System.
- B. NIST: National Institute of Science and Technology.
- C. PC: Personal computer.
- D. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; used as a worldwide standard for time synchronization.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual.
- B. Shop Drawings:
 - 1. Wiring diagrams to detail power, signal, control, and correction circuits. Identify terminals and wiring color-codes to facilitate installation, operation, and maintenance. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.
 - 2. Riser diagram of system components.
- C. Samples for Initial Selection: Include the following:
 - 1. Manufacturer's color charts showing the full range of colors available for clocks, signal equipment, control panels, and other items exposed to view.
 - 2. Full-size operating models of each clock type indicated.

- D. Qualification Data: For Installer and manufacturer.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For clock and program control to include in emergency, operation, and maintenance manuals. Include information regarding the microprocessor, signal generator, power supplies, and other major components. Include four (4) quick-reference guides for the Building Engineer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative of master clock manufacturer, who is trained and approved for installation and maintenance of units required for this Project, and who maintains a service center within 100 miles of Project site, that is certified by the manufacturer to providing replacement parts and emergency maintenance repairs.
- B. Source Limitations: Obtain master and secondary clocks and signal-device-control components through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with City of Chicago Building Code.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not install electronic components until major construction work in the area is complete. Do not install in areas where dust or moisture can contaminate the working parts or where finish can be marred by construction work.
- B. Stage materials in a secure area of the project site until installation. Materials and items shall be placed so that they are protected from damage and deterioration.

1.6 SYSTEM DESCRIPTION

- A. System shall perform the following functions:
 - 1. Supply power to remote indicating clocks.
 - 2. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock to any one type of secondary indicating clocks, including the following:
 - a. Analog Synchronous Clocks: Correct for minute- and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
 - 3. Initiate and execute programs for scheduled automatic operation of remote devices. Include audible signal devices.
 - 4. Provide for manual control of programmed signal and equipment switching circuits.
 - 5. Regulate system timing functions backed up for power outages by an internal battery-powered, temperature-compensated crystal-controlled oscillator.

6. System shall be capable of programming multiple independent event schedules into memory and running them simultaneously for different output circuits.
 - a. Quantity of Programmable Schedules: Four minimum.
 - b. Number of Weekly Events That Can Be Programmed for Each Schedule: 600 minimum.
 - c. Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment-switching output circuits.
 - d. Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be 10, and each change may be programmed up to a year in advance to occur on any day of the calendar year.
7. Daylight Savings Time Correction: Programmable for automatic correction, or accomplished by manual controls on front of panel.
8. Adjustments to Master Clock Output Signals: Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.

1.7 EXTRA MATERIALS

- A. Extra Materials: Extra materials shall be delivered to the Owner in the manufacturer's original packaging and stored at the Project site where directed. Extra materials shall include, but not be limited to, the following:
 1. Analog Clocks: Full-size, functioning clocks equal to 10 percent of quantity installed, but not more than five clocks.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace master clock system components that fail in materials or workmanship within the specified warranty period.
 1. Warranty Period: Three (3) years from date of Preliminary Acceptance or Substantial Completion.
 2. Warranty Work: Warranty work shall be performed during normal working hours.
 - a. Emergency callback service shall be provided, at additional cost, within the following response times:
 - 1) Elementary Schools: Eight (8) hours or less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. National Time and Signal.

2. Rauland-Borg Corporation.
3. Simplex Grinnell.
4. Sapling.

2.2 MASTER CLOCK

- A. Description: Microprocessor-based, software-controlled unit complying with Class A device requirements in 47 CFR 15, and having the following components and features:
1. Programming and control switches.
 2. Informational Display: LED or backlit LCD type.
 - a. Normally shows current time display.
 - b. Provides programming instructions when system is being programmed.
 3. Output Circuits for Power and Correction of Secondary Indicating Clocks:
 - a. Wired Synchronous Clock Power and Correction Circuits: For analog clocks; minimum of one required. Relay controlled.
 - b. Existing Clock Power and Correction Circuit: An output circuit suitable to match, and compatible with, existing system.
 4. Circuits for audible signal devices: Relay controlled, manually switchable, using controls on master clock. Rated 120-V ac, 5 A minimum. A minimum of four circuits.
 5. Power Supplies: Capacity for internal loads and power and correction circuits of connected clocks.
 6. Enclosure: Metal cabinet with locking front panel. When cabinet is locked, display indication shall be visible on or through front panel face. Arrange cabinet for surface, semi recessed, or flush mounting as indicated.
 7. Battery Backup for Time Base: Lithium battery to maintain the timekeeping function and retain the programs in memory during outage of normal ac power supply for up to 10 years.

2.3 SECONDARY INDICATING CLOCKS, GENERAL

- A. Analog Clock: Equipped with a second hand. Movement shall be driven by self-starting, permanently lubricated, sealed synchronous motor equipped with a correcting solenoid actuator, operating voltage shall be 24 VAC, compatible with the master clock.
- B. Connection Provision for Secondary Indicating Clocks: Plug connector or wire pigtail.
- C. Provision for Modular Panel Installation: Equip designated clock for panel mounting. Mount flush or semi recessed with arrangement and trim as indicated. Coordinate wiring with other modular panel components, including room lighting switches, intercom devices, convenience outlets, speaker, and other similar devices.
- D. Provision for Time-Tone-Unit Installation: Equip indicated clocks for housing or mounting in an acoustically treated and baffled speaker compartment.

2.4 DETAILED REQUIREMENTS FOR SECONDARY INDICATING CLOCKS

A. Clock Type: Analog.

1. Face Configuration: Single face and double face. Refer to drawings for locations of each type.
2. Mounting: Semi recessed in annex building, Surface for existing building, and within time-tone unit for annex. Refer to drawings for location of each type.
3. Nominal Dimensions: 12 inch diameter, round.
4. External Finish: Metal case, black finish.
5. Trim and Hardware:
 - a. Letter height: 1-1/4" minimum.
 - b. Letter color: black.
 - c. Hour hand color: black.
 - d. Minute hand color: black.
 - e. Second hand color: red.
6. Crystal: Clear polycarbonate lens.

2.5 PROGRAM SIGNAL DEVICES

- A. Bells: Heavy-duty, modular, vibrating type with the following sound output ratings measured at 10 feet:
 1. 6-Inch Bell: 95 dB.
 2. 10-Inch Bell: 104 dB.
- B. Horns: Modular, adjustable-output, vibrating type with minimum full-intensity-rated sound output of 103 dB measured at 10 feet.
- C. Projector Horns: Adjustable-output, vibrating-type units with double projector arranged to channel the sound in the direction of the projector axis, and with minimum full-intensity-rated sound output of 104 dB measured at 10 feet.
- D. Outdoor Signal Equipment: Weatherproof models listed for outdoor use.
- E. Mounting Arrangement for Signal Devices: Designed for attachment with screws on the mounting plate of a flush-mounted back box, unless otherwise indicated.
- F. Enclosures for Flush-Mounting Bells and Horns: Enclosure, mounting plate, and grille assembly shall be furnished by device manufacturer to match features of the device to be mounted. Enclosure shall be recessed in wall, completely enclosing the device, with the grille mounting over the open side of the enclosure and flush with the wall.
- G. Connection Provision for Signal Indicating Devices: Wire pigtail.

2.6 BACK BOXES FOR SECONDARY INDICATING CLOCKS AND PROGRAM DEVICES

- A. Description: Box and cover plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting device, unless otherwise indicated.

2.7 GUARDS

- A. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch maximum clearance.
 - 1. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.
 - 2. Finish for Indoor Devices: Clear epoxy lacquer over zinc plating.
 - 3. Finish for Outdoor Devices: Black powder coat over zinc plating and primer.
- B. Locations: Provide guards for clock locations for lunch room and locker rooms, and as indicated on Drawings.

2.8 WIRE AND CABLE

- A. Conductors: Insulated copper, with minimum sizes as recommended by the connected device manufacturer. Voltage drop for signal, control, and clock correction circuits shall not exceed 10 percent under peak load conditions.
- B. 120-V AC and Class 1 Signal and Control Circuits: Stranded single conductors of size recommended by system manufacturer. Materials and installation requirements are specified in Division 26 Section "Conductors and Cables for Electrical Systems."
- C. Classes 2 and 3 Signal and Control Circuits: Single conductor or twisted-pair cable, unshielded, unless manufacturer recommends shielded cable.
- D. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams. Provide black (hot), white (neutral), and red (correction).

PART 3 - EXECUTION

3.1 WIRING METHOD

- A. Wiring: Install 110V system wiring in raceways. Install low-voltage system wiring in EMT conduit raceways. Conceal raceways except in unfinished spaces.
 - 1. Install raceways and conduit in accordance with requirements of Division 26 Section "Raceways and Boxes for Electrical Systems."
 - 2. Control Circuit Wiring: Install control circuits according to NFPA 70-90 and as indicated. Install number of conductors recommended by system manufacturer to functions indicated.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points.

3.2 ELECTRICAL CONNECTIONS

- A. Make terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures. Tighten connections with tightening torques specified in UL 486A.
- B. Use plug connectors or splices for connections to clocks and signal devices.

- C. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
- B. Color-code conductors and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.4 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in programming and field testing. Report results in writing.
- B. Perform the following field adjustments, tests, and inspections and prepare test reports:
 - 1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
 - 2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- C. Remove and replace malfunctioning units and retest as specified above.

3.5 CLEANING

- A. On completion of installation inspect exposed finishes. Remove burrs, dirt, paint spots, and construction debris. Repair damaged finish(es), including chips, scratches, and abrasions.
- B. All equipment, hardware and finishes shall be cleaned prior to final acceptance of the work. Unless otherwise indicated, clean shall mean free of dust, dirt, mud, debris, oil, grease, residues, paint, and contamination.
- C. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Preliminary Acceptance or Substantial Completion. Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. Cover fixtures, materials, equipment and devices furnished or installed under this Section or otherwise protect against damage, both before and after installation. Hardware, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced.

3.6 CONTRACTOR STARTUP AND REPORTING

- A. **Programming and Adjustments:** Program system according to Owner's requirements. Set system so signal devices operate on Owner-required schedules and are activated for durations selected by Owner. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.

1. Adjust sound-output level of adjustable signal devices to suit Owner's requirements.
- B. Demonstration: Train Owner's operating personnel in the programming and operation of the system. Train Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components. Refer to Division 01 Section "Demonstration and Training". Provide a minimum of two sessions of two (2) hours of training. Schedule training with at least seven (7) days advance notice.
- C. Occupancy Adjustments: When requested within 12 months of date of Preliminary Acceptance or Substantial Completion, provide on-site assistance for adjusting and reprogramming system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- D. Contractor to provide sign off sheet to Board's Authorized Representative upon completion of the work.

END OF SECTION

SECTION 32 95 00

VEGETATED ROOF ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Providing equipment, materials, tools, and labor to install vegetated roofing modules.
2. Providing vegetated roof modules including growth media and plants.
3. Edge treatments, custom shaping of modules, and installing slip sheet/root barrier.

1.2 SUBMITTALS

A. Submit list of sources for plant material to be provided.

B. Product data for vegetated roofing systems.

C. Planting mix design indicating species.

D. Samples:

1. Typical vegetated roofing module, unplanted.
2. Soil media, 1 gallon, in plastic ziploc bag
3. Edging material, 3 feet long with typical fasteners

E. Shop Drawings: Indicating layout of modules, pavers, irrigation, and square footage.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Special Vegetation Warranty: Submit two (2) signed copies of vegetation warranty of health plant growth for two (2) full growing seasons after final acceptance: 1 year – 50% minimum coverage; 2-years – 80 % minimum coverage.

H. Maintenance instructions for inclusion into owner's manuals.

I. LEED Submittals:

1. LEED Credit MR 4.1 and Credit MR 4.2: Submit product data for products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
2. LEED Credit MR 5.1 and Credit MR 5.2: Submit product data for products that have extracted, harvested, or recovered, as well as manufactured within 500 miles of the Project site.
 - a. Include a statement indicating the percentage by weight which is extracted,

harvested, or recovered within 500 miles of the Project site

- J. The vegetated roofing modules shall be anchored to the structure to withstand uplift due to an outward pressure of 20 PSF acting normal to the surface. However, the vegetated roofing modules placed within an area at the edge of the roof equal to 10 percent the width of the structure parallel to the wind direction being considered, shall be anchored to the structure to withstand uplift due to an outward pressure of 40 PSF acting normal to the surface. Green roof system manufacturer shall submit calculations for record showing compliance to the aforementioned uplift criteria.

1.3 QUALITY ASSURANCE

- A. No deviation shall be made from this specification. Contractor and installer assumes liability for any deviations from specification.
- B. Only certified installer personnel shall complete all work.
- C. Prior to installing vegetated roof modules, the following procedures shall be conducted:
 - a. The building Architect shall verify that the roof is properly designed and constructed to adequately support the load of the vegetated roof system.
 - b. The roof shall be tested for water tightness prior to installation of vegetated roof system.
 - c. Slipsheet/root barrier shall be properly installed, seams overlapped and bonded, in accord with architect's and manufacturer's specifications.
 - d. The roof shall be inspected and determined ready to accept the vegetated roof modules by a Technical Representative of the Installer.
- D. Once the vegetated roof module installation is completed, an inspection shall be conducted by a Technical Representative of the installer to verify that the vegetated roof modules have been installed tight against each other, in straight rows, corners aligned, properly oriented, and tight against the edging.

1.4 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section. Review vegetated roof standardized procedures with supervisory staff.
- B. Review membrane roof protection procedures.

1.5 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Vegetated roof modules shall be:
 - 1. Delivered in good condition free from shipping damage.
 - 2. Kept out of the sun if plastic wrapped to prevent overheating.
 - 3. Installed on the roof top within 4 hours of delivery.
 - 4. Handled on the job-site to prevent damage to the modules themselves and all roofing components.

- B. Vegetated roof modules shall be conveyed to roof surface with equipment designed to carry the collective load of the vegetated roof modules and transport
- C. Never exceed the load capacity of the roof deck when placing vegetated roof modules on the roof.
- D. Roof Protection
 - 1. During installation, protect the roof deck and membranes with 1” of crushable insulation covered with ½” plywood sheeting in ALL areas where work is going on. At no time shall work be performed in areas where roof is not protected.
 - 2. Never scrape or puncture slip sheet or membranes.
 - 3. Keep roof surfaces free of soil, grit, or debris at all times with broom. Vegetated roof modules shall not be set on top of soil, dirt or grit.
- E. Transport carts shall:
 - 1. Have pneumatic tires.
 - 2. Be wheeled about only upon protective plywood sheeting.
 - 3. Be loaded so as not to exceed weight capacity of roof deck.

PART 2 - PRODUCTS

2.1 VEGETATED ROOFING MODULE MANUFACTURER

- A. General: Provide vegetated roofing systems from one of the following manufacturers:
 - 1. Weston GreenGrid
Weston Solutions, Inc.
750 Bunker Court, Suite 500
Vernon Hills, IL 60061
(847) 918-4135
(847) 918-4055
 - 2. LiveRoof System LiveRoof, LLC
Subsidiary of Hortech, Inc.
P.O. Box 533
Spring Lake, MI 49456
(800) 875-1392
(616) 842-1392 Fax
 - 3. American Hydrotech
303 East Ohio Street
Chicago, IL 60611
(312) 337.4998
(312)661-0731 Fax
 - 4. Or approved equal.
- B. Other manufacturer’s may be considered provided they can meet the following criteria:

1. Vegetated roofing module shall consist of a modular unit filled with engineered soil materials.
2. Modules shall be provided vegetated upon installation with the plant species indicated on the plans.

C. Modules shall have the following specifications:

1. Sidewalls: 150 mil thick 100% recycled polyethylene with UV inhibitors and stabilizers.
2. Dimensions: 4 inches tall.
3. Saturated weight with mature vegetation: approximately 18-22 lb. per square ft. (4" system)

2.2 GROWING MEDIUM

- A. Growing medium shall be an engineered blend of inorganic and organic components based upon German FLL granulometric guidelines modified so as to contain ecologically sustainable levels of organic content

2.3 PLANTS

- A. Vegetated roof module shall be filled with plants in mix as indicated on the plans and as supplied by the manufacturer.
- B. Minimum plug spacing shall be 8" each direction. Actual number of plugs per module depends on module size.
- C. Plants shall be grown to a minimum of 50% soil coverage prior to installation.
- D. Pre-vegetated System
1. Plugs, Sedum Cuttings, Sedum Carpet shall be planted and maintained in accordance with manufacturer's/grower's written specifications by an approved installer.
 2. Provide 4-7 varieties sedum species from the following list
 - a. Sedum acre 'Gold Moss'
 - b. Sedum album 'Coral Carpet'
 - c. Sedum album 'Murale'
 - d. Sedum divergens
 - e. Sedum floriferum 'Weihenstephaner Gold'
 - f. Sedum hispanicum 'Purple Form'
 - g. Sedum hybridum 'Immergrunchen'
 - h. Sedum kamtschaticum
 - i. Sedum reflexum 'Blue Spruce'
 - j. Sedum rupestre 'Angelina'
 - k. Sedum sexangulare
 - l. Sedum spurium 'Fuldaglut'
 - m. Sedum spurium 'John Creech'
 - n. Sedum spurium 'Red Carpet'
 - o. Sedum spurium 'Tricolor'

2.4 ACCESSORIES

- A. Slip Sheet
1. Non-woven geotextile sheeting made from 100% post consumer polyester material

2. Weight: 6.0 ounces/square yard
3. Thickness: 120 mils
4. UV Resistance: 70 min.

B. Edging:

1. L-shaped extruded aluminum edging with perforations for drainage as specified by vegetated roof module manufacturer.
2. Edging shall allow for adequate drainage via sufficient drain perforations.
3. Edging is required around all perimeter and exposed edges of vegetated roof modules.
4. Edging is required at edge of all cut modules.
5. Edging shall be attached to modules, using 10-24 x 1" wafer head self-tapping screws in gray spex finish.

C. Irrigation

1. A hose bib connection is provided at the roof level for use during the installation and maintenance of the vegetated roof module system.
2. Prior to reaching fall freezing temperatures, hose bib system shall be blown out with compressed air no greater than 60 psi.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Vegetated roof installation must be conducted by certified installer.

3.2 PREPARATION OF ROOF SURFACE

- A. Contractor shall install slip sheet/root barrier in accordance with manufacturer's recommendations.
- B. All surfaces shall be smooth, free of debris, soil, and grit prior to placing modules. All materials shall be tested water tight and free draining prior to module placement.
- C. All surfaces shall be maintained clean and free of debris, soil, and grit during installation process.

3.3 INSTALLATION SEASON

- A. Vegetated roof module installation shall be conducted when plants are:
1. Properly adapted and acclimatized to local weather conditions.
 2. When weather is above 35° F and there is no ice on the roof and planting soil is unfrozen.

3.4 INSTALLING VEGETATED ROOF MODULES

- A. Vegetated roof module installation shall follow behind installation of slip sheet/root barrier, irrigation system, and edging.
- B. Vegetated roof module installation to be conducted in strict accordance with manufacturer's installation guidelines. Rows shall be straight, modules to be tight against each other with edges overlapping and arranged in proper directional orientation.
- C. Vegetated roof module installation shall be conducted in accordance with green roof design

indicated on the plans.

- D. Vegetated roof modules shall be placed directly on top of appropriate slip sheet.
- E. It is recommended that any custom cutting/fitting be oriented on the high side (top), or sides of the roof. It is recommended that the cut side of the module be set tight against the edging or toward the side of an intact module so as to prevent soil spillage. If custom cutting must be done on the low, draining, side of the roof, it is imperative that no filter cloth be inserted as it could impede drainage. It is best to orient the cut side against another module, facing upstream.
- F. After installation, modules shall be immediately watered so as to thoroughly moisten the media from top to bottom. Water shall be of suitable quality for plant growth and irrigation system or hoses and sprinklers may be used for such purpose.

3.5 MAINTENANCE

- A. Documentation: Record all green roof maintenance events. Include name of person, date and activity.
 - 1. If fertilizer, record type and amount applied per 1000sf
 - 2. If soil test, record lab
 - 3. If irrigation, record duration and quantity
- B. Annual Maintenance
 - 1. Soil Testing and Fertilization. During April 1 to 15 of each year, administer an annual soil test for PH and fertility levels.
 - a. Maintain pH in the range of 6.5 to 8.0. In the event that pH is outside of the 6.5 to 8.0 range, consult vegetated roof module supplier for the appropriate amendment.
 - b. Maintain fertility in the normal range using a typical field soil fertility test as provided by A&L labs. When indicated, apply a single springtime application of Nutricote 14 14 14, Type 180 (180 day release period), at 20lbs per 1000sf. Follow the Nutricote labeled directions for application rate, which take priority over any recommendations listed here. Runoff potential does exist and should be evaluated by the applicator in accord with the site specifics; the greater the runoff sensitivity, the lower the application rate. All applications of fertilizer are the sole responsibility of the applicator.
- C. Irrigation
 - 1. Contractor shall water the new vegetated roof modules to ensure proper growth through the maintenance and warranty period.
 - 2. Contractor shall monitor the moisture content of the vegetated roof modules throughout the roof to ensure that the moisture content is properly maintained.
- D. Inspections and Plant Care Protocol
 - 1. Conduct the following every 2 weeks (twice per month) During the entire spring through fall growing season:
 - a. Conduct hand weeding during the twice monthly inspection. Pull all weeds, never allow any weed to flower, set seed and complete its life cycle. Weeding should be conducted spring through fall in areas where the roof becomes frozen and snow-covered in winter. In warmer climates, it should be continued year round.

- b. The interval may be adjusted in accord with seasonal variations in weed growth, but the interval should never exceed 2 weeks or be long enough to allow for weeds to flower and set seed. Never allow woody plants to establish in a green roof system as their root systems are extensive and can damage roof membranes.
 - c. Herbicides, whether pre-emergent or post-emergent, are not recommended as they are not healthy for the environment and can contaminate runoff. A need for pre-emergent herbicides is a sign of weeding too infrequently.
2. Displaced Soil - Any displaced soil must be immediately replaced.
 3. Drainage Inspection - Roof drains must be cleared of any debris, pebbles, leaves, etc. during the twice monthly inspection to keep drains flowing freely.
 4. Debris / Trash Removal - Remove immediately debris or trash during twice monthly inspection. During fall and spring, rake vegetated roof planting clean of any matted tree leaves to prevent smothering.
 5. Pesticides - Pesticide use is discouraged and should always be considered secondary to cultural and biological control measures, as pesticides can get into runoff water and cause environmental damage. Pesticide use should only be conducted by qualified and licensed applicators, and on an "as needed" basis. All applications of pesticides are the sole responsibility of the applicator.
 6. Optional Mowing - If desired, around April 1, mow the green roof to a height of 2" or less. The clippings should stay on the roof. Do not bag and remove. Use protective equipment.
 7. Wintertime - Avoid applying salt and other deicing agents to vegetated roof module plantings. Avoid walking on frozen plants and roof surfaces.
- E. Apply slow release fertilizer as needed in accord with manufacturer's directions. Avoid runoff into sensitive areas.

3.6 ACCEPTANCE

- A. Conduct post installation inspection to determine acceptance of modules. Inspection to be made by General Contractor's Representative and Owner's Representative upon General Contractor's request; five working days notice required.
- B. Upon acceptance, Owner assumes responsibility for module/plant maintenance.

3.7 CLEAN UP

- A. Throughout installation, keep all work surfaces clean and free of grit, dirt, or debris. Use broom not blower, do not sweep soil under modules or slip sheet. Following installation, remove all excess materials and tools from job site. Ensure that any damage that occurs as a result of installation is appropriately and immediately repaired.

END OF SECTION