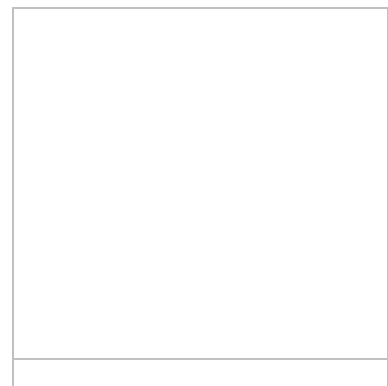
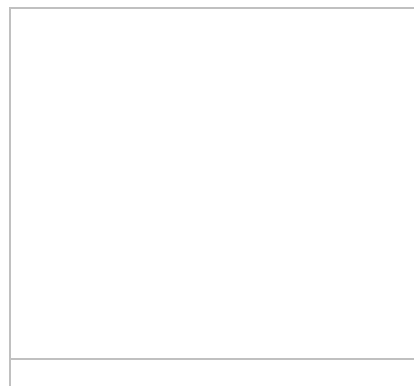

WARNER PARK COMMUNITY RECREATION CENTER EXPANSION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

1. Section 031000 "Concrete Forms and Accessories" for **installing** dovetail or channel slots for masonry-veneer anchors.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R.
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. **Sustainable Design Submittals:**
1. **Regional Materials: Verify CMUs are manufactured within 100 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.**
 2. **Regional Materials: Manufacture aggregate for mortar and grout, cement, and lime within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.**

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type of the following:
1. Masonry units.
 - a. Include **data on material properties**.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M
 - e. For masonry units include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 3. Mortar admixtures.
 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 5. Grout mixes. Include description of type and proportions of ingredients.
 6. Reinforcing bars.
 7. Joint reinforcement.
 8. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar **and grout**. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.
- D. **Cold-Weather and Hot-Weather** Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications:
1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
 2. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (610 mm) down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (610 mm) down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For **exposed masonry units and cementitious mortar components**, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, **units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.**

2.3 CONCRETE MASONRY UNITS

- A. Verify CMU's are manufactured within 100 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. Provide **[bullnose]** units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C90, **normal weight**.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2800 psi (19.3 MPa)**.
 2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.
 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- D. Concrete Building Brick: ASTM C55, **normal weight**.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2800 psi (19.3 MPa)**.
 2. Size (Actual Dimensions): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
- E. Decorative CMUs: ASTM C90, **normal weight**.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2800 psi**.
 2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
 3. Pattern and Texture:
 - a. MSN-1: County Materials Decorative Concrete Masonry, Splitface texture, 8" x 16" running bond pattern.
 - b. MSN-2: Arriscraft Thin-Clad Renaissance Units, Smooth texture, 12" x 24" running bond pattern.
 - c. **CMU-1: As indicated on Drawings**
 - d. **CMU-2: As indicated on Drawings**
 4. Colors:
 - a. MSN-1: 18-121C Bisque (Matched to Existing)
 - b. MSN-2: Oak Ridge.
 - c. **CMU-1: As indicated on Drawings**
 - d. **CMU-2: As indicated on Drawings**
 5. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2800 psi (19.3 MPa)**.
 6. Size: Manufactured to dimensions specified in "CMUs" Paragraph above but with pre-faced surfaces having 1/16-inch- (1.6-mm-) wide returns of facing to create 1/4-inch- (6.2-mm-) wide mortar joints with modular coursing.

2.4 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.
- B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 032000 "Concrete Reinforcing," and with reinforcing bars indicated.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Cement: ASTM C1329/C1329M.
- F. Aggregate for Mortar: ASTM C144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch (6.4 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

I. **Manufacture aggregate for mortar and grout, cement, and lime within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.**

2.6 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Galvanized carbon steel.

2. Exterior Walls: **Hot-dip galvanized carbon steel.**

3. Wire Size for Side Rods: **0.148-inch (3.77-mm)** diameter.

4. Wire Size for Cross Rods: **0.148-inch (3.77-mm)** diameter.

5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.

6. Provide in lengths of not less than 10 ft. (3 m).

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

2.7 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.

2. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, **hot-dip galvanized steel** wire.

2. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)]** diameter, **[hot-dip galvanized steel** wire.

D. Rigid Anchors: Fabricate from steel bars **1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.**

1. Corrosion Protection: **Hot-dip galvanized to comply with ASTM A153/A153M .**

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Use **portland cement-lime** mortar unless otherwise indicated

3. For exterior masonry, use **portland cement-lime** mortar.

4. For reinforced masonry, use **portland cement-lime** mortar.

5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, **Property** Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.

2. For reinforced masonry, use **Type S.**

3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476..
 3. Provide grout with a slump of [8 to 11 inches (203 to 279 mm)] [10 to 11 inches (254 to 279 mm)] as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (13 mm) or minus 1/4 inch (6.4 mm).
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.
- B. Lines and Levels:
 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
- C. Joints:
 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3.2 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.6 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **running bond**; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **4 inches (102 mm)**. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (610 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors, and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors **48 inches (1219 mm)** o.c. unless otherwise indicated.
 2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay **CMUs** as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (152 mm).
 - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 - 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings **in addition to continuous reinforcement.**
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Cut and bend reinforcing units as directed by manufacturer for continuity at[**corners,**] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry **using one of the following methods:**
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide **masonry**lintels where indicated and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are indicated without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (203 mm) at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms 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.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than **60 inches (1524 mm)**

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. tion, where indicated.
- D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
4. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches (102 mm) in each dimension.
 2. Do not dispose of masonry waste as fill within 18 inches (457 mm) of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 07 53 23

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Vapor barrier.
3. Accessory roofing materials.
4. Substrate board.
5. Roof insulation.
6. Insulation accessories.
7. Asphalt materials.
8. Walkways.

1.2 PREINSTALLATION MEETINGS

- A. Preliminary Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.

C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness if insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

D. Samples: For the following products:

1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
- B. Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.
- D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet with factory-applied seam tape.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Syntec Systems.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Versico Roofing Systems; Carlisle Construction Materials.
 2. Thickness: 90 mils, nominal.
 3. Exposed Face Color: Black.

4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.

2.3 VAPOR BARRIER

- A. Composite Sheet for wood or glass-mat sheathing or concrete: Self-adhering 35-mil rubberized asphalt laminated to 5-mil polypropylene film.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Syntec Systems.
 - 1) Basis-of-Design: VapAir Seal 725TR.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Versico Roofing Systems; Carlisle Construction Materials.
 2. Thickness: 40 mils, nominal.
 3. Permeability: .015 perms per ASTM D1970 tested to E96 standards.
 4. Air Permeance: .000 L*m²@75 Pa per ASTM E2148.
- B. Composite Sheet for metal deck: Reinforced aluminum foil with self-adhering SBS; 15-mil overall thickness.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Syntec Systems.
 - 1) Basis-of-Design: VapAir Seal MD.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Versico Roofing Systems; Carlisle Construction Materials.
 2. Thickness: 40 mils, nominal.
 3. Permeability: .030 perms per ASTM D1970 tested to E96 standards.
 4. Air Permeance: .000 L*m²@75 Pa per ASTM E2148.

2.4 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.

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- 1 b. Gypsum Board and Panel Adhesives: 50 g/L.
 - 2 c. Multipurpose Construction Adhesives: 70 g/L.
 - 3 d. Fiberglass Adhesives: 80 g/L.
 - 4 e. Contact Adhesives: 80 g/L.
 - 5 f. PVC Welding Compounds: 510 g/L.
 - 6 g. Other Adhesives: 250 g/L.
 - 7 h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - 8 i. Nonmembrane Roof Sealants: 300 g/L.
 - 9 j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 10 k. Sealant Primers for Porous Substrates: 775 g/L.
 - 11 3. Verify adhesives and sealants comply with the testing and product requirements of the California
 - 12 Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic
 - 13 Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 14 B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
 - 15 C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by
 - 16 EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil. *Install within 8'-0" of*
 - 17 *perimeter of kitchen exhaust duct.*
 - 18 D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
 - 19 E. Bonding Adhesive: Manufacturer's standard.
 - 20 F. Seaming Material: Use factory-applied seam tape, width as recommended by manufacturer to extent possible.
 - 21 Then use manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape
 - 22 with release film Factory-applied seam tape, width as recommended by manufacturer.
 - 23 G. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
 - 24 H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
 - 25 I. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by
 - 26 1/8 inch thick; with anchors.
 - 27 J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions
 - 28 in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system
 - 29 manufacturer.
 - 30 K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot
 - 31 flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers,
 - 32 in-seam sealants, termination reglets, cover strips, and other accessories.
 - 33 1. Provide white flashing accessories for white EPDM membrane roofing.
 - 34 **2.5 SUBSTRATE BOARD**
 - 35 A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 36 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 37 a. CertainTeed; SAINT-GOBAIN.
 - 38 b. Georgia-Pacific Gypsum LLC.
 - 39 c. USG Corporation.
 - 40 2. Thickness: Type X, 5/8 inch.
 - 41 3. Surface Finish: Factory primed.
 - 42 B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions
 - 43 in FM Approvals 4470, designed for fastening substrate panel to roof deck.
 - 44 **2.6 ROOF INSULATION**
 - 45 A. Roof insulation assembly must provide an overall average of R-35.
 - 46 B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1 felt facer on both major surfaces.
 - 47 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 48 a. Atlas Polyiso Roof and Wall Insulation.
 - 49 b. Carlisle Syntec Systems.
 - 50 c. CertainTeed; SAINT-GOBAIN.
 - 51 d. GAF.
 - 52 e. Hunter Panels; a Carlisle company.
 - 53 f. Insulfoam; a Carlisle Company.
 - 54 g. Johns Manville; a Berkshire Hathaway company.
 - 55 h. Rmax, A Business Unit of Sika Corporation.
 - 56 2. Size: 48 by 96 inches.
 - 57 3. Thickness:
 - 58 a. Base Layer: 1-1/2 inches.

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- 1 b. Upper Layer: As needed per tapered insulation plan to meet required R-value.
- 2 C. Tapered Insulation (if applicable): Provide factory-tapered insulation boards.
- 3 1. Material: Match roof insulation.
- 4 2. Minimum Thickness: 1/4 inch.
- 5 3. Slope:
- 6 a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
- 7 b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.
- 8 **2.7 INSULATION ACCESSORIES**
- 9 A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions
- 10 in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system
- 11 manufacturer.
- 12 B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to
- 13 substrate or to another insulation layer as follows:
- 14 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- 15 2. Verify adhesives and sealants comply with the following limits for VOC content:
- 16 a. Plastic Foam Adhesives: 50 g/L.
- 17 b. Gypsum Board and Panel Adhesives: 50 g/L.
- 18 c. Multipurpose Construction Adhesives: 70 g/L.
- 19 d. Fiberglass Adhesives: 80 g/L.
- 20 e. Contact Adhesives: 80 g/L.
- 21 f. PVC Welding Compounds: 510 g/L.
- 22 g. Other Adhesives: 250 g/L.
- 23 h. Single-Ply Roof Membrane Sealants: 450 g/L.
- 24 i. Nonmembrane Roof Sealants: 300 g/L.
- 25 j. Sealant Primers for Nonporous Substrates: 250 g/L.
- 26 k. Sealant Primers for Porous Substrates: 775 g/L.
- 27 3. Verify adhesives and sealants comply with the testing and product requirements of the California
- 28 Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic
- 29 Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 30 C. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant
- 31 to UV degradation; type and weight as recommended by roofing system manufacturer for application.
- 32 **2.8 ASPHALT MATERIALS**
- 33 A. Roofing Asphalt: ASTM D312/D312M, Type III or Type IV.
- 34 B. Asphalt Primer: ASTM D41/D41M.
- 35 **2.9 WALKWAYS**
- 36 A. Flexible Walkways (if called for in drawings): Factory-formed, nonporous, heavy-duty, slip-resisting, surface-
- 37 textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
- 38 1. Size: Approximately 36 by 60 inches.
- 39 2. Color: Contrasting with roof membrane.
- 40 **PART 3 - EXECUTION**
- 41 **3.1 EXAMINATION**
- 42 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other
- 43 conditions affecting performance of the Work.
- 44 1. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
- 45 2. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal
- 46 relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer when
- 47 tested in accordance with ASTM F2170.
- 48 a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with not less
- 49 than three test probes.
- 50 b. Submit test reports within 24 hours of performing tests.
- 51 3. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have
- 52 been removed.
- 53 4. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
- 54 **3.2 PREPARATION**
- 55 A. Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.
- 56 1. Submit test result within 24 hours of performing tests.
- 57 a. Include manufacturer's requirements for any revision to previously submitted fastener patterns
- 58 required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system in accordance with roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition (and to not void warranty for existing roofing system when applicable).
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install where identified in roofing details and/or roof assembly descriptions in the drawings.
- B. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
 - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 - 2. At wood sheathing, install substrate board parallel to long axis of wood panels.
 - a. Locate end joints over structural framing below but not over wood sheathing joints.
 - 3. Tightly butt substrate boards together.
 - 4. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 5. Fasten substrate board to top flanges of steel deck (or wood sheathing) in accordance with recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
 - 6. Fasten substrate board to top flanges of steel deck (or wood sheathing) to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written instructions.

3.5 INSTALLATION OF VAPOR BARRIER

- A. See product description above for correct product for application.
- B. Install self-adhering membrane per manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Insulation installation intent:
 - 1. Top-most course of insulation is to be adhered to course below with lower courses screwed to deck as a stack (i.e., lower courses are not screwed per course).
- D. Installation Over Metal Decking (applies to decks with or without substrate board):
 - 1. Install base *and subsequent layers* of insulation with joints staggered not less than 24 inches in adjacent rows, end joints staggered not less than 12 inches in adjacent rows, and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch with insulation.
 - g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - h. Loosely lay base layer of insulation units over substrate.
 - i. Mechanically attach base layer of insulation (and substrate board when noted) using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation in accordance with requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

-
- 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 2. Install top layer of tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch with insulation.
 - g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - h. Adhere top layer of tapered insulation to layer below using adhesive in accordance with FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - E. Installation Over Wood Sheathing (applies to decks with or without substrate board):
 1. Follow direction for "Installation Over Metal Decking" above, except that ends of insulation to be mechanically attached are to align with wood framing below.
- 3.7 ADHERED ROOFING INSTALLATION**
- A. Adhere roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.
 - B. Unroll membrane roof membrane and allow to relax before installing.
 - C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
 - D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
 - E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
 - F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
 - G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
 - H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - I. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
 - K. Adhere protection sheet over roof membrane at locations indicated.
- 3.8 INSTALLATION OF BASE FLASHING**
- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates in accordance with roofing system manufacturer's written instructions.
 - B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
 - C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
 - D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
 - E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- 3.9 INSTALLATION OF WALKWAYS**
- A. Flexible Walkways: Install walkway products in accordance with manufacturer's written instructions.
 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.

- e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
- f. Locations indicated on Drawings.
- g. As required by roof membrane manufacturer's warranty requirements.
- 2. Provide 6-inch clearance between adjoining pads.
- 3. Adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

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PART 1 – GENERAL

- 1.1 SUMMARY**
 - A. Section Includes:
 - 1. Commercial door hardware for aluminum entrances, wood and steel doors
 - 2. Coordination and interface with Owner's Security System.
 - 3. Templates
 - 4. Keying System
- 1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS**
 - A. Furnish all hardware to Section 06200 for installation.
- 1.3 RELATED WORK**
 - A. Section 08 11 00 - Metal Doors and Frames: Doors and Frames prepared for finish hardware.
 - B. Section 08 21 00 - Wood Doors: Wood doors: Doors and Frames prepared for finish hardware.
 - C. Division 26 - Electrical Power supply to electric hardware devices and low voltage control.
- 1.4 REFERENCES**
 - A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - B. ANSI/NFPA 80 - Fire Doors and Windows.
 - C. BHMA - Builders' Hardware Manufacturers Association.
 - D. DHI - Door and Hardware Institute.
 - E. NAAMM - National Association of Architectural Metal Manufacturers.
 - F. NFPA 101 - Life Safety Code.
 - G. SDI - Steel Door Institute.
 - H. ADA - The Americans with Disabilities Act.

1.5 COORDINATION

- A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for hardware.
- B. Furnish template for application to doors and jambs with machine or wood screws or through-bolts as required. Templates or hardware or both shall be delivered to factory or building as required by those furnishing items to which hardware is to be applied. Refer to other Sections of Specifications for this information. Locksets for metal doors shall have beveled faces to correspond with bevel of doors. Strikes shall be ASA Standard dimension. Locks having bolts or latches engaging with mullions or jambs of hollow metal shall have box type strikes with curved lips.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- D. Cooperate with installing contractor and others with regard to application of hardware. Make occasional inspections to verify that items are properly used, installed, in correct location and master-key system is maintained. Report improper application of hardware.
- E. Prior to preparing shop drawing submittal, contact Architect to set up a meeting with the Owner to review door functions.

1.6 QUALITY ASSURANCE

- A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three years experience.
- B. Hardware Supplier: Company specializing in supplying commercial and institutional door hardware with five years experience.
- C. Each type of hardware shall be furnished from only one manufacturer.
- D. No hardware shall be attached to metal frames with self-tapping or sheet metal screws.
- E. Furnish thru bolts for fastening overhead holders and closers on composite core doors.

1.7 REGULATORY REQUIREMENTS

- A. Conform to NFPA Standard No. 80 requirements applicable to fire rated doors and frames.
- B. Provide only hardware which has been tested and listed by U.L. for types and sizes of doors required and complies with requirements of door and door frame labels.

1.8 CERTIFICATIONS

- A. Architectural Hardware Vendor shall inspect complete installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified herein.
- B. Provide two copies of certifications to Architect.

1.9 SUBMITTALS

- A. Before ordering material, prepare and submit complete vertical hardware schedule for all hardware materials to Architect for review. Approval of schedule does not relieve Contractor of any responsibility for furnishing material in accordance with requirements of work.
- B. Schedule shall be specific and conclusive with respect to catalog numbers, finishes, template requirements, brackets, type of fasteners and locations. Incomplete schedule will not be checked.
- C. Include in schedule, installation dimensions, hardware locations and mounting heights of each type of hardware.
- D. Prepare detailed keying schedule after obtaining Owner's instructions and requirements, and submit for approval.
- E. Samples, if requested shall be submitted to Architect for approval. Approved samples, if of proper finish, will be delivered to job for ultimate use; otherwise samples will be returned to Contractor upon completion.
- F. Submit certificate that hardware to be furnished meets or exceeds specified requirements.
- G. Submit catalog cut sheets describing all hardware items.
- H. Coordinate with Electrical Contractor and Owner's Security Design Vendor installation requirements for locksets that have electric strikes, door position switches and other line or low voltage requirements.
- I. Operation and Maintenance data.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data for all hardware items provided.
- B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- C. Include one copy of final approved hardware and keying schedule.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Send duplicate list of hardware in each shipment to Contractor. Original list shall accompany shipment. Hardware vendor shall pay shipping and delivery charges.
- B. Deliver hardware to Carpenter (Section 06200) or to respective shops of other Contractors as required. Consult with named Contractors and follow their directions regarding manner, sequence and time of delivery and obtain receipt.
- C. Responsibility for safekeeping after delivery rests with trade to whom hardware was delivered.

- 1 D. Hardware shall be sorted and delivered to jobsite plainly marked to correspond with item numbers of vendor's
- 2 approved schedule and be specific as to exact openings and other locations for which items are packaged. Each door
- 3 opening shall receive separate item number on Hardware Schedule.
- 4 E. Plainly mark packages of hardware so that locations of their use may be ascertained without breaking package.
- 5 Where several packages are needed to complete schedule for one location, securely tie together or box.
- 6 F. Pack hardware by building area unless Contractor receiving hardware orders otherwise.
- 7 G. Hardware Supplier shall check all shipments to insure proper accessories and templates.
- 8 H. Deliver hardware only after detailed schedule, keying diagrams, and samples have been approved.
- 9 I. Provide secure lock-up for hardware delivered to the project. Control handling and installation of hardware items
- 10 which are not immediately replaceable so that the completion of the work will not be delayed by hardware losses.

11 1.12 MAINTENANCE MATERIALS

- 12 A. Provide three each special wrenches and tools applicable to each difference or special hardware component.
- 13 B. Provide three each maintenance tools and accessories supplied by hardware component manufacturer.

14 1.13 WARRANTY

- 15 A. Provide manufacturer's standard warranty.

16
17 PART 2 - PRODUCTS

18
19
20 2.1 SOURCE LIMITATIONS

- 21 A. Obtain each type of door hardware from single manufacturer.

22 2.2 PERFORMANCE REQUIREMENTS

- 23 A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80
- 24 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive
- 25 pressure in accordance with NFPA 252 or UL 10C.
- 26 B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for
- 27 intended location and application.
- 28 C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use
- 29 of a key, tool, or special knowledge for operation.
- 30 D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
- 31 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that
- 32 operate with a force of not more than 5 lbf (22.2 N).
- 33 2. Comply with the following maximum opening-force requirements:
- 34 a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
- 35 b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- 36 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm)
- 37 high.
- 38 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5
- 39 seconds to move to a position of 12 degrees from the latch.
- 40 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to
- 41 move to the closed position.

42 2.3 MATERIALS

- 43 A. Locks, Latches, Cylinders, and Dead Locks
- 44 1. Shall be Schlage L series as noted in hardware sets. Backset shall be 2-3/4" for all locks, latches and dead
- 45 locks, unless otherwise required to match existing door prep's. No substitutions.
- 46 2. All locks and latches shall be of one manufacturer.
- 47 3. Included construction cores for all cylinders.
- 48 4. All cylinder cores shall be Schlage Primus brand cores. No substitutions. Primus cores are to be supplied by
- 49 owner.
- 50 B. Exit Devices
- 51 1. Devices shall be as manufactured by Von Duprin as noted in hardware sets. No substitutions.
- 52 2. Function shall be as noted in schedule.
- 53 3. Mount exit devices to match mullions at adjacent doors and frames wherever possible.
- 54 C. Butt Hinges
- 55 1. Shall be Best, Hager, or Ives ball bearing, nonrising loose pin, flat button tip, unless specified to the contrary.
- 56 2. Number of butts required:
- 57 a. Doors up to 7' - 4" - 3 butts
- 58 b. Doors 7'- 4" up to 10' - 4 butts

- 1 3. Butt size requirements
- 2 a. Interior doors up to 36" wide 4-1/2 x 4-1/2 standard weight.
- 3 b. Interior doors over 36" wide 4-1/2 x 4-1/2 heavy weight.
- 4 c. Exterior doors 4-1/2 x 4-1/2 heavy weight.
- 5 4. Door butt legend: (unless otherwise noted in Schedule)
- 6 a. Exterior doors and interior doors exposed to garage/wet areas –stainless steel-NRP.
- 7 b. All other doors steel based.
- 8 5. Furnish UL approved butts on labeled doors.
- 9 6. Provide non-removable pins (NRP) on all exterior and lockable outswinging doors.
- 10 7. Continuous Gear Hinges: Hager, Ives, or Select.
- 11 D. Door Closers
- 12 1. Shall be LCN 4040XP series unless otherwise specified in hardware groups. No substitutions.
- 13 2. Closers shall have key adjusting device.
- 14 3. Mount to provide maximum opening permitted by building construction or equipment. Note on schedule
- 15 the maximum swing per location for other trades involved in reinforcement or installation.
- 16 4. All door closers shall be similar in design and appearance to those listed in the schedule, so far as possible, of
- 17 one manufacturer. Furnish special arms and applications as indicated in hardware schedule or as dictated by
- 18 structural conditions or local code requirements. Provide appropriate brackets for doors with transoms.
- 19 5. Door closers at labeled fire doors shall bear UL approval. Provide thru-bolts for mineral core doors unless
- 20 otherwise specified in door specifications.
- 21 E. Pushes, Pulls, and Kickplates
- 22 1. Shall be as manufactured by Hager, Ives, Rockwood, or Trimco..
- 23 2. All plates shall be 16 gauge (0.50), beveled sides and with countersunk screw holes at intervals of not over 6"
- 24 on all four sides. Screws shall be stainless steel oval head, finish to match plates.
- 25 F. Stops and Bumpers
- 26 1. Shall be Hager, Ives, Rixson, Rockwood, or Trimco..
- 27 2. Install bumper behind each door.
- 28 3. Overhead stops and holder types as specified in hardware groups.
- 29 4. Apply with expansion shield and machine screws only.
- 30 5. Provide special templates as required for proper coordination of door closers and overhead door holders.
- 31 G. Manual and Automatic flushbolts.
- 32 1. Shall be Hager, Ives, Rockwood, or Trimco.
- 33 H. Low Energy Openers
- 34 1. ADA Automatic Openers: Stanley Magic Force, Horton 4000LE or Motion Access Condor Swing as specified in
- 35 hardware groups. Automatic operators are to be included as supply and install. Coordinate installation and
- 36 operation of opener and switches with electrical contractor.
- 37 I. Thresholds, Weatherstripping, Sound Seals
- 38 1. National Guard, Hager, or Pemko.
- 39 J. Door Silencers or Mutes
- 40 1. Furnish three for each pressed steel frame for single doors, two for each pressed steel frame for pairs of
- 41 doors.
- 42 K. Other Materials
- 43 1. Provide other materials not specifically described but required for a complete and proper installation, as
- 44 selected by the Contractor and approved by the Architect.
- 45 2.4 KEYING
- 46 A. Keying is by owner.
- 47 2.5 FABRICATION
- 48 A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using
- 49 manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or
- 50 greater than that of specified door hardware units and ANSI/BHMA A156.18.
- 51 B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood,
- 52 and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application
- 53 intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to
- 54 match surface of door hardware unless otherwise indicated.
- 55 2.6 FINISHES
- 56 A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.
- 57 B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective
- 58 covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights **to comply with the following** unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every **30 inches (760 mm)** of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
1. Configuration: Provide one power supply for each door opening or least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.

3.4 INSPECTION AND ADJUSTMENTS

- A. Hardware vendor shall, before substantial completion of project, and/or as directed by Architect, inspect all locks that are part of this project to see that keys pass proper locks as required.
- B. Check that all locks and latches are properly lubricated, as recommended by manufacturer, with lock lubricant and that all moving parts are adjusted correctly to insure free, smooth operation.
- C. Door closers and holders shall be checked for proper lubrication. After building is in use, arrange with factory representative of closer manufacturer to make final adjustments to closers to meet building conditions.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

1
2
3
4 SCHEDULE

5
6 Check specified schedule against latest revised plans when making up schedule for approval. Schedule each door separately and,
7 where practical, item numbers shall be same as door numbers and in consecutive sequence.

8
9 If hardware is not scheduled for a particular door, furnish hardware of types specified for similar locations as far as practical.

10
11 Include accessories required to fully equip in satisfactory manner, doors and the like as shown and specified. Include necessary
12 screws, nuts, bolts, expansion shields and other devices necessary for proper application.]

13
14 Items of hardware herein described shall be considered as standard and, unless otherwise specifically mentioned, all hardware
15 used throughout work shall be equal thereto in size, weight, material and workmanship. Revision of standard hardware, which
16 may be necessary to conform to details shall be provided. Items not specifically mentioned but necessary for completion of work
17 shall be of most suitable type matching in quality and finish items which are described.

18
19
20 **SET 01**

21	EA	HINGES	AS SPECIFIED	640 IVES
22	2	EA	EXIT DEVICE	9927L-BE X LBR
23	2	EA	CLOSER	4040XP EDA
24	2	EA	OVERHEAD HOLDER	GJ100H SERIES
25	2	EA	KICKPLATE	10" X 1" LDW

26
27
28
29
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31
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33
34
35 **SET 02**

36	EA	HINGES	AS SPECIFIED	640 IVES
37	EA	EXIT DEVICE	99L-BE	613 VON DUPRIN
38	1	EA	CLOSER	4040XP EDA
39	1	EA	OVERHEAD STOP	GJ100H SERIES
40	1	EA	KICKPLATE	10" X 2" LDW

41
42
43
44 **SET 03**

45	EA	HINGES	AS SPECIFIED	640 IVES
46	1	EA	PRIVACY	L9040 X 03A X L283-722
47	1	EA	CLOSER	4040XP
48	1	EA	WALL STOP	409
49	1	EA	KICKPLATE	10" X 2" LDW

50
51
52 **SET 04**

53	EA	HINGES	AS SPECIFIED	640 IVES
54	1	EA	EXIT DEVICE	9927NL X LBR
55	1	EA	EXIT DEVICE	9927DT X LBR
56	1	EA	I/C CYLINDER	AS REQUIRED
57	1	EA	PRIMUS CORE	AS REQUIRED
58	2	EA	CLOSER	4040XP

1	2	EA	OVERHEAD HOLDER	GJ100H SERIES	613 GLYNN-JOHNSON
2	2	EA	KICKPLATE	10" X 1" LDW	613 IVES
3					
4	**PREP DOORS WITH RACEWAYS FOR FUTURE ELECTRIC LATCH RETRACTION KITS AND ELECTRIC HINGES FOR FUTURE CARD				
5	ACCESS.				
6					
7					
8	SET 05				
9		EA	HINGES	AS SPECIFIED	640 IVES
10	2	EA	EXIT DEVICE	9927DT X LBR	613 VON DUPRIN
11	2	EA	CLOSER	4040XP	695 LCN
12	2	EA	OVERHEAD HOLDER	GJ100H SERIES	613 GLYNN-JOHNSON
13	2	EA	KICKPLATE	10" X 1" LDW	613 IVES
14					
15	**PREP DOORS WITH RACEWAYS FOR FUTURE ELECTRIC LATCH RETRACTION KITS AND ELECTRIC HINGES FOR FUTURE CARD				
16	ACCESS.				
17					
18					
19	SET 06				
20		EA	HINGES	224HD	640 IVES
21	1	EA	EXIT DEVICE	99EO	613 VON DUPRIN
22	1	EA	CLOSER	4040XP	695 LCN
23	1	EA	OVERHEAD STOP	GJ100 SERIES	613 GLYNN-JOHNSON
24	1	SET	WEATHERSTRIP	700SDKB	DKB NGP
25	1	EA	SWEEP	200NDKB	DKB NGP
26	1	EA	THRESHOLD	8425	AL NGP
27					
28					
29	SET 07				
30	1	EA	CONTINUOUS HINGE	112HD	DKB IVES
31	1	EA	EXIT DEVICE	99EO	613 VON DUPRIN
32	1	EA	CLOSER	4040XP	695 LCN
33	1	EA	OVERHEAD STOP	GJ100 SERIES	613 GLYNN-JOHNSON
34	1	EA	SWEEP	200NDKB	DKB NGP
35	1	EA	THRESHOLD	8425	AL NGP
36					
37	**SEALS BY DOOR SUPPLIER.				
38	**PROVIDE DROP PLATE AND BLADE STOP SPACER AS REQUIRED FOR CLOSER INSTALLATION.				
39					
40					
41	SET 08				
42		EA	HINGES	AS SPECIFIED	640 IVES
43	1	EA	STOREROOM LOCK	L9080T X 03A	613 SCHLAGE
44	1	EA	PRIMUS CORE	AS REQUIRED	613 SCHLAGE
45	1	EA	CLOSER	4040XP-SCUSH	695 LCN
46	1	EA	FLUSHBOLT	FB458-12"	613 IVES
47	2	EA	KICKPLATE	10" X 1" LDW	613 IVES
48	1	SET	SEALS	870	DKB ZERO
49	1	SET	SEALS	119W	DKB ZERO
50	1	SET	ASTRAGAL	41	DKB ZERO
51	1	EA	ASTRAGAL	40	DKB ZERO
52	2	EA	AUTO DR BOTTOM	355	AL ZERO
53	1	EA	THRESHOLD	564	AL ZERO
54					
55	**COORDINATE SEALS AND HINGE REQUIREMENTS WITH STC DOOR SUPPLIER.				
56					
57					
58					

1 **SET 09**

2	EA	HINGES	AS SPECIFIED	640 IVES	
3	1	EA	STOREROOM LOCK	L9080T X 03A	613 SCHLAGE
4	1	EA	PRIMUS CORE	AS REQUIRED	613 SCHLAGE
5	1	EA	CLOSER	4040XP HEDA	695 LCN
6	2	EA	OVERHEAD HOLDER	GJ100 SERIES	613 GLYNN-JOHNSON
7	1	EA	FLUSHBOLT	FB458-12"	613 IVES
8	2	EA	KICKPLATE	10" X 1" LDW	613 IVES
9	1	SET	SEALS	870	DKB ZERO
10	1	SET	SEALS	119W	DKB ZERO
11	1	SET	ASTRAGAL	41	DKB ZERO
12	1	EA	ASTRAGAL	40	DKB ZERO
13	2	EA	AUTO DR BOTTOM	355	AL ZERO
14	1	EA	THRESHOLD	564	AL ZERO

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16 ****COORDINATE SEALS AND HINGE REQUIREMENTS WITH STC DOOR SUPPLIER.**

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19 **SET 10**

20		EA	HINGES	AS SPECIFIED	640 IVES
21	1	EA	STOREROOM LOCK	L9080T X 03A	613 SCHLAGE
22	1	EA	PRIMUS CORE	AS REQUIRED	613 SCHLAGE
23	1	EA	CLOSER	4040XP	695 LCN
24	1	EA	WALL STOP	409	613E ROCKWOOD
25	1	EA	KICKPLATE	10" X 2" LDW	613 IVES
26	1	EA	DEADBOLT FILLER PLATE	AS REQUIRED	

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28 **GC TO CUT NEW 4 7/8" ANSI STRIKE PREP IN FRAME FOR NEW LOCK.

29 **PROVIDE NEW FILLER FOR EXISTING DEADBOLT STRIKE. FIELD VERIFY.

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32 **SET 11**

33		EA	HINGES	AS SPECIFIED	640 IVES
34	1	EA	PUSH	70C	613 ROCKWOOD
35	1	EA	PULL	BF111 X 70C	613 ROCKWOOD
36	1	EA	CLOSER	4040XP	695 LCN
37	1	EA	WALL STOP	409	613E ROCKWOOD
38	1	EA	KICKPLATE	10" X 2" LDW	613 IVES
39	1	EA	FOOT PULL	FP1230	613E ROCKWOOD

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END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Glass products.
 2. Laminated glass.
 3. Insulating glass.
 4. Glazing sealants.
 5. Glazing tapes.
 6. Miscellaneous glazing materials.

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.
 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass.
- B. Product test reports.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample warranties.

1.6 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.
 1. Large-Missile Test: For glazing located within 30 feet of grade.
 2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.
- F. Acoustic Performance:
 1. Exterior Glazing: 28 OITC min.
 2. Interior Glazing: 35 STC min.

2.2 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Cardinal Glass Industries, Inc.
 - b. Guardian Glass LLC.
 - c. Pilkington North America; NSG Group.
 - d. Saint-Gobain Glass Corp.
 - e. Viracon.
- B. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- C. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- D. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
- E. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- F. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- G. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

H. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

I. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

J. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

K. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, ionoplast interlayer, or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.

2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

C. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

D. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type GL-4:

1. Annealed float glass. Provide fully tempered where safety glazing is required as noted in drawings.

2. Minimum Thickness: 6 mm.

3.7 LAMINATED GLASS SCHEDULE

- A. Clear Laminated Glass Type **GL-3**:
1. Two plies of annealed float glass.
 2. Minimum Thickness of Each Glass Ply: 3 mm.
 3. Interlayer Thickness: 0.030 inch min.
 4. Safety glazing required.

3.8 INSULATING GLASS SCHEDULE

- A. Clear With Applied Membrane Insulating Glass Type **GL-2**:
1. Provide fully tempered where safety glazing is required as noted in drawings.
 2. Basis-of-Design Product: Solera, Solera S R5+Aerogel.
 3. Applied Membrane: Light Diffusing Veil (by Solera).
 4. Overall Unit Thickness: 1 inch.
 5. Minimum Thickness of Each Glass Lite: 6 mm.
 6. Outdoor Lite: Annealed float glass.
 7. Interspace Content: Aerogel.
 8. Indoor Lite: Annealed float glass.
 9. Safety glazing required.
 10. Panel Characteristics:
 - a. SHGC: 0.37 max.
 - b. **VLT: 0.35 min.**
 - c. U-factor: 0.20 max.
- B. Low-E&Ceramic-Coated, Insulating Vision Glass Type **GL-1**:
1. Provide fully tempered where safety glazing is required as noted in drawings.
 2. Basis-of-Design Product: Viracon, 51767 Bird Friendly glass.
 3. Ceramic Coating Color and Pattern: 1% coverage, 1/4" dot, 2x2, staggered in warm grey.
 4. Overall Unit Thickness: 1 inch.
 5. Minimum Thickness of Each Glass Lite: 6 mm.
 6. Outdoor Lite: Clear heat-strengthened float glass.
 7. Interspace Content: Argon.
 8. Indoor Lite: Clear heat-strengthened float glass.
 9. Ceramic Coating Location: Second surface.
 10. Low-E Coating: Pyrolytic or sputtered on third surface.
 11. Panel Characteristics:
 - a. SHGC: 0.25 max.
 - b. VLT: 0.60 min.
 - c. U-factor: 0.20 max.

END OF SECTION

SECTION 09 51 33
ACOUSTICAL METAL PAN CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum pans for acoustical metal pan ceiling.
 - 2. Metal suspension system for acoustical, standard-grid metal pan ceilings.
 - 3. Metal suspension system for acoustical, snap-in metal pan ceilings.
- B. Specified system might be intended for WALL installation. See Drawings for scope.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants, indicating VOC content.
 - 3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
 - 4. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.
 - 5. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
 - 6. Environmental Product Declaration: For each product.
 - 7. Health Product Declaration: For each product.
 - 8. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Product test reports.
- C. Research reports.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design attachment devices.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL METAL PANS, GENERAL

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Recycled Content of Insulation: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Verify insulation complies with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Regional Materials: Manufacture products within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured within 100 miles of Project site.
- F. Acoustical Panel Standard: Comply with ASTM E1264.

- G. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
1. Aluminum Sheet: Rolled aluminum sheet, complying with ASTM B209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- H. Adhesive: Manufacturer's standard nonflammable adhesive for sound-absorbent pads.
1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 ALUMINUM PANS FOR ACOUSTICAL METAL PAN CEILING

- A. Aluminum Pans for Acoustical Metal Pan Ceiling:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- a. Arktura.
- 1) Basis-of-Design: Vapor Trail system – See Finish Key for selected options and detailing.
- B. Classification: Units complying with ASTM E1264 for Type VII, perforated aluminum facing (pan) with mineral- or glass-fiber-base backing.
1. Pattern: See Finish Key.
- C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
1. Lay-in Pans: Formed to set in exposed suspension grid.
2. Clip-in Pans: Designed to clip in and be securely retained in exposed suspension grid by formed edges or accessory clips provided by manufacturer.
3. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
4. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted, exposed suspension grid by torsion springs provided by manufacturer.
- D. Pan Thickness: Not less than basis-of-design.
- E. Pan Edge Detail: Manufacturer's standard edge detail unless noted otherwise in Finish Key.
- F. Pan Size: As indicated on Drawings.
- G. Pan Face Finish: Painted in color selected from manufacturer's full range.
- H. Light Reflectance Coefficient: Manufacturer's standard.
- I. NRC: Manufacturer's standard.
- J. Ceiling Attenuation Class: Manufacturer's standard.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Regional Materials: Manufacture products within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured within 100 miles of Project site.
- C. Metal Suspension System Standard: Comply with ASTM C635/C635M.
- D. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL, STANDARD-GRID METAL PAN CEILINGS

- A. Metal Suspension System for Acoustical, Standard-Grid Metal Pan Ceilings:
1. Manufactured by panel manufacturer.
- B. Suspension System: For clip-in, lay-in, or torsion-spring-hinged pans.
1. Capped, Double-Web, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized in accordance with ASTM A653/A653M, G30 coating designation, with prefinished, cold-rolled, 15/16-inch-wide, sheet metal caps on flanges.
- a. Structural Classification: Intermediate-duty system.
- b. End Condition of Cross Runners: Override (stepped) or butt-edge type.
- c. Face Design: Flat, flush.
- d. Cap Material: Steel or aluminum cold-rolled sheet.
- e. Cap Finish: Painted in color as selected from manufacturer's full range.
- f. Profile: See Finish Key.
- C. Suspension System for Torsion-Spring-Hinged Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring-hinged attachment.

2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL SNAP-IN METAL PAN CEILINGS

- A. Snap-In Grid Suspension System:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by snap-in metal pan ceiling manufacturer.
- B. Indirect-Hung, Snap-Tee or Bar System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure.
- C. Access Panels: For access at locations indicated, provide acoustical snap-in metal pan ceiling units.
 - 1. Access Key or Tool: Provide manufacturer's standard key or tool for opening access panels; one.

2.7 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Color-Coated Finish: Manufacturer's standard powder-coat baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install acoustical metal pan ceiling assemblies to comply with ASTM C636/C636M and manufacturer's written instructions.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
- C. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim. Comply with manufacturer's installation tolerances.
 - 1. Install directionally patterned or textured metal pans in directions indicated.
- D. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules.

END OF SECTION

SECTION 09 93 00
STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood stains.
 - 2. Transparent finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of finish system and in each color and gloss of finish required.
- C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- D. Sustainable Design Submittals:
 - 1. Product Data: For paints and coatings, indicating VOC content.
 - 2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
 - 3. Environmental Product Declaration: For each product.
 - 4. Health Product Declaration: For each product.
 - 5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 - 6. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Penofin.
 - 3. PPG Paints; PPG Industries, Inc.
 - 4. Sherwin-Williams Company (The).
 - 5. Sikkens.

2.2 MATERIALS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- B. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Primers, Sealers, and Undercoaters: 100 g/L.
 - 2. Clear Wood Finishes, Varnishes: 275 g/L.
 - 3. Clear Wood Finishes, Lacquers: 275 g/L.
 - 4. Shellacs, Clear: 730 g/L.
 - 5. Stains: 100 g/L.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors: **Match existing.**

2.3 WOOD STAINS

- A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

2.4 TRANSPARENT FINISHES

- A. Varnish, Interior, Polyurethane, Oil Modified: Solvent-based, one-component, oil-modified polyurethane clear satin varnish for new or previously varnished or stained interior wood surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- B. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

- A. Wood Substrates, Wood Trim, Architectural Woodwork, Doors, Windows, and/or Wood Board Paneling:
 - 1. Polyurethane Varnish over Stain System:
 - a. Stain Coat: Stain, semitransparent, for interior wood – color to match existing.
 - b. First Intermediate Coat: Polyurethane varnish matching topcoat.
 - c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
 - d. Topcoat: Varnish, interior, polyurethane, oil modified, satin.

END OF SECTION

SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-plastic toilet compartments.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for blocking.
 - 2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
 - 3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

- A. Product data.
- B. Shop Drawings: Plans, elevations, sections, details, and attachment details.
- C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.
- D. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Include structural design calculations indicating compliance with specified structural-performance requirements.
- E. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.
- D. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. ASI Global Partitions.
 - 2. Scranton Products.
- B. Basis-of-Design: Scranton Products.
- C. Toilet-Enclosure Style: Overhead braced.
- D. Entrance-Screen Style: Overhead braced.
- E. Urinal-Screen Style: Wall hung.
- F. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).
 - 1. Heat-Sink Strip: Manufacturer's continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 2. Color: One color in each room as selected by Architect from manufacturer's full range.
- G. Entrance-Screen Construction: Matching panel construction.
- H. Urinal-Screen Construction: Matching panel construction.
- I. Pilaster Sleeves (Caps): Manufacturer's standard design; solid plastic or stainless steel.
 - 1. Plastic Color: Matching pilaster.
- J. Urinal-Screen Post: 1-3/4-inch-square aluminum tube with satin finish; with sleeve (cap) matching that on the pilaster (i.e., not to floor)
- K. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.
1. Hinges:
 - a. Manufacturer's continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
 - 1) Material, Continuous Hinge: Stainless steel.
 2. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
 - a. Material: Stainless steel.
 3. Coat Hook: As identified in Toilet Accessory section.
 4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors UNLESS specified in Toilet Accessory section.
 - a. Material: Stainless steel.
 5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
 - a. Material: Stainless steel.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.
- E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.5 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls, with leveling adjustment nuts at tops and bottoms of posts. Provide sleeves (caps) at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, inswinging doors for standard toilet enclosures and 36-inch-wide, outswinging doors with a minimum 32-inch-wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall guards.
 - 2. Impact-resistant handrails.
 - 3. Corner guards.
- B. Related Requirements:
 - 1. Section 06 64 00 "Plastic Paneling" for fiber-reinforced wall paneling.
 - 2. Section 08 71 00 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [Product Data](#): For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- D. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Material certificates.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 WALL GUARDS

- A. Rub Rail: Standard-duty, PVC-free assembly consisting of continuous snap-on cover installed over concealed, continuous retainer.
 - 1. [Manufacturers](#): Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Construction Specialties – Acrovyn.
 - b. [inpro Corporation](#).
 - c. **Basis-of-Design**: See Finish Schedule and Finish Key in Drawings.
 - 2. Cover: Extruded plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Color and Texture: As selected by Architect from manufacturer's full range.
 - 3. Retainer: Minimum 0.0625-inch-thick, one-piece, extruded aluminum.
 - 4. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
 - 5. Accessories: Concealed splices and mounting hardware.
 - 6. Mounting: See basis-of-design product.

2.3 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

- B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.
 - C. Stainless Steel: Type 304.
 - D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
 - E. Adhesive: As recommended by protection product manufacturer.
- 1. [Verify adhesives have a VOC](#) content of 70 g/L or less.
 - 2. [Verify adhesive complies with the](#) testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
 - 3. Adjust end and top caps as required to ensure tight seams.

END OF SECTION

**SECTION 11 66 23
GYMNASIUM EQUIPMENT**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basketball equipment.
 - 2. Volleyball equipment.
 - 3. Safety pads.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For gymnasium equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each item and color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved.
- B. Product Certificates: For each type of gymnasium equipment.
- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BASKETBALL EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Porter – basis-of-design.
- B. Standard Rules: Provide equipment according to the requirements of NFHS's "Basketball Rules Book."
- C. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 05 50 00 "Metal Fabrications" of size and type required to transfer loads to building structure.
- D. Overhead-Supported Backstops:
 - 1. Folding Type: Manufacturer's standard assembly for side-folding backstop, with hardware and fittings to permit folding.
 - 2. Goal Height Adjuster: Adjustable from 8 to 10 feet to top of ring with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
 - a. Operation:
 - 1) Electrical: Electric operation with integral gear-drive motor, with limit switches preset to goal heights.
- E. Winch: Hoist consisting of heavy-duty, fully enclosed worm-gear; brake; cable drum; cable; and fittings, for mounting on wall with equipment-mounting board; designed to move and hold backboard in any raised or lowered position.
- F. Backstop Electric Operator: Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Motor Electrical Characteristics:

-
- 1 a. Horsepower: 3/4 hp.
 - 2 b. Voltage: 115 V ac, single phase, 60 hertz.
 - 3 3. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-
 - 4 contact, three-position, switch-operated control with up, down, and off functions.
 - 5 a. Keys: Provide ~~[one key] [two keys] [one set of dual keys] [two sets of dual keys] [dual keys, one~~
 - 6 ~~key for up and one for down]~~ per station.
 - 7 4. Limit Switches: Adjustable switches at each backstop, interlocked with motor controls and set to
 - 8 automatically stop backstop at fully retracted and fully lowered positions.
 - 9 G. Basketball Backboards:
 - 10 1. **Basis-of-Design:** Bison.
 - 11 a. Model: BA42XL – See Drawings for location(s).
 - 12 b. Model: BA48XL – See Drawings for location(s).
 - 13 c. Other manufacturers will be considered if they substantially match the basis-of-design models.
 - 14 H. Goal-Mounting Assembly: Compatible with goal, backboard, and backstop.
 - 15 I. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded
 - 16 around underside of ring.
 - 17 1. Single-rim basket ring competition goal.
 - 18 2. Double-rim basket ring.
 - 19 3. Type:
 - 20 a. Fixed: Nonmovable.
 - 21 b. Movable: pressure-release design with manufacturer's standard breakaway mechanism and
 - 22 rebound characteristics identical to those of fixed, nonmovable ring.
 - 23 4. Finish: Manufacturer's standard finish.
 - 24 J. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit ring diameter, and as follows:
 - 25 1. Cord: Made from white cotton.
 - 26 K. Backboard Safety Pads: Designed for backboard thickness and extending continuously along bottom and up sides of
 - 27 backboard and over backstop according to manufacturer's standard design.
 - 28 1. Color: As selected by Architect from manufacturer's full range.
 - 29 L. Basketball Shot Clock:
 - 30 1. **Basis-of-Design:** Bison.
 - 31 a. Model: In-Time Wireless with all necessary mounting hardware and accessories to be a fully-
 - 32 functional system.
 - 33 b. Other manufacturers will be considered if they substantially match the basis-of-design model.
 - 34 **2.2 VOLLEYBALL EQUIPMENT**
 - 35 A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be
 - 36 incorporated into the Work include, but are not limited to the following:
 - 37 1. Porter – basis-of-design.
 - 38 B. Standard Rules: Provide equipment according to the requirements of NFHS's "Volleyball Rules Book".
 - 39 C. Floor Insert: Solid-brass floor plate and steel pipe sleeve, concealed by floor plate, with capped bottom end, 3 inch
 - 40 diameter, minimum 12 inches long, to securely anchor pipe sleeve as indicated on Drawings; with anchors designed
 - 41 for securing floor insert to floor substrate indicated; quantity as indicated on Drawings.
 - 42 1. Flush Floor Plate: Manufacturer's standard hinged access cover, designed to be flush with adjacent flooring.
 - 43 Provide one tool(s) for unlocking access covers.
 - 44 2. Floor Plate: 5 inch diameter brass.
 - 45 **2.3 SAFETY PADS**
 - 46 A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be
 - 47 incorporated into the Work include, but are not limited to the following:
 - 48 1. Porter Supersafe.
 - 49 B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with
 - 50 appropriate markings of applicable testing agency.
 - 51 1. Flame-Spread Index: 25 or less.
 - 52 2. Smoke-Developed Index: 50 or less.
 - 53 C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated
 - 54 polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. and treated with fungicide for mildew resistance;
 - 55 with surface-burning characteristics indicated, and lined with fire-retardant liner.
 - 56 D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section
 - 57 consisting of fill laminated to backer board, with visible surfaces fully covered by seamless fabric covering, free of
 - 58 sag and wrinkles and firmly attached to back of backer board.

-
1. Backer Board: Minimum 7/16-inch-thick wood board.
 2. Fire-Resistive Fill: Multiple-impact-resistant foam minimum 2-inch-thick, fire-resistive neoprene, 6.0-lb/cu. ft. density.
 3. Size: Each panel section 24 inches wide by minimum 72 inches long.
 4. Number of Modular Panel Sections: As indicated on Drawings.
 5. Installation Method: Manufacturer's standard.
 - E. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color(s).
 - F. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.
 1. Color: Gray.

2.4 MATERIALS

- A. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings according to the wire rope manufacturer's written instructions for size, number, and installation method.
- B. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy-steel chains, according to ASTM A391/A391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.
- C. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A413/A413M (Grade 30 proof coil chain or higher grade recommended by gymnasium equipment manufacturer). Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.
- D. Castings and Hangers: Malleable iron, according to ASTM A47/A47M; grade as required for structural loading.
- E. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- F. Softwood Plywood: DOC PS 1, exterior.
- G. Particleboard: ANSI A208.1.
- H. Equipment-Mounting Board: Wood, transparent or neutral-color-painted finish; size and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.
- I. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed.
- J. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C1107/C1107M, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relationship to adjacent construction; and aligned with court layout.
- C. Connections: Connect electric operators to building electrical system.
- D. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order. Disassemble removable gymnasium equipment after assembled configuration is approved by Owner, and store units in location indicated on Drawings.
- E. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

3.2 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION

**SECTION 23 64 23
MODULAR HEAT RECOVERY CHILLERS**

PART 1 - GENERAL

SCOPE

This section includes specifications for modular heat recovery scroll water chillers. Included are the following topics:

PART ONE - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Performance Requirements
- Operating Sound Pressure Level
- Submittals
- Operation and Maintenance Data
- Delivery, Storage and Handling
- Warranty

PART TWO - PRODUCTS

- Manufacturers
- General
- Manufactured Units
- Compressors and Refrigeration
- Evaporator and Condenser Heat Exchanger
- Virtual Moveable Endcap II (VME II)
- Insulation
- Controls
- Electrical
- Vibration Isolation

PART THREE - EXECUTION

- Installation
- Startup
- Training
- Construction Verification Items
- Functional Performance Testing

RELATED WORK

- Section 23 05 00 - Common Work Results for HVAC
- Section 23 05 13 - Common Motor Requirements for HVAC Equipment
- Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
- Section 23 21 13 - Hydronic Piping
- Section 23 09 23 - Direct Digital Control for HVAC
- Section 23 09 93 - Sequence of Operations for HVAC Controls

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

ARI 550/590-2003	Centrifugal or Rotary Screw Water-Chilling Packages
ARI 575	Method of Measuring Machinery Sound Within an Equipment Space
ASHRAE 15	Safety Code for Mechanical Refrigeration
ASHRAE 90.1	Energy Standard for Building except Low Rise Residential Buildings
ASME SEC 8	Boiler and Pressure Vessel Code
NEMA MG1	Motors and Generators
UL 1995	Central Cooling Air Conditioners
UL 984	Safety Standards for Hermetic Compressors
COMM 45	Wisconsin Department of Commerce Mechanical Refrigeration Code

QUALITY ASSURANCE

Refer to Division 1, General Conditions, Equals and Substitutions.

Construct, test and rate chiller performance in accordance with ARI 550 with exceptions as noted in this specification.

Construct, install and operate chillers in accordance with ANSI/ASHRAE 15- Safety Code for Mechanical Refrigeration and COMM 45 Wisconsin Mechanical Refrigeration Code.

Construct and test chillers in accordance with ASME SEC 8.

Construct and label chillers in accordance with UL 1995.

PERFORMANCE REQUIREMENTS

Include the following performance documentation submitted along with the submittals.

OPERATING SOUND PRESSURE LEVEL

The unit shall operate at full load and all part load conditions without exceeding 85-dBA sound pressure level in the equipment room. If units do not meet the 85-dBA requirements, as measured in accordance with latest version ARI Standard 575, furnish all attenuation devices necessary to meet this requirement. The sound pressure levels in all octave bands must be met as scheduled for full load and part load conditions.

SUBMITTALS

Refer to Division 1, General Conditions, Submittals

Submit chiller shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, minimum load achievable without hot gas bypass, pressure ratings, refrigerant charge, pumpout refrigerant storage capacity, component information, assembly information, size and location of piping connections, electrical connections, wiring diagrams, motor information (ref. 23 05 13), surfaces requiring insulation, SqFt of surface insulation, sound pressure levels in all octave bands at 25%/50%/75%/100% load, information for all specialties and accessories.

Include an ARI approved chiller selection method for the specified refrigerants. Verification of date and version of computer program selection or catalog is available through the Vice-President, Engineering, ARI (703) 524-8800.

Indicate ASME construction and stamping of pressure vessels or unit physical characteristics and ASME code section and paragraph references that allow non-compliance with this construction and stamping requirement.

Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

At substantial completion, submit warranty certificate and copy of start-up report.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DELIVERY, STORAGE AND HANDLING

Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

Protect units from physical damage. Leave factory-shipping covers in place until installation.

WARRANTY

Provide a one year all-inclusive warranty to begin upon acceptance of project by owner.

Provide an additional four (4) year material and labor warranty extension for compressor motor, compressor assembly and unit controls.

PART 2 - PRODUCTS

MANUFACTURERS

Multistack.

GENERAL

The chiller shall be a Multistack VME II patent pending geothermal heat recovery, heat recovery chiller. It shall be equipped with integral valving that allows the assembly to serve the following functions:

- Simultaneous Heating and Cooling Mode – Chiller/Heater assembly must be capable of varying the flow rate on the evaporator and condenser sides of the modules to maintain heating and cooling water set points simultaneously. Simultaneous loads must be satisfied with a single compression cycle and cannot use the source/sink solution as the means of energy transfer. Systems that require double compression to satisfy simultaneous loads are not acceptable.
- Cooling Dominant Mode – Chiller/Heater must be able to reject cooling dominant load to the source/sink. Cooling dominant modules must be capable of running at a lower head pressure than simultaneous modules to minimize power consumption.
- Heating Dominant Mode – Chiller/Heater must be able to satisfy heating dominant load by extracting heat from the source/sink solution. Heating dominant modules must be capable of running at optimal suction pressure to minimize power consumption.
- Packaged System Shall Be Reversing Valve Free Design – Chiller/Heater must be reversing valve free and optimize heat transfer in all control modes.
- Source/Sink Water Connections – Chiller/Heater must allow geothermal loop water to enter both the evaporator and condenser side of the machine.

System shall be configured to allow modules to run in simultaneous DHRC™ mode, dominant cooling mode, and dominant heating mode. The Chiller/Heater must be capable of allowing modules to run in multiple modes at the same time to optimize efficiency.

MANUFACTURED UNITS

Provide factory assembled and tested, packaged, heat recovery liquid chiller consisting of modular dual scroll compressor(s), compressor motor, condenser, evaporator, refrigeration accessories, instrument and control panel, gages and indicating lights, auxiliary components and accessories, solid state motor starter.

Acceptable refrigerant is R-410A R-513a.

Firmly attach metal nameplates to major components indicating the name of the manufacturer, unit model number, compressor/condenser/cooler type, refrigerant used, pounds of refrigerant needed for normal operation, operating pressures, and unit serial number.

Modules shall be provided with acoustical panels.

COMPRESSORS AND REFRIGERATION

Compressor assemblies shall be run tested at the factory. Vibration shall not exceed 1.0 mil peak to peak. Over-speed test compressor impeller(s) to not less than 20% above operating conditions.

Chiller must be supplied with dual refrigeration circuits and each circuit complete with externally equalized thermal expansion valve, liquid line solenoid to prevent liquid migration during the off cycle, liquid line filter dryer, sight glass moisture indicator and two (2) hermetic scroll compressors.

Each module have (2) stages of capacity at a minimum.

Scroll compressors must each be supplied with crankcase heaters, internal thermal protection, rubber isolation pads between compressor and frame, have two steps of capacity control by cycling of compressors, 100%, 50% and off.

EVAPORATOR AND CONDENSER HEAT EXCHANGERS

Evaporator and condenser shall be dual circuit brazed plate heat exchanger designed and constructed to ASME and UL standards.

Heat exchangers shall be constructed of copper brazed 316 stainless steel plates. Heat exchangers shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.

Condenser and Evaporator heat exchangers shall be equipped with motorized modulating butterfly type valves driven independently by signals from the module controller and powered from the main power feed (ball valves are not acceptable).

1 The motorized actuators shall be NEMA 4X rated with easily visible position indicator and internal thermal motor overload
2 protection. Valves shall be fast acting type with a maximum stroke time (full closed to full open) of 15 seconds. Load side
3 valves shall modulate to maintain modular leaving load temperatures.

4
5 When heat exchangers are using sink/source due to unequal heating/cooling duty, master controller shall modulate valve to
6 provide minimum required head pressure control in order to maximize efficiency of those Chiller/Heater modules and to
7 provide equipment protection.

8
9 All valves must be installed such that proper piping practices are observed, including proper distances before and after elbows.
10 Contractor shall provide required butterfly valves and actuators.

11
12 Each inlet water header shall incorporate a built-in 30 mesh inline strainer system to prevent heat exchanger fouling and
13 accommodate 100% flow filtration with a minimum surface area of 475 square inches per module. This filtration is in addition
14 to a field mounted Y-strainer in the chilled water loop piping.

15
16 Each module shall include supply and return mains for both load and source-sink water. Grooved end connections are provided
17 for interconnection with Victaulic type couplings. Water Mains shall be installed such that they are beneath any power or
18 control wiring so as to insure for safe operation in the event of any condensation or piping leaks.

19
20 Provide thermometer and pressure wells for temperature controller and low temperature cutout.

21 22 **VIRTUAL MOVEABLE ENDCAP II (VME II)**

23 The heat recovery chiller shall be designed for simultaneous variable heating and cooling capacity. The VME II valve module
24 shall contain fast-acting motorized butterfly valves that open/close on a command from the central control system (ball valves
25 are not acceptable). The motorized actuators shall be NEMA 4X rated with easily visible position indicators and internal
26 thermal motor overload protection. Valves shall be fast acting type with a maximum stroke time (full closed to full open) of 30
27 seconds. Valve modules shall be built into pre-engineered headers and powered by the heat recovery chiller bussbar. VME II
28 valves shall be Victaulic grooved connections.

29 30 **INSULATION**

31 3/4" thick, flexible closed cell elastomeric foam insulation; minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity
32 of not more than 0.27 at 75 °F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor
33 transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 °F to 180 °F.

34
35 Factory insulate the following:

- 36 • Evaporator and condenser heat exchangers
- 37 • Motor housing (hermetic compressors)
- 38 • Motor cooling lines (hermetic compressors)
- 39 • All lines and surfaces 65°F or colder

40 41 **CONTROLS**

42 Provide fully automatic microprocessor controller in a lockable steel control panel containing solid state chiller operating and
43 safety controls for each chiller. Factory mount, wire and test controls on chiller. Operating setpoints and diagnostic procedures
44 to be programmed through a color-coded, tactile-feel keypad. Provide an alphanumeric display showing all system parameters,
45 safety and cycle shutdowns in the English language with numeric data in English units. Safety and cycle shutdown display to
46 consist of date, time, cause of shutdown, and type of restart required.

47
48 Provide master chiller controller, of same manufacturer of chillers, for sequencing, controlling and managing multiple modular
49 chillers in a single plant.

50
51 The master controller shall sequence the operation of the of the various compressors, VME Isolating Valves, and Heat
52 Exchanger Variable Flow Valves to maximize efficiency and minimize system energy usage.

53
54 Provide the following safety controls arranged so that activation of any one will shut down the respective chiller or plant and
55 require a manual reset:

- 56
- 57 Low refrigerant pressure
- 58 Loss of flow through the source/sink heat exchanger
- 59 Loss of flow through the load (cooling and/or heating) heat exchanger
- 60 High refrigerant pressure
- 61 High compressor motor temperature
- 62 Low suction gas temperature
- 63 Low leaving water temperature
- 64

1 The Master Controller to be powered from the main Chiller/Heater power. Master controller will monitor and report the
2 following on each refrigeration system:

3
4 Discharge Pressure Fault
5 Suction Pressure Fault
6 Suction Temperature
7 Load Leaving Water Temperature
8 Source-Sink Leaving Water Temperature
9

10 The Master Controller shall monitor and report the following system parameters:

11
12 Cooling Load Water Entering and Leaving Temperature
13 Heating Load Water Entering and Leaving Temperature
14 Source-Sink Water Entering and Leaving Temperature
15 Load Water (both heating and cooling) and Source-Sink Water Flow
16

17 Individual monitoring of leaving water temperatures from each refrigeration system shall be programmed to protect against
18 heat exchanger freeze-up.

19
20 The control system shall evaluate the water temperatures of the heating and cooling systems to assess the required capacity of
21 each and cycle compressors of the Chiller/Heater Modules, open/close VME Isolation Valves, & modulate Heat Exchanger
22 Variable Flow Valves to meet load requirements, optimize efficiency, minimize system energy usage and equalize compressor
23 run times.

24
25 Chiller/Heater shall have a single point power connection and external inputs and outputs to be compatible with the building
26 management system. Hardwire Inputs/Outputs include:

27
28 Remote Start/Stop
29 General Alarm
30 Cooling Load Limit
31 Heating Load Limit
32 Cooling Load Reset
33 Heating Load Reset
34

35 Failure of DHRC Chiller/Heater/Heater to start or Chiller/Heater shutdown due to any of the above safety cutouts shall be
36 enunciated by display of the appropriate diagnostic description at the unit control panel. This annunciation will be in plain
37 English. Alphanumeric codes shall be unacceptable.

38
39 The DHRC Chiller/Heater/Heater shall be furnished with a Master Controller as an integral portion of the Chiller/Heater control
40 circuitry to provide the following functions:

41
42 Provide automatic Chiller/Heater shutdown during periods when the load level decreases below the normal operating
43 requirements of the Chiller/Heater. Upon an increase in load, the Chiller/Heater shall automatically restart.

44
45 Provisions for connection to automatically enable the Chiller/Heater from a remote energy management system.

46
47 The control panel shall provide alphanumeric display showing all system parameters in plain English language with
48 numeric data in English units.

49
50 Normal Chiller/Heater Operation

51
52 When DHRC Chiller/Heater/Heater is enabled, the factory supplied Master Controller modulates the Chiller/Heater
53 heating and cooling capacity from minimum to maximum as required by building load.

54
55 The DHRC Chiller/Heater/Heater control system shall respond to Entering Water Temperature and will have an integral
56 reset based on entering water temperature to provide for efficient operation at part-load conditions.

57
58 Power Phase Monitor

59
60 Provide a Power Phase Monitor on the incoming power supply to the Chiller/Heater. This device shall prevent the
61 Chiller/Heater from operating during periods when the incoming power is unsuitable for proper operation.

62
63 The Power Phase Monitor shall provide protection against the following conditions:
64 Low Voltage (Brown-Out)

Phase Rotation
Loss of Phase
Phase Imbalance

The Chiller/Heater shall be capable of communicating the above points with the Building Automation System via an Interoperability Web Portal. BacNet, Lonmark, or Modbus available.

Additional points shall include:

Chiller/Heater leaving chilled water temperature
Chiller/Heater leaving hot water temperature
Chiller/Heater percent cooling capacity
Chiller/Heater percent heating capacity
Module level leaving condenser temperature
Module level leaving evaporator temperature
Individual Compressor Status On/Off
Condenser VME valves Open/Close status
Evaporator VME valve Open/Close status

The master chiller controller shall convert information into the BACnet/IP protocol, or format compatible with the building direct digital control system (DDC) as specified in Section 23 09 23. This output shall be through the appropriate interface port capable of two-way communication with the building DDC system. Coordinate with the DDC contractor so that the data port connection provided at the chiller shall not require any additional intermediate gateway or media conversion devices to provide throughput of data. No additional labor by the DDC contractor to integrate the chiller data points to the DDC system shall be required other than to make the communication trunk connection and program the points at the DDC workstation.

The chiller master controller shall allow the modules to have IP addresses assigned utilizing DHCP. Manufacturer supplied static IP addresses will not be allowed for web interface.

ELECTRICAL

Modular chiller section groups shall have a single point electrical connection. Entire VME II package shall be equipped with a bussbar electrical distribution system to allow for single point power.

Refer to Drawing schedules for chiller section groups.

The pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be taken off-line for repair while the rest of the modules continue to operate.

Future chiller modules and VME II shall be provided with their own electrical power connection.

VIBRATION ISOLATION

The chiller supplier shall furnish refrigeration machine vibration isolation in accordance with 23 05 48 for the installation by the mechanical contractor.

PART 3 - EXECUTION

INSTALLATION

Install chillers in accordance with manufacturer's installation instructions.

Chillers shall be factory assembled, tested, and shipped to the job site. The chiller manufacturer is responsible for unloading at the job site and the Mechanical Contractor is responsible for final setting and installation.

STARTUP

Include the service of a factory-trained technician/mechanic employed by the chiller manufacturer for the initial startup, 6 month maintenance review, and 1 year maintenance review. Accomplish initial startup before State acceptance of the installation.

Furnish a startup log to the Owner's operating personnel with a copy to the state construction representative for this project. Document each subsequent startup or shutdown procedure and send report to Owner's operating personnel. Demonstrate the following items have been accomplished:

1. Inspect/clean evaporator and condenser heat exchangers.

- 1 a. 6 Month & 1 Year Review: Visually inspect for corrosion, pitting, erosion and general appearance. Chemical
2 cleaning will not be allowed.
3
- 4 2. Perform leak test on fabricated compressor, vessel and piping joints after the system has been serviced and closed.
5
- 6 a. Initial startup: Follow manufacturer's instructions with respect to evacuation, charging, positive pressure
7 and/or vacuum testing. Pressure/vacuum testing to be in accordance with manufacturer's instructions.
8 Perform any repairs necessary to obtain a successful pressure test.
9 Do not operate chiller until it is successfully pressure tested. Use nitrogen and suitable refrigerant for pressure
10 test unless manufacturer's instructions require otherwise.
11
- 12 b. 6 Month & 1 Year Review: Electronically leak test all fabricated compressor and vessel joints in accordance
13 with manufacturer's instructions and perform any repairs necessary to obtain a successful test.
14
- 15 3. Lubrication system
16
- 17 a. Initial startup: Charge unit with oil in accordance with manufacturer's instructions. Energize oil sump heater
18 and verify thermostat setting per manufacturer's specification.
19
- 20 b. 6 Month & 1 Year Review: Remove lubrication charge from modules. Visually inspect for color, dirt, sludge,
21 and burnt or acidic condition. Test oil in the chiller manufacturer's laboratory or a laboratory approved by the
22 manufacturer to determine condition of oil and notify owner of the results. Clean lubrication system if visual
23 and/or laboratory results indicate necessary. Recharge with new oil per manufacturer's specifications and
24 replace oil filter elements.
25
- 26 4. Filters and strainers.
27
- 28 a. 6 Month & 1 Year Review: Remove and replace all oil and refrigerant filters, strainers and filter-drier cores.
29 Use acid/moisture type replacement filter-drier cores.
30
- 31 5. Energize oil sump heater and verify thermostat setting is per manufacturer's instructions at each inspection.
32
- 33 6. Electrical
34
- 35 Tighten all starter electrical power connections and all control terminations at each inspection.
36
- 37 Check all contactors at each inspection for proper mechanical linkage, freedom of operation and contact surfaces for
38 pitting, corrosion and spring tension. Clean all contact surfaces as required; notify owner if replacement is
39 recommended.
40
- 41 Megger test and record all compressor and oil pump motor insulation readings at initial startup and each succeeding
42 inspection. Compare findings to previous readings and make recommendations on any preventative maintenance
43 required.
44
- 45 Visually inspect and clean all components including resistor banks, disconnects, fuse holders, arc chutes, ammeters,
46 voltmeters, watt-hour meters, dash-pots, etc.
47
- 48 8. At initial startup and whenever refrigerant is transferred from a storage device to the chiller, record date and
49 pounds of refrigerant in machine.
50
- 51 9. Clean and touchup paint unit as required for protection.
52
- 53 10. Repair or replace damaged insulation caused by service/repair/maintenance work.
54
- 55 11. Give any used compressor oil to owner; owner will make arrangements for proper disposal.
56
- 57 12. At the initial startup and each maintenance review, check all safety and operating controls, log all pertinent
58 parameters of the unit, including but not limited to the following:
59 a. Refrigerant pressure in cooler
60 b. Saturated refrigerant temperature in cooler
61 c. Water inlet and outlet temperatures in cooler and condenser
62 d. Water side pressure drop in cooler and condenser
63 e. Flow rate in gallons per minute in cooler and condenser
64 f. Bearing temperatures

- g. Oil sump temperature
- h. Oil pressure
- i. Motor voltage and amperage in each phase
- j. Purge count and purge unit operating hours, if applicable
- k. Purge condensing pressure, if applicable
- l. Starter transition time, actual as measured

TRAINING

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied by the third party commissioning agent in accordance with the procedures defined for construction verification in Section 01 91 00.

FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for utilizing the functional performance test forms supplied by the third party commissioning agent in accordance with the procedures defined for functional performance testing in Section 01 91 00.

END OF SECTION