

ETHYLENE PROPYLENE DIENE MONOMER (EPDM) MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Adhered EPDM membrane roofing system (Re-cover and Re-Roof systems).
- B. Cover board.
- C. Roof insulation.

1.2 RELATED SECTIONS

- A. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, cants, curbs, and blocking.
- B. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter flashings.

1.3 REFERENCES

- A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms used in this Section:
 - 1. ASTM D 1079 "Standard Terminology Relating to Roofing and Waterproofing."
 - 2. Glossary of NRCA's "The NRCA Roofing Manual."
 - 3. Roof Consultants Institute "Glossary of Roofing Terms."
- B. Sheet Metal Terminology and Techniques: SMACNA "Architectural Sheet Metal Manual."

1.4 DESIGN CRITERIA

- A. General: Installed roofing membrane systems shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. Installer must comply with current code requirements based on authority having jurisdiction.
- D. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7. Wind uplift as determined by roofing manufacturer for project locale.

- E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each product to be provided.
- B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:
 - 1. Base flashings, cants, and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Crickets, saddles, and tapered edge strips, including slopes.
 - 4. Insulation fastening patterns.
- C. Verification Samples: Provide for each product specified.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Maintenance Data: Refer to manufacture's latest published documents on their website.
- F. Guarantees: Provide manufacturer's current guarantee specimen.
- G. Prior to beginning the work of this section, roofing sub-contractor shall provide a copy of the final System Assembly Letter issued by selected roofing manufacturer indicating that the products and system to be installed shall be eligible to receive the specified manufacturer's guarantee when installed by a certified contractor in accordance with our application requirements, inspected and approved by a certified roofing manufacturer's technical representative.
- H. Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by manufacturer indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.
 - 1. "CIDA, INC." must be listed as the Specifier/Consultant of record in the appropriate fields on the Guarantee Application Confirmation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and is eligible to receive the specified manufacturer's guarantee.

- B. Manufacturer Qualifications: Qualified manufacturer that has UL listing for roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: Independent testing agency with the experience and capability to conduct the testing indicated, as documented in accordance with ASTM E329.
- D. Test Reports:
 - 1. Roof drain and leader test or submit plumber's verification.
 - 2. Core cut (if requested).
 - 3. Roof deck fastener pullout test.
- E. Moisture Survey (Re-cover Only):
 - 1. Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:
 - a. Infrared Thermography
 - b. Nuclear Backscatter
- F. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing system manufacturer issuing the guarantee.
- G. Fire-Test-Response Characteristics: Roofing materials shall comply with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.9 GUARANTEES

- A. Provide manufacturer's system guarantee as follows:
1. Single-Source special guarantee includes roofing membrane, base flashings, roofing membrane accessories, **roof insulation, fasteners, cover board, walkway products**, and other single-source components of roofing system marketed by the manufacturer.
 2. Guarantee Period: **20** years from date of Substantial Completion.
 3. Contractor is required to list "CIDA, INC." as the Specifier/Consultant of record in the appropriate fields ("Specifier Account") when applying for the manufacturer's warranty.
- B. Installer's Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:
1. Guarantee Period: Two years from date of Substantial Completion.
- C. Existing Guarantees: Guarantees on existing building elements should not be affected by scope of work.
1. Installer is responsible for coordinating with building owner's representative to verify compliance.

PART 2 - PRODUCTS

2.1 ETHYLENE PROPYLENE DIENE MONOMER ROOFING MEMBRANE - EPDM

- A. Non-reinforced uniform, flexible sheet made from Ethylene Propylene Diene Monomer, ASTM D 4637, Type I.

Basis of Design: EPDM NR by JOHNS MANSVILLE,

1. Thickness (minimum): 90 mils
2. Exposed Face Color: Black.
3. Factory Inseam Tape: **6-inch (150-mm)** wide minimum, butyl splice tape with release film.

2.2 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Plastic Foam Adhesives: 50 g/L.
- b. Gypsum Board and Panel Adhesives: 50 g/L.
- c. Multipurpose Construction Adhesives: 70 g/L.
- d. Fiberglass Adhesives: 80 g/L.
- e. Contact Adhesive: 80 g/L.
- f. Single-Ply Roof Membrane Sealants: 450 g/L.
- g. Nonmembrane Roof Sealants: 300 g/L.
- h. Sealant Primers for Nonporous Substrates: 250 g/L.
- i. Sealant Primers for Porous Substrates: 775 g/L.
- j. Other Adhesives and Sealants: 250 g/L.

- B. Sheet Flashing: 90-mil thick EPDM, partially cured or cured, according to application. Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- C. Primer Material: Manufacturer's standard synthetic-rubber polymer primer.
- D. Seaming Material: Manufacturer's standard **6-inch- (150-mm-)** wide minimum, butyl splice tape with release film.
- E. Sealing Strip: Manufacturer's standard **12-inch- (300-mm-)** wide, 45 mil (1.14 mm) thick minimum, cured EPDM with factory-laminated, self-adhering seam tape.
- F. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane and base flashings.
- G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.
- H. Membrane Battens: Manufacturer's standard polymer or aluminum-zinc-alloy-coated steel sheet, pre-punched.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, sealants and other accessories.

2.3 AUXILIARY ROOFING SYSTEM COMPONENTS

- A. Metal/Membrane Flashing: Specially designed and manufactured flashing for sealing and waterproofing.
- B. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.4 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer.

2.5 COVER BOARD

- A. High-Density Polyisocyanurate: ASTM C 1289, Type II, Class 4, Grade 3, High-density Polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 140 lbs of compressive strength.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 3, Grade 3 (**25 psi**)
 - 1. Provide insulation package with minimum R Value: 21
 - 2. Provide insulation package in multiple layers.
 - 3. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.
 - a. Determined in accordance with CAN/ULC S770 at 75°F (24°C)

2.7 TAPERED INSULATION

- A. Tapered Insulation: ASTM C 1289, Type II, Class 3, Grade 3 (**25 psi**), provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.

2.8 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.
- D. Urethane Adhesive: Manufacturer's two component polyurethane adhesive formulated to adhere insulation to substrate.
- E. Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

PART 3 - EXECUTION

3.1 EXAMINATION

1. General:

- a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
- b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

2. Wood Decks:

- a. Verify that wood decking is visibly dry and free of moisture according to manufacturer's approved method.
- b. Verify that wood has ability to provide minimum fastener pull-out resistance.

- 1) Provide documentation of pull out resistance values using manufacturer's approved procedures.

3. Ensure general rigidity and proper slope for drainage.
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units more than 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner's Representative and must be corrected prior to installation of roofing system.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. If applicable, prime surface of deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RE-ROOF PREPARATION (GYM LOCATION)

A. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives, etc.

1. Remove an area no larger than can be re-roofed in one day.
- B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.
- C. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.
 1. Install decking to match existing as directed by Owner's Representative.
- D. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
 1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
 2. Secure of flashing and install new metal counterflashing prior to re-installation of unit.
 3. Perimeter nailers must be elevated to match elevation of new roof insulation.
- E. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 RE-COVER PREPARATION (ALL LOCATIONS EXCEPT GYM)

- A. Prepare existing roof according to roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer, and requirements in this Section.
- B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.
- C. **Disable existing roof membrane per manufacturer's written instruction.**
- D. Remove and replace wet, deteriorated or damaged roof insulation and decking as identified in moisture survey.
- E. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations. Install decking to match existing as directed by Owner's Representative.
- F. Raise, (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
 1. Modify curbs as required to provide a minimum 8 inch base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
 2. Secure top of flashing and install new metal counterflashing prior to re-installation of unit.
 3. Perimeter nailers must be elevated to match elevation of new roof insulation.
- G. Immediately remove all debris from roof surface, including existing rock ballast and moss. Demolished roof system may not be stored on the roof surface.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 INSULATION INSTALLATION

- A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.
- E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- H. Preliminarily Fastened Insulation: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.
 - 1. Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 COVER BOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.
- C. Install cover board with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
 - 1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

- E. Adhered Cover Board: Adhere cover board to substrate as follows:
 - 1. Install in a two-part urethane adhesive according to roofing system manufacturer's instruction.
 - 2. Install to resist uplift pressure at corners, perimeter, and field of roof.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
- B. Where roof slope exceeds 1/2 inch per 12 inches (1:24), contact the membrane manufacturer for installation instructions regarding installation direction and backnailing.
- C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
 - 1. Provide tie-offs at the end of each day's work to cover exposed roofing membrane sheets and insulation materials with a course of sacrificial EPDM membrane material. When or where necessary to prevent water intrusion under unfinished roof areas, contractor shall apply a heavy bead of JM Single Ply Sealing Mastic to the underside of the EPDM membrane for a temporary tie-off.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing in accordance with membrane roofing system manufacturer's written instructions.
 - 1. Unroll roofing membrane and allow to relax before installing.
 - 2. Install sheet in accordance with roofing system manufacturer's written instructions.
- B. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

- D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Field Fabricated Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
- G. Tape to Tape Installation: Align membrane for appropriate overlap, remove release liners and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation.
- H. Tape to Standard Sheet Installation: Align membrane for appropriate overlap, clean and prime non-taped face of splice area, remove release liners and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation.
- I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- J. Install roofing membrane and auxiliary materials to tie in to existing roofing.
- K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.10 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 PROTECTION AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
- 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 according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

DEDICATED OUTDOOR-AIR UNITS

1.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Desert Aire.
 2. REZNOR, a brand of Nortek Global HVAC.
 3. Valent

1.2 CABINET

- A. Construction: Single wall.
- B. Exterior Casing Material: Galvanized steel with paint finish.
- C. Base Rails: Galvanized steel rails for mounting on roof curb or pad as indicated.
- D. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.
- E. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.
- F. Cabinet Insulation:
1. Type: Fibrous-glass duct lining complying with ASTM C1071, Type II
 2. Insulation Adhesive: Comply with ASTM C916, Type I.
 3. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

1.3 SUPPLY FAN

- A. Plenum Fan Type: Single width, non-overloading, with backward-inclined or airfoil blades.
1. Fan Wheel Material: Aluminum; attached directly to motor shaft.
 2. Fan Wheel Drive and Arrangement: Direct drive, AMCA Arrangement 4.
 3. Fan panel and frame Material: Powder-coated steel, stainless steel, or aluminum.
 4. Fan Enclosure: Easily removable enclosure around rotating parts.
- B. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1.4 INDIRECT-FIRED GAS FURNACE HEATING

A. Furnace Assembly:

1. Factory assembled, piped, and wired.
2. Comply with requirements in NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
3. AGA Approval: Designed and certified by and bearing label of AGA.

B. Burners:

1. Heat-Exchanger Material: Aluminized steel with stainless-steel inserts with a minimum thermal efficiency of 80 percent.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark with flame sensor.

C. Heat-Exchanger Drain Pan Material: Stainless steel.

D. Venting: Gravity vented.

E. Venting: Power vent with integral, motorized centrifugal fan interlocked with gas valve.

F. Safety Controls:

1. Gas Control Valve: Electronic modulating.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

1.5 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood or louver.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

1.6 FILTERS

A. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Factory-fabricated, viscous-coated, flat-panel type.
3. Thickness: 2 inches.

1.7 ELECTRICAL POWER CONNECTIONS

- A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.

1.8 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC"
- B. Control Valves: Comply with requirements in Section 230923.11 "Control Valves."
- C. Control Wiring: Factory wire connection for controls' power supply.