Retail Space Exterior Finish Materials

Manufacturer: Kawneer

Material: Storefront Glazing (Encore Framing System)

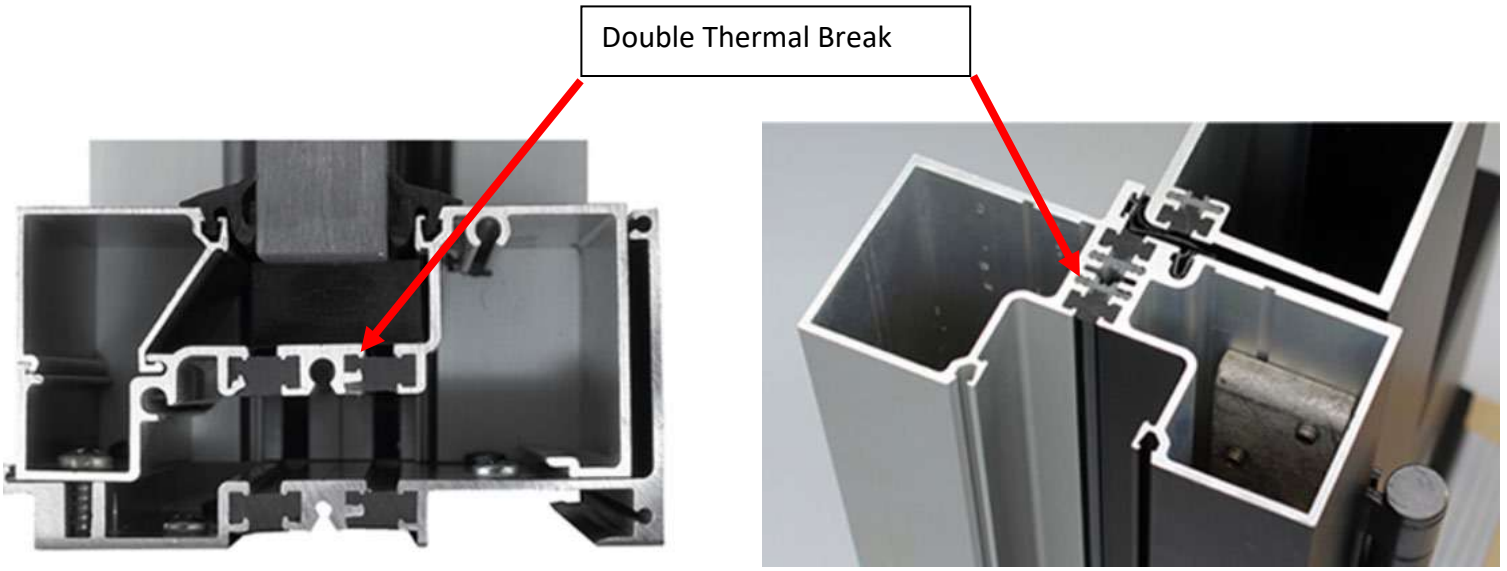
Location: Retail Space

Key Features Include: (Double Thermal Break) *(Medium Cost)*

- Economical
- 1-3/4" (44.5) sightline with a 3-9/16" (90.5), 4-1/2" (114.3) or 6" (152.4) depth
- Front or Center (4-1/2") glass applications
- Outside glazed
- Screw Spline, Shear Block or Type-B fabrication
- SSG option
- Infill options up to 1-1/8" (28.6)
- Thermal break via. Polymer glazing clip
- Permanodic® anodized finishes in 7 standard choices
- Painted finishes in 42 standard choices and unlimited custom choices

Estimated SF Needed: 2,720 sf

Cost: $32/sf ($32)(2,720sf)=$87,040



SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

This suggested guide specification has been developed using the current edition of the Construction Specifications Institute (CSI) "Manual of Practice", including the recommendations for the CSI 3 Part Section Format and the CSI Page Format. Additionally, the development concept and organizational arrangement of the American Institute of Architects (AIA) MASTERSPEC Program has been recognized in the preparation of this guide specification. Neither CSI, AIA, USGBC nor ILFI endorse specific manufacturers and products. The preparation of the guide specification assumes the use of standard contract documents and forms, including the "Conditions of the Contract", published by the AIA.

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
   1. Types of Kawneer Aluminum Storefront Systems include:
      a. EnCORE™ Framing System – 1-3/4" (44.5) x 3-9/16" (90.5), 4-1/2" (114.3) or 6" (228.6) nominal dimension; Thermally improved; Front, Center, or Structural Silicone Glazed; Screw Spline, Shear Block, or Punched Opening (Type B) Fabrication.

EDITOR NOTE: BELOW RELATED SECTIONS ARE SPECIFIED ELSEWHERE HOWEVER KAWNEER RECOMMENDS SINGLE SOURCE RESPONSIBILITY FOR ALL OF THESE SECTIONS AS INDICATED IN PART 1.6 QUALITY ASSURANCE.

B. Related Sections:
   1. 072700 "Air Barriers"
   2. 079200 "Joint Sealants"
   3. 083213 "Sliding Aluminum-Framed Glass Doors"
   4. 084113 "Aluminum-Framed Entrances and Storefronts"
   5. 084329 "Sliding Storefronts"
   6. 084413 "Glazed Aluminum Curtain Walls"
   7. 084433 "Sloped Glazing Assemblies"
   8. 085113 "Aluminum Windows"
   9. 086300 "Metal-Framed Skylights"
   10. 088000 "Glazing"
   11. 107113 "Exterior Sun Control Devices"
   12. 122600 "Interior Daylighting Devices"

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. Storefront System Performance Requirements:

EDITOR NOTE: AIR AND WATER PERFORMANCE RESULTS ARE BASED UPON ASTM AND AAMA STANDARDS FOR STOREFRONT FRAMING SYSTEMS. CONSULT YOUR LOCAL KAWNEER REPRESENTATIVE CONCERNING SPECIFIC PROJECT PERFORMANCE REQUIREMENTS.

EDITOR NOTE: PROVIDE WIND LOAD DESIGN PRESSURES IN PSF AND INCLUDE APPLICABLE BUILDING CODE AND YEAR EDITION

   1. Wind loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures of (____) lbs./sq. ft. inward and (____) lbs./sq. ft. outward. The design pressures are based on the (____) Building Code; (____) Edition.
   2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.24 psf (300 Pa).
   3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501
   4. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

EDITOR NOTE: THERMAL TRANSMISSITTANCE AND CONDENSATION RESISTANCE PERFORMANCE RESULTS ARE BASED UPON 1" CLEAR INSULATING GLASS (1/4" CLEAR WITH e= 0.035 LOW E COATING ON #2 SURFACE, 1/2" AS WITH WARM EDGE SPACER AND 90% ARGON GAS FILL, 1/4" CLEAR).

5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Glass to Exterior – 0.46 (low-e) or 0.63 (clear) or Project Specific (____) BTU/hr/ft^2/°F.
6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
   a. Glass to Exterior – 60_{frame} and 63_{glass} (low-e) or 60_{frame} and 58_{glass} (clear).

B. Environmental Product Declarations (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

EDITOR NOTE: MATERIAL INGREDIENT REPORTING IF REQUIRED TO MEET PROJECT REQUIREMENTS AND ON ANY GREEN BUILDING CERTIFICATIONS SUCH AS LEED OR LBC.

*EDITOR NOTE: MATERIAL INGREDIENT REPORTING **ONLY FOR ANODIZED PRODUCTS**.*

C. Material Ingredient Reporting: Shall have a complete list of chemical ingredients to at least 100ppm (0.01%) that covers 100% of the product, acceptable documentation includes:
   1. Manufacturer's inventory with Chemical Abstract Service Registration Number (CASRN or CAS#).
      a. Kawneer's Material Transparency Summary (MTS).

1.5 Submittal

*EDITOR NOTE: ADD RECYCLED CONTENT SECTION **IF REQUIRED TO MEET PROJECT REQUIREMENTS** AND/OR GREEN BUILDING CERTIFICATIONS SUCH AS LEED, LIVING BUILDING CHALLENGE (LBC), ETC. ARE REQUIRED.*

** IF RECYCLED CONTENT REQUIREMENTS **ARE NOT SPECIFIED** - **PRIME (ZERO RECYCLED CONTENT) ALUMUNUM COULD BE SUPPLIED.***

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.
   1. Recycled Content:
      a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content with a sample document illustrating project specific information that will be provided after product shipment.
      b. Once product has shipped, provide project specific recycled content information, including:
         1) Indicate recycled content; indicate percentage of pre- and post-consumer recycled content per unit of product.
         2) Indicate relative dollar value of recycled content product to total dollar value of product included in project.
         3) Indicate location recovery of recycled content.
         4) Indicate location of manufacturing facility.
   2. Environmental Product Declaration (EPD):
      a. Include a Type III Product-Specific EPD created from a Product Category Rule.

*EDITOR NOTE: MATERIAL INGREDIENT REPORTING **ONLY** FOR **ANODIZED** PRODUCTS*

   3. Material Ingredient Reporting:
      a. Include documentation for material reporting that has a complete list of chemical ingredients to at least 100ppm (0.01%) that covers 100% of the product.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, of aluminum-framed storefront.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

G. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements". Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

G. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
   2. EnCORE™ Framing System (Thermally improved)
   3. System Dimensions: 1-3/4" (44.5) x 3-9/16" (90.5), 4-1/2" (114.3) or 6" (228.6) nominal dimension
   4. Glass: Center or Exterior

EDITIOR NOTE: PROVIDE INFORMATION BELOW INDICATING APPROVED ALTERNATIVES TO THE BASIS-OF-DESIGN PRODUCT

B. Subject to compliance with requirements, provide a comparable product by the following:
   1. Manufacturer: (_____)
   2. Series: (_____)
   3. Profile dimension: (_____)

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements
   1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
   2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid storefront installation and construction delays.
   3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
   4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefront for a period of not less than ten (10) years. (Company Name)
   5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
   6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

*EDITOR NOTE: ADD RECYCLED CONTENT SECTION **IF REQUIRED TO MEET PROJECT REQUIREMENTS** AND/OR GREEN BUILDING CERTIFICATIONS SUCH AS LEED, LIVING BUILDING CHALLENGE (LBC), ETC. ARE REQUIRED.*

** IF RECYCLED CONTENT REQUIREMENTS **ARE NOT SPECIFIED** - **PRIME (ZERO RECYCLED CONTENT) ALUMUNUM COULD BE SUPPLIED**.*

1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
   c. Indicate location recovery of recycled content.
   d. Indicate location of manufacturing facility.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Thermal Barrier: A minimum 1/4" (6.4) separation between the interior and exterior aluminum created by intermittent polymer clips.

G. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

*EDITOR NOTE: MATERIAL INGREDIENT REPORTING **ONLY** FOR **ANODIZED** PRODUCTS*

H. Red List Free: All parts and materials comply with the Living Building Challenge/DECLARE Red List and the Cradle-to-Cradle (C2C) Banned List.
   1. PVC free
   2. Neoprene free

   OR

I. Red List Free: Product does not contain PVC or Neoprene.

2.3 Storefront Framing System

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing Systems

A. Glazing: As specified in Division 08 Section “Glazing”

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Color: Black
   2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
      a. Color: Matching structural sealant.

2.5 Entrance Door Systems

A. Entrance Doors: As specified in Division 084113 Section “Aluminum-Framed Entrances and Storefronts”.

B. Entrance Door Hardware: As specified in Division 084113 Section “Door Hardware”.

2.6 Accessory Materials

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section “Joint Sealants”.

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 Fabrication

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufacturer’s standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color _____).
   2. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional).
   3. Kawneer Permanodic™ AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear) (Standard).
   4. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color _____).
   5. Kawneer Permadize™ (50% PVDF), AAMA 2604, Fluoropolymer Coating (Color _____).
   6. Kawneer Permacoat™ AAMA 2604, Powder Coating (Color _____)
   7. Other: Manufacturer _____ Type _____ Color _____.

PART 3 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight aluminum-framed storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
      a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
      b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 Adjusting, Cleaning, and Protection

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

DISCLAIMER STATEMENT

This guide specification is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The guide specification must be used and coordinated with the procedures of each design firm, and the particular requirements of a specific construction project.

END OF SECTION 084113

Manufacturer: Kawneer 350/500 IR Entrances

Material: Impact Resistant Storefront *(High Cost)*

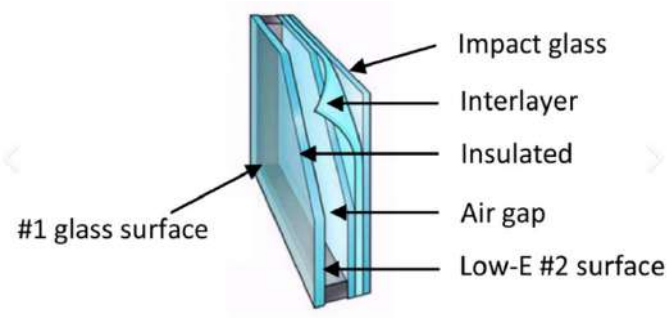
Location: Retail Space

Features:

- 350 IR medium stile has 3-1/2" (88.9) vertical stiles, 3-1/2" (88.9) top and 6-1/2" (165.1) bottom rails
- Door is 1-3/4" (44.5) deep
- Welded corner construction (16 welds per door)
- Single acting
- Offset pivots, butt hinges or continuous geared hinge
- Surface mounted or concealed closers
- MS locks, 3-point locks or exit device hardware
- Architects Classic push/pulls
- Square stops with an interior silicone seal for 9/16" (14.3) glazing infill
- Adjustable astragal utilizing pile weathering with polymeric fin at meeting stiles
- Adjustable bottom rail sweep with EPDM blade
- Bulb polymeric weatherstripping in door frames
- Permanodic™ anodized finishes in 7 choices
- Painted finishes in standard and custom choices

Estimated Square Footage: 2,720 sf

Cost: $40/sf ($40)(2,720sf)=$108,800



SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

This suggested guide specification has been developed using the current edition of the Construction Specifications Institute (CSI) "Manual of Practice", including the recommendations for the CSI 3 Part Section Format and the CSI Page Format. Additionally, the development concept and organizational arrangement of the American Institute of Architects (AIA) MASTERSPEC Program has been recognized in the preparation of this guide specification. Neither CSI, AIA, USGBC nor ILFI endorse specific manufacturers and products. The preparation of the guide specification assumes the use of standard contract documents and forms, including the "Conditions of the Contract", published by the AIA.

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

EDITOR NOTE: CHOOSE DOOR TYPE (NARROW, MEDIUM, WIDE) BASED ON PROJECT REQUIREMENTS.

A. This Section includes Kawneer Aluminum Entrances, glass and glazing, and door hardware and components.
   1. Types of Kawneer Aluminum Entrances include.
      a. 350 IR Swing Door; Medium stile, 3-1/2" (89 mm) vertical face dimension, 1-3/4" (44.5) mm depth, high traffic applications.
      b. 500 IR Swing Door; Wide stile, 5" (127 mm) vertical face dimension, 1-3/4" (44.5) mm depth, high traffic applications.

EDITOR NOTE: BELOW RELATED SECTIONS ARE SPECIFIED ELSEWHERE HOWEVER KAWNEER RECOMMENDS SINGLE SOURCE RESPONSIBILITY FOR ALL OF THESE SECTIONS AS INDICATED IN PART 1.6 QUALITY ASSURANCE.

B. Related Sections.
   1. 072700 "Air Barriers".
   2. 079200 "Joint Sealants".
   3. 083213 "Sliding Aluminum-Framed Glass Doors".
   4. 084313 "Aluminum-Framed Storefronts".
   5. 084329 "Sliding Storefronts".
   6. 084413 "Glazed Aluminum Curtain Walls".
   7. 084433 "Sloped Glazing Assemblies".
   8. 085113 "Aluminum Windows".
   9. 086300 "Metal-Framed Skylights".
   10. 087000 "Hardware".
   11. 088000 "Glazing".
   12. 280000 "Electronic Safety and Security".

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. General Performance: Aluminum-framed entrance system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Aluminum Framed Entrance Performance Requirements.

EDITOR NOTE: PROVIDE WIND LOAD DESIGN PRESSURES IN PSF AND INCLUDE APPLICABLE BUILDING CODE AND YEAR EDITION.

1. Wind loads: Provide entrance system; include anchorage, capable of withstanding wind load design pressures of (____) lbs./sq. ft. inward and (____) lbs./sq. ft. outward. The design pressures are based on the (____) Building Code; (____) Edition.

2. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 Pa) for single doors and pairs of doors. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft^2. A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm/ft^2.

3. Structural Performance: Corner strength shall be tested per the Kawneer dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity [Testing procedure and certified test results available upon request].

4. Uniform Load: A static air design load of 85 psf (4070 Pa), (65 psf (3113 Pa) for laminated infill) shall be applied in the positive and negative direction in accordance with Florida Building Code TAS202 and ASTM E 330. There shall be no deflection in excess of L/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage shall occur.
5. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E1886, information in ASTM E1996, and TAS 201/203.
   a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1m) of grade.
   b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.
6. Blast Mitigation Performance: Shall be tested or proven through analysis to meet ASTM F1642, GSA-TS01, and UFC 04-010.01 performance criteria.

   To meet UFC 04-010-01, B-3.3 Standard 12 for Exterior Doors and Standard 10 for Windows and Skylights, the following options are available:
   a. Section B-3.1.1 Dynamic analysis.
   b. Section B-3.1.2 Testing.
   c. Section B-3.1.3 ASTM F2248 Design Approach.
7. Forced Entry: Tested in accordance with AAMA 1304.

C. Environmental Product Declarations (EPD): Shall have a Type III Product-Specific EPD.

1.5 Submittals

*EDITOR NOTE: ADD RECYCLED CONTENT SECTION **IF REQUIRED TO MEET PROJECT REQUIREMENTS** AND/OR GREEN BUILDING CERTIFICATIONS SUCH AS LEED, LIVING BUILDING CHALLENGE (LBC), ETC. ARE REQUIRED.*

** IF RECYCLED CONTENT REQUIREMENTS **ARE NOT SPECIFIED** - **PRIME (ZERO RECYCLED CONTENT) ALUMUNUM COULD BE SUPPLIED.***

A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed entrance door indicated.
   1. Recycled Content:
      a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content with a sample document illustrating project specific information that will be provided after product shipment.
      b. Once product has shipped, provide project specific recycled content information, including:
         1) Indicate recycled content; indicate percentage of pre- and post-consumer recycled content per unit of product.
         2) Indicate relative dollar value of recycled content product to total dollar value of product included in project.
         3) Indicate location recovery of recycled content.
         4) Indicate location of manufacturing facility.
   2. Environmental Product Declaration (EPD).
      a. Include a Type III Product-Specific EPD.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed entrance doors and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed entrance doors.

F. Fabrication Sample: Corner sample consisting of a door stile and rail, of full-size components and showing details of the following.
   1. Joinery, including welds.
   2. Glazing.

G. Other Action Submittals.
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum-framed entrance doors and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed entrance doors through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed entrance doors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements". Do not modify size and dimensional requirements.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup for type(s) of swing entrance door(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum-framed entrance door openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

EDITOR NOTE: CHOOSE DOOR TYPE BASED ON PROJECT REQUIREMENTS.

A. Basis-of-Design Product.
1. Kawneer Company Inc.
2. The door stile and rail face dimensions of the 350IR/500IR entrance door will be as follows:

Door	Vertical Stile	Top Rail	Bottom Rail	Optional Bottom Rail
350 IR	3-1/2" (89 mm)	3-1/2" (89 mm)	6-1/2" (166 mm)	10" (254 mm)
500 IR	5" (127 mm)	5" (127 mm)	6-1/2" (166 mm)	10" (254 mm)

3. Major portions of the door members to be 0.125" (4) nominal in thickness and glazing molding to be 0.05" (1.5) thick.
4. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
5. Structural silicone sealant to be Dow Corning 983, 995 or Tremco Proglaze SSG.

EDITIOR NOTE: PROVIDE INFORMATION BELOW INDICATING APPROVED ALTERNATIVES TO THE BASIS-OF-DESIGN PRODUCT.

B. Subject to compliance with requirements, provide a comparable product by the following.
1. Manufacturer: (_____).
2. Series: (_____).
3. Profile dimension: (_____).
4. Performance Grade: (_____).

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements.
1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid aluminum-framed entrance door installation and construction delays.
3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum-framed entrance doors for a period of not less than ten (10) years. (Company Name)
5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum-framed entrance door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and door leaf members.

*EDITOR NOTE: ADD RECYCLED CONTENT SECTION **IF REQUIRED TO MEET PROJECT REQUIREMENTS** AND/OR GREEN BUILDING CERTIFICATIONS SUCH AS LEED, LIVING BUILDING CHALLENGE (LBC), ETC. ARE REQUIRED.*

** IF RECYCLED CONTENT REQUIREMENTS **ARE NOT SPECIFIED** - **PRIME (ZERO RECYCLED CONTENT) ALUMUNUM COULD BE SUPPLIED**.*

1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
   c. Indicate location recovery of recycled content.
   d. Indicate location of manufacturing facility.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
   1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

2.3 Storefront Framing System

EDITIOR NOTE: CHOOSE ENTRANCE FRAMING TYPE BASED ON PROJECT REQUIREMENTS.

A. Storefront Entrance Framing.
   1. Trifab™ VG 450/451/451T.
   2. IR500/501.
   3. IR501UT/IR501T.
   4. Trifab™ 601/601T.

B. Non-Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after aluminum-framed entrance door installation.

2.4 Glazing

A. Glazing: As specified in Division 08 Section "Glazing".

B. Glass.
   1. 9/16" laminated infill with .090" (3) PVB interlayer.
   2. 9/16" laminated infill with Solutia Vanceva .075" (2) interlayer, Dupont SGP .090" (3) interlayer.

C. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 Hardware

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors.

B. Standard Hardware.
1. Weather-stripping.
   a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.
   b. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
2. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (Necessary to meet specified performance tests).
3. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.
4. Offset Pivots: [_____].
5. Butt Hinge: [_____].
6. Continuous Hinge: [_____].
7. Push/Pull: [_____] style.
8. Exit Device: Kawneer 1686 Concealed Rod Exit Device, Paneline™ Concealed Rod Exit Device, Adams Rite G86 Concealed Rod Exit Device, Calibre 9100 Concealed Rod Exit Device, Falcon HH1690 Concealed Rod Exit Device, Jackson 2080 Concealed Rod Exit Device, Sargent 8400AD Concealed Rod Exit Device or Von Duprin HH9947 Concealed Rod Exit Device.
9. Closer: Surface or concealed closer (concealed closer with non-transom and non-sidelite Trifab™ VG 450 (Center) and 1600 Wall sub-frames only).
10. Security Lock/Dead Lock: MS 1850A lock with 3-point active stile locking and hurricane flushbolts on pairs, Adams Rite 2180 2-Point Dead Lock or MS 1850A with 1871 cylinder operated flushbolts.
11. Cylinder(s)/Thumbturn: Kawneer standard.
12. Cylinder Guard: Kawneer standard.

EDITOR NOTE: BELOW HARDWARE SCHEDULE TO BE USED WHEN SPECIFYING PANELINE™ MEL CONCEALED ROD EXIT DEVICE OR OTHER ELECTRONIC SECURITY ITEMS.

C. Access Control Entrance Hardware.
1. Stand alone Key Pad: AC-G43 Key Pad System – Kawneer Standard.
2. Stand alone Key Pad (with Optional Proximity Card Reader): AC-G44 Key Pad/ Reader (Note: Proximity Cards not included).
3. Proximity Cards.
4. Exit Device: Kawneer Paneline™ MEL.
5. Power supply for Exit Device: SP-2000 (One per pair. Max of 2 doors per power supply) **Required for Paneline™ MEL.**
6. Power Transfer [_____]. One per EL Exit Device required for access control.
   a. EPT (Electric Power Transfer) Note: EPT used for continuous geared hinge applications.
   b. EL Intermediate Pivot.
   c. EL Butt Hinge.
7. Interior push button release.
8. Point to Point wiring diagram.

2.6 Fabrication

A. Fabricate aluminum-framed glass entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate aluminum-framed glass doors that are reglazable without dismantling perimeter framing.
1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" (29 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
3. Prepare components with internal reinforcement for door hardware.
4. Arrange fasteners and attachments to conceal from view.

C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.

2.7 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing.
1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color _____).
2. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional).
3. Kawneer Permanodic™ AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear) (Standard).
4. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color _____).
5. Kawneer Permadize™ (50% PVDF), AAMA 2604, Fluoropolymer Coating (Color _____).
6. Kawneer Permacoat™ AAMA 2604, Powder Coating (Color _____).
7. Other: Manufacturer _____ Type _____ Color _____.

PART 3 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76.2 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories, and other components.

B. Install aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill threshold in bed of sealant, as indicated, for weather tight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

A. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 Adjusting, Cleaning, and Protection

A. Clean aluminum surfaces immediately after installing aluminum-framed entrance doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

DISCLAIMER STATEMENT

This guide specification is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The guide specification must be used and coordinated with the procedures of each design firm, and the particular requirements of a specific construction project.

END OF SECTION 084113

Manufacturer: US Aluminum *(Non-Thermal, Low Cost)*

Material: Storefront Glazing (Aluminum Series 451 & IT451 Center Glaze System)

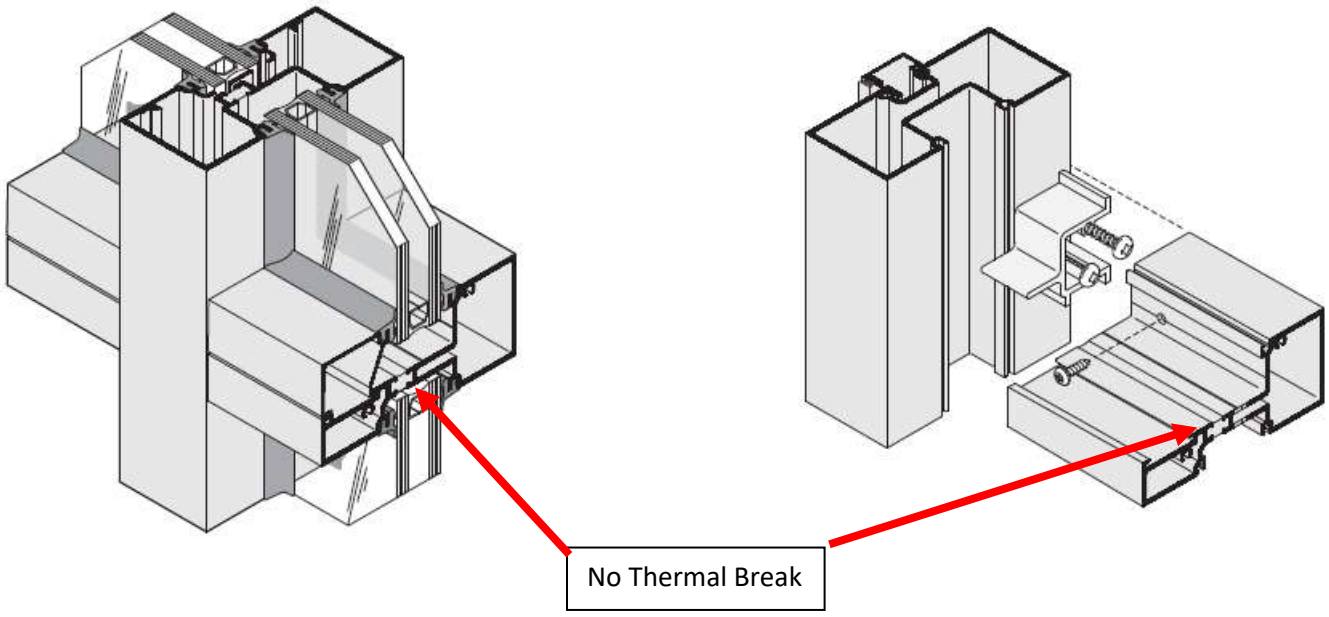
Location: Retail Space

Key Features Include:

- Series 451 - 2" x 4-1/2" (50.8 x 114.3 mm) Non-Thermal
- Series IT451 - 2" x 4-1/2" (50.8 x 114.3 mm) Thermal
- Screw Spline or Shear Block Assembly
- Stacking Installation Option

Estimated Sf Needed: 2,720 sf

Cost: $26/sf ($26)(2,720sf)=$70,720



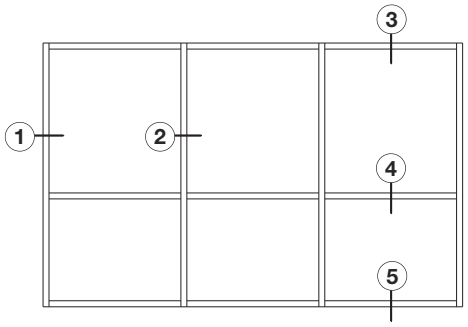
STOREFRONTS

Typical Details

Center Glazed • Series 451

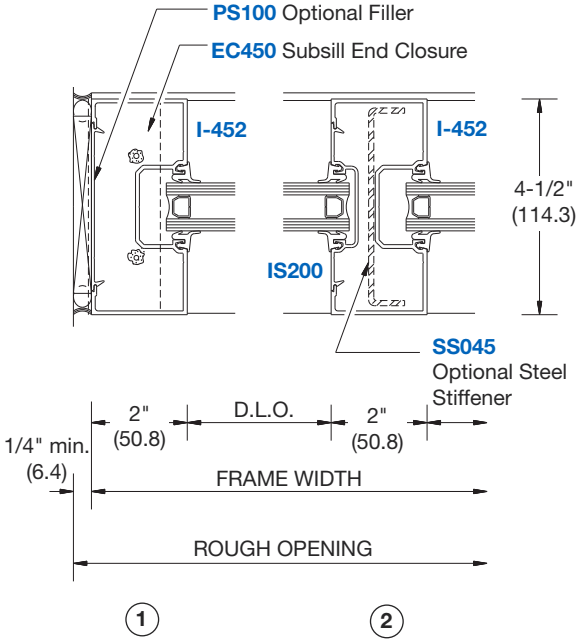
SCREW RACE JOINERY FOR 1" (25) GLAZING

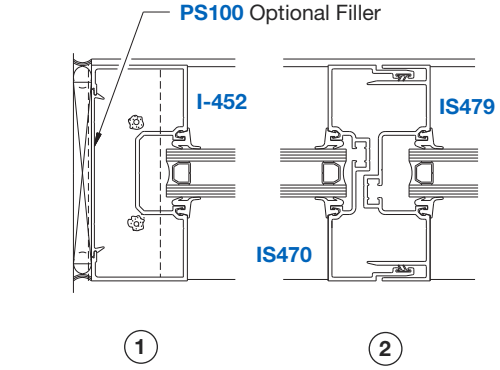
NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths. Visit **usalum.com** for more information.



TYPICAL ELEVATION

NOTE: **NP225** Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)





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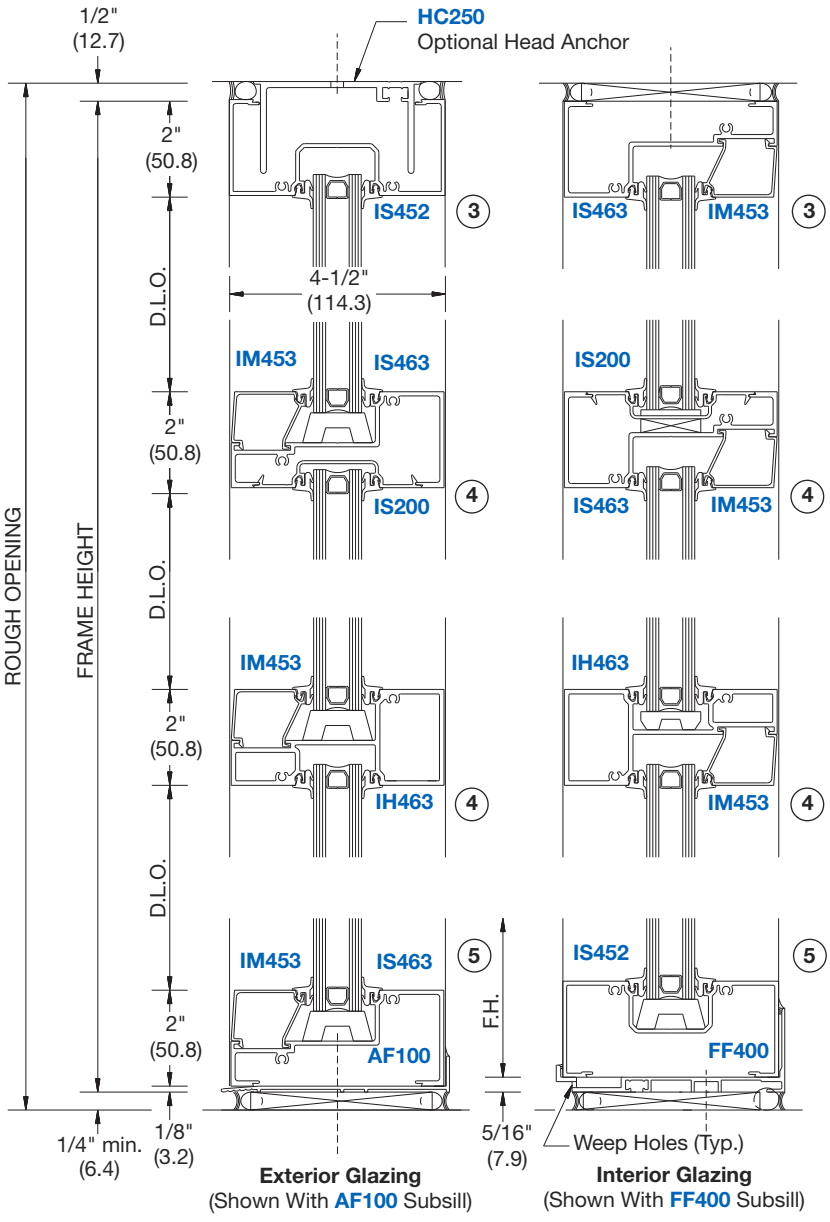


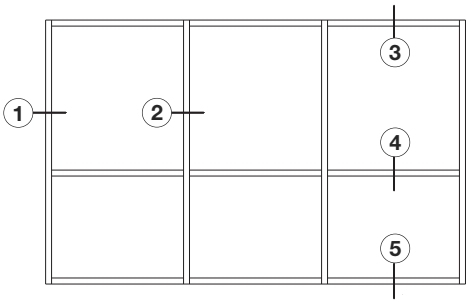
STOREFRONTS

Typical Details

Center Glazed • Series 451

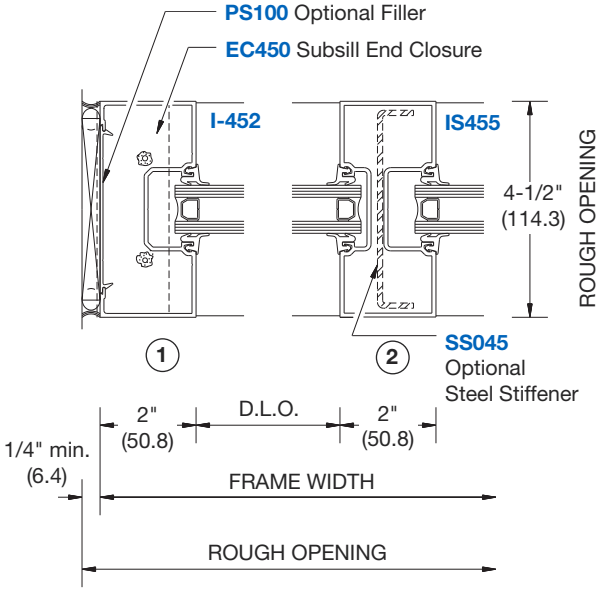
ANCHOR CLIP JOINERY FOR 1" (25) GLAZING

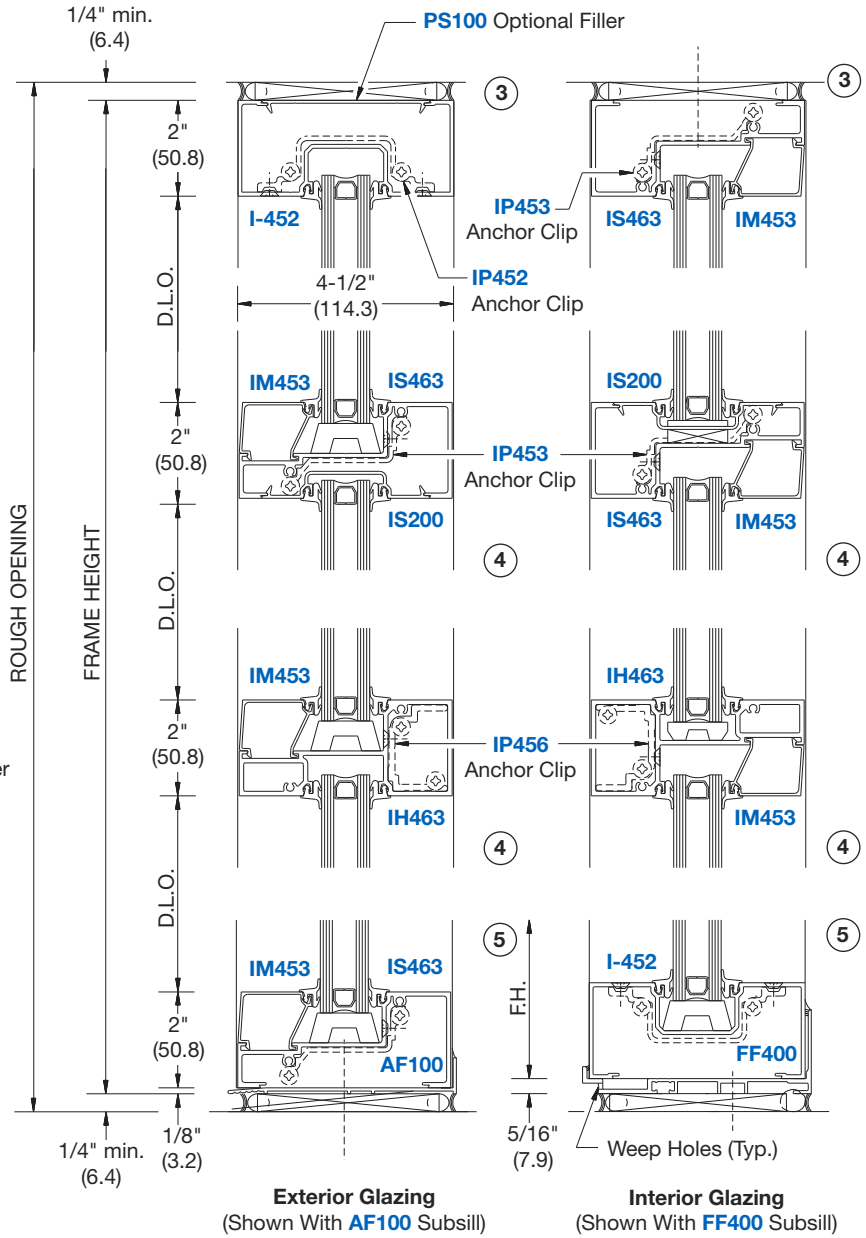
NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths. Visit **usalum.com** for more information.



TYPICAL ELEVATION

NOTE: **NP225** Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)





Exterior Glazing
(Shown With **AF100** Subsill)

Interior Glazing
(Shown With **FF400** Subsill)

NOT TO SCALE

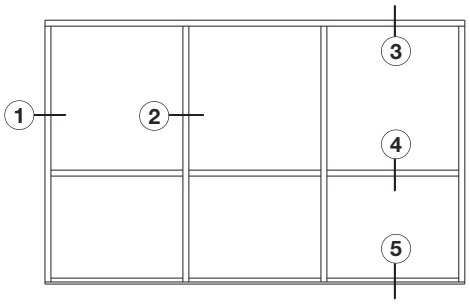
STOREFRONTS

Typical Details

Center Glazed • Series 451-S

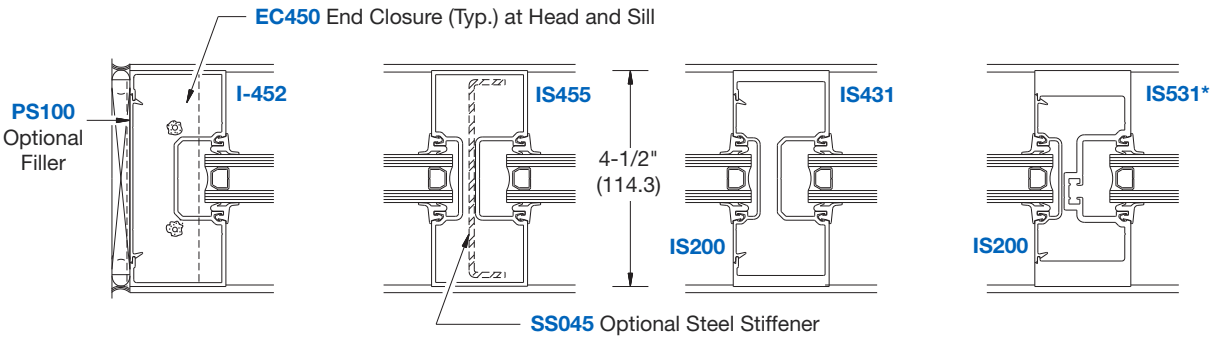
STACKING INSTALLATION FOR 1" (25) GLAZING

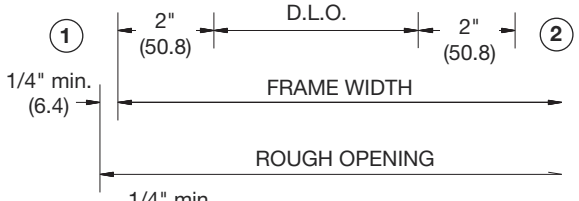
NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths.
*IS531 Available in 12' (3.6 m) only.
Visit **usalum.com** for more information.

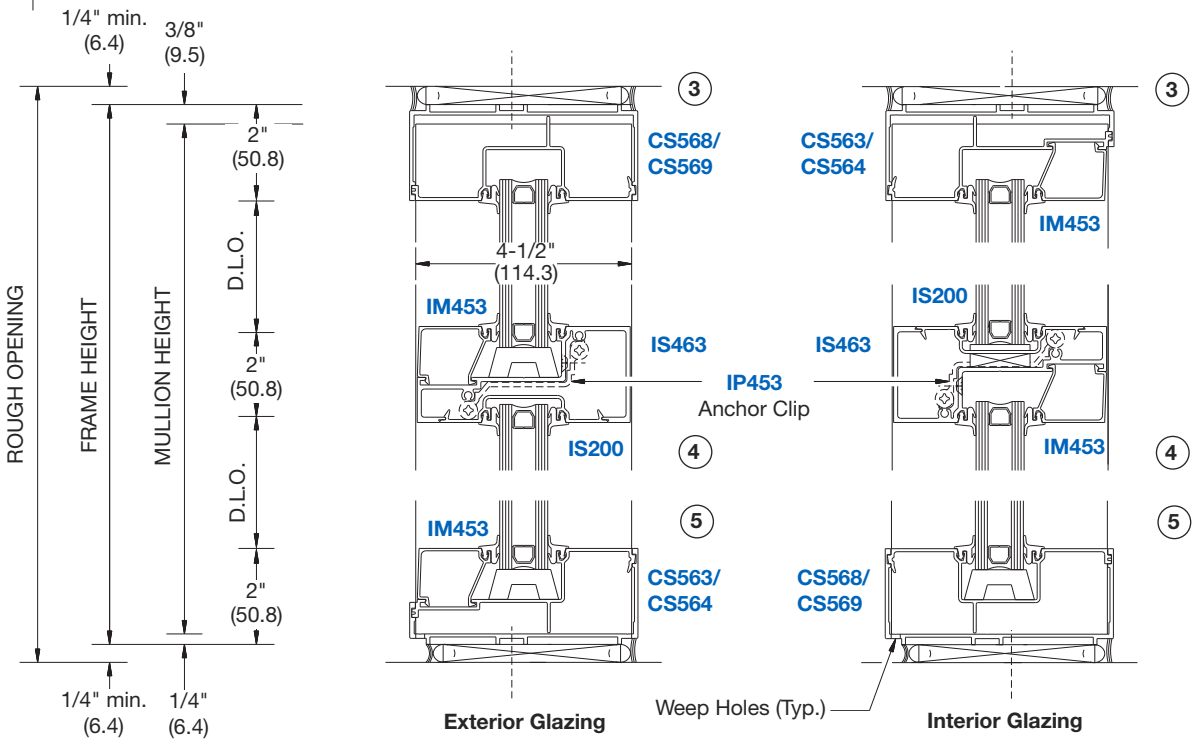


TYPICAL ELEVATION

NOTE: **NP225** Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)







NOT TO SCALE

CRL U.S. ALUMINUM

STOREFRONTS

Typical Details

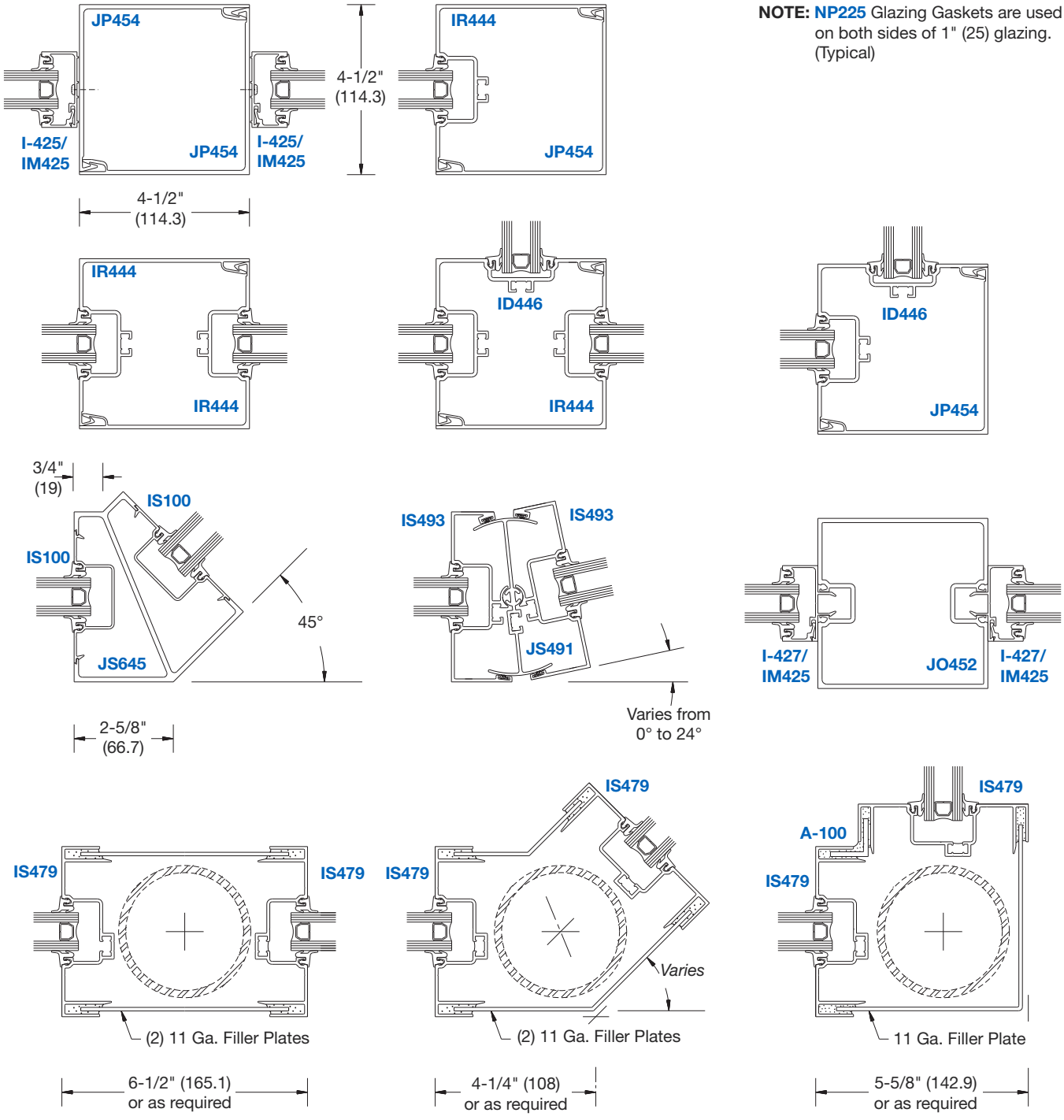
Center Glazed
- Series 451
- Series 451-S

B

VERTICAL CORNER CONDITIONS AND POST COVERS FOR 1" (25) GLAZING

NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths. Visit **usalum.com** for more information.

NOTE: NP225 Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)



NOT TO SCALE

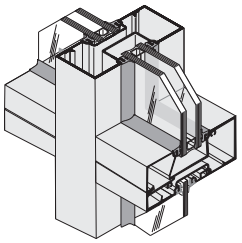
STOREFRONTS

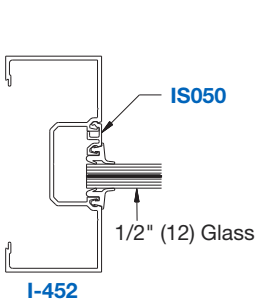
Typical Details

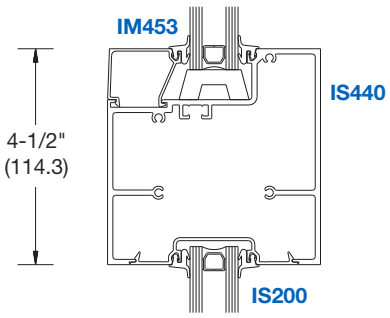
Center Glazed
- Series 451
- Series 451-S

SPECIAL GLASS ADAPTORS AND TRANSITION GLAZING USING 1/4" (6), 1/2" (12), AND 1" (25) GLAZING

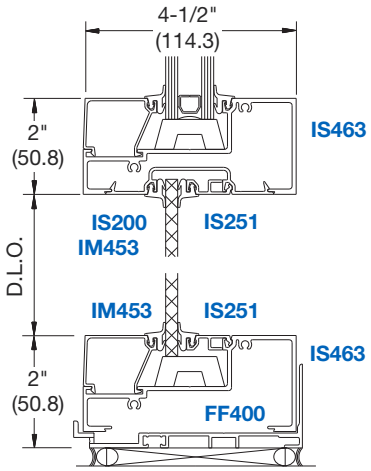
NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths. Visit **usalum.com** for more information.





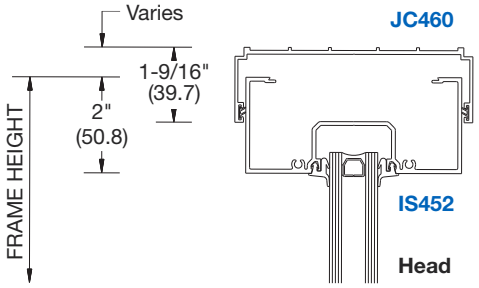


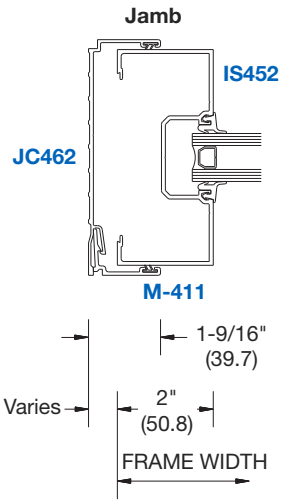
4-1/2" (114.3) high intermediate horizontal



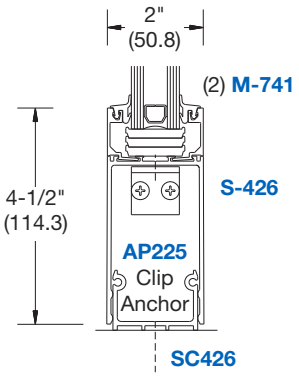
Exterior face of 1/4" (6) glazing aligns with exterior face of 1" (25) glazing

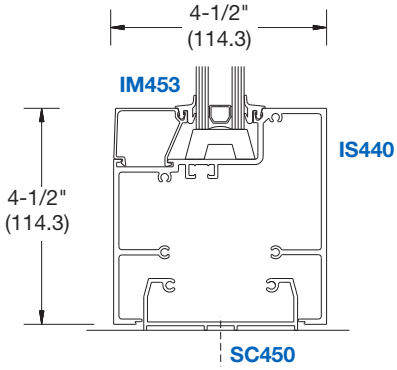
COMPENSATING CHANNELS (FOR HEAD AND JAMBS)





BULKHEADS (IN LIEU OF STANDARD SILLS)



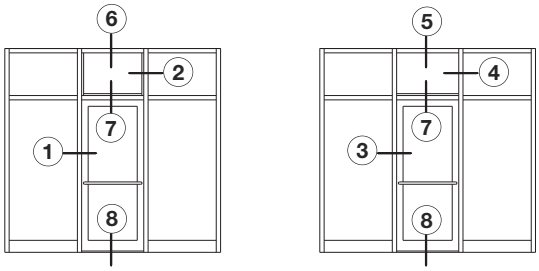


NOT TO SCALE

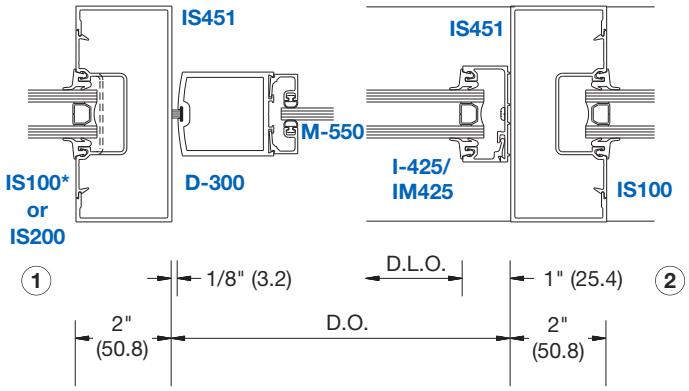
Typical Details

DOOR FRAMING

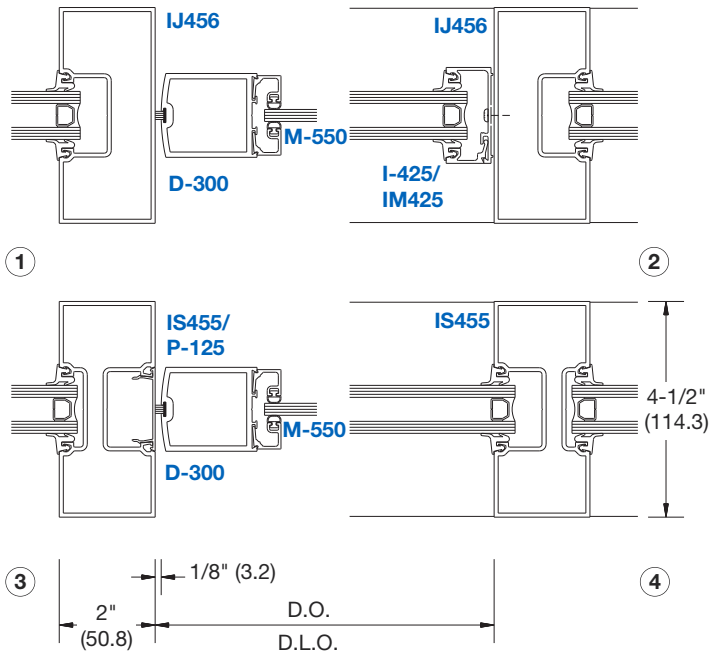
NOTE: Door Frames are available in stock to accommodate 36" x 84" (914 x 2134) and 72" x 84" (1829 x 2134) door openings.
Visit **usalum.com** for more information.



CENTER HUNG DOOR

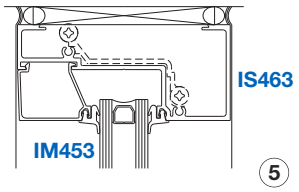


***NOTE:** **IS100** Insert is required to install glass between doors

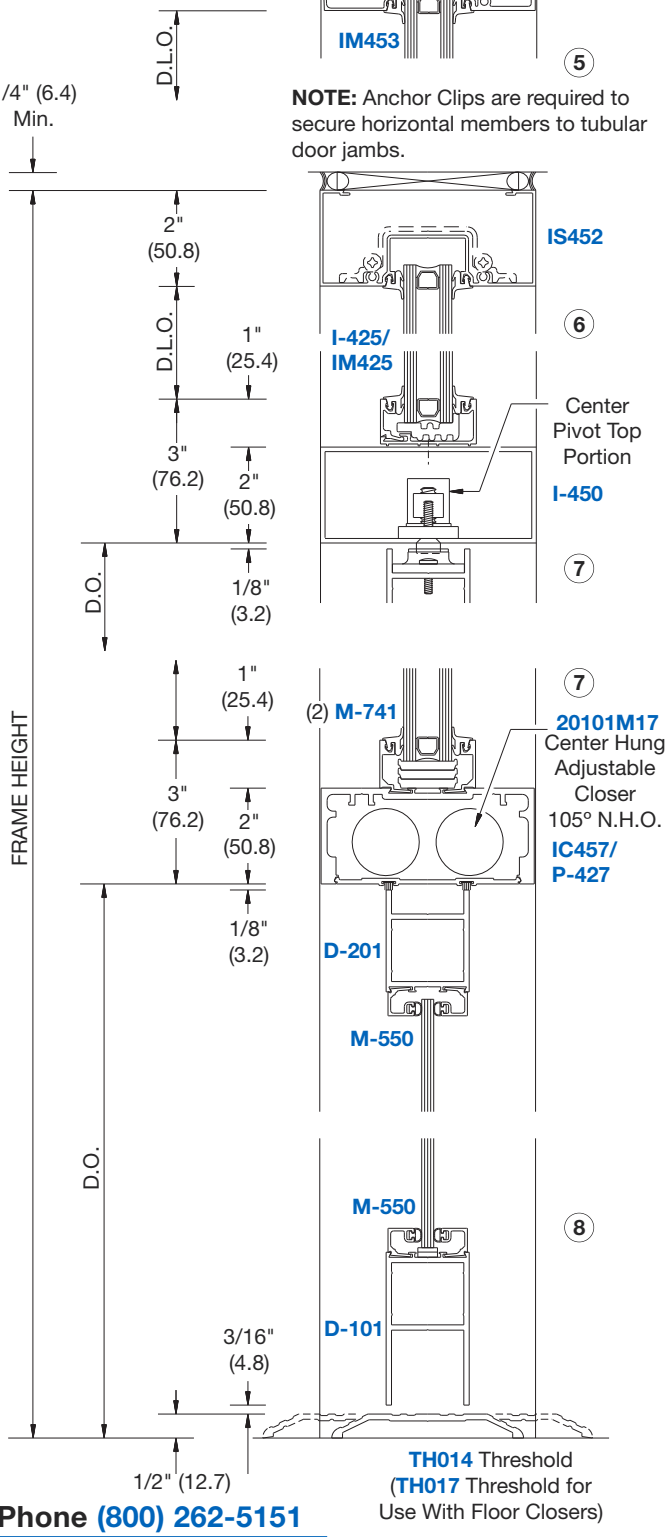


Center Glazed

- **Series 451**
- **Series 451-S**



NOTE: Anchor Clips are required to secure horizontal members to tubular door jambs.



NOT TO SCALE

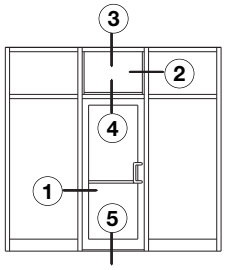
STOREFRONTS

B

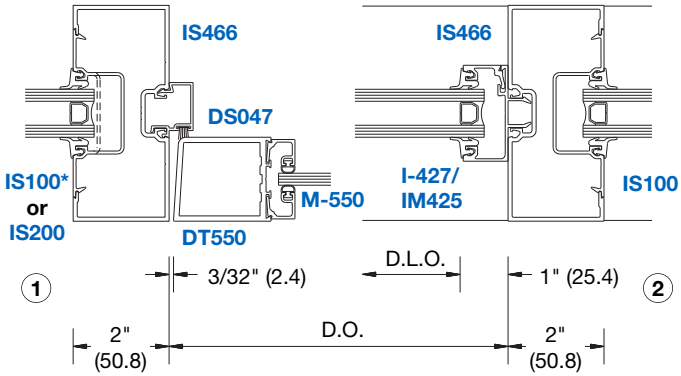
Typical Details

DOOR FRAMING

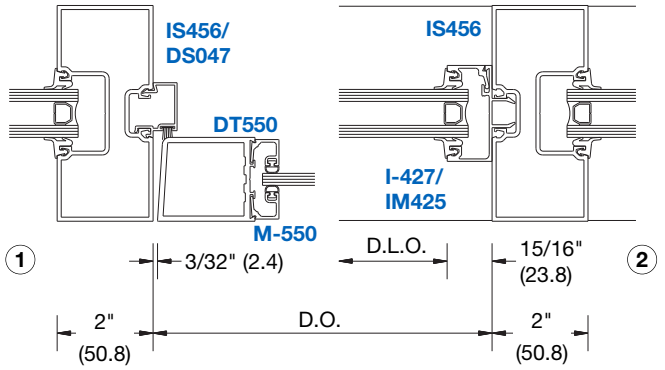
NOTE: Door Frames are available in stock to accommodate 36" x 84" (914 x 2134) and 72" x 84" (1829 x 2134) door openings. Visit usalum.com for more information.



OFFSET HUNG DOORS



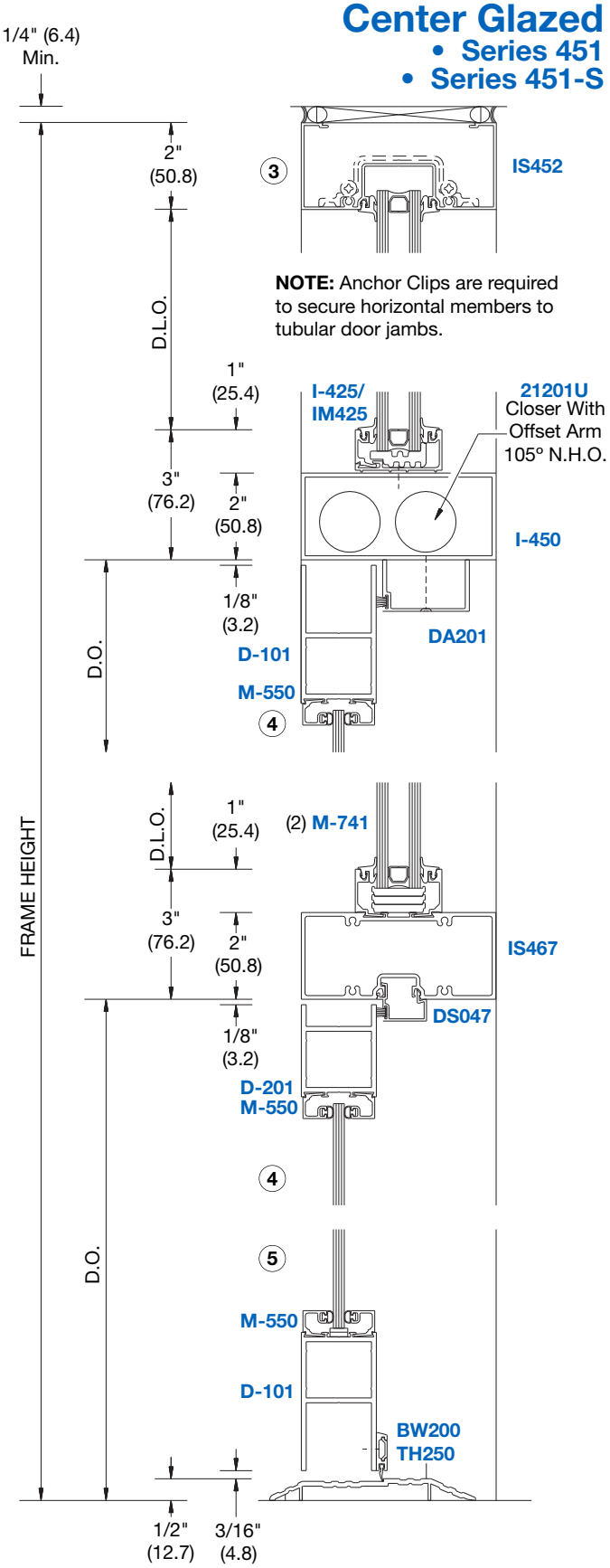
***NOTE:** IS100 Insert is required to install glass between doors



NOT TO SCALE

Center Glazed

- Series 451
- Series 451-S



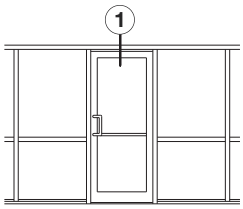
NOTE: Anchor Clips are required to secure horizontal members to tubular door jambs.

Typical Details

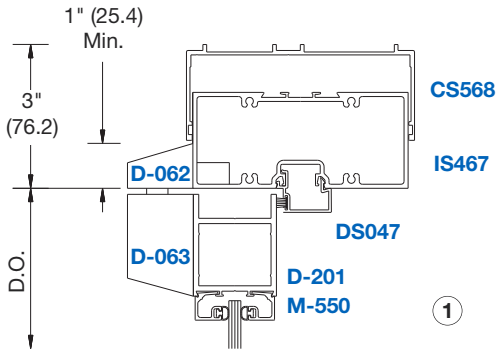
Center Glazed
- Series 451
- Series 451-S

DOOR FRAMING SPECIAL CONDITIONS

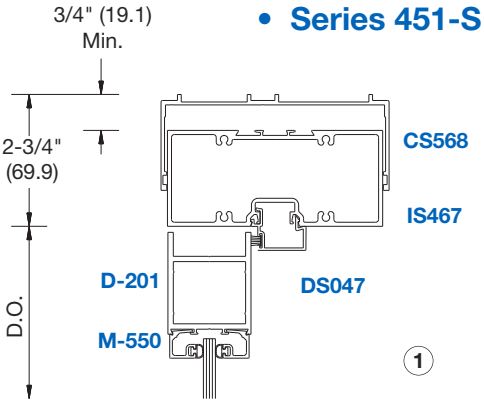
NOTE: Door Frames are available in stock to accommodate 36" x 84" (914 x 2134) and 72" x 84" (1829 x 2134) door openings. Visit usalum.com for more information.



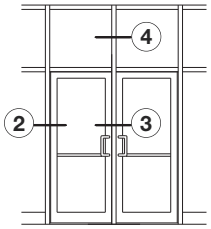
Series 451-S Door Header



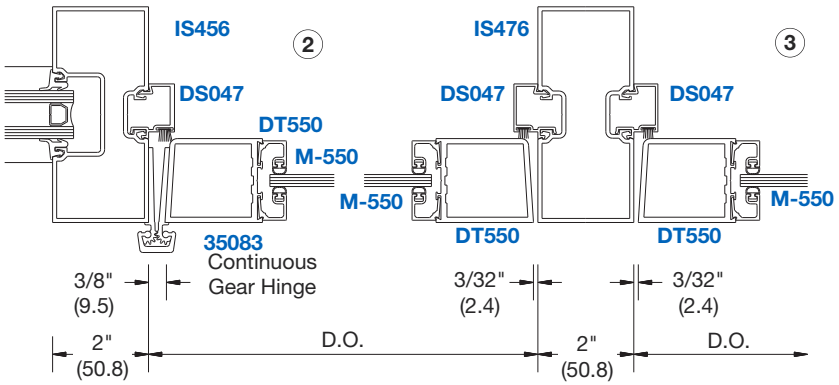
Offset Pivoted Door

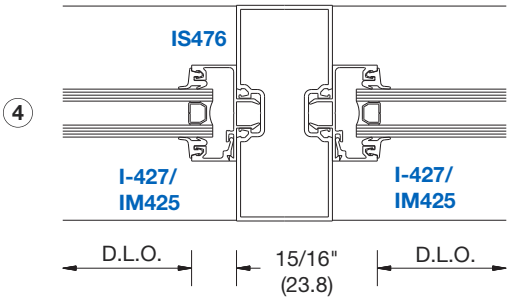


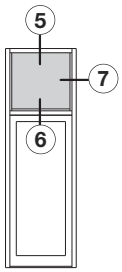
Butt Hung Door



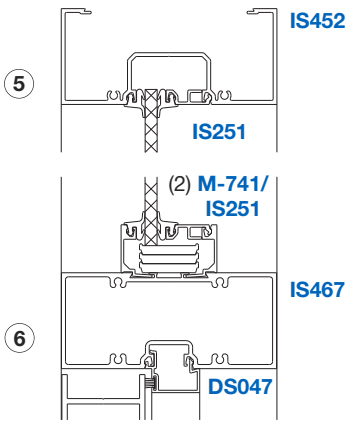
Optional Hinge and Intermediate Door Jamb

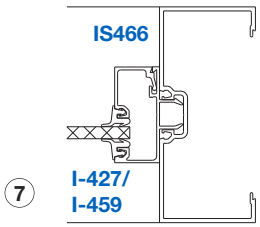






Spandrel Transom





NOT TO SCALE

STOREFRONTS

Windload Charts

Center Glazed
- **Series 451**
- **Series 451-S**

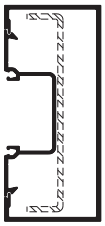
STANDARD WALL VERTICAL MULLIONS FOR 1" (25) GLAZING

Deflection criteria to be in accordance with AAMA TIR-A11 - L/175 or L/240 + 1/4" (6.4 mm) for spans greater than 13'-6" (4.1 m) but less than 40'-0" (12.2 m). Codes and specifications may vary. No single lite of glass shall deflect more than 3/4" (19 mm). Glass is not considered as contributing to resistance of deflection. Aluminum alloy 6063-T6 allowable stress for windload is 15,200 psi. (89 MPa), and steel reinforcing allowable stress for windload is 21,600 psi. (183 MPa).

These charts include unbraced length analysis and are based on at least one horizontal being placed at the midpoint of the span. For other applications, please contact U.S. Aluminum Technical Sales at (800) 262-5151, or visit our web site at **usalum.com**.

SS045
Steel Stiffener
I = 1.122 (46.70 x 10^4)
S = .544 (8.92 x 10^3)

SS045 Fits all Verticals except IS431, IS531, and IS470/IS479

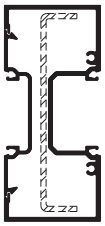


IS451/IS100
I = 2.861 (119.08 x 10^4)
S = 1.271 (20.84 x 10^3)

IAL+STL = 6.115 (254.52 x 10^4) with SS045 Steel

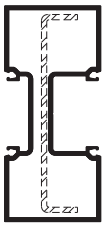
I-452/IS200
I = 2.886 (120.12 x 10^4)
S = 1.298 (21.67 x 10^3)

IAL+STL = 6.140 (255.56 x 10^4) with SS045 Steel



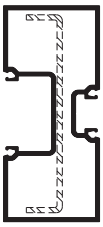
IS452/IS200
I = 3.000 (124.87 x 10^4)
S = 1.333 (21.85 x 10^3)

IAL+STL = 6.254 (260.30 x 10^4) with SS045 Steel



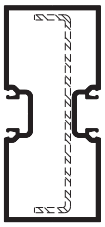
IS455
I = 3.005 (125.08 x 10^4)
S = 1.336 (21.89 x 10^3)

IAL+STL = 6.259 (260.51 x 10^4) with SS045 Steel



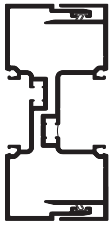
IS456
I = 2.951 (122.83 x 10^4)
S = 1.312 (21.50 x 10^3)

IAL+STL = 6.205 (258.26 x 10^4) with SS045 Steel

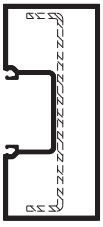


IS476
I = 2.848 (118.54 x 10^4)
S = 1.266 (20.75 x 10^3)

IAL+STL = 6.102 (253.98 x 10^4) with SS045 Steel

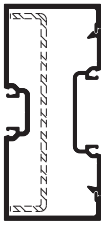


IS479/IS470
I = 4.274 (177.90 x 10^4)
S = 1.877 (30.76 x 10^3)



IJ456
I = 2.930 (121.96 x 10^4)
S = 1.302 (21.34 x 10^3)

IAL+STL = 6.184 (257.39 x 10^4) with SS045 Steel



IS466/IS200
I = 2.914 (121.29 x 10^4)
S = 1.295 (21.22 x 10^3)

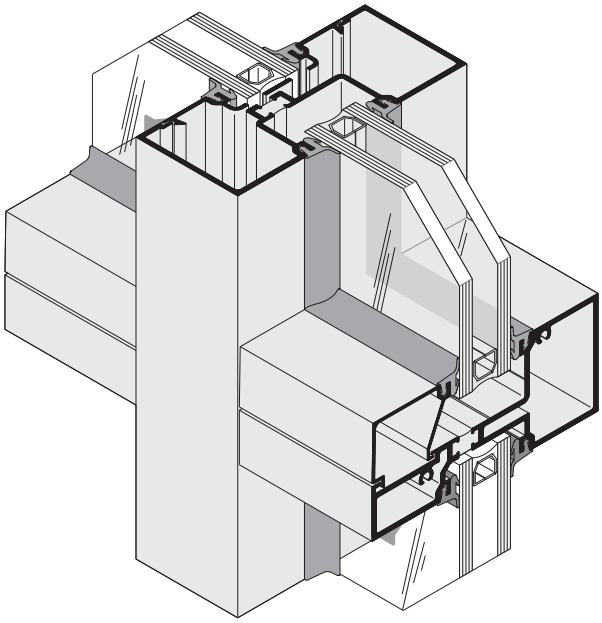
IAL+STL = 6.168 (256.72 x 10^4) with SS045 Steel

STOREFRONTS

Technical Data

Thermal Center Glazed
- Series IT451
- Series IT451-S

Series IT451 and IT451-S Thermal Center Glazed Systems offer an outstanding value by combining increased thermal performance with low-cost conventional flush glazing. These systems feature the Poly-Aluminizer™ and Lancer™ Thermal Break Technologies with a Two Year Warranty as described in the Warranty for Thermally Broken Framing Systems. They were especially engineered to satisfy the increasing demands for energy conservation. Both series may be glazed from the interior or exterior, and are well suited for storefront applications requiring increased thermal performance. See page 01-B3 for E.P.D.M. gasket options.



SERIES	WIDTH	DEPTH	GLAZING INFILLS	APPLICATION
IT451 IT451-S	2" (50.8)	4-1/2" (114.3)	1" (25)	Storefronts in Geographic Areas Requiring Thermal Performance

GLASS SIZES*	
Glass Width and Glass Height	= Daylight Opening + 7/8" (22.2).

* These formulae do not take into account glass tolerances. Consult glass manufacturer before ordering glass.

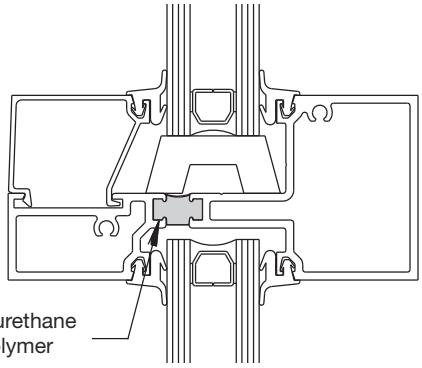
STOREFRONTS

Technical Data

Thermal Center Glazed
- Series IT451
- Series IT451-S

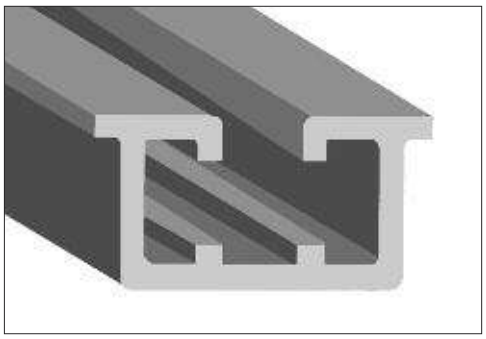
THERMAL BREAK TECHNOLOGY FEATURING THE POLY-ALUMINIZER™ AND LANCER™ METHODS

U.S. Aluminum engineers thermally broken framing systems to satisfy the increasing demands for energy conservation. This one small, but very important component in our thermally broken framing products addresses several important concerns expressed by various architects, structural engineers, and glazing contractors in our industry.



What About Dry Shrinkage?

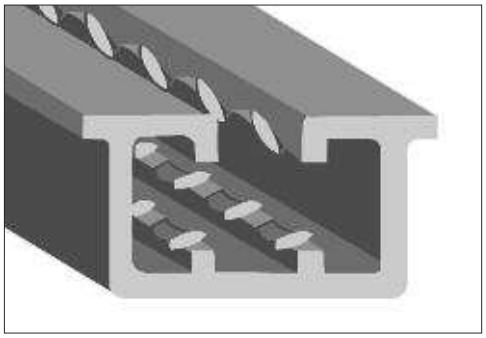
Our response is the Poly-Aluminizer™ and Lancer™ methods which mechanically modifies the aluminum extrusion and effectively improves the adhesive bond between the polyurethane polymer and the surface finish of the aluminum cavity. The Poly-Aluminizer™ accomplishes this through a unique method of abrading the thermal pocket in such a way as to produce a mechanical bond. The Lancer™ process provides mechanical surface conditioning of the extrusion cavity to insure proper adhesion to difficult finishes. Test results indicate 100% adhesion even on mill finish after 90 cycles in an environmental chamber.



Channel before the process

What About Structural Integrity?

To meet the need to maintain structural integrity, designers should specify U.S. Aluminum framing for a structurally superior thermally broken product. After the aluminum channel has been modified, it is filled with a polyurethane polymer that cures to a rigidity that is equal to or better than that of the aluminum channel. Then we debridge the aluminum channel along its entire length. The structural integrity is maintained while adding the benefits of thermally broken framing.



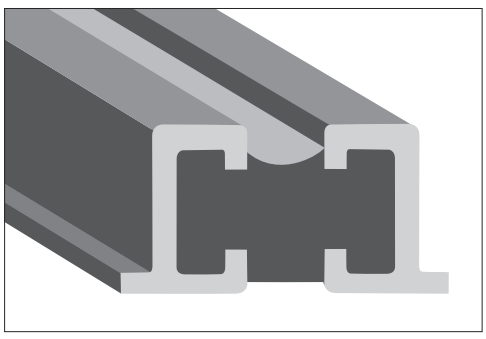
Channel after being mechanically modified

What About CRF Values?

Certified thermal test reports for all U.S. Aluminum products tested in accordance with AAMA 1503.1-88 are available upon request from any of our service centers, or by calling our national toll free number at (800) 262-5151.

Why Take a Chance?

U.S. Aluminum uses the latest thermal break technology and equipment for producing polyurethane thermally broken aluminum framing systems. All thermally broken framing products are manufactured in-house by U.S. Aluminum technicians and tested in accordance with AAMA-A8-1990. Our products are backed by the people and technology of an organization where innovation and reliability create a proven standard of excellence.



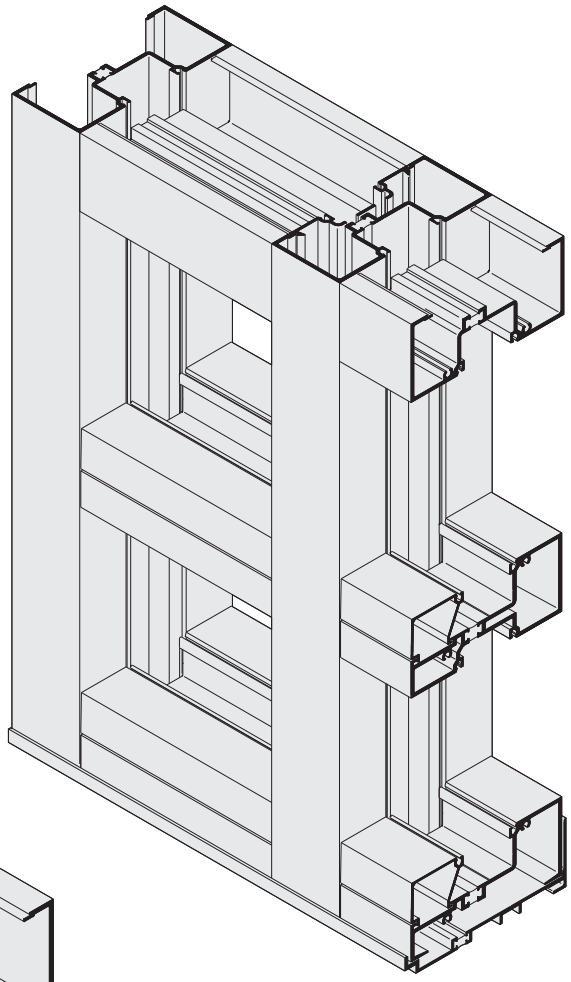
Channel with polyurethane thermal break

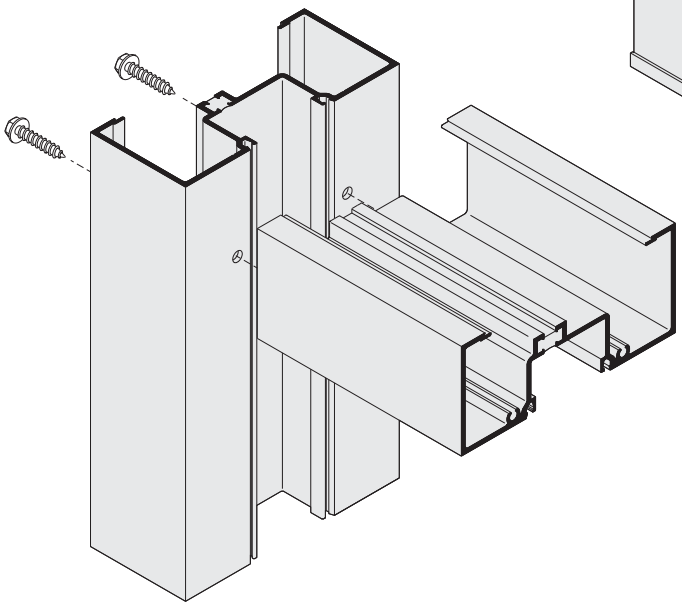
STOREFRONTS

Special Features

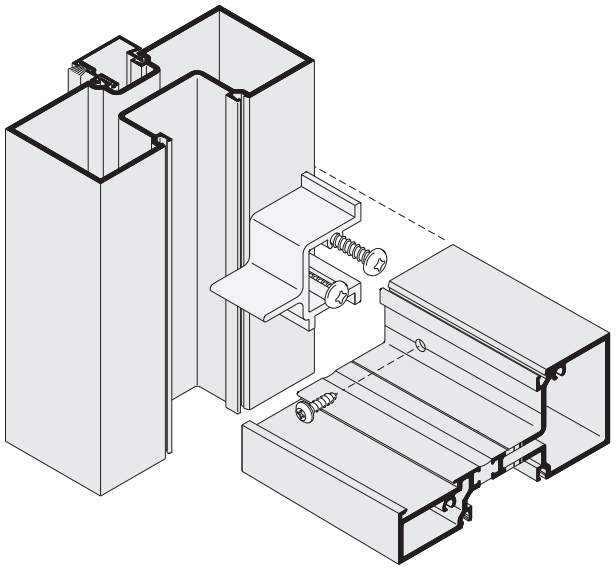
Thermal Center Glazed
• Series IT451

Two Piece (split) Vertical Mullions and Horizontals are joined together with screws driven through back of vertical members into the extruded screw splines in the horizontals as shown below. The panels are then snapped together in the field to create long runs. Extruded subsill flashing must be used with this type of installation.
NOTE: For Stacking System features see page 06-B1.





Anchor Clips are available for attaching horizontal members to tubular vertical members when required or selected.



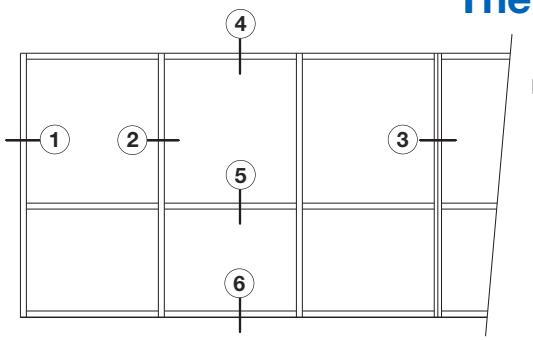
STOREFRONTS

Typical Details

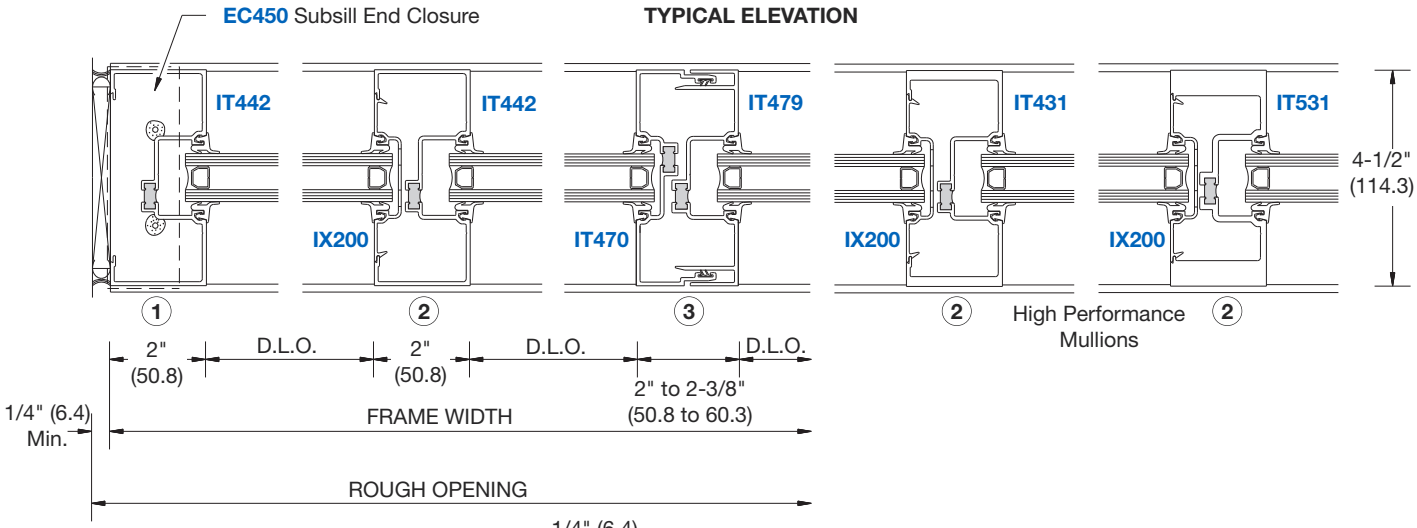
SCREW RACE JOINERY FOR 1" (25) GLAZING

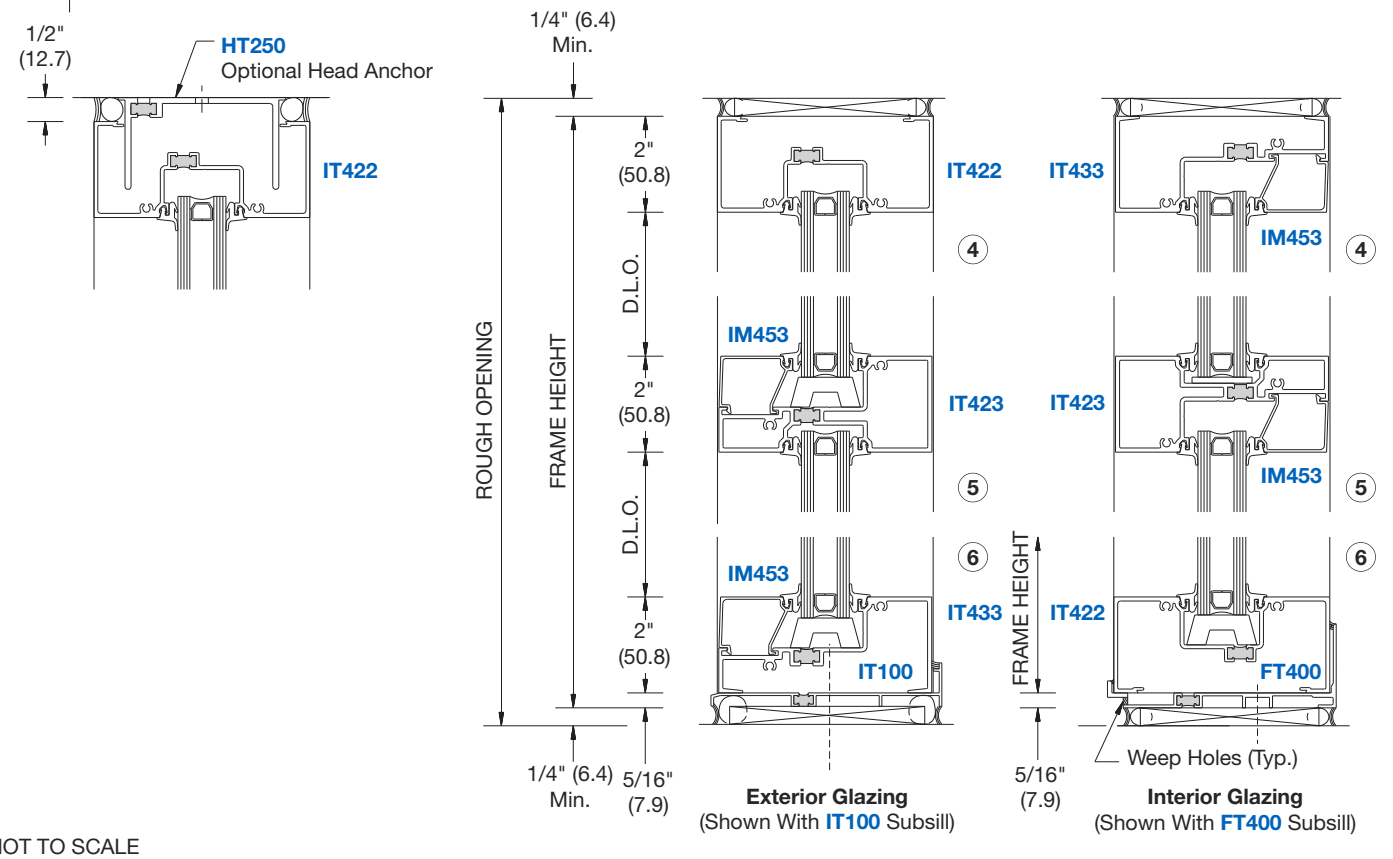
Thermal Center Glazed
• Series IT451

NOTE: NP225 Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)



TYPICAL ELEVATION





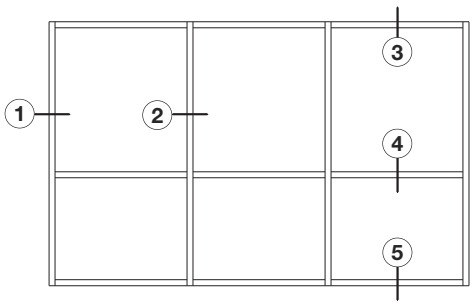
NOT TO SCALE

STOREFRONTS

Typical Details

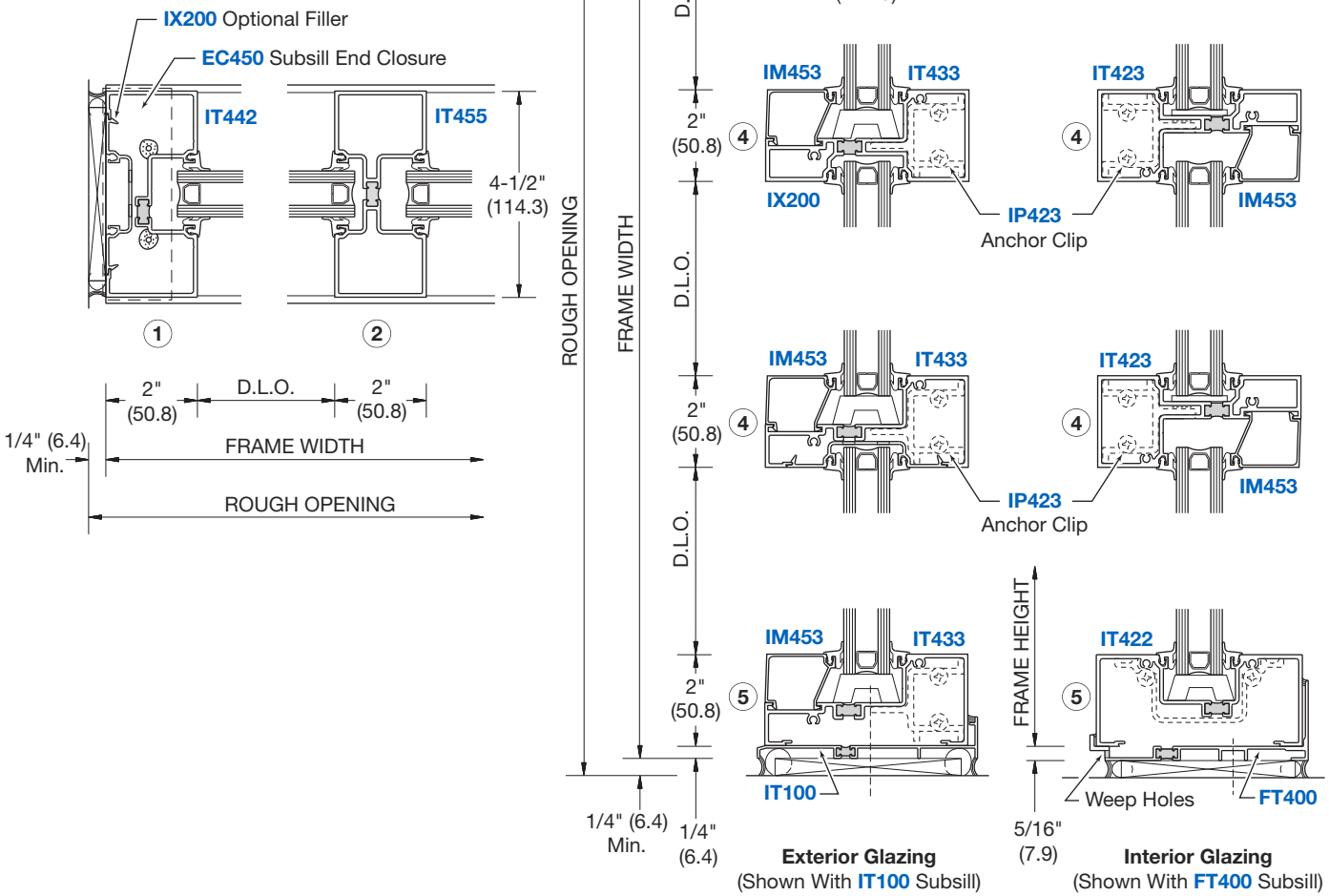
Thermal Center Glazed
• Series IT451

ANCHOR CLIP JOINERY FOR 1" (25) GLAZING



TYPICAL ELEVATION

NOTE: **NP225** Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)

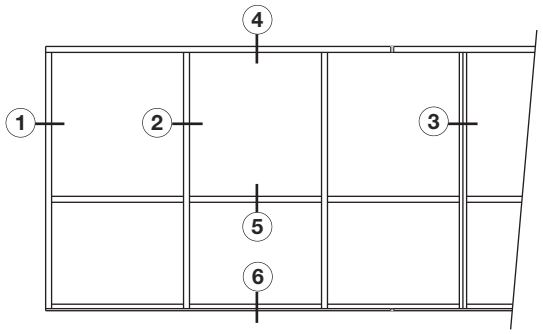


NOT TO SCALE

STOREFRONTS

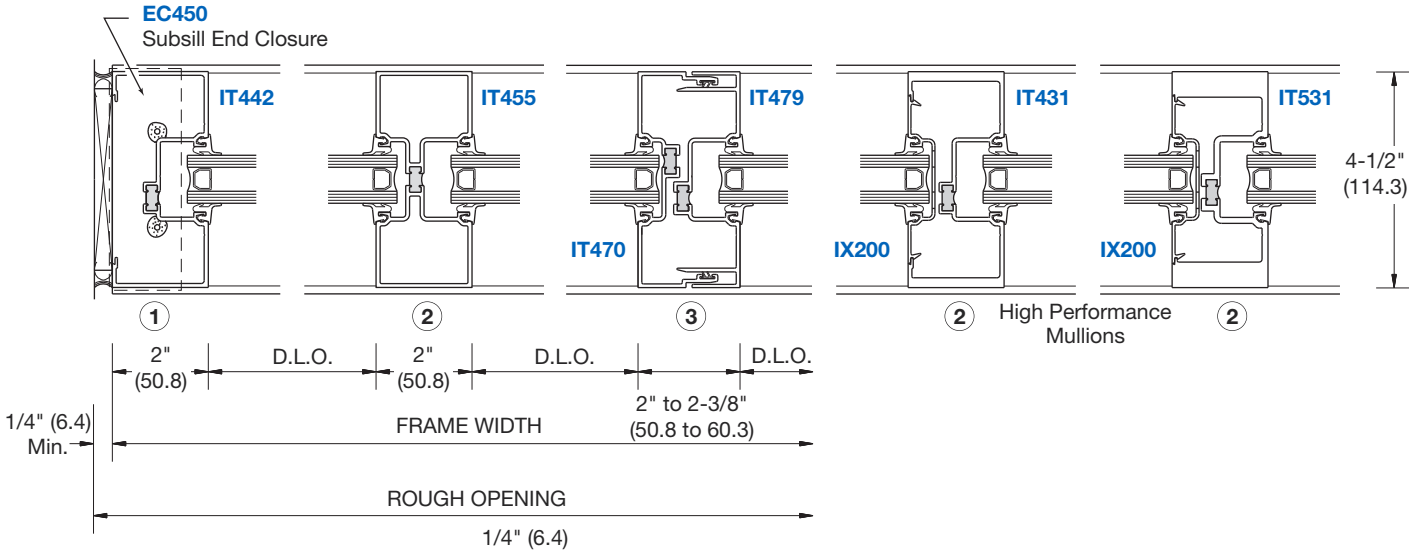
Typical Details
FOR 1" (25) GLAZING

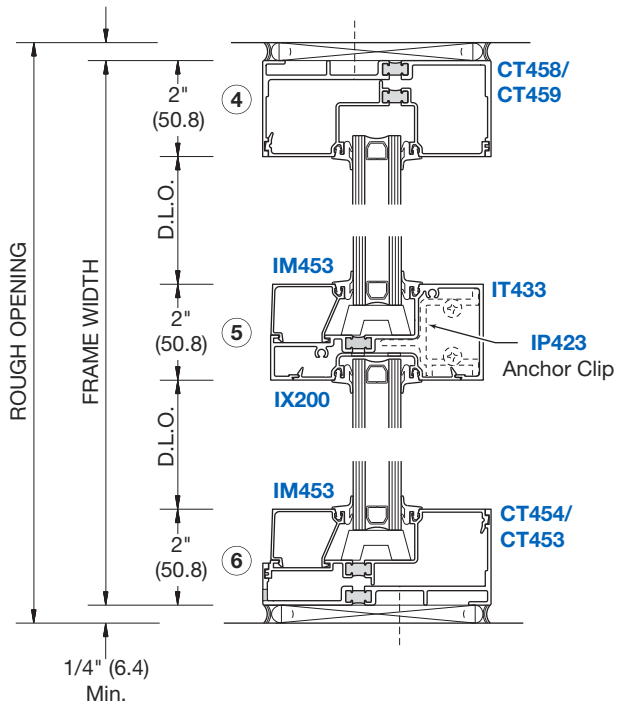
Thermal Center Glazed
• Series IT451-S



TYPICAL ELEVATION

NOTE: NP225 Glazing Gaskets are used on both sides of 1" (25) glazing. (Typical)





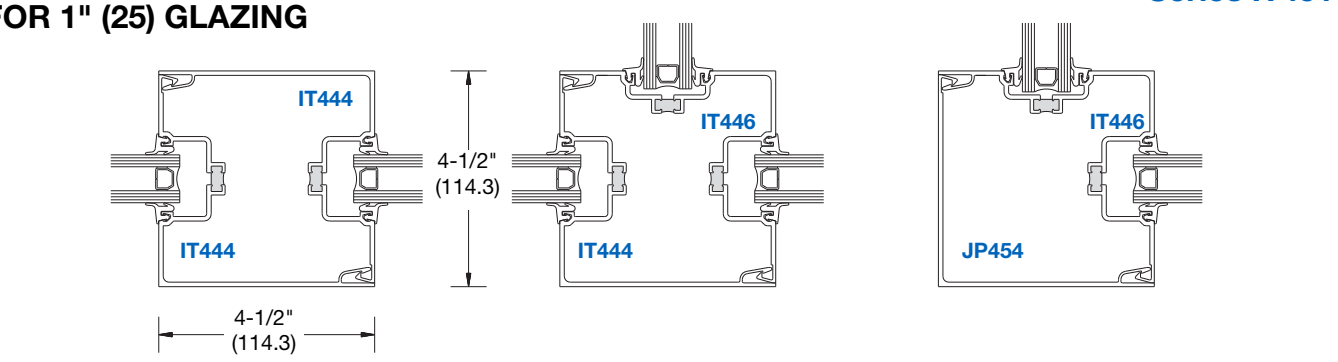
NOT TO SCALE

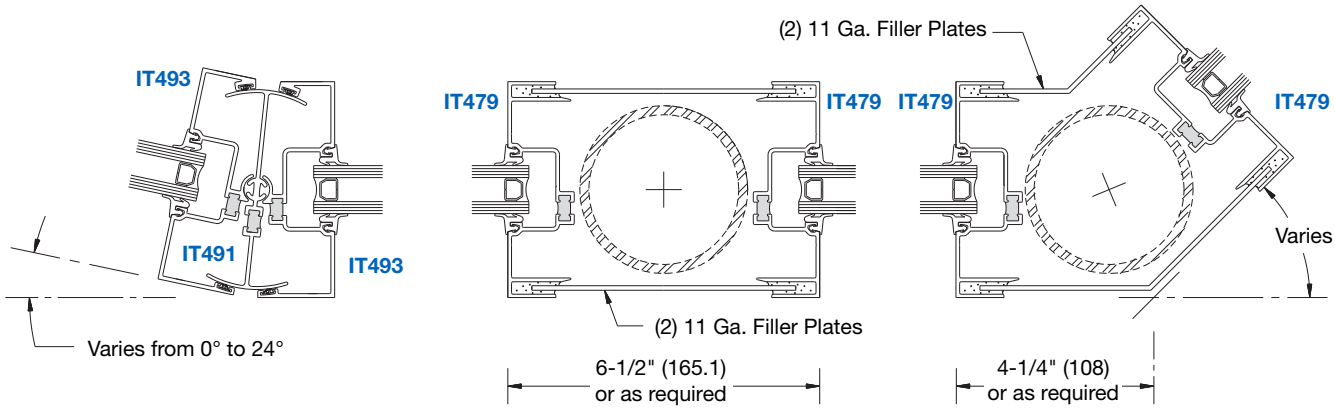
STOREFRONTS

Typical Details

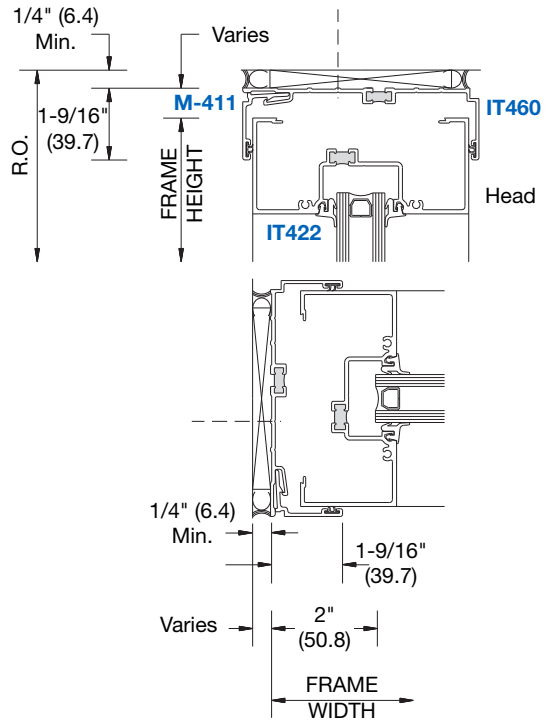
Thermal Center Glazed
- Series IT451
- Series IT451-S

VERTICAL CORNER CONDITIONS AND POST COVERS FOR 1" (25) GLAZING

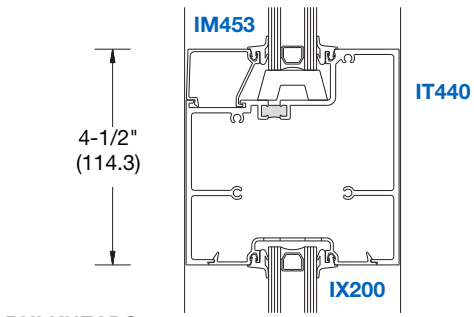




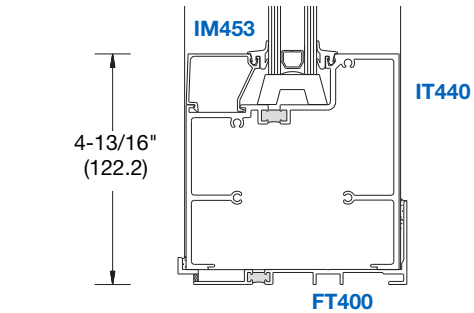
COMPENSATING CHANNEL FOR HEAD AND JAMBS



4-1/2" (114.3) HIGH INTERMEDIATE HORIZONTAL



BULKHEADS



(IN LIEU OF STANDARD SILLS)

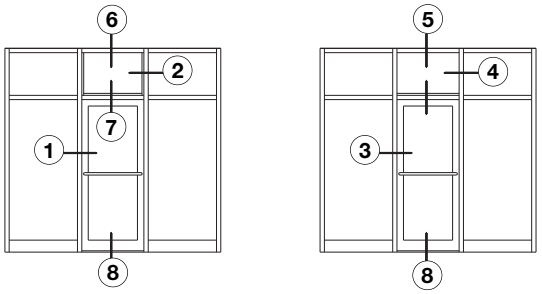
NOT TO SCALE

STOREFRONTS

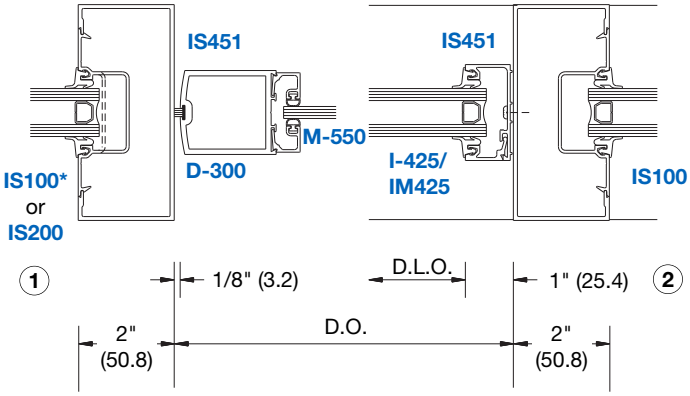
Typical Details

DOOR FRAMING

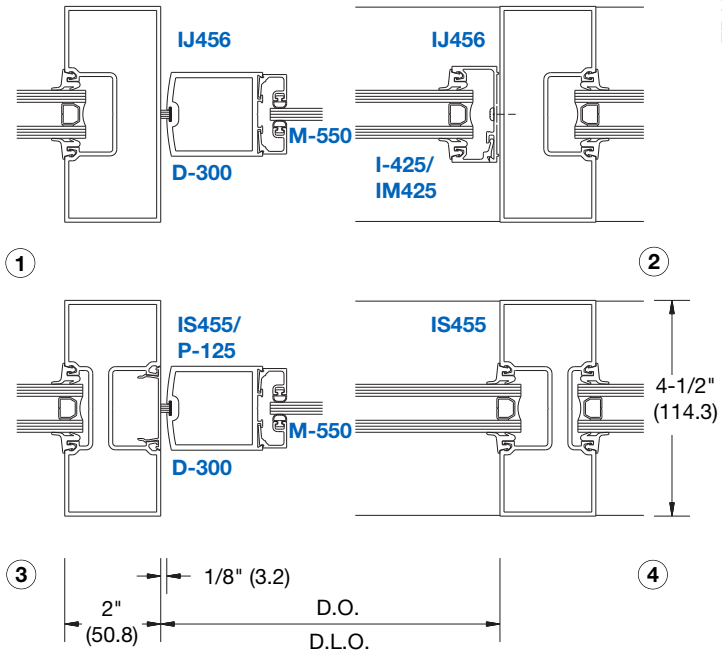
NOTE: Door Frames are available in stock to accommodate 36" x 84" (914 x 2134) and 72" x 84" (1829 x 2134) door openings. Visit usalum.com for more information.



CENTER HUNG DOORS



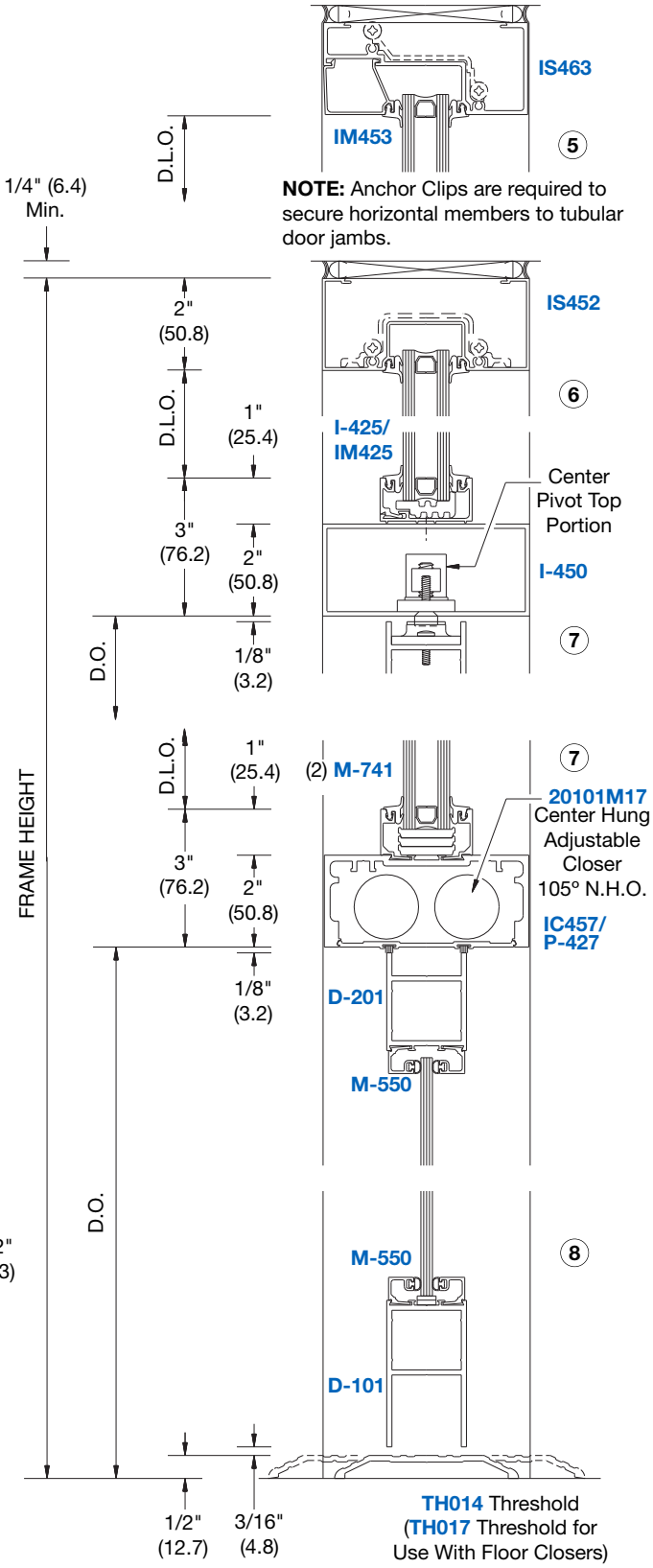
***NOTE:** IS100 Insert is required to install glass between doors



NOT TO SCALE

Thermal Center Glazed

- Series IT451
- Series IT451-S



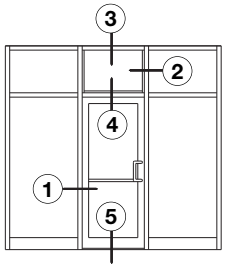
NOTE: Anchor Clips are required to secure horizontal members to tubular door jambs.

STOREFRONTS

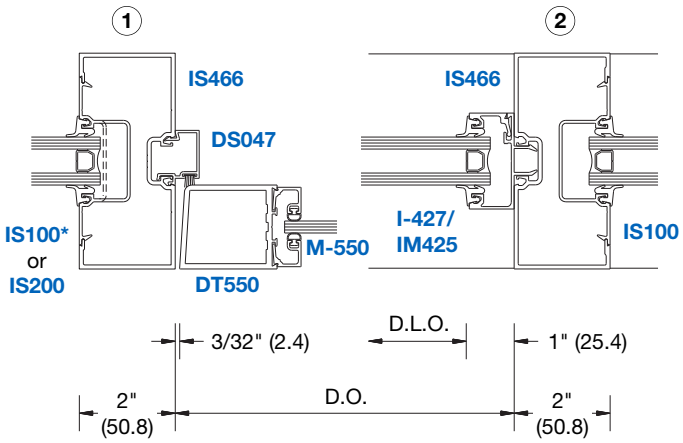
Typical Details

DOOR FRAMING

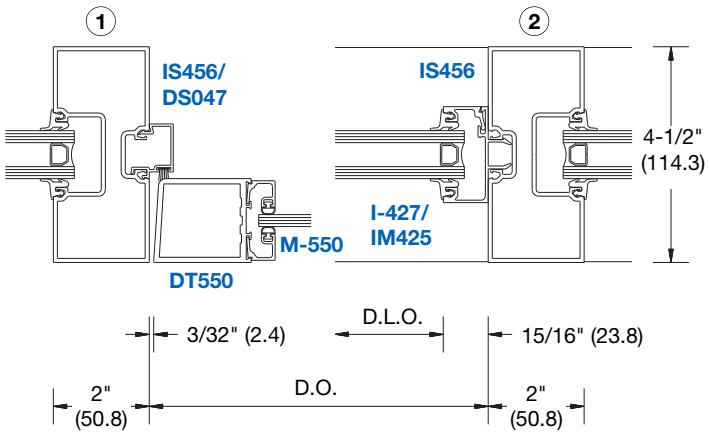
NOTE: Door Frames are available in stock to accommodate 36" x 84" (914 x 2134) and 72" x 84" (1829 x 2134) door openings. Visit usalum.com for more information.



OFFSET HUNG DOORS

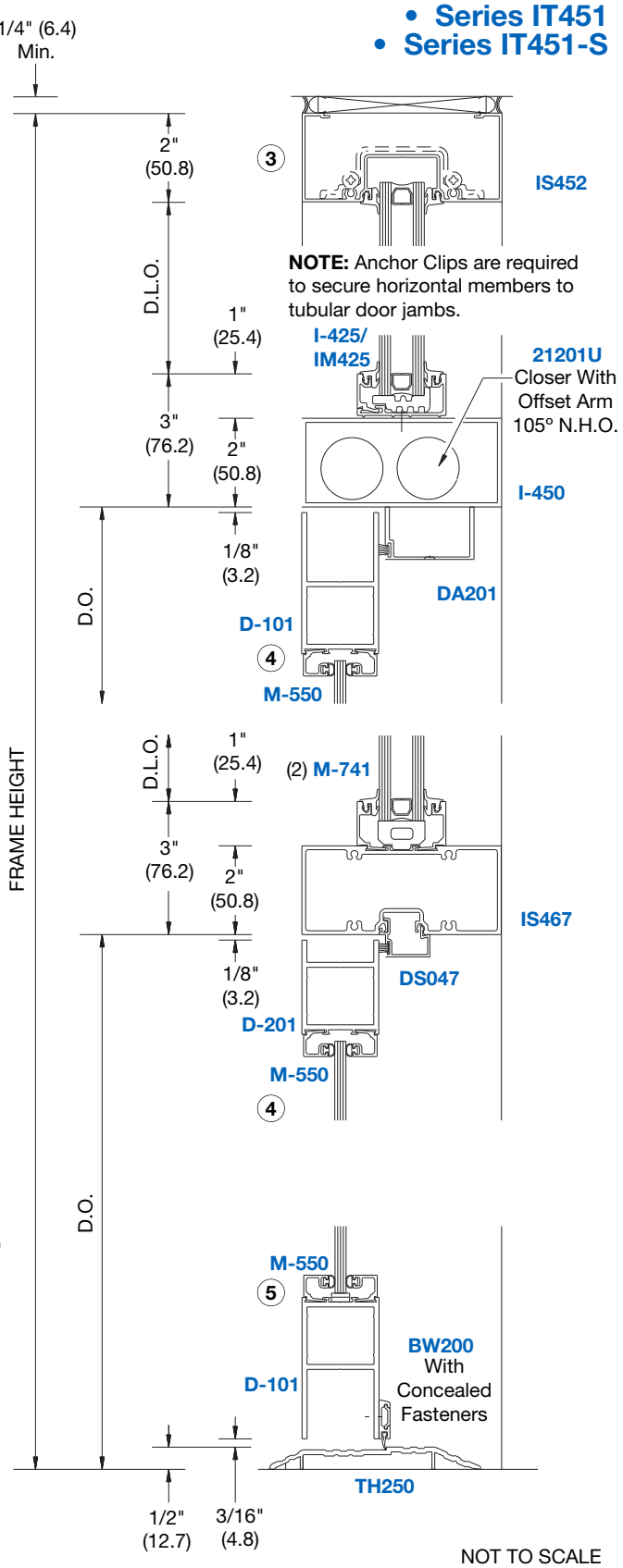


***NOTE:** IS100 Insert is required to install glass between doors



Thermal Center Glazed

- Series IT451
- Series IT451-S



NOT TO SCALE

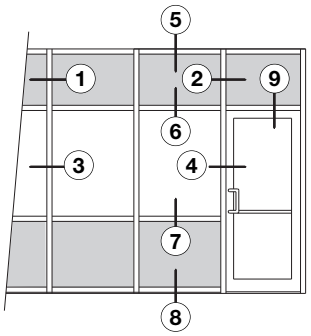
STOREFRONTS

Typical Details

Thermal Center Glazed
- Series IT451
- Series IT451-S

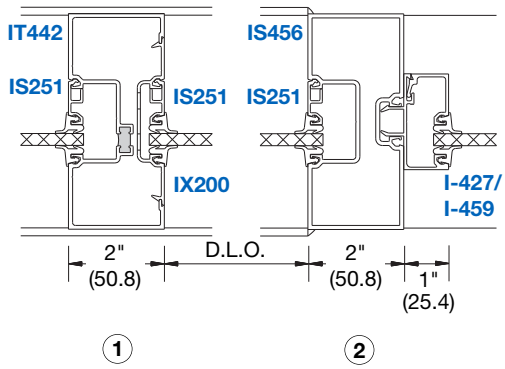
TRANSITION GLAZING FOR 1" (25) OR 1/4" (6) GLAZING

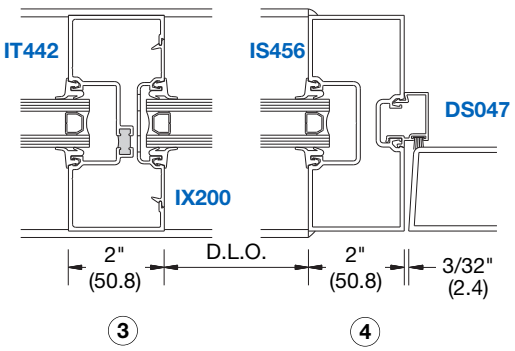
NOTE: Part numbers shown are available in 24' (7.3 m) stock lengths. Visit usalum.com for more information.

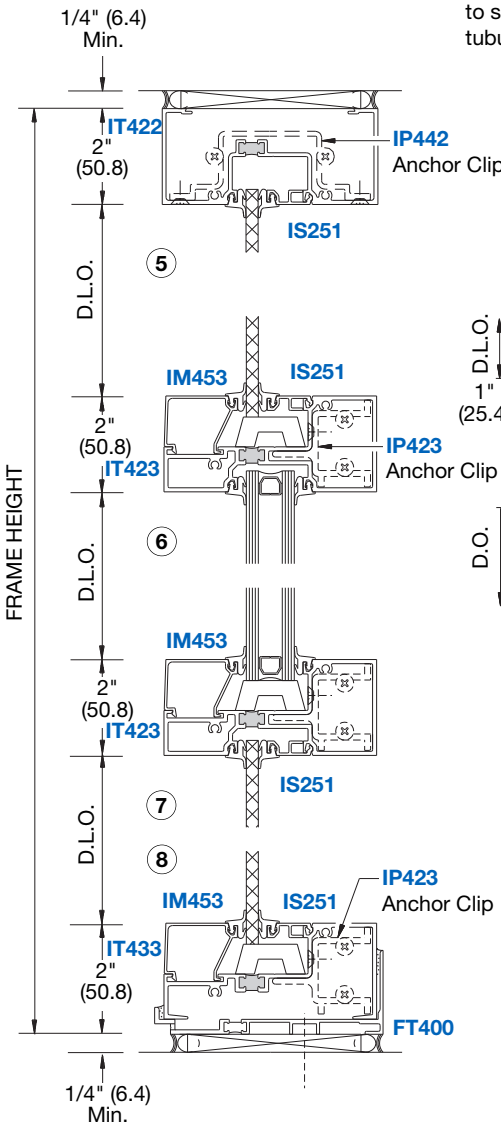


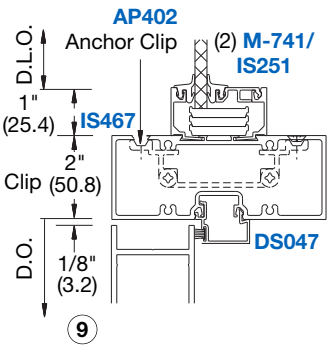
TYPICAL ELEVATION

NOTE: Anchor Clips are required to secure horizontal members to tubular door jambs.









NOT TO SCALE

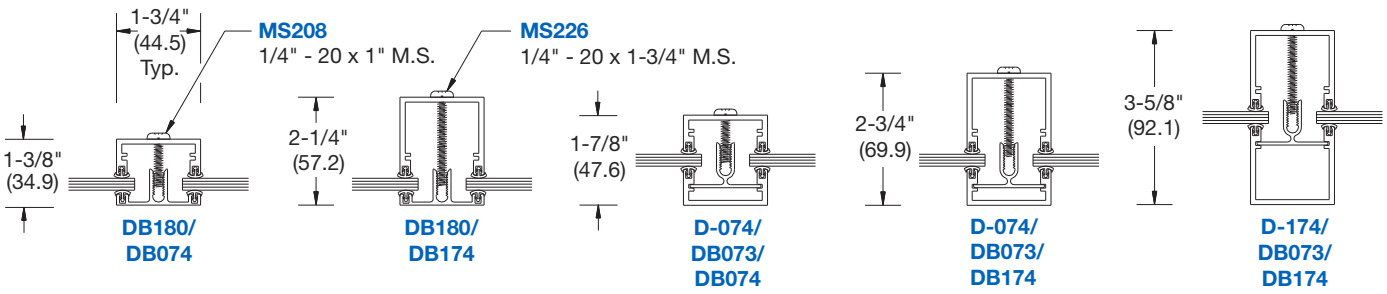
STOREFRONTS

Typical Details

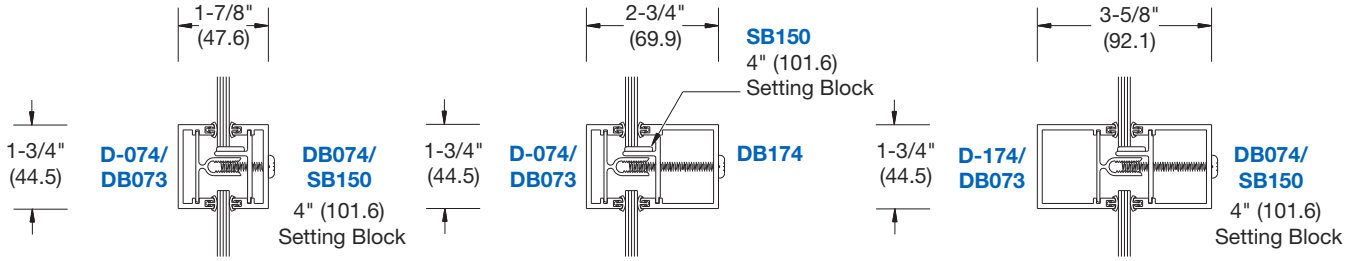
DIVISION BARS

SHOWN WITH 1/4" (6) GLAZING TYPICAL

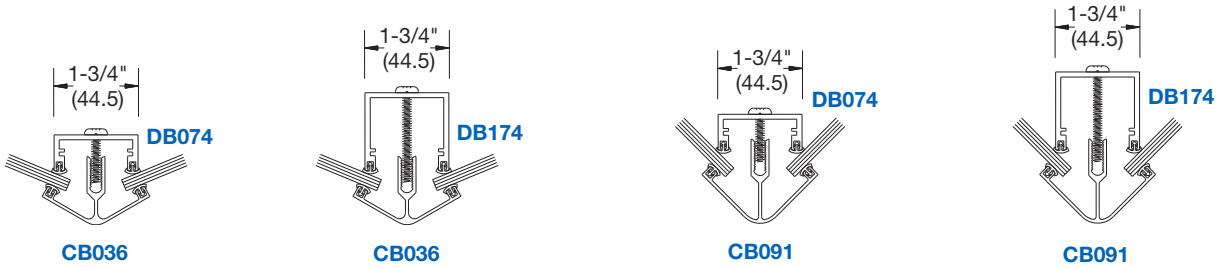
VERTICAL MEMBERS



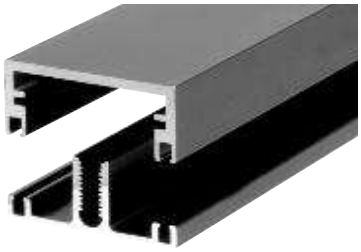
HORIZONTAL MEMBERS



CORNER MEMBERS



Miscellaneous Framing



NOTE: All stocks lengths on this page are available in clear anodized or bronze anodized finishes, and are 24' (7.3 m) in length unless noted otherwise. Visit **usalum.com** for more information.

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GUIDE SPECIFICATION

Manufacturer:
U.S. Aluminum
2450 E. Vernon Ave.
Los Angeles, California 90058-1802
Toll Free Phone: (800) 262-5151, Phone: (323) 268-4230
Toll Free Fax: (866) 262-3299
www.usalum.com

SECTION 08 41 13
ALUMINUM FRAMED 250, 400, 550, 800, and 850 ENTRANCES
ALUMINUM FRAMED 400, 450, 451, IT451, IT451-S, 400-S, 450-S, 451-S, FF450, FF451, FF600, and FF601 STOREFRONTS

This guide specification has been prepared by U.S. Aluminum in printed and electronic form as an aid to specifiers in preparing written construction documents for aluminum framed entrances and storefront systems.

This section includes factory fabricated and pre-finished aluminum doors and frames for field assembly and glazing. Storefront framing is designed with screw-race joinery for dealer shop fabrication, field assembly and glazing.

Door hardware may be specified in whole or in part in this section or in Section 08 71 00 – Door Hardware; coordinate requirements.

Sealants are referenced in Section 07 92 00, Joint Sealants.

Glass and glazing are referenced in Section 08 81 00, Glass and Glazing.

Where work of this section integrates with curtain wall, slope glazed system, skylight, windows or other glazing system, carefully coordinate all sections to function together.

Edit entire master to suit project requirements. Modify or add items as necessary. Delete items that are not applicable. Words and sentences within brackets [_____] reflect a choice to be made regarding inclusion or exclusion of a particular item or statement. This section in some cases may include performance, proprietary and descriptive type specifications. Edit to avoid conflicting requirements.

Editor notes are included within the text of this section to assist the specifier in knowledgeable decision-making. They should be deleted from the final text.

This guide specification is written using imperial measurements with metric conversions in parentheses. These may be switched or one may be deleted to suit project requirements. The conversion to metric is "soft" in the fact that rounding was utilized to the nearest unit.

PART 1 - GENERAL

1.1SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

Edit this paragraph to briefly describe the contents of the section. After editing section, refer back to this paragraph to verify no conflicts exist.

B. Section Includes:
   1. Entrances and Storefront Systems complete with reinforcing, fasteners, anchors, and attachment devices.
   2. Aluminum doors complete with hardware, and welded corners.
   3. Accessories necessary to complete work.

This document incorporates CSI (Construction Specifications Institute) Manual of Practice and MasterFormat (2011 edition) principles of cross-referencing to Division 1 sections and other sections. The cross references must be edited to retain only those other sections used. Other guide specifications for U.S. Aluminum products include:
Section 08 32 13 - Aluminum Framed Mall Sliding Doors
Section 08 42 36 - Aluminum Balance Entrances
Section 08 43 13 - Aluminum Framed Window Wall System
Section 08 44 13 - Aluminum Curtain Walls
Section 08 51 13 - Aluminum Windows
Section 08 70 00 - Hardware

C. Related Sections:
1.Section 08 80 00 – Glazing
2.Section 08 41 13 - All Glass Entrances.
3.Section 08 42 33 - Revolving Entrance Doors.
4.Section 08 32 13 - Aluminum Framed Mall Sliding Doors.
5.Section 08 43 13 - Aluminum Framed Storefronts and Window Walls.
6.Section 08 71 00 - Door Hardware.
7.Section 08 81 00 - Glass and Glazing.
8.Section 08 44 13 - Glazed Aluminum Curtain Wall.
9.Section 08 44 33 - Slope Glazed System.

List reference standards that are included within the text of this section. Edit the following as required for project conditions.

1.2REFERENCES

A. Aluminum Association (AA):

1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. 503.1 Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Systems.
2. 605.2-92 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. 607.1 Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
4. 608.1 Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
5. 701.2 Specifications for Pile Weatherstripping.
6. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
7. SFM-1 Aluminum Storefront and Entrance Manual.

C. American National Standards Institute (ANSI):
1. A117.1 Safety Standards for the Handicapped.

D. American Society for Testing and Materials (ASTM):
1. A36 Structural Steel.
2. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
3. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
5. C509 Cellular Elastomeric Pre-formed Gasket and Sealing Material.
6. C864 Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
7. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
8. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
9. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):
1. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):
1. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

Use the article below carefully; restrict statements to describe components used to assemble the system. Do not repeat statements made in the SECTION INCLUDES article. Restrict statements to identify system performance requirements or function criteria only. Delete paragraphs not appropriate to project.
The following paragraphs represent a suggested listing of performance criteria

1.3SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
   2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
   3. Provide concealed fastening.
   4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
   5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
   6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
   7. Provide for expansion and contraction without detriment to appearance or performance.
   8. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
   9. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

In B1 below, 6.24 psf (300 Pa) is equal to a 50 mph (80 km/h) wind. 0.06 cfm/sq. ft. (0.0003 m3/sm2) is industry standard. In item B2 below, edit test pressure as required for intended system. Series 400 and 450 meet 8 psf (383 Pa). Series 451 and IT451 meet 10.0 psf (480 Pa).

B. Performance Requirements:
   1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot (0.0003 m3/sm2) of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).
   2. Water infiltration: No uncontrolled water penetration when tested in accordance with ASTM E 331 at test pressure of [8.0] [10.0] psf ([380] [480] Pa).

C. Thermal Requirements:
   1. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees Fahrenheit (82 degrees Celsius) without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
   2. Ensure doors function normally within limits of specified temperature range.

Coordinate wind loads with applicable building code, or appropriate wind loads may be determined by using ANSI A58.1-1982, "Minimum Design Loads for Buildings and Other Structures". Edit following paragraph accordingly.

D. Structural Requirements, as measured in accordance with ANSI/ASTM E330:
   1. Wind loads for exterior assemblies:
      a. Basic loading:
         1) [_____] psf acting inward.
         2) [_____] psf acting outward.

In cases of large spans, calculate maximum deflection and give consideration to visual impact. An allowable deflection less than L/175 of clear span is industry standard. Smaller deflections will often require use of heavier cross sections or internal reinforcements.

   2. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures shall not exceed [L/175] [___] of its clear span.

E. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

Include submittal requirements below that are consistent with scope of project and extent of work of this section. Only request submittals that are absolutely necessary.

1.4SUBMITTALS

A. General: Submit in accordance with Section 01 30 00.

B. Product Data:
   1. Submit manufacturer's descriptive literature and product specifications.
   2. Include information for factory finishes, hardware, accessories and other required components.
   3. [Include color charts for finish indicating manufacturer's standard colors available for selection.]

C. Shop Drawings:
   1. Submit shop drawings covering fabrication, installation and finish of specified systems.
   2. Include following:
      a. Fully dimensioned plans and elevations with detail coordination keys.
      b. Locations of exposed fasteners and joints.
   3. Provide detailed drawings of:
      a. Composite members.
      b. Joint connections for framing systems and for entrance doors.
      c. Anchorage.
      d. System reinforcements.
      e. Expansion and contraction provisions.

f. Hardware, including locations, mounting heights, reinforcements and special installation provisions.
g. Glazing methods and accessories.
h. Internal sealant requirements as recommended by sealant manufacturer.

4. Schedule of finishes.

D. Samples:
1. Submit samples indicating quality of finish, in required colors, on alloys used for work, in sizes as standard with manufacturer.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.

E. Test Reports:
1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of re-testing. Include other supportive data as necessary.

F. Certificates:
1. Submit manufacturer's certification stating that systems are in compliance with specified requirements.

G. Qualification Data:
1. Submit installer qualifications verifying years of experience.
2. Include list of projects having similar scope of work identified by Brand name, location, date, references, contact, and phone number.

H. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

Include quality assurance requirements consistent with size and scope of project and extent of work of this section. Edit following article accordingly.

1.5QUALITY ASSURANCE

A. Single Source Responsibility:
1. To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.

B. Installer Qualifications: Certified in writing by Contractor as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

Mock-ups are typically not required, however, depending on scope of work, a mock-up may be desirable; retain and edit following article accordingly. Ensure section 01400 includes details for each mock-up required.

1.6 MOCK-UPS

A. Visual Mock-up: Provide mock-up to demonstrate visual features and workmanship; refer to Section 01400 for requirements.

B. Test Mock-up: Provide mock-up for laboratory testing; refer to Section 01 40 00 for requirements. Architect shall have approved sample mock prior to construction of test mock-up.

1.7DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

Contractor's statutory one-year warranty may be sufficient and following article can be deleted. U.S. Aluminum offers, at no additional cost, a 2 year warranty on products and materials. When special coatings, insulating glass, or high quality applications are specified or owner has requested an extended warranty, retain following article. Edit article commensurate with project conditions and/or owner's instructions.

1.8WARRANTY

A. Provide warranties in accordance with Section 01 77 00.

B. Provide written manufacturer's warranty, executed by company official, warranting against defects in materials and products for 2 years from date of Substantial Completion.

C. [Provide written installer's warranty, warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design,

and agreeing to replace components that fail within [2] [__] years from ship date.

1. Warranty shall cover following:
    a. Complete watertight and airtight system installation within specified tolerances.
    b. Completed installation will remain free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
    c. System is structurally sound and free from distortion.
    d. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement.
    e. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

Delete paragraph below if high performance fluoropolymer finish is not used.

D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 2 years from date of Substantial Completion and agreeing to promptly correct defects.

Delete paragraph below if thermal barrier framing system is not used.
A 2-year warranty is offered by U.S. Aluminum exclusively.

E. Provide a written thermal integrity warranty for 2 years from ship date against thermal barrier system failure resulting from the following:
    1. Longitudinal and transverse thermal barrier shrinkage.
    2. Thermal barrier cracking.
    3. Structural failure of the thermal barrier material.
    4. Loss of adhesion or loss of prescribed edge pressure on glazing material resulting in excessive air and water infiltration.

PART 2 - PRODUCTS

2.1MANUFACTURERS AND PRODUCTS

In this article, list the manufacturers acceptable for this project.

A. Subject to compliance with requirements indicated, provide products by one of the following:

1. **U.S. Aluminum**
    2450 E. Vernon Ave Los Angeles, California 90058-1802
    Toll Free Phone: (800) 262-5151 Phone: (323) 268-4230
    Toll Free Fax: (866) 262-3299
    Email: usalum@crlaurence.com

www.usalum.com

B. Substitutions: Submit under provisions of Section 01 60 00, a minimum of 10 days prior to bid date.

Edit the following paragraphs for appropriate system in each category and delete remaining. Refer to U.S. Aluminum technical literature for additional information.

When specifying manufacturer's standard product or manufacturer's standard product with modifications, describe using manufacturer's name and model numbers.

C. Acceptable Entrance Doors:

1. Standard Duty Doors: Series [250] [400] [550] available for panic devices or standard locking hardware consult factory for options available.
2. Heavy Duty Doors: Series [800] [850] Durafront, available for panic or standard locking hardware, consult factory for options available.
3. All doors provided with Life-Time Warranty on Door Corner Construction.

U.S. Aluminum offers a variety of systems as follows (all doors can accommodate 1/4 inch [6 mm] and 1 inch [25 mm] glazing):

Standard duty doors have 0.125 inch (3 mm) wall thickness; 1-3/4 inch (44 mm) deep in three frame widths:

SERIES	STILES	TOP RAIL	BOTTOM RAIL	GLAZING INFILL
250 Narrow Stile	2" (50.8)	2-1/8" (54)	3-3/16" (81)	1/4" (6) or 1" (25)
400 Medium Stile	3-1/2" (88.9)	3-3/16" (81)	6-1/2" (165.1)	1/4" (6) or 1" (25)
550 Wide Stile	5" (127)	5-1/2" (139.7)	6-1/2" (165.1)	1/4" (6) or 1" (25)
A.D.A. Bottom Rail Option for Any Series			9-1/2" (241.3)	

Heavy-duty doors have 0.188 inch (5 mm) wall thickness; 1-7/8 inches (48 mm) deep for 1/4 inch (6 mm) glazing and 1-7/8 inches (48 mm) deep for 1 inch (25 mm) insulated glazing, in two frame widths:

SERIES	STILES	TOP RAIL	BOTTOM RAIL	GLAZING INFILL
800 Medium Stile	3-1/2" (88.9)	3-11/32" (84.9)	6-1/2" (165.1)	1/4" (6) or 1" (25)
850 Wide Stile	5" (127)	5-1/2" (139.7)	6-1/2" (165.1)	1/4" (6) or 1" (25)
A.D.A. Bottom Rail Option for Either Series			9-1/2" (241.3)	

NOTE: Both standard and heavy-duty systems are available for panic device or standard locking hardware, and 9-1/2 inch tall bottom rails to meet A.D.A. requirements.

D. Acceptable Storefront Framing Systems:

U.S. Aluminum Storefront Framing Systems included in this section are as follows:

1. Framing System: Series [400] [450] [451] [IT451] [400-S] [450-S] [451-S] [FF450] [FF451] [FT451] [FF600] [FF601] [FT601]
   All Storefront Systems must be provided with ***E.P.D.M. Top Load Gasketing.***

Center Glazed Systems feature screw race joinery and panel type installation.

SERIES	FACE WIDTH	DEPTH	GLAZING INFILLS	GLAZING METHOD
400	1-3/4" (44.5)	4" (101.6)	1/4" (6) or 3/8" (10)	Exterior/Interior
450	1-3/4" (44.5)	4-1/2" (114.3)	1/4" (6) or 3/8" (10)	
451	2" (50.8)	4-1/2" (114.3)	1" (25)	

SERIES	WIDTH	DEPTH	GLAZING INFILLS	APPLICATION
IT451 IT451-S	2" (50.8)	4-1/2" (114.3)	1" (25)	Storefronts in Geographic Areas Requiring Thermal Performance

Center Glazed "Stack" Systems feature continuous head and sill channels allowing vertical and horizontal inserts to be stacked into the channels.

SERIES	FACE WIDTH	HEAD/SILL DEPTH	GLAZING INFILLS	GLAZING METHOD
400-S	1-3/4" (44.5)	4-1/4" (108)	1/4" (6) or 3/8" (10)	Exterior/Interior
450-S	1-3/4" (44.5)	4-3/4" (120.7)	1/4" (6) or 3/8" (10)	
451-S	2" (50.8)	4-3/4" (120.7)	1" (25)	

SERIES	FACE WIDTH	DEPTH	GLAZING INFILL	GLAZING METHOD
FF450	1-3/4" (44.5)	4-1/2" (114.3)	1/4" (6) or 3/8" (10)	Exterior/Interior
FF451	2" (50.8)	4-1/2" (114.3)	1" (25)	
FF600	1-3/4" (44.5)	6" (152.4)	1/4" (6) or 3/8" (10)	
FF601	2" (50.8)	6" (152.4)	1" (25)	

SERIES	FACE WIDTH	DEPTH	GLAZING INFILL	GLAZING METHOD
FT451	2" (50.8)	4-1/2" (114.3)	1" (25)	Exterior/Interior
FT601		6" (152.4)		

Flush Front features screw race joinery and panel type installation with the glass being front set which offers the designer to move the glass line from the outer edge to the inner edge or alternating the glass line from bay to bay creating a custom look.

Series IT451, FT451 and FT601 utilize the Poly-Aluminizer and Lancer™ Thermal Break Technology which comes with a two year warranty.

2.2FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
   1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H34 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
   1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
   2. Shapes and sizes to suit installation.
   3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.]

C. Anchorage Devices:
   1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.

D. Fasteners:
   1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.
   2. Do not use exposed fasteners, except where unavoidable for application of hardware.
   3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
   4. For concealed locations, provide manufacturer's standard fasteners.
   5. Provide nuts, washers of design having means to prevent disengagement;

deforming of fastener threads is unacceptable.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil (0.77 mm) thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Glazing Gaskets:
1. Compression type design, replaceable, molded or extruded, of neoprene or ethylene propylene diene monomer (EPDM).
2. Conform to ASTM C509 or C864.
3. Profile and hardness as required to maintain uniform pressure for watertight seal.
4. Provide in manufacturer's standard black color.

H. Weatherstripping:
1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

I. Internal Sealants: Types recommended by sealant manufacturer.

J. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.

K. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.

2.3GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08 81 00.

Entrance manufacturer's standard hardware should be specified here and all other non-standard hardware can be specified here or in section 08710 – Careful consideration as all Door hardware should be given installed by door manufacturer. Coordinate requirements.

List each item of hardware to be furnished. Describe each item by giving manufacturer's name, catalog number, size, finish and special features. Add, delete and edit as required.

2.4DOOR HARDWARE

A. Hardware Items:

1. Pivot hinges: [Offset type [with intermediate]] [Center hung type].
2. Butt hinges: [_____].
3. Concealed overhead closers: [_____].
4. Surface closers: [_____].
5. Push bar: [_____].
6. Pulls: [_____].
7. Panic devices: [Mid-panel panic device] [_____].
8. Deadlocks: [_____].
9. Deadlatch: [_____].
10. Cylinders: Specified in Section 08710.
11. Electric strikes: [_____].
12. Flush bolts: [_____].
13. Coordinators: [_____].
14. Door holders: [_____].
15. Stops: [_____].
16. Kickplates: [_____].
17. Thresholds: [_____].
18. Weatherstripping: Manufacturer's standard.

Create a hardware set for each door. List each item of hardware to be used on a specific door to form a hardware set. List item by title and quantity required per opening. Each set shall list door openings to which set is applicable. Following hardware set is an example. Edit as necessary and create additional sets as required by project conditions.

B. Hardware Set 1, each single door shall have:
   1. Offset pivots.
   2. 1 each deadlock.
   3. 1 each closer.
   4. 1 set push/pull bars.
   5. 1 each stop.
   6. 1 each threshold.

2.5FABRICATION

A. Coordination of Fabrication:
   1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
   2. Fabricate units to withstand loads that will be applied when system is in place.

B. General:
   1. Conceal fasteners wherever possible.
   2. Reinforce work as necessary for performance requirements and for support to structure.
   3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators that will prevent contact and corrosion.

4. Comply with Section 08 81 00 for glazing requirements.

Glazing is normally done after system has been erected and done from inside or outside. Large plates of glass can normally be glazed most readily from outside. Headroom and space often make it impossible to glaze from inside. Glass replacement must also be considered. Edit item below for inside or outside glazing.

C. Aluminum Framing:
   1. Supply size of members, shape, and profile designed to provide for glazing from [exterior] [interior].
   2. Fabricate frame assemblies with joints straight and tight fitting.
   3. Reinforce internally with structural members as necessary to support design loads.
   4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
   5. Seal horizontals and direct moisture accumulation to exterior.
   6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
   7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
   8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.
   9. Provide tight fitting, injection molded, water deflectors at all intermediate horizontals.

D. Entrance Doors:
   1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
   2. Provide extruded aluminum glazing stops of [square] [beveled and mitered (for single glazing only)] design, [permanently anchored on security side and removable on opposite side.]

E. Hardware:
   1. Receive hardware supplied in accordance with Section 08 71 00 and install in accordance with requirements of this Section.
   2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
   3. Comply with hardware manufacturer's templates and instructions.
   4. Use concealed fasteners wherever possible.

F. Welding:
   1. Comply with recommendations of the American Welding Society.

2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

G. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

Select and edit following items for appropriate finish; delete inapplicable types. U.S. Aluminum offers, at no additional cost, a 2 year warranty on either of the painted finishes below.

2.6FINISH

A. Organic Coating (high performance DURANAR):
1. Comply with requirements of AAMA 2605.2-92.
2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.2 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
3. Finish coat of [70 percent] minimum fluoropolymer resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil (0.25 mm) minimum dry film thickness.
4. Acceptable manufacturer's coatings: PPG Industries Inc.
5. Provide either 2, 3, or 4 coat system as required for color selected.
6. [Custom colors as selected by Architect.]

***** OR *****

7. [Manufacturer's standard colors as selected by Architect.]

***** OR *****

B. Clear Anodized:
1. Conforming to AA-M12C22A31 and AAMA 607.1.
2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil (0.010 mm) minimum thickness.

***** OR *****

Note: AA class 44 is a type I coating and is 0.7 mil (0.018 mm) thick. AA Class 34 is a type II coating and is 0.4mil (0.010 mm) thick. U.S. Aluminum offers, at no additional cost, a two-year warranty on either of the finishes below.

C. [Color Anodized:
1. Conforming to AA-M12C22A [34] [44] and AAMA 608.1.

2. Architectural Class [II] [I], etched, medium matte, [black] [dark bronze] [medium bronze] [light bronze] colored anodic coating, [0.4] [0.7] mil ([0.010] [0.018] mm) minimum thickness.]

PART 3 - EXECUTION

3.1EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 40 00.
B. Verify dimensions, tolerances and method of attachment with other Work.

3.2INSTALLATION

A. Erection Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch (3 mm) in 10 feet (3 M) vertically.
      b. 1/8 inch (3 mm) in 20 feet (6 M) horizontally.
   2. Limit variations from theoretical locations: 1/4 inch (6 mm) for any member at any location.
   3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch (2 mm) from flush surfaces not more than 2 inches (51 mm) apart or out-of-flush by more than 1/4 inch (6 mm).
B. Install doors and hardware in accordance with manufacturer's printed instructions.
C. Set units plumb, level and true to line, without warp or rack of frame.
D. Anchor securely in place, allowing for required movement, including expansion and contraction.
E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or pre-formed separators to prevent contact and corrosion.
F. Seal perimeter members as shown on manufacturer’s installation instructions or as required for unique job conditions. Set other members with internal sealants and baffles as called for in manufacturer’s installation instructions. Use sealants as recommended by sealant manufacturer.
G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.
H. Glazing: Refer to requirements of Section 08 81 00. Utilize "anti-walk" edge blocking on all vertical edges of glazing.

3.3ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.4CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

Retail Space Finish Roof Materials

Manufacturer: Henry *(Low Cost)*

Material: Green Roof System (790-11 Hot Rubberized Asphalt)

Location: Retail Space Roof

Key Features Include:

- Seamless application provides monolithic waterproofing.
- Bridges non-working cracks up to 1/16” in width.
- Conforms to surface irregularities.
- Full adhesion to deck restricts lateral water movement.
- 100% solids provides immediate cure on cooling.

Estimated SF Needed: 3,600 sf

Cost: $18/sf ($18)(3,600sf)=$64,800

EFFECTIVE OCTOBER 30, 2020 AND SUPERSEDES ALL PREVIOUS VERSIONS.

****

SPEC NOTE: **Henry® Vegetative Roofing for 790-11 or 790-11EV Hot Applied Rubberized Asphalt Waterproofing/Roofing System.** This specification is ideally suited for the protection and waterproofing of roofs and decks where vegetative overburden is anticipated.

SPEC NOTE: Henry 790-11 hot rubberized asphalt waterproofing/roofing system is certified by FM approval when installed per FM approved tested criteria. Buildings requiring a FM approved Henry 790-11 assembly must refer to the FM RoofNav Assembly Number: 397437-397438-0 for authorized assembly components and utilize the Henry 790-11 FM specific guide specification.

SPEC NOTE: This guide specification is a reference for recommended installation procedures of the products/assembly described; formatted in accordance with the Construction Specifications Institute (CSI) Manual of Practice. It is the discretion of the project specification author to use the information within as a whole, or in part, to set a minimum standard of performance. Update "[project specific]" notes and coordinate as required. Use of General Contractor/installing Subcontractor identified accordingly; modify as required.

SPEC NOTE: This document includes Henry Company notes to assist the architect/specification writer. A Henry Company "SPEC NOTE" will always immediately precede the text to which it is referring. The section serves as a guideline; modify to meet specific project requirements.

SPEC NOTE: Delete "SPEC NOTE" sections in the final copy of the specification.

SPEC NOTE: This spec is for new construction projects located in the continental US. For remedial and construction additions or projects located in Alaska, Hawaii, Puerto Rico, and non-US locations contact Henry Company technical services at (800) 486-1278.

SPEC NOTE: Contact Henry Company technical services at (800) 486-1278 for hurricane speed winds or Miami Dade installation requirements.

****

SECTION 07 55 63
VEGETATED PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.01. GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions, Instructions to Bidders, and Division 01-General Requirements shall be read in conjunction with and govern this section.

B. Read this Specification as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the installing Subcontractor the extent of their Work.

1.02. SUMMARY

A. This Section includes requirements for supplying labor, materials, tools, and equipment to complete the Work as shown on the Drawings Architectural Division and as specified herein including, but not limited to, the following:
   1. Primer
   2. Flashing
   3. Reinforced Hot Rubberized Asphalt Waterproofing Membrane
   4. Protection Course/Separation Sheet
   5. Root Barrier
   6. Drainage Composite (Optional)
   7. Insulation

8. Water Retention and Drainage Composite
9. Moisture Retention Fabric (Optional)
10. Filter Fabric
11. Metal Edging
12. Drain Inspection Chambers
13. Growing Media
14. Erosion Control (Optional)
15. Vegetation
16. Paver Ballast (Optional)

****
SPEC NOTE: Coordination of terminations, transitions, and penetrations are pertinent to ensure chemical compatibility and adhesion of adjacent products. Edit the following related sections as required to specify a continuous air and watertight building envelope. Contact manufacturer(s) where products transition from one assembly to another to confirm minimum installation requirements for warranty issuance.
****

1.03. RELATED REQUIREMENTS

A. DIVISION 03 – Concrete, Section 03 50 00 – Cast Roof Decks
1. Coordination of this section is necessary to facilitate the successful installation of the waterproofing membrane. Refer to Sections 3.01 Examination and 3.02 Preparation for additional information.
2. Acceptable substrates:
a. Form Release Agents: Submit technical data sheet to Henry® Company technical services for formal review.
b. Curing compounds: Submit technical data sheet to Henry Company technical services for formal review.
c. Cast-in-Place/Precast Structural Concrete/Composite Deck:
1. Strength/density:
a. Minimum 2,500 psi (17 mPa) compressive strength and minimum 115 pcf (1842 kg/m3) density
2. Finish:
a. Broom, wood-float, or wood-troweled equivalent finish.
3. Concrete Hydration (Cure):
a. Method of Cure: Water cure, wet coverings, paper sheets, plastic sheets or approved liquid curing compound (sodium silicate preferred).
b. Duration of Cure/Dry:
1. Recommend 28 days, minimum 14 days, after concrete form removal.
d. Lightweight Insulating Concrete:
1. Not an acceptable substrate.
e. Lightweight Structural Concrete:
1. Metal pan decks should be venting type.
2. Contact Henry Company technical services if metal pan deck is not venting type.
3. Strength/density:
a. Minimum 2,500 psi (17mPa) compressive strength and minimum 115 pcf (1842 kg/m3) density
4. Finish:
a. Broom, wood-float, or wood-troweled equivalent finish.
5. Concrete Hydration (Cure):
a. Method of Cure: Water cure, wet coverings, paper sheets, plastic sheets or approved liquid curing compound (sodium silicate preferred).
b. Duration of Cure/Dry:
1. Recommend 60 days, minimum 28 days, after concrete form removal.

****
SPEC NOTE: Metal pan decks should be venting type due to moisture trapping potential. Coordinate metal decking section as required and contact Henry Company technical services at (800) 486-1278 for further assistance.
****

B. DIVISION 05 – Metals, Section 05 30 00 – Metal Decking
   1. Acceptable Substrates:
      a. Metal Deck
         1. Vented metal deck

C. DIVISION 06 – Wood, Plastics, and Composites, Section 06 16 00 – Sheathing
   1. Acceptable Substrates:
      a. Sheathing over [metal decking] [steel decking]
         1. Gypsum roof board:
            a. Thickness: 5/8” (15.9 mm) minimum
         2. Plywood:
            a. Thickness: 1/2” (12 mm) minimum
            b. Tongue and groove joints: required
            c. Free of chemicals that may affect membrane adhesion.

D. DIVISION 07 – Flashing and Sheet Metal, Section 07 62 00 – Sheet Metal Flashing and Trim

E. DIVISION 07 – Thermal and Moisture Protection, Section 07 22 16 – Roof Board Insulation

F. DIVISION 07 – Thermal and Moisture Protection, Section 07 92 00 – Joint Sealants

G. DIVISION 22 – Plumbing, Section 22 14 00 – Facility Storm Drainage

H. DIVISION 32 – Exterior Improvements, Section 32 80 00 – Irrigation

I. DIVISION 32 – Exterior Improvements, Section 32 90 00 – Planting

****
SPEC NOTE: Projects not referencing LEED delete Sections “1.03. J” and “1.06.H” as stated below.
****

J. DIVISION – Project Specific # - LEED Requirements [Section Project Specific #] – Project Specific Title.

1.04. ALTERNATES

A. Submit requests for alternates in accordance with Section [project specific].

B. Vegetative Roofing must meet the following standards:
   1. A single source manufacturer must warrant vegetative roofing components.
   2. Hot Rubberized Asphalt Waterproofing:
      a. UL/ULC: Class A Classification for use in Ballasted Systems.
      b. Meets ASTM D5329; chemically resistant to water, calcium, chloride, salt, mild acid, alkaline solutions, fertilizer, and animal waste.
      c. CAN/CGSB-37.50-M89, Standard for Asphalt, Rubberized, Hot Applied, for Roofing and Water-proofing
      d. FM Approval Certification 4470

C. Alternate submission format to include:

1. Evidence that alternate materials meet or exceed performance characteristics of product requirements and documentation from an approved independent testing laboratory certifying that the performance of the system including auxiliary components exceed the requirements of the local building code.
2. References clearly indicating that the Vegetative Roofing Manufacturer has successfully completed projects of similar scope and nature on an annual basis for a minimum of ten (10) years.
3. Vegetative Roofing Manufacturer's complete set of technical data sheets for assembly.

D. Submit requests for alternates to this specification a minimum of ten (10) working days prior to bid date. Include a list of twenty-five (25) projects executed over the past five (5) years.

E. Issued addendums confirm acceptable alternates. Do not submit substitute materials after tender closing.

1.05. DEFINITIONS

A. Vegetated Roofing – Vegetation/landscaping installed over a waterproofed substrate separated from the ground surface by a manufactured structure.

B. Extensive Vegetative Roofing – Low maintenance landscaping consisting of shallow growing media depths (< 6 inches (152 mm)) with plant varieties restricted to primarily mosses, herbs and succulents capable of withstanding harsh growing conditions.

C. Intensive Vegetative Roofing – Regular maintenance landscaping, consisting of deeper growing media depths (> 6 inches (152 mm)) with a variety of feasible plant species including shrubs and small trees.

D. Vegetative Roofing – Complete system consisting of, but not limited to, the following components supplied for the installation of vegetative roofing over Henry 790-11/790-11EV hot rubberized asphalt:
1. Root barrier, aeration, drainage, insulation, water retention, filter fabric, growing media, and vegetation.

E. Steep Slope Vegetated Roofing – sloped substrates exceeding 3:12 pitch.

1.06. REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D41M-11: Asphalt Primer used in Roofing, Dampproofing, and Waterproofing.
2. ASTM D92-12: Standard Test Method for Flash and Fire Points by Cleveland Open Cup
3. ASTM D3407: Standard Test Method for Joint Sealants, Hot Poured, for Concrete and Asphalt Pavements.
4. ASTM D5329-09: Standard Test Method for Sealants and Fillers, Hot-Applied for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.
5. ASTM E96: Water Vapor Transmission of Materials
6. ASTM E2397–11 - Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems.
7. ASTM E2399–11 - Standard Test Method for Maximum Media Density for Dead Load Analysis of Vegetative (Green) Roof Systems.
8. ASTM E2400–06 - Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems.

B. ANSI/SPRI
1. VF- 1 External Fire Design Standard for Vegetative Roofs.

2. RP-14 Wind Design Standard for Vegetative Roofing Systems.

C. Canadian General Standards Board (CGSB):
1. CAN/CGSB-37.50-M89, Standard for Asphalt, Rubberized, Hot Applied, for Roofing and Water-proofing
2. CAN/CGSB-37.51M90, Application for Hot-Applied Rubberized Asphalt, for Roofing and Waterproofing
3. CAN/CGSB-37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing.
4. CAN/CGSB-37-GP-9MA, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing

D. Factory Mutual (FM):
1. Approval Standard for Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction (Class Number 4470)

E. Underwriters Laboratories (UL):
1. UL/ULC: Class A Classification for use in Ballasted Systems

F. US Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED):
1. LEED Reference Guide, Version 4.0, and USGBC Project Calculation Spreadsheet. Web Site http://www.usgbc.org.

1.07. ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meetings:
1. When required, and with prior notice, a Vegetative Roofing Manufacturer representative will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the assembly.

****
SPEC NOTE: Observe Gold Seal Warranted installations as described below. Material and System Warranties do not require installation observations. Delete sections not applicable to project specific conditions.
****

B. Installation Observations:
1. Onsite installation observations include the following phases:
a. Waterproofing membrane installation start
b. Prior to overburden installation
c. Plant installation

1.08. SUBMITTALS

A. Provide the following requested information in accordance with Section [project specific] Submittal Procedures.

B. Action Submittals:
1. Product Data:
a. Vegetative Roofing Manufacturer's guide specification.
b. Vegetative Roofing Manufacturer's complete set of technical data sheets for assembly.
c. Vegetative Roofing Manufacturer's complete set of standard details.
d. Evidence that the waterproofing assembly meets the following standards:
1. CAN/CGSB-37.50-M89
2. UL/ULC: Class A Classification for use in Ballasted Systems

2. Certificates:
    a. Product certification stating that assembly components are supplied and warranted by a single source Vegetative Roofing Manufacturer.
    b. Statement that installing Subcontractor is authorized by Vegetative Roofing Manufacturer to complete Work as specified.
    c. Copy of Vegetative Roofing Manufacturer's current ISO Certifications
3. Warranty:
    a. Warranty and verification documents as required by the Vegetative Roofing Manufacturer.
        1. Sample warranty
4. Shop Drawings:
    a. Subcontractor to provide documentation indicating vegetative roofing layout to confirm design intent and indicate where Vegetative Roofing Manufacturer typical details apply.

****
SPEC NOTE: Mock-ups establish quality of Work for the materials indicated in this Section. Delete the following paragraph if the scope of work in this Section is minimal and a mock-up is not required.
****

1.09. MOCK-UPS

A. Mock-ups:
    1. Where directed by [engineer] [architect] [consultant] construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution in accordance with Section [project specific].

1.10. QUALITY ASSURANCE

A. Single Source Responsibility:
    1. Obtain vegetative roofing and auxiliary materials including waterproofing, flashings, fabric reinforcement, sealants, adhesives, and overburden as authorized from a Vegetative Roofing Manufacturer regularly engaged in the manufacturing and supply of the specified products.
    2. Verify product compliance with federal, state, and local regulations.

B. Manufacturer Qualifications:
    1. Vegetative Roofing Manufacturer shall demonstrate qualifications to supply materials of this section by certifying the following:
        a. Vegetative Roofing Manufacturer must not issue warranties for terms longer than they have been manufacturing and supplying specified products for similar scope of Work.

C. Installer Qualifications:
    1. Waterproofing installing Subcontractor:
        a. Only authorized Subcontractor(s) shall install the vegetative roofing.
        b. Perform Work in accordance with the Vegetative Roofing Manufacturer's published literature and as specified in this section.
        c. Maintain one (1) copy of the Vegetative Roofing Manufacturer's instructions on site.
        d. Allow the Vegetative Roofing Manufacturer representative site access during installation.
        e. Contact the Vegetative Roofing Manufacturer a minimum of two weeks prior to scheduling a meeting.

1.11. DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver materials to the jobsite in undamaged and clearly marked containers and/or wrapping indicating the name of the Vegetative Roofing Manufacturer and product.

B. Storage of Materials:
1. Store materials as recommended by the Vegetative Roofing Manufacturer and conform to applicable safety regulatory agencies. Refer to all applicable data including, but not limited to, SDS sheets, Product Data sheets, product labels, and specific instructions for personal protection.
2. Keep solvents away from open flame or excessive heat.
3. Store rolled materials on end.
4. Product requirements may vary. Refer to Vegetative Roofing Manufacturer's published literature.

C. Handling:
1. Product requirements may vary. Refer to Vegetative Roofing Manufacturer's published literature.

1.12. SITE CONDITIONS

A. Environmental Requirements:
1. Do not perform Work during rain or inclement weather.
2. Do not perform Work on frost covered substrates or surfaces that are wet to touch.
3. Product requirements may vary. Refer to Vegetative Roofing Manufacturer's published literature.

B. Protection:
1. It is the responsibility of the installing Subcontractor to protect all surfaces not included in scope of Work from damage.
2. It is the responsibility of the General Contractor to organize and protect installed waterproofing components from damage by other trades.
a. Temporary protection:
1. Protect waterproofing membrane to prevent damage from work of other trades, foreign materials, and exposure to oil or solvents until permanent protection provided.

C. Complete preparation Work prior to installing the vegetative roofing.

D. Ground all electrical equipment during operations.

1.13. WARRANTY

A. Single Source Warranty:
1. Installing Subcontractor Warranty:
a. Installing Subcontractor must warrant the system and installation. Provide material and labor costs for repair for a period of two years from the date of installation completion as a result of any of the following:
1. Faulty workmanship

****
SPEC NOTE: Henry Company offers two (2) warranty configurations. Select one (1) of the following warranty terms and desired warranty durations. Delete sections not applicable to project specific conditions.
****

2. Manufacturer's Single Source Warranty:
a. System warranty:
1. Installing Subcontractor must be an authorized subcontractor.

2. Manufacturer must warrant the system and installation. Provide material and labor costs for repair for a period of [five (5)] [ten (10)] [fifteen (15)] [twenty (20) years from the date of installation completion as a result of any of the following:
    a. Manufacturing product defect
3. Insulation shall retain a minimum of eighty percent (80%) of its thermal value for the duration of the insulation warranty.
4. Pavers shall not split, crack or disintegrate prematurely due to freeze-thaw cycling for the duration of the paver warranty.

b. Gold Seal warranty:
1. Installing Subcontractor must be a Gold Seal Authorized Subcontractor.
2. Manufacturer must warrant the system and installation. Provide material and labor costs for repair for a period of [five (5)] [ten (10)] [fifteen (15)] [twenty (20) years from the date of installation completion as a result of any of the following:
    a. Manufacturing product defect
    b. Faulty workmanship
3. Insulation shall retain a minimum of eighty percent (80%) of its thermal value for the duration of the insulation warranty.
4. Pavers shall not split, crack or disintegrate prematurely due to freeze-thaw cycling for the duration of the paver warranty.
5. Vegetative survival rate coverage:
    a. One (1) year after installation: Minimum fifty percent (50%)
    b. Two (2) yeas after installation: Minimum eighty percent (80%)

****
SPEC NOTE: Henry Company collaborates with various green roof component suppliers to accommodate project specific designs. Project specific modifications to Henry supplied vegetative roofing materials as described below may vary as needed. Contact Henry Company for alternative solutions and warrantable product substitutions.
****

PART 2 - PRODUCTS

2.01. MANUFACTURERS

A. Acceptable Manufacturers:
1. Henry Company
   999 N. Pacific Coast Highway, Suite 800
   El Segundo, CA 90245
   (800) 486-1278
   www.henry.com

2.02. MATERIALS

A. Obtain vegetative roofing and auxiliary materials as authorized from a Vegetative Roofing Manufacturer regularly engaged in the manufacturing, supply and approval of the specified products to ensure compatibility, warranty, and compliance with the following requirements:
1. Hot applied rubberized asphalt waterproofing/roofing assembly; having the following properties:
    a. Complies with CAN/CGSB-37.50
    b. Meets ASTM D5329; chemically resistant to water, calcium, chloride, salt, mild acid, alkaline solutions, fertilizer, and animal waste.
    c. FM Approval Certification 4470

****
SPEC NOTE: Henry Company supplies two types of hot rubberized asphalt. Warranty duration and performance characteristics remain constant for both 790-11 and 790-11EV, however Henry 790-11EV is comprised of recycled content as listed in the product description below. Delete sections not applicable to project specific conditions.
****

B. Primary Assembly Products:
   1. Hot Applied Rubberized Asphalt Waterproofing/Roofing Membrane; choose from the following:
      a. Hot applied, rubberized asphalt composed of a specially selected blend of refined asphalts, synthetic rubber and mineral stabilizers to promote adhesion, improve low temperature flexibility, and provide a monolithic fully bonded roofing and waterproofing membrane; having the following typical properties:
         1. Basis of Design: Henry 790-11 EV Environmental Grade Hot Applied Rubberized Asphalt Waterproofing/Roofing Membrane
         2. Complies with CAN/CGSB-37.50
         3. Recycled Content: 25%
         4. Chemical Resistance:
            a. Resists water, calcium chloride, salt, mild acids, alkaline solutions, fertilizer, and animal waste
            b. Non-resistant to oil, grease, or solvents
         5. Solids Content: 100%
         6. Flash Point (Open cup): 555 degrees F (291 degrees C)
         7. Flow (1/8" film, 75 degree angle, 5 hours @ 140 degrees F): No Flow
         8. Toughness (CAN/CGSB-37.50): 16.0J
         9. Ratio of Toughness to Peak Load (CAN/CGSB-37.50): 0.05
         10. Water Absorption (CAN/CGSB-37.50): +0.10 g
         11. Low Temperature Flexibility and Adhesion @ Minus 13ºF (CAN/CGSB-37.50):
            a. No cracking
            b. No loss of adhesion
            c. No delamination
         12. Heat Stability for 5 hours @ 390ºF (CAN/CGSB-37.50):
            a. No loss of adhesion
            b. Meets Flow, Penetration
         13. Crack Bridging Capability:
            a. No cracking
            b. No splitting
         14. Viscosity @ 390 degrees F (CAN/CGSB-37.50): Low temperature flexibility
         15. Resistance to Hydrostatic Pressure
         16. Volatile Organic Content (VOC) (ASTM D3960/EPA Method 24): 0 grams/liter
         17. Water Vapor Permeability (ASTM E96 Procedure E): 0.016 perms
      b. Hot applied, rubberized asphalt composed of a specially selected blend of refined asphalts, synthetic rubber and mineral stabilizers to promote adhesion, improve low temperature flexibility, and provide a monolithic fully bonded roofing and waterproofing membrane; having the following typical properties:
         1. Basis of Design: Henry 790-11 Hot Applied Rubberized Asphalt Waterproofing/Roofing Membrane
         2. Complies with CAN/CGSB-37.50
         3. Chemical Resistance:
            a. Resists water, calcium chloride, salt, mild acids, alkaline solutions, fertilizer, and animal waste
            b. Non-resistant to oil, grease, or solvents
         4. Solids Content: 100%
         5. Flash Point (Open cup): 555 degrees F (291 degrees C)
         6. Flow (1/8" film, 75 degree angle, 5 hours @ 140 degrees F): No Flow
         7. Toughness (CAN/CGSB-37.50): 16.0J

8. Ratio of Toughness to Peak Load (CAN/CGSB-37.50): 0.05
9. Water Absorption (CAN/CGSB-37.50): +0.10 g
10. Low Temperature Flexibility and Adhesion @ Minus 13ºF (CAN/CGSB-37.50):
    a. No cracking
    b. No loss of adhesion
    c. No delamination
11. Heat Stability for 5 hours @ 390ºF (CAN/CGSB-37.50):
    a. No loss of adhesion
    b. Meets Flow, Penetration
12. Crack Bridging Capability:
    a. No cracking
    b. No splitting
13. Viscosity @ 390 degrees F (CAN/CGSB-37.50): Low temperature flexibility
14. Resistance to Hydrostatic Pressure
15. Volatile Organic Content (VOC) (ASTM D3960/EPA Method 24): 0 grams/liter
16. Water Vapor Permeability (ASTM E96 Procedure E): 0.016 perms

****
SPEC NOTE: Henry Company supplies two types of primer for the hot rubberized asphalt waterproofing system. Henry 910 Asphalt Primer achieves significantly improved adhesion; however, Henry 930 Polymer Modified Adhesive is required in OTC States for VOC compliance. Delete sections not applicable to project specific conditions.
****

2. Primer; choose from the following:
    a. Solvent based synthetic rubber adhesive, where VOC compliant, for priming surfaces prior to hot rubberized asphalt application to assure substrate bond:
        1. Basis of Design: Henry 930-18 Polymer Modified Adhesive
    b. Thin penetrating solution of selected asphalt base in a petroleum solvent for priming surfaces prior to hot rubberized asphalt application to assure substrate bond:
        1. Basis of Design: Henry 910-01 Asphalt Primer
3. Polyester fabric reinforcement:
    a. Polyester Fabric unsaturated spun bonded polyester mat reinforcement sheet:
        1. Basis of Design: Henry Polyester Fabric

****
SPEC NOTE: Henry Company offers flashing membrane options for exposed and non-exposed installations. Henry Company recommends the use of Henry 990-25 Henry ModifiedPLUS® NP180, or Pumadeq™ System flashings in place of standard neoprene sheets. Delete sections not applicable to project specific conditions.
****

4. Flashing membranes; choose from the following:
    a. Torch grade flashing; choose from the following:
        1. SBS modified bitumen non-woven polyester reinforced granulated cap sheet with a thermofusible poly lower surface for torch applied installation to substrate specifically designed for indefinite UV exposure:
            a. Basis of Design: Henry ModifiedPLUS® NP180gT4
        2. SBS modified bitumen with a sanded upper surface to receive liquid applied membranes and a thermofusible lower surface for torch applied installation:
            a. Basis of Design: Henry ModifiedPLUS NP180s/p
    b. Mop grade flashing; choose from the following:
        1. SBS modified bitumen non-woven polyester reinforced granulated cap sheet with a sanded lower surface for liquid applied membrane installation to substrate specifically designed for indefinite UV exposure:
            a. Basis of Design: Henry ModifiedPLUS NP180gM4

2. SBS modified bitumen non-woven polyester reinforced membrane with a sanded upper and lower surface for liquid applied membrane installation to substrate not intended for indefinite UV exposure:
    a. Basis of Design: Henry ModifiedPLUS NP180s/s
3. Butyl and EPDM polymer combination flexible flashing membrane specifically designed for enhanced elongation:
    a. Basis of Design: Henry 990-25 Elastomeric Flashing Sheet Unreinforced
4. Uncured neoprene flexible flashing membrane specifically designed for enhanced elongation:
    a. Basis of Design: Henry Neoflash Uncured Neoprene

c. Liquid applied flashing:
1. Polyurethane modified methyl methacrylate (PUMA) reinforced liquid flashing:
    a. Basis of Design: Henry Pumadeq™ System

5. Protection course/separation sheet:
a. SBS modified bitumen glass reinforced membrane with a sanded upper and lower surface for liquid-applied membrane installation not intended for indefinite UV exposure:
    1. Basis of Design: Henry ModifiedPLUS G100s/s
6. Sealant; choose from the following:
a. A one part moisture cure premium silyl-terminated polyether polymer with low VOC and odor providing excellent weathering resistance and flexibility:
    1. Basis of Design: Henry 925 BES Sealant
b. Polymer modified sealing compound used in concealed applications:
    1. Basis of Design: Henry Polybitume 570-05 Polymer Modified Sealing Compound

****
SPEC NOTE: Henry Company offers two root barrier options. Delete sections not applicable to project specific conditions.
****

7. Root Barrier; choose from the following:
a. Polyethylene composite geo-membrane specially designed as a barrier against root penetration in vegetative roofs; having the following typical properties:
    1. Basis of Design: Henry Root Bloc™ 20
b. Polyethylene composite geo-membrane specially designed as a barrier against root penetration in vegetative roofs; having the following typical properties:
    1. Basis of Design: Henry Root Bloc 30

****
SPEC NOTE: Installation of a drainage composite is an optional feature; deletion from the Henry Vegetative Roofing will not negatively affect the warranty duration or terms. Coordinate with Section 3.03 Installation and delete sections not applicable to project specific conditions.
****

8. Drainage Composite (optional); choose from the following:
a. Prefabricated polystyrene or PVC core composite combined with a polypropylene fabric ; choose from the following:
    1. Basis of Design: Henry DB200
        a. AOS: 70 sieve
        b. Compressive strength: 11,000 lbs/ft^2
        c. Flow rate: 12.5 gpm/ft^2
    2. Basis of Design: Henry DB650
        a. AOS: 45 sieve
        b. Compressive strength: 18,000 lbs/ft^2
        c. Flow rate: 21 gpm/ft^2

9. Insulation:
    a. Extruded polystyrene rigid board insulation supplied by Henry Company; choose from the following:
        1. Acceptable Manufacturers:
            a. Owens Corning
            b. DOW
        2. Minimum Thermal Resistance (R-Value): Project specific Minimum R-Value
        3. Cellular Polystyrene Thermal Insulation (ASTM C-578): [Type VI], [Type VII]
        4. Compressive Strength: [40], [60], [100] psi.
        5. Water Absorption (ASTM C272): 0.1%

****
SPEC NOTE: Henry Company offers high and low water retention and drainage composites. All listed offerings meet Henry Company warranty conditions when installed per project specific performance requirements. Coordinate with Section 3.03 Installation and delete sections not applicable to project specific conditions.
****

10. Water Retention and Drainage Composite; choose from the following:
    a. High water storage capacity prefabricated polystyrene or PVC core composite combined with a polypropylene fabric; having the following typical properties:
        1. Basis of Design: Henry DB100
            a. Water storage capacity: 0.11 gal/ ft^2
            b. Compressive strength: 9,000 lbs/ft^2
            c. Flow rate: 21 gpm/ft^2
            d. Thickness: 1 inch
    b. Low water storage capacity prefabricated polystyrene or PVC core composite combined with a polypropylene fabric; having the following typical properties:
        1. Basis of Design: Henry DB50
            a. Water storage capacity: 0.06 gal/ ft^2
            b. Compressive strength: 15,000 lbs/ft^2
            c. Flow rate: 6 gpm/ft^2
            d. Thickness: 0.44 inch
    c. Other as authorized by Henry Company
11. Moisture Retention Fabric (Optional); choose from the following:
    a. Secondary water retention fabric, commonly specified for dry environments, shallow soils and non-irrigated vegetative roofing:
        1. Basis of Design: Henry Moisture Retention Fabric
            a. Moisture retention capacity: 0.12 gallons/ft^2
            b. Flow rate: 75 gpm/ft^2
            c. Recycled content: 100%
    b. Other as authorized by Henry Company
12. Filter Fabric:
    a. Non-woven biodegradable geotextile fabric made up of polypropylene fibers and resistance to most soil chemicals, acids, and alkali with a pH range of 3 to 12:
        1. Basis of Design: Henry Filter Fabric N04
            a. Tensile strength: 90 lbs.
            b. Puncture strength: 55 lbs.
            c. AOS: 70 US sieve
        2. Other as authorized by Henry Company

****
SPEC NOTE: Growing media is evaluated on a project specific basis. Contact Henry technical services for further information on regional selections, availability, and pricing.
****

13. Growing Media:
    a. Light-weight growing media, designed, and specifically blended for regional vegetative roofing applications to be optimized for roof growing conditions:
        1. Acceptable Manufacturers:
            a. Contact Henry for a complete list of local authorized vendors
        2. Thickness: [project specifc see spec note above]

****
SPEC NOTE: Vegetation is evaluated on a project specific basis. Contact Henry technical services for further information on maintenance guidelines, regional selections, availability, and pricing.
****

14. Vegetation:
    a. Custom regionally grown vegetation for use on Vegetative Roofs as designed and specified to meet project specific applications; supplied by Henry Company:
        1. Acceptable Manufacturers:
            a. Contact Henry for a complete list of local authorized vendors
        2. Vegetation type(s): [Sedum Mats/Tiles, Plugs, Sedum Cuttings]

C. Assembly Auxiliary Materials:
1. Metal edging:
    a. Custom metal accessories available in aluminum and stainless steel at a variety of thicknesses and sized to suit project specific requirements; supplied by Henry Company:
        1. Basis of Design: Metal Edging
2. Drain Inspection Chambers:
    a. Custom metal accessories available in aluminum and stainless steel at a variety of thicknesses and sized to suit project specific requirements; supplied by Henry Company:
        1. Basis of Design: Drain Inspection Chambers
3. Paver Systems (Optional):
    a. Paver and pedestal assembly supplied by Henry Company; choose from the following:
        1. Acceptable Manufacturers:
            a. Bison
            b. Hanover
            c. T-Clear
            d. Wausau
            e. Westile
4. Erosion Control (Optional):
    a. Erosion control blanket (ECB) consisting of seed free Great Lakes Aspen curled wood excelsior with 80% six (6) inch minimum fibers; supplied by Henry Company:
        1. Basis of Design: Curlex® Wind Erosion Control

PART 3 - EXECUTION

3.01. EXAMINATION

A. It is the installing Subcontractor's responsibility to verify the substrate is dry and in accordance with Section 1.03 Related Requirements prior to installation of the vegetative roofing. Commencement of the Work or any parts thereof, indicates installer acceptance of the substrate.
1. Verify substrates are in accordance with Vegetative Roofing Manufacturer's published literature and as specified in this Section prior to installation.
2. Substrates must be continuous and secured.
3. Fill spalled areas with appropriate repair mortar to provide an even plane.

4. Remove curing compounds or foreign matter detrimental to the adhesion.

B. The installing Subcontractor must verify the following:
   1. Moisture detection survey:
      a. Visual inspection
      b. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
   2. Adhesion/Pull Test:
      a. Complete a waterproofing adhesion test in accordance with Vegetative Roofing Manufacturer's published literature prior to installation of vegetative roofing.

C. Do not apply vegetative roofing components until substrate and environmental conditions are in accordance with Vegetative Roofing Manufacturer's product specific TDS, and as specified in this Section.

3.02. PREPARATION

A. Surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.

B. Waterproofing Membrane Preparation:
   1. Heat waterproofing membrane in a mechanically agitating melter specifically designed for the preparation of hot rubberized asphalt membranes to a consistent temperature:
      a. Heating temperature: 356 ºF (180 ºC) to 392 ºF (200 ºC)

3.03. INSTALLATION

A. Verify substrate is ready to receive the vegetative roofing in accordance with the Vegetative Roofing Manufacturer's TDS and guide specification.

B. Air and substrate temperature limitations:
   1. Waterproofing:
      a. None
   2. Vegetation:
      a. Do not install vegetation if extended freezing temperatures are anticipated.
      b. Do not install vegetation if extended temperatures of growing media below 50 degrees F (10 degrees C) are anticipated.
      c. For optimal thrive rate potential it is recommended that vegetation be installed between April 1 and November 1 (at northern latitudes) at temperatures between 40 degrees F (4 degrees C) and 95 degrees F (35 degrees C).
      d. Contact Vegetative Roofing Manufacturer where installation of vegetation is anticipated at temperatures outside of the recommended range.

C. Primer:
   1. Apply primer in accordance with Vegetative Roofing Manufacturer's TDS.
   2. Do not over spray primer; excessive and/or ponding primer is not recommended.

D. Detailing/Flashing:
   1. Install detailing and flashings per Vegetative Roofing Manufacturer's details.
   2. Install prefabricated expansion joint assemblies prior to installation of waterproofing.
   3. Set drains at proper deck height and do not impede drainage.
   4. Secure flashing at drain with an integral clamping ring.

E. Installation of Waterproofing Assembly:

1. Install one layer of waterproofing membrane at ninety (90) mils minimum to form a continuous monolithic membrane over horizontal and vertical surfaces.
2. Fully embed polyester fabric into waterproofing membrane.
3. Coat side and end laps of embedded polyester fabric with waterproofing membrane. Overlap of dry polyester fabric is not acceptable.
4. Overlap polyester fabric a minimum of one-quarter (1/4) inch.
5. Apply second layer of waterproofing membrane at one-hundred twenty-five (125) mils minimum to form a continuous monolithic membrane over previously coated areas.
6. Total reinforced waterproofing membrane thickness shall be two-hundred and fifteen (215) mils minimum.

F. Installation of Protection Course:
1. Install protection course in a shingle pattern starting at the low point(s) or drain location(s).
2. Install protection course while waterproofing membrane is partially cured to a warm and tacky consistency.
3. Install protection course in full continuous sheets.
4. Overlap protection course dry adjoining edges approximately two (2) inches.

G. Waterproofing Integrity Test; choose from the following:
1. Electronic Leak Detection (Alternate to Flood Test):
    a. Conduct electronic leak detection upon waterproofing assembly completion and prior to overburden placement.
    b. Contact pre-approved test provider several weeks in advance to coordinate schedule.
    c. In the event of a breach of the membrane, repair and retest the system in accordance with project specifications.
    d. Report results of testing to the [Architect] [Consultant] and Vegetative Roofing Manufacturer. Submit results with the warranty application.
    e. No other Work is to proceed without prior direction from the [Architect] [Consultant].
2. Flood Test:
    a. Conduct flood test upon waterproofing assembly completion prior to overburden placement.
    b. Provide temporary stops and plugs for the roof drain(s) or scupper(s) within the test area.
    c. Flood test with a minimum of two (2) inches of water for no less than twenty-four (24) hours.
    d. In the event of a breach of the membrane, repair, and retest the system for no less than twenty-four (24) hours.
    e. Remove temporary stops and plugs.
    f. Report results of testing to the [Architect] [Consultant] and Vegetative Roofing Manufacturer. Submit results with the warranty application.
    g. No other Work is to proceed without prior direction from the [Architect] [Consultant].

H. Installation of Root Barrier:
1. Install root barrier in a shingle pattern starting at the low point(s) or drain location(s).
2. Loose lay root barrier in full continuous sheets to restrict root penetration.
3. Overlap root barrier adjoining edges approximately twenty-four (24) inches.
4. Provide temporary ballasting over root barrier where required until permanent covering material is installed.

I. Installation of Metal Edging:
1. Confirm root barrier is installed and ready for subsequent installations.
2. Install metal edging in accordance with ASTM E2400 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems.
3. Refer to project specific drawings for specified location and layout.

J. Installation of Drain Inspection Chambers:
   1. Securely install drainage components in accordance with Drainage Unit Manufacturer and ready for subsequent installations.
   2. Confirm root barrier is installed and ready for subsequent installations.
   3. Install drain inspection chamber and cover in accordance with ASTM E2400 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems.
   4. Refer to project specific drawings for specified location and layout.

****
SPEC NOTE: Installation of an aeration and drainage composite is an optional feature; deletion from the Henry Vegetative Roofing will not negatively affect the warranty duration or terms. Coordinate with Section 2.02 Materials and delete sections not applicable to project specific conditions.
****

K. Installation of Drainage Composite:
   1. Loose lay aeration and drainage composite in full continuous sheets to promote water drainage.
   2. Abut adjacent aeration and drainage composite panels overlapping the fabric approximately one (1) inch.
   3. Cut aeration and drainage composite to fit around penetrations and drain(s).
   4. Provide temporary ballasting until installing permanent covering material.

L. Installation of Insulation:
   1. Refer to Insulation Manufacturer's published literature for a complete guide to required installation practices and exposure limitations.
   2. Loose lay insulation in full continuous sheets to provide a continuous thermal resistance layer:
      a. Stagger and firmly abut adjacent insulation.
      b. Stagger board joints between layers.
   3. Cut insulation to fit around penetrations and drain(s).
   4. Provide temporary ballasting until installing permanent covering material.

M. Installation of Water Retention and Drainage Composite:
   1. Loose lay water retention drainage composite in full continuous sheets to promote water drainage.
   2. Abut adjacent drainage composite panels overlapping the fabric approximately one (1) inch.
   3. Cut drainage composite to fit around penetrations and drain(s).
   4. Provide temporary ballasting until installing permanent covering material.

N. Installation of Moisture Retention Fabric:
   1. Install moisture retention fabric in a shingle pattern starting at the low point(s) or drain location(s).
   2. Loose lay moisture retention fabric in full continuous sheets to promote water retention.
   3. Overlap moisture retention fabric edges approximately four (4) inches.
   4. Provide temporary ballasting until permanent covering material is installed.

O. Installation of Filter Fabric:
   1. Install filter fabric in a shingle pattern starting at the low point(s) or drain location(s).
   2. Loose lay filter fabric in full continuous sheets to promote debris obstruction.
   3. Overlap the filter fabric adjoining edges approximately six (6) inches.
   4. Provide temporary ballasting until installing permanent covering material.

P. Installation of Growing Media:
   1. Install growing media taking care to avoid displacement or damage to previously installed vegetative roofing components.

2. Install growing media to a sufficient depth to allow compaction.
3. Growing media compaction; choose from the following:
    a. Final grades equal to or less than eight (8) inches:
        1. Growing media with specified final grades equal to or less than eight (8) inches of growing media require one sequence of equipment compaction.
        2. Loose lay growing media to a level of three-quarters (3/4) final grade.
        3. Using a 300-400 pound landscape roller compact growing media to a smooth surface until 50-60% compaction. Do not use mechanical or plate compactors.
        4. Loose lay and hand compress remaining growing media allowing growing media to exceed the specified final grade by one (1) inch.
    b. Final grades greater than eight (8) inches:
        1. Growing media with specified final grades greater than eight (8) inches of growing media require multiple sequences of installation and compaction.
        2. Loose lay growing media up to six (6) inches.
        3. Using a 300-400 pound landscape roller compact growing media to a smooth surface until 50-60% compaction. Do not use mechanical or plate compactors.
        4. Continue installation and compaction procedures as described above until installed growing media equals approximately two (2) inches less than the specified final grade.
        5. Loose lay remaining growing media allowing growing media to exceed the specified final grade by one (1) inch.
4. Verify final grade of growing media by watering growing media until lightly saturated. Areas where low areas in growing media are observed shall be filled with additional growing media and re-watered until a continuous final grade as specified is achieved.

Q. Installation of Erosion Control:
1. Verify final grade of growing media is ready for subsequent installations.
2. Unroll and install erosion control mat directly over growing media until material is even and smooth. Do not stretch.
3. Abut adjacent erosion control fabrics and secure with erosion control assembly anchors at rate and layout to provide a continuous and secure erosion control layer.

R. Installation of Vegetation:
1. Installation of vegetation shall be in accordance with Vegetative Roofing Manufacturer guidelines.
    a. Refer to Section 3.03.B. Temperature limitations.
    b. Contact Vegetative Roofing Manufacturer for installations outside of recommended environmental conditions.
2. Refer to project specific drawings for vegetation specified location(s) and layout.
3. Vegetation installation requirements are dependent upon vegetation varieties; choose from the following:
    a. Sedum Mats/Tiles
        1. Water growing media until lightly saturated prior to sedum mats/ tiles installation.
        2. Install sedum mats/ tiles onto moistened growing media ensuring smooth continuous contact with growing media.
        3. Abut adjacent sedum mats/tiles to avoid air gaps.

4. Stagger sedum mats/tiles in accordance with Vegetative Roofing Manufacturer's published literature.

b. Plugs
   1. Confirm growing media moisture content is high enough to eliminate dust production upon disturbance prior to plug installation.
      a. Growing media indicating dust production upon disturbance requires watering of growing media until lightly saturated.
   2. Install plugs to a depth where the top of the plug root ball corresponds to the surface of the growing media.
   3. Install plugs at the specified spacing of project/plant specific rate inches on center in staggered rows resembling the number five (5) on a dice.

c. Sedum Cuttings
   1. Confirm growing media moisture content is high enough to eliminate dust production upon disturbance prior to sedum cutting installation.
      a. Growing media indicating dust production upon disturbance requires watering of growing media until lightly saturated.
   2. Hand sow sedum cuttings at a rate of project/plant specific rate pounds per 100 square feet.

4. Water vegetation at end of workday until lightly saturated.

S. Installation of Paver Ballast:
   1. Install paver ballast in accordance with Paver Ballast Manufacturer's published literature.
   2. Install paver ballast ensuring pavers are accurately aligned and leveled with upper surface of pavers in plane with adjacent units.
   3. Cut paver ballast to fit irregularly shaped areas and around protrusions.
   4. Refer to project specific drawings for specified location and layout.

3.04. FIELD QUALITY CONTROL

A. Final Observation and Verification:
   1. [Architect] [Consultant] [General Contractor] and Vegetative Roofing Manufacturer to complete final inspection of vegetative roofing as required by warranty.
   2. Contact Vegetative Roofing Manufacturer for warranty issuance requirements.

3.05. CLEANING

A. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

Manufacturer: Henry *(Medium Cost)*

Material: Green Roof System (Prodeq System)

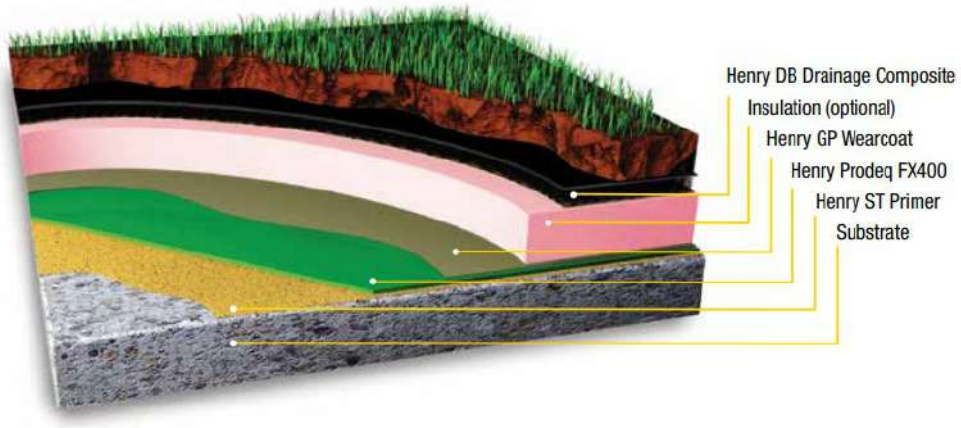
Location: Retail Space Roof

Key Features Include:

- Innovative, instant-setting, spray-applied technology setting, spray applied membrane speeds installation time and can reduce labor costs
- Durable, robust membrane can be directly trafficked by other trades and construction vehicles
- No protection board or root barrier are required, reducing material and labor costs
- Prodeq has zero VOC's and no odor

Estimated SF Needed: 3,600 sf

Cost: $26/sf ($26)(3,600sf)=$93,600



EFFECTIVE SEPTEMBER 25, 2019 AND SUPERSEDES ALL PREVIOUS VERSIONS.

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SPEC NOTE: **Henry® Company Prodeq™ System – for Cold Fluid-Applied Waterproofing.** This specification is ideally suited for protected membrane roof (PMR) assemblies including inverted roof membrane assemblies (IRMA), plaza decks/ terraces with ballast or overburden and requiring an instant setting, spray applied polyurethane hybrid waterproofing. Although prepared in CSI three (3) part format, this specification should be adapted to suit the requirements of the individual project and be included as a separate section under Division 07 - Thermal and Moisture Protection.

SPEC NOTE: This guide specification is a reference for recommended installation procedures of the products/assembly described; formatted in accordance with the Construction Specifications Institute (CSI) Manual of Practice. It is the discretion of the project specification author to use the information within as a whole, or in part, to set a minimum standard of performance. Update "[project specific]" notes and coordinate as required. Use of General Contractor/installing Subcontractor identified accordingly; modify as required.

SPEC NOTE: This document includes Henry Company notes to assist the architect/specification writer. A Henry Company "SPEC NOTE" will always immediately precede the text to which it is referring. The section serves as a guideline; modify to meet specific project requirements.

SPEC NOTE: Delete "SPEC NOTE" sections in the final copy of the specification.

SPEC NOTE: This specification refers to estimated application rates when applied to surface profiles ICRI CSP 3-4. Substrates with surface profiles greater than CSP 4 may require an increased application rate of primer and/or waterproofing membrane.

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SECTION 07 14 16
COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions, Instructions to Bidders, and Division 01-General Requirements shall be read in conjunction with and govern this Section.

B. Read this Specification as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the installing Subcontractor the extent of their Work.

1.02 SUMMARY

A. This Section includes requirements for supplying labor, materials, tools, and equipment to complete the Work as shown on the Drawings Architectural Division as specified herein including, but not limited to, the following:
   1. Primer
   2. Waterproofing Membrane
   3. Wear coat (optional)
   4. Top coat (optional)
   5. Insulation
   6. Drainage composite
   7. Filter fabric
   8. Paver ballast

1.03 RELATED REQUIREMENTS

A. DIVISION 03 – Concrete; Section 03 51 00 – Cast Roof Decks

B. DIVISION 05 – Metals; Section 05 30 00 – [Metal decking] [Steel decking]

C. DIVISION 06 – Wood, Plastics, and Composites; Section 06 16 00 – Sheathing

D. DIVISION 07 – Thermal and Moisture Protection; Section 07 22 16 – Roof Board Insulation

E. DIVISION 07 – Thermal and Moisture Protection; Section 07 27 00 – Air Barriers

F. DIVISION 07 – Thermal and Moisture Protection; Section 07 33 63 – Vegetative Roofing

G. DIVISION 05 – Thermal and Moisture Protection; Section 07 60 00 – Flashing and Sheet Metal

H. DIVISION 07 – Thermal and Moisture Protection; Section 07 70 00 – Roof and Wall Specialties and Accessories

I. DIVISION 07 – Thermal and Moisture Protection; Section 07 90 00 – Joint Protection

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SPEC NOTE: Projects not referencing LEED delete Sections "X.XX" and "X.XX" as stated below.
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J. DIVISION [project specific] - LEED Requirements Section [project specific] – [project specific].

1.04 ALTERNATES

A. Submit requests for alternates in accordance with Section [project specific].

B. Waterproofing system must meet the following standards to be considered an acceptable substitution:
   1. A single source manufacturer must warrant waterproofing system components.
   2. Waterproofing membrane:
      a. Instant Setting, Spray Applied Polyurethane Hybrid Waterproofing
      b. Root barrier (FLL guidelines): Pass, no root barrier required
      c. Rain ready within 1 hour
      d. Foot traffic ready within 1 hour
      e. UV Resistance: Permanent UV exposure
      f. Crack bridging (ASTM C1305): Pass
      g. Complies with ASTM C836

C. Alternate submission format to include:
   1. Documentation from an independent testing laboratory certifying the performance of the system including auxiliary components meet requirements of this specification.
   2. References indicating that the Waterproofing System Manufacturer has successfully completed projects of similar scope and nature on an annual basis for a minimum of ten (10) years.
   3. Product Data:
      a. Waterproofing System Manufacturer's guide specification
      b. Waterproofing System Manufacturer's technical data sheets
      c. Waterproofing System Manufacturer's details
   4. Certificates:
      a. Product certification that the system components are supplied and warranted by single source Waterproofing System Manufacturer
      b. Statement that installing Subcontractor is Gold Seal authorized by Waterproofing System Manufacturer to complete Work as specified
      c. Copy of Waterproofing System Manufacturer's current ISO Certifications
   5. Warranty:
      a. Warranty and verification documents as required by the Waterproofing System Manufacturer.
         1. Sample warranty

D. Submit requests for alternates to this specification a minimum of ten (10) working days prior to bid date. Include a list of ten (10) projects executed over the past five (5) years.

E. Issued addendums confirm acceptable alternates. Do not submit substitute materials after tender closing.

1.05 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C836 – Standard Specification for High Solids Content, Cold-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
2. ASTM C1305 – Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
3. ASTM C1583 – Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
4. ASTM C7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers,
5. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
6. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating
7. ASTM D4259 – Standard Practice for Abrading Concrete
8. ASTM D4261 – Standard Practice for Surface Cleaning Concrete Masonry Units for Coating
9. ASTM D5295 – Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems
10. ASTM F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings

B. US Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED):
1. LEED Reference Guide, Version 4.0, and USGBC Project Calculation Spreadsheet. Web Site http://www.usgbc.org.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meetings:
1. When required, and with prior notice, a Waterproofing System Manufacturer representative will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the system.

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SPEC NOTE: Observe Gold Seal Warranted installations as described below. Delete sections not applicable to project specific conditions.
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B. Installation observations:
1. Onsite installation observations include the following phases:
   a. Substrate verification prior to waterproofing system installation start
   b. Waterproofing system installation start
   c. Waterproofing system waterproofing integrity test

1.07 SUBMITTALS

A. Provide the following requested information in accordance with Section [project specific] Submittal Procedures.

B. Action submittals:
1. Product Data:
   a. Waterproofing System Manufacturer’s guide specification

b. Waterproofing System Manufacturer's technical data sheets
c. Waterproofing System Manufacturer's details

2. Certificates:
   a. Product certification that the system components are supplied and warranted by single source Waterproofing System Manufacturer
   b. Statement that installing Subcontractor is Gold Seal authorized by Waterproofing System Manufacturer to complete Work as specified
   c. Copy of Waterproofing System Manufacturer's current ISO Certifications
3. Warranty:
   a. Warranty and verification documents as required by the Waterproofing System Manufacturer.
      1. Sample warranty
      2. Copy of warranty check list

1.08 QUALITY ASSURANCE

A. Single source responsibility:
   1. Obtain waterproofing and auxiliary materials including primer, flashings, waterproofing, and aggregate from a single Waterproofing System Manufacturer regularly engaged in the manufacturing and supply of the specified products.
   2. Verify product compliance with federal, state, and local regulations.

B. Manufacturer qualifications:
   1. Waterproofing System Manufacturer shall demonstrate qualifications to supply materials of this section by certifying the following:
      a. Waterproofing System Manufacturer must not issue warranties for terms longer than they have been manufacturing/supplying specified products for similar scope of Work.

C. Installer qualifications:
   1. Only authorized Subcontractor(s) shall install the Waterproofing System.
   2. Perform Work in accordance with the Waterproofing System Manufacturer's published literature and as specified in this section.
   3. Maintain one (1) copy of the Waterproofing System Manufacturer's instructions on site.
      a. Waterproofing System Manufacturer's technical bulletins
      b. Waterproofing System Manufacturer's details
      c. Waterproofing System Manufacturer's technical data sheets (TDS).
   4. Allow the Waterproofing System Manufacturer representative site access during installation.
   5. Contact the Waterproofing System Manufacturer a minimum of two weeks prior to scheduling a meeting.

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SPEC NOTE: Create mock-up to establish quality of work where practical. Henry recommends a mock-up to confirm project specific aggregate is in line with Henry minimum requirements and project specific aesthetics. Refer to and coordinate with Section 2.02 Materials. Projects not referencing Mock-Ups delete Section "1.09" as stated below.

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1.09 MOCK-UPS

A. Mock-ups: Construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution in accordance with Section [project specific] for mock-ups and as follows:
   1. Where directed by [engineer] [architect] [consultant], conduct moisture detection survey and install typical waterproofing system, ten (10) feet by ten (10) feet, incorporating waterproofing system, substrate materials, and adjacent materials including surface preparation, crack and joint treatment, waterproofing system application, flashings,

transitions, and terminations.

B. Notify [engineer] [architect] [consultant] a minimum fourteen (14) days prior to mock-up construction.

C. Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless [engineer] [architect] [consultant] specifically notes such deviations in writing.

D. Once reviewed by [engineer] [architect] [consultant], acceptable mock-up can form a permanent part of the Work and will form the basis for acceptance for the remainder of the project.

E. Remove and replace materials found unacceptable at no additional cost to Owner.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery of materials:
1. Deliver materials to the jobsite in undamaged and clearly marked containers and/or wrapping indicating name of the Waterproofing System Manufacturer and product.

B. Storage of materials:
1. Store materials as recommended by the Waterproofing System Manufacturer and conforming to applicable safety regulatory agencies. Refer to applicable data including, but not limited to, Safety Data Sheets (SDS), Technical Data Sheets (TDS), product labels, and specific instructions for personal protection.
2. Keep solvents away from open flame or excessive heat.
3. Store waterproofing system in closed containers.
4. Refer to Waterproofing System Manufacturer's published literature.

C. Handling:
1. Product requirements may vary. Refer to Waterproofing System Manufacturer's published literature.

1.11. SITE CONDITIONS

A. Environmental requirements:
1. Do not perform Work during rain or inclement weather.
2. Do not perform Work on frost covered substrates or surfaces that are not in accordance with Waterproofing System Manufacturer's Tech-Talk Bulletins.

B. Protection:
1. It is the responsibility of the installing Subcontractor to protect all surfaces not included in scope of Work from damage.
2. Secure protective coverings against wind.
3. Seal air intake ventilation equipment with activated carbon filters to prevent fumes from entering building.
4. Provide odor control including, air fans, exhausts, and portable enclosure for mixing station as required.

C. Complete preparation Work prior to installing the waterproofing system.

D. Ground electrical equipment during operation.

1.12. WARRANTY

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SPEC NOTE: Henry Company offers three (3) warranty configurations. Select one (1) of the following warranty terms and desired warranty duration. Delete sections not applicable to project specific conditions.

SPEC NOTE: Longer warranty durations are considered on a case by case basis. Contact Henry for project specific authorization.
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A. Warranty submittals to Waterproofing System Manufacturer:
   1. Contact Henry Company sales representative for a complete list of required documents and procedures prior to material purchase. Warranties submitted without required documents and procedures completed may result in delay or rejection of warranty request.

B. Single source Warranty:
   1. Installing Subcontractor warranty:
      a. Installing Subcontractor must warrant the system and installation. Provide material and labor costs for repair for a period of two years from the date of installation completion as a result of any of the following:
         1. Faulty workmanship
   2. Manufacturer's single source warranty:
      a. Material warranty:
         1. Installing Subcontractor must be an authorized subcontractor.
         2. Manufacturer must warrant the material against product defect for a period of [five (5)] [ten (10)] [fifteen (15)] [twenty (20)] years from date of purchase.
      b. System warranty:
         1. Installing Subcontractor must be an authorized subcontractor.
         2. Manufacturer must warrant the system and installation. Provide material and labor costs for repair for a period of [five (5)] [ten (10)] [fifteen (15)] [twenty (20)] years from the date of installation completion as a result of any of the following:
            a. Manufacturing product defect
         3. Insulation shall retain a minimum of eighty percent (80%) of its thermal value for the duration of the insulation warranty.
         4. Pavers shall not split, crack or disintegrate prematurely due to freeze-thaw cycling for the duration of the paver warranty.
      c. Gold Seal warranty:
         1. Installing Subcontractor must be a Gold Seal Authorized Subcontractor.
         2. Manufacturer must warrant the system and installation. Provide material and labor costs for repair for a period of [five (5)] [ten (10)] [fifteen (15)] [twenty (20)] years from the date of installation completion as a result of any of the following:
            a. Manufacturing product defect
            b. Faulty workmanship
         3. Insulation shall retain a minimum of eighty percent (80%) of its thermal value for the duration of the insulation warranty.
         4. Pavers shall not split, crack or disintegrate prematurely due to freeze-thaw cycling for the duration of the paver warranty.

PART 2 - PRODUCTS

2.01. MANUFACTURERS

A. Acceptable manufacturers:
1. Henry Company
999 N. Pacific Coast Highway, Suite 800
El Segundo, CA 90245
(800) 486-1278
www.Henry.com

2.02. MATERIALS

A. Obtain waterproofing and auxiliary materials as a single-source from the Waterproofing System Manufacturer to ensure compatibility and compliance with the following requirements:
1. Waterproofing system; having the following typical properties:
a. Instant Setting, Spray Applied Polyurethane Hybrid Waterproofing
b. Root barrier (FLL guidelines): Pass, no root barrier required
c. Rain ready within 1 hour
d. Foot traffic ready within 1 hour
e. UV Resistance: Permanent UV exposure
f. Crack bridging (ASTM C1305): Pass
g. Complies with ASTM C836

****
SPEC NOTE: Henry supplies various primer options. Review the following primer descriptions and delete sections not applicable to project specific requirements.
1. Henry ST Primer and aggregate: standard primer used in the Prodeq System.
2. Henry LV Primer: applications where the waterproofing membrane is installed within 24 hours of primer installation.
3. Henry STXL Primer and aggregate: applications where temperatures are lower than 50 ºF.
4. Pumadeq Primer 20 and aggregate: metal (stainless steel, galvanized steel, aluminum and copper) and PVC (rigid pipe) substrates.
5. Henry GC Epoxy Primer: applications where moisture mitigation is desired; prevents vapor drive and moisture emission over saturated substrates or green concrete.

SPEC NOTE: Refer to Henry Prodeq System Primer Guidelines Tech-Talk Bulletin for substrate specific primer requirements.
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B. Henry Prodeq System (Basis of Design):
1. Primer; choose from the following:
a. Standard primer:
1. Epoxy Primer:
a. 100% solids, epoxy primer having the following typical properties:
1. Basis of design: Henry ST Primer
2. Color(s): Clear/Amber
2. Aggregate:
a. Dry, contamination free, silica sand; having the following typical properties:
1. Basis of Design: Silica sand
2. Sieve size: #20-30, #12 Silica or NJ0
b. Low viscosity primer:
1. 100% solids, low viscosity primer for applications where the waterproofing membrane is installed within 24 hours of primer installation, having the following typical properties:
a. Basis of design: Henry LV Primer
b. Color(s): Clear

c. Low temperature primer:
    1. 100% solids, epoxy primer for applications where temperatures are lower than 50 ºF
        a. Basis of Design: Henry STXL Primer
        b. Color(s): Clear/Amber
    2. Aggregate:
        a. Dry, contamination free, silica sand; having the following typical properties:
            1. Basis of Design: Silica sand
            2. Sieve size: #20-30, #12 Silica or NJ0
d. Metal (stainless steel, galvanized steel, aluminum and copper) and PVC (rigid pipe) substrates:
    1. PMMA primer:
        a. PMMA primer having the following typical properties:
            1. Basis of design: Pumadeq™ Primer 20
            2. Color(s): Colorless, cloudy
    2. Aggregate:
        a. Dry, contamination free, silica sand; having the following typical properties:
            1. Basis of Design: Silica sand
            2. Sieve size: #20-30, #12 Silica or NJ0
e. Moisture mitigating epoxy primer
    1. Two-component, epoxy sealer/primer specifically formulated to seal water and prevent vapor drive and moisture emission over saturated substrates or green concrete; having the following typical properties:
        a. Basis of design:
            1. Henry GC Epoxy Primer (Parts A and B)
        b. Color(s): Gray, Red

2. Waterproofing:
    a. 100% solids, polyurethane hybrid, instant setting, spray applied, waterproofing membrane; having the following typical properties:
        1. Basis of Design: Henry Prodeq FX 400
        2. Color(s): Green, Gray

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SPEC NOTE: Install Henry GP Wearcoat wear coat at areas anticipating heavy construction traffic or where overburden is bonded directly to the waterproofing system. Henry recommends a mock-up to confirm project specific aggregate is in line with Henry minimum requirements and project specific aesthetics.

SPEC NOTE: Refer to and coordinate with Section 1.09 Mock-Ups. Delete sections not applicable to project specific conditions, and coordinate with Section 3.03 Installation.
****

3. Wear coat:
    a. Liquid applied coating:
        1. 100% solids, two-component, polyurethane coating specifically designed as an aggregate holding wear coat for areas anticipating heavy construction traffic or where overburden is bonded directly to the waterproofing system; having the following typical properties:
            a. Basis of Design: Henry GP Wearcoat
            b. Color(s): Gray, Clear/Amber
    b. Aggregate:
        1. Dry, contamination free, silica sand; having the following typical properties:
            a. Basis of Design: Silica sand
            b. Sieve size: #20-50, #12 Silica or NJ0-NJ00

****
SPEC NOTE: Install Henry GP Topcoat at areas exposed to indefinite UV when long-term color stability is desired.

SPEC NOTE: Refer to and coordinate with Section 1.09 Mock-Ups. Delete sections not applicable to project specific conditions, and coordinate with Section 3.03 Installation.
****

4. Top coat:
    a. Two-component, aliphatic polyurethane topcoat specifically designed for areas requiring long term color stability:
        1. Basis of design: Henry GP Topcoat
        2. Color(s): Light/mid/dark gray, terracotta, tan or custom

C. Auxiliary materials:
1. Waterproofing cleaner:
    a. Need a data sheet in order to fill in product description; having the following typical properties:
        1. Basis of design: FX Activator
        2. Color(s): Colorless

****
SPEC NOTE: Henry Company offers optional pavers, rigid insulation, and/or prefabricated drainage composites as a single source warranty per project specific requirements. Select from the following, delete sections not applicable to project specific conditions, and coordinate with Section 3.03 Installation.
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D. Additional Materials:
1. Insulation:
    a. Extruded polystyrene rigid board insulation; having the following typical properties:
        1. Acceptable Manufacturers:
            a. DOW
            b. Owens Corning
        2. Minimum thermal resistance (R-Value): Project specific Minimum R-Value
        3. Cellular Polystyrene Thermal Insulation (ASTM C-578): [Type VI], [Type VII]
        4. Compressive Strength: [40], [60], [100] psi.
        5. Water Absorption (ASTM C272): 0.1%
2. Drainage Composite; choose from the following:
    a. Vertical applications:
        1. Basis of Design: Henry DB200
            a. Compressive strength: 11,000 lbs./ft^2
            b. Flow rate: 12.5 gpm/ft^2
        2. Basis of Design: Henry DB500
            a. Compressive strength: 15,000lbs./ft^2
            b. Flow rate: 17 gpm/ft^2
    b. Horizontal applications:
        1. Basis of Design: Henry DB200
            a. Compressive strength: 11,000 lbs./ft^2
            b. Flow rate: 12.5 gpm/ft^2
        2. Basis of Design: Henry DB350
            a. Compressive strength: 30,000 lbs./ft^2
            b. Flow rate: 13 gpm/ft^2
        3. Basis of Design: Henry DB650
            a. Compressive strength: 18,000 lbs./ft^2
            b. Flow rate: 21 gpm/ft^2
3. Filter Fabric:
    a. Non-woven biodegradable geotextile fabric made up of polypropylene fibers and resistance to most soil chemicals, acids, and alkali with a pH range of 3 to 12:
        1. Basis of Design: Henry Filter Fabric NO4
4. Paver ballast:

a. Paver and pedestal assembly; choose from the following:
    1. Acceptable Manufacturers:
        a. Bison
        b. Hanover
        c. T-Clear
        d. Wausau
        e. Westile

PART 3 - EXECUTION

3.01. EXAMINATION

A. It is the installing Subcontractor's responsibility to verify the substrate is in accordance with Waterproofing System Manufacturer's Tech-Talk Bulletins and as specified in this Section prior to installation of the waterproofing system. Commencement of the Work or any parts thereof, indicates installer acceptance of the substrate.

B. Verify components are in place, including, but not limited to, copings, railings, flashings, electrical conduit, pipes, pedestals, or curbs.

C. Concrete surface profiles:
    1. Recommended surface profiles:
        a. Concrete Surface Profiles: CSP 3 – 4
            1. Surface profiles greater than CSP 4 may require an increased application rate of primer and/or waterproofing membrane
        b. Broom finish
        c. Wood float (groove depth may alter application rates)
    2. Do not install Waterproofing System over substrates with concrete laitance
        a. Laitance removal required; shot blast or mechanically grind
    3. Refer to Waterproofing System Manufacturer's Concrete Surface Profiles Tech-Talk Bulletin.

D. Verify the following:
    1. Moisture detection survey:
        a. Conduct a moisture detection survey in accordance with the Waterproofing System Manufacturer's Moisture Test Methods Tech-Talk Bulletin.
    2. Adhesion/pull test (optional):
        a. Complete a waterproofing primer and waterproofing membrane adhesion test, in accordance with ASTM D7234 prior to installation of waterproofing system in accordance with the Waterproofing System Manufacturer's Coating Adhesion Test Guidelines Tech-Talk Bulletin.
            1. Minimum number of tests: 2; (1) test per 5,000 sq.ft.
            2. Minimum primer adhesion to concrete: 200 psi. or greater than concrete cohesive strength.

E. Do not apply waterproofing system until substrate and environmental conditions are in accordance with Waterproofing System Manufacturer's Tech-Talk Bulletin's, TDS, and as specified in this Section.

3.02. PREPARATION

A. Refer to Waterproofing System Manufacturer's Application Tools and Equipment Tech-Talk Bulletin.

B. Surfaces must be sound, dry, clean, and free of laitance, oil, grease, dirt, excess mortar, frost, loose and flaking particles, curing compounds or other contaminants.

C. Substrate preparation:
1. Prepare concrete to meet Waterproofing System Manufacturer's recommended surface profiles:
a. Concrete Surface Profiles: CSP 3 – 4
1. Surface profiles greater than CSP 4 may require an increased application rate of primer and/or waterproofing membrane
b. Broom finish
c. Wood float (groove depth may alter application rates)
2. Do not install Waterproofing System over substrates with concrete laitance
a. Laitance removal required; shot blast or mechanically grind
3. Mechanically abrade metal surfaces to meet SSPC-SP3.
a. Clean and prime abraded surfaces immediately after abrasion to avoid flash rusting.
4. Refer to Waterproofing System Manufacturer's Substrate Preparation Guidelines Tech-Talk Bulletin for further information including, but not limited to, the following:
a. Concrete cure time
b. Concrete compressive strength
c. Substrate finish for concrete, metal, PVC, exterior grade sheathing, and masonry.
5. Prepare substrates a minimum of two (2) inches beyond anticipated waterproofing system installation**.**

3.03. INSTALLATION

A. Verify substrate is ready to receive waterproofing system in accordance with Waterproofing System Manufacturer's Tech-Talk Bulletin's and product specific TDS.

B. Temperature limitations:
1. Refer to product specific TDS for product specific temperature guidelines.

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SPEC NOTE: Henry supplies various primer options. Review the following primer descriptions and delete sections not applicable to project specific requirements.
1. Henry ST Primer and aggregate: standard primer used in the Prodeq System.
2. Henry LV Primer: applications where the waterproofing membrane is installed within 24 hours of primer installation.
3. Henry STXL Primer and aggregate: applications where temperatures are lower than 50 ºF.
4. Pumadeq Primer 20 and aggregate: metal (stainless steel, galvanized steel, aluminum and copper) and PVC (rigid pipe) substrates.
5. Henry GC Epoxy Primer: applications where moisture mitigation is desired; prevents vapor drive and moisture emission over saturated substrates or green concrete.

SPEC NOTE: Refer to Henry Product System Substrate Primer Guidelines Tech-Talk Bulletin for substrate specific primer requirements.
****

C. Primer:
1. Apply primer in accordance with the product specific TDS and Waterproofing System Manufacturer's Substrate Primer Guidelines Tech-Talk Bulletin; choose from the following:
a. Standard primer
1. Install primer per Waterproofing System Manufacturer's minimum required thickness
a. Total dry film thickness = ten (10) mils
b. Application rate = ten (10) mils thick [approximately one-hundred and thirty-five (135) sq.ft./gal.]. Applications rates may vary depending on substrate porosity.
2. Fully broadcast aggregate, to rejection, onto wet primer.
a. Average application rate = approximately one-quarter (0.25) lbs per square foot

3. Allow primer to cure in accordance with Waterproofing System Manufacturer's product specific TDS prior to subsequent installations.
4. Remove excess aggregate; choose from the following:
    a. Heavy duty brooms
    b. Mechanical blowing equipment
    c. Industrial vacuum

b. Low viscosity primer
1. Install primer per Waterproofing System Manufacturer's minimum required thickness
    a. Total dry film thickness = five (5) mils
    b. Application rate = five (5) mils thick [approximately two-hundred (200) sq.ft./gal.]. Applications rates may vary depending on substrate porosity.

c. Low temperature primer:
1. Install primer per Waterproofing System Manufacturer's minimum required thickness
    a. Total dry film thickness = ten (10) mils
    b. Application rate = ten (10) mils thick [approximately one-hundred and thirty-five (135) sq.ft./gal.]. Applications rates may vary depending on substrate porosity.
2. Fully broadcast aggregate, to rejection, onto wet primer.
    a. Average application rate = approximately one-quarter (0.25) lbs per square foot
3. Allow primer to cure in accordance with Waterproofing System Manufacturer's product specific TDS prior to subsequent installations.
4. Remove excess aggregate; choose from the following:
    a. Heavy duty brooms
    b. Mechanical blowing equipment
    c. Industrial vacuum

d. Metal (stainless steel, galvanized steel, aluminum and copper) and PVC (rigid pipe) primer
1. Primer application rates may vary. Refer to product specific technical data sheet for installation instructions.
2. Fully broadcast aggregate, to rejection, onto wet primer.
    a. Average application rate = approximately one-quarter (0.25) lbs per square foot
3. Allow primer to cure in accordance with Waterproofing System Manufacturer's product specific TDS prior to subsequent installations.
4. Remove excess aggregate; choose from the following:
    a. Heavy duty brooms
    b. Mechanical blowing equipment
    c. Industrial vacuum

e. Moisture mitigating epoxy primer
1. Primer application rates may vary. Refer to product specific technical data sheet for installation instructions.

D. Detailing/flashing:
1. Install detailing and flashings per Waterproofing System Manufacturer's details including, but not limited to, the following:
    a. Cracks
    b. Drains
    c. Inside corners
    d. Outside corners
    e. Pipe penetrations
    f. Substrate terminations
    g. Wall/curb to deck interface
2. Application of flashing:
    a. Install flashing per Waterproofing System Manufacturer's minimum required thickness.

1. Total dry film thickness = forty (40) mils minimum
2. Application rate = forty (40) mils thick [forty (40) sq.ft./gal.]

b. Do not install waterproofing beyond cured primer.

E. Application of waterproofing:
1. Install waterproofing per Waterproofing System Manufacturer's minimum required thickness.
   a. Total dry film thickness = one-hundred (100) mils minimum
   b. Application rate = one-hundred (100) mils thick [sixteen (16) sq.ft./per gal.].
2. Do not install waterproofing beyond cured primer.
3. Allow waterproofing to cure in accordance with Waterproofing System Manufacturer product specific TDS prior to subsequent installations.

****
SPEC NOTE: Install Henry GP Wearcoat wear coat at areas anticipating heavy construction traffic or where overburden is bonded directly to the waterproofing system. Henry recommends a mock-up to confirm project specific aggregate is in line with Henry minimum requirements and project specific aesthetics. Refer to and coordinate with Section 1.09 Mock-Ups.

SPEC NOTE: Delete sections not applicable to project specific conditions, and coordinate with Section 2.02 Materials.
****

F. Application of wear coat:
1. Install wear coat per Waterproofing System Manufacturer's minimum required thickness
   a. Total dry film thickness = twenty-six (26) mils minimum (not including aggregate)
   b. Application rate = sixty (60) mils thick [sixty (60) sq.ft./gal]
2. Fully broadcast aggregate, to rejection, onto wet wear coat.
   a. Average application rate = approximately 1.5 lbs per square foot
3. Allow wear coat to cure in accordance with Waterproofing System Manufacturer's product specific TDS prior to subsequent installations.
4. Remove excess aggregate; choose from the following:
   a. Heavy duty brooms
   b. Mechanical blowing equipment
   c. Industrial vacuum

****
SPEC NOTE: Install Henry GP Topcoat at areas exposed to indefinite UV when long-term color stability is desired.

SPEC NOTE: Refer to and coordinate with Section 1.09 Mock-Ups. Delete sections not applicable to project specific conditions, and coordinate with Section 2.02 Materials.
****

G. Application of topcoat:
1. Install top coat per Waterproofing System Manufacturer's minimum required thickness
   a. Total dry film thickness = twenty (20) mils minimum
   b. Average application rate for two layers of top coat = seventy-five (75) sq.ft./gal
2. Install first layer of top coat at ten (10) mils thick [one-hundred and fifty (150) sq.ft./gal.]
3. Apply second layer of top coat at ten (10) mils thick [one-hundred and fifty (150) sq.ft./gal.]

H. Waterproofing integrity test; choose from the following:
1. Electronic Leak Detection (Alternate to Flood Test):
   a. Conduct electronic leak detection upon waterproofing system completion.
   b. Contact pre-approved test provider several weeks in advance to coordinate schedule.
   c. In the event of a breach in the membrane, repair and retest the system in accordance with project specifications.
   d. Report results of testing to the [Architect] [Consultant] and Waterproofing System Manufacturer. Submit results with the warranty application.

e. Do not proceed with Work without prior direction from the [Architect] [Consultant].

2. Flood Test:
   a. Conduct flood test upon waterproofing system completion.
   b. Provide temporary stops and plugs for the roof drain(s) or scupper(s) within test area.
   c. Flood test with a minimum of two (2) inches of water for no less than twenty-four (24) hours.
   d. In the event of a breach in the membrane, repair, and retest the system for no less than twenty-four (24) hours.
   e. Remove temporary stops and plugs.
   f. Report results of testing to the [Architect] [Consultant] and Waterproofing System Manufacturer. Submit results with the warranty application.
   g. Do not proceed with Work without prior direction from the [Architect] [Consultant].

****
SPEC NOTE: Henry Company offers optional pavers, rigid insulation, and/or prefabricated drainage composites as a single source warranty per project specific requirements. Delete sections not applicable to project specific conditions, and coordinate with Section 2.02 Materials.
****

I. Installation of insulation:
   1. Loose lay insulation onto cured waterproofing system in full continuous sheets completely covering the field membrane to maximize thermal resistance.
   2. Refer to Insulation Manufacturer's published literature for a complete guide of required installation practices and exposure limitations.

J. Installation of drainage composite:
   1. Install drainage composite in a shingle pattern starting at the low point(s)/drain location(s) in full continuous sheets to promote drainage.
   2. Abut adjacent drainage composite panels, overlapping the fabric approximately one (1) inch and closely adjoining nest cups.
   3. Cut drainage composite to fit around penetrations and drain(s).

K. Installation of filter fabric:
   1. Install filter fabric in a shingle pattern starting at the low point(s)/drain location(s).
   2. Loose lay filter fabric in full continuous sheets to promote debris obstruction.
   3. Overlap filter fabric adjoining edges approximately six (6) inches.

L. Installation of paver ballast:
   1. Install paver ballast ensuring pavers are accurately aligned and leveled with upper surface of adjacent units.
   2. Cut paver ballast to fit irregularly shaped areas and around protrusions.
   3. Install paver ballast in accordance with Paver Ballast Manufacturer's published literature.
   4. Refer to project specific drawings for specified location and layout.

3.04. FIELD QUALITY CONTROL

A. Do not allow traffic on waterproofing system until waterproofing system is fully cured. Cure times may vary; refer to product specific TDS.

B. Damage to surface by other trades shall not be the responsibility of the installing Subcontractor.
   1. Provide temporary protection as required.

C. Do not penetrate waterproofing system. Ensure all components are in place, including, but not limited to, copings, railings, flashings, electrical conduit, pipes, pedestals, or curbs prior to waterproofing system installation.
   1. Contact Henry where subsequent penetrations are anticipated.

D. Final Observation and Verification:
   1. [Architect] [Consultant] [General Contractor] and Waterproofing System Manufacturer to complete final inspection of waterproofing system prior to overburden installation as required by warranty.
   2. Contact Waterproofing System Manufacturer for warranty issuance requirements.

3.05. CLEANING

A. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage to adjacent areas caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

Manufacturer: Furbish *(High Cost)*

Material: Green Roof System (Ecoline Series)

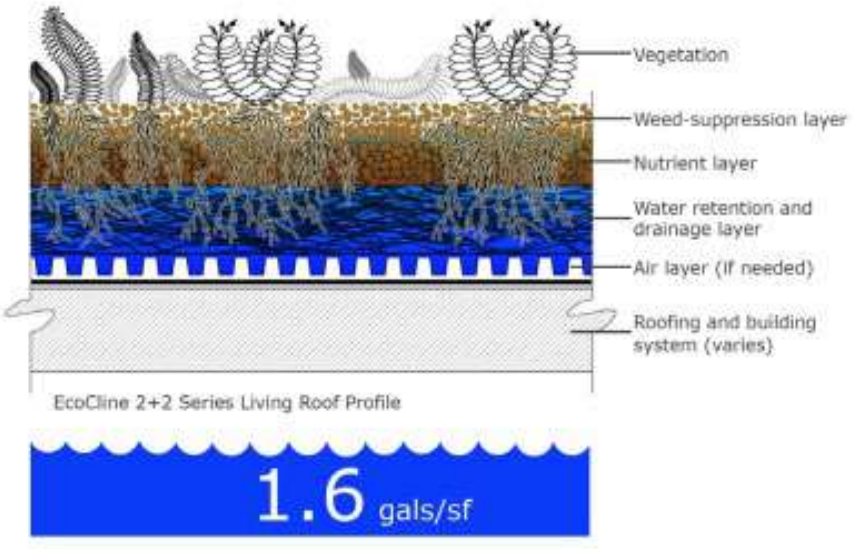
Location: Retail Space Roof

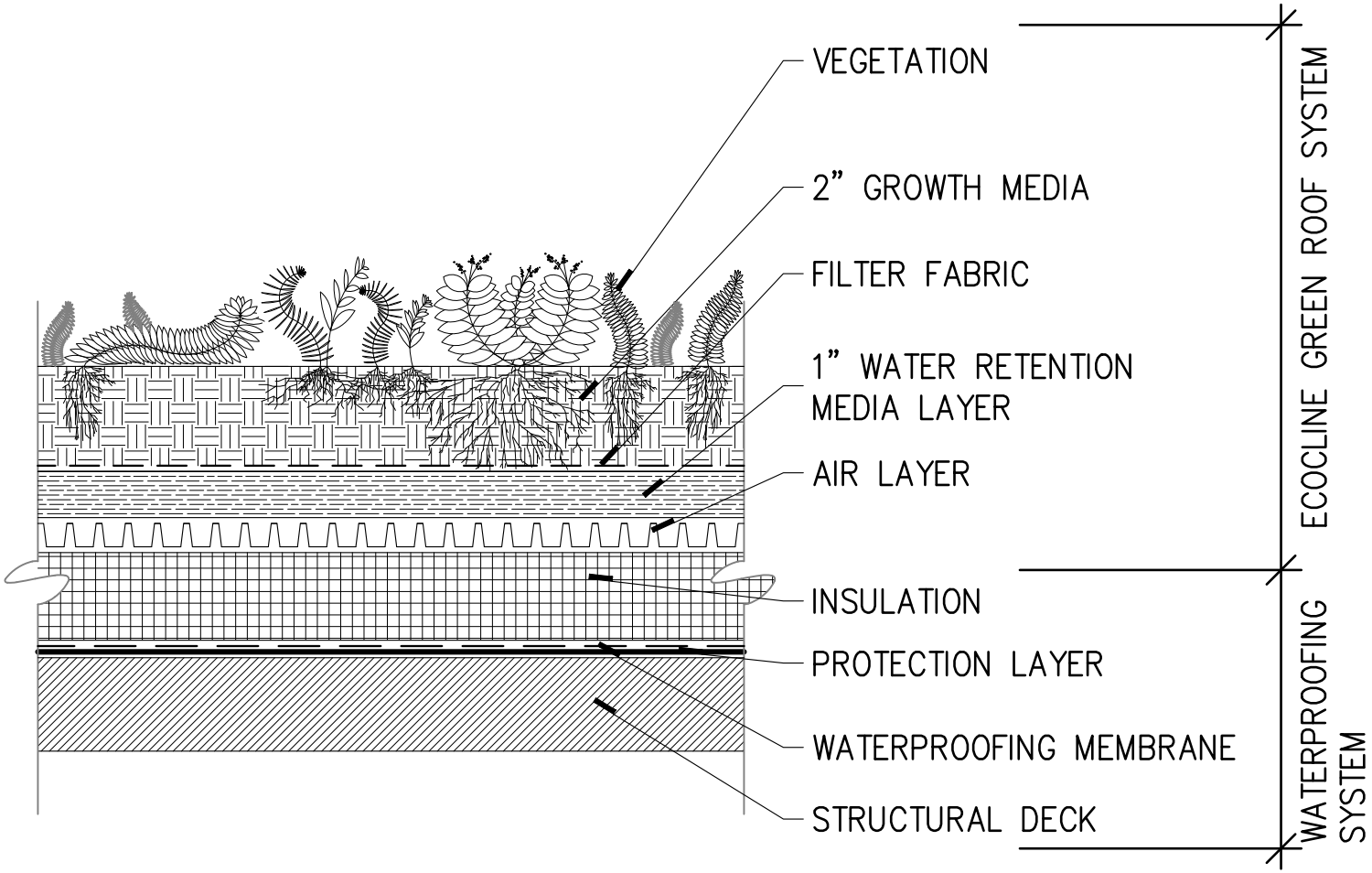
Key Features Include:

- Low Maintenance
- Retains 50-60% of Rainwater
- Growing media does not degrade in freeze-thaw cycles
- Weight: 29lbs/sf
- Water Coverage: 1.6gal/sf

Estimated SF Needed: 3,600 sf

Cost: $31/sf ($31)(3,600sf)=$111,600





FURBISH
3430 2nd Street, Suite 100
Baltimore, MD 21225
(443) 874-7465
www.furbishco.com

EcoCline

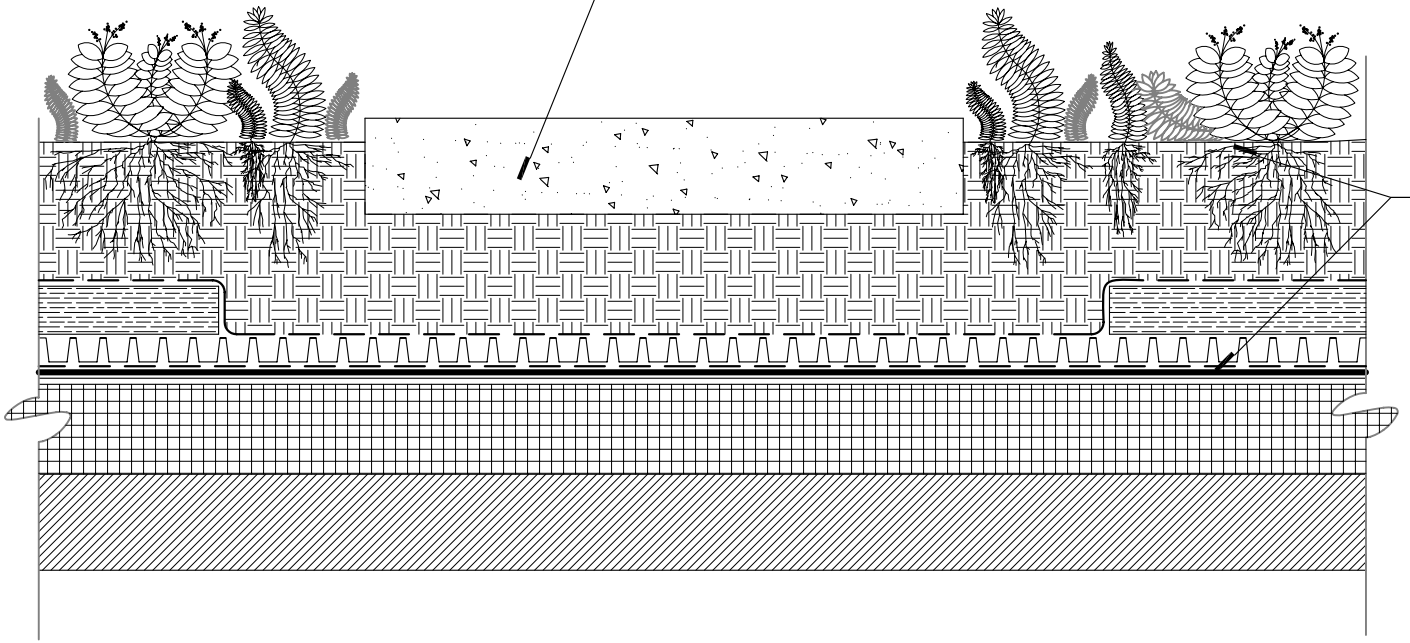
Scale: N.T.S.

Date:

Dwg:

EcoCline 2 + 1
Green Roof Typical Section

PRECAST CONCRETE ROOF ACCESS
PAVERS AS SHOWN ON DRAWINGS.
SET DIRECTLY IN COMPACTED MEDIA,
1/2" ABOVE GRADE OF MEDIA.
OMIT MOISTURE RETENTION
LAYER WITHIN 4" OF PAVERS.



TYPICAL GREEN
ROOF ASSEMBLY

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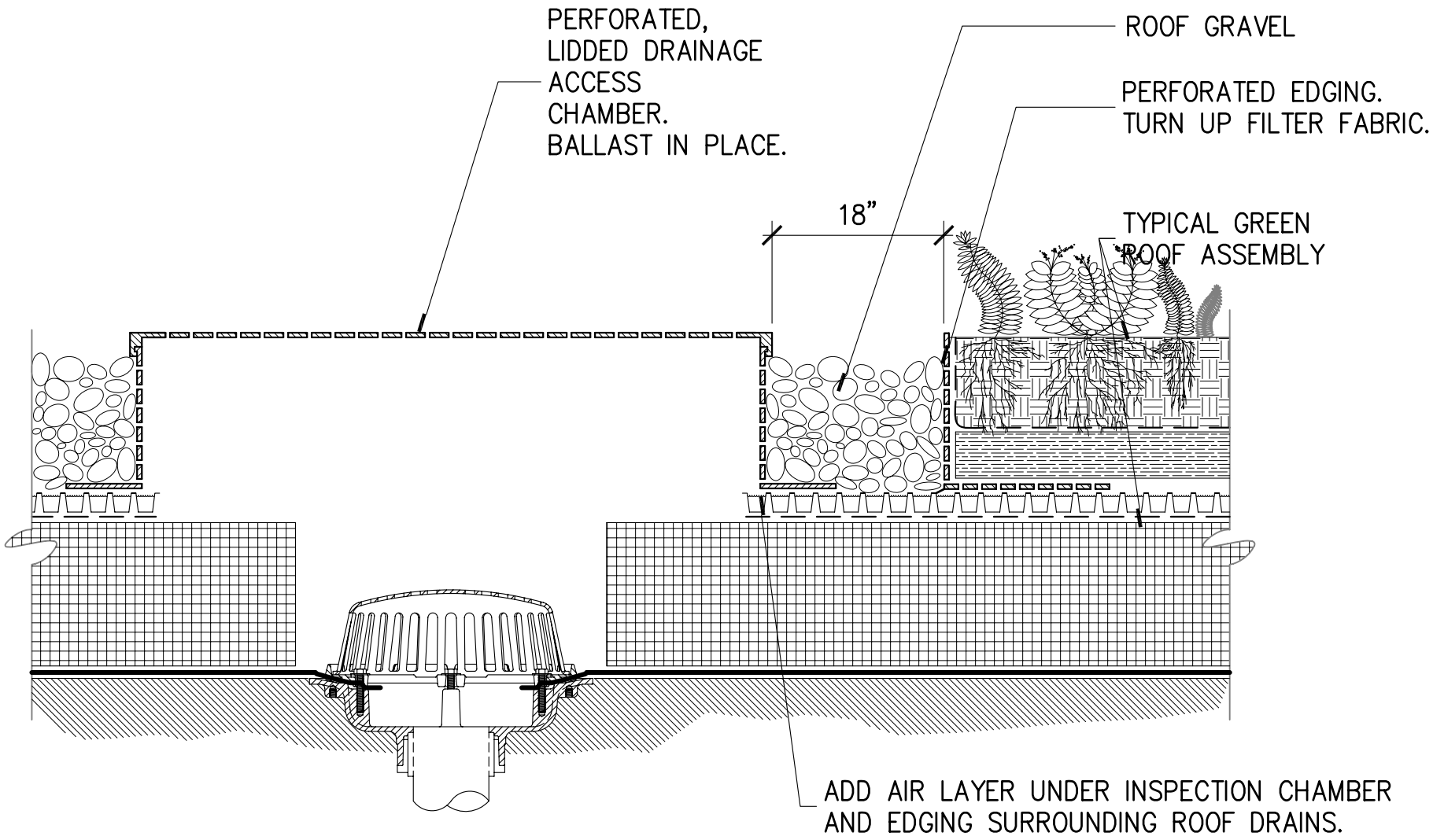
Baltimore, MD 21225
(443) 874-7465
www.furbishco.com

EcoCline

Scale:
N.T.S.

Date:

EcoCline Green Roof
at Rooftop Access Pavers



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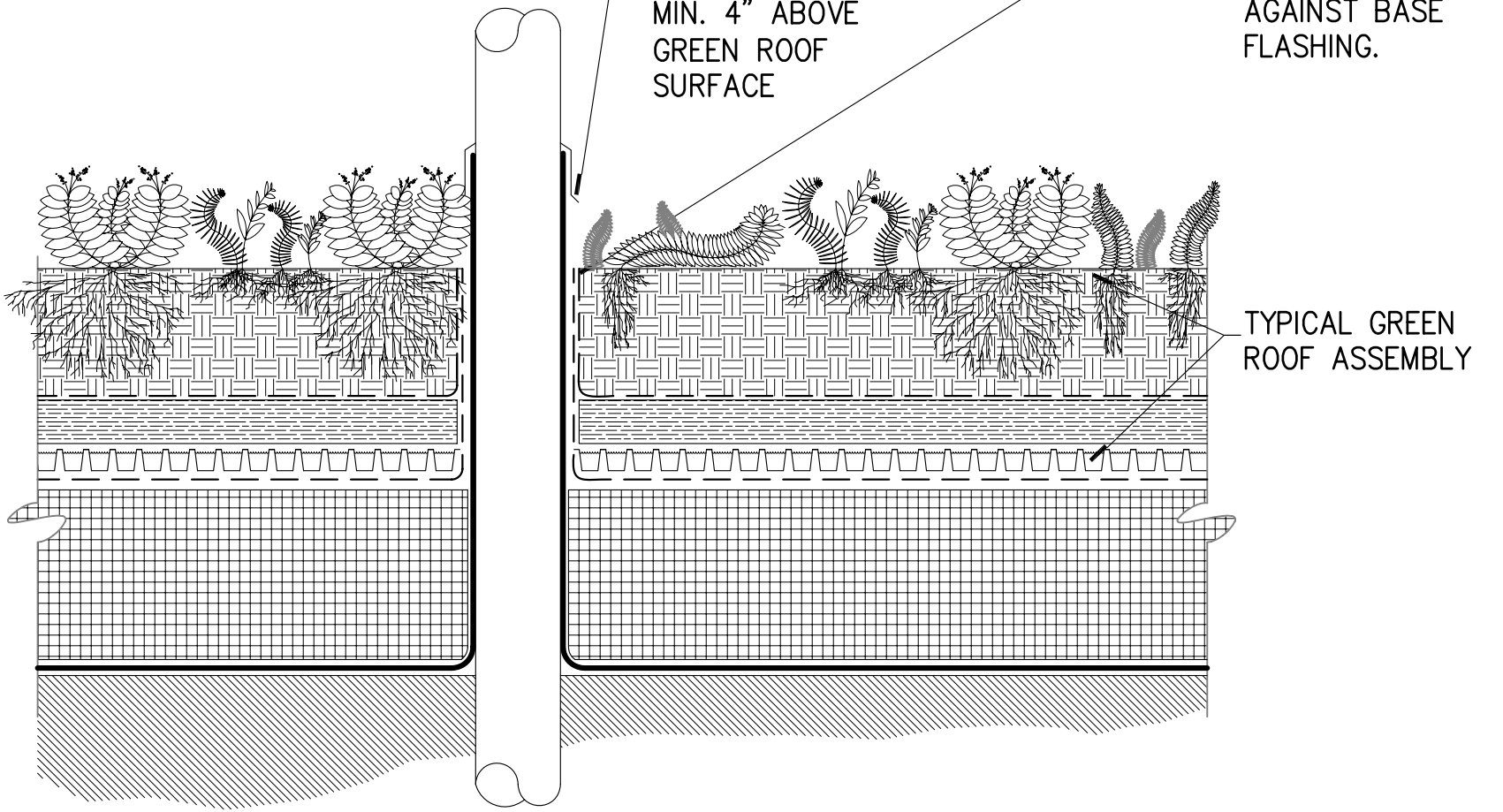
EcoCline

Scale:
N.T.S.

Date:

Green Roof at Roof Drain



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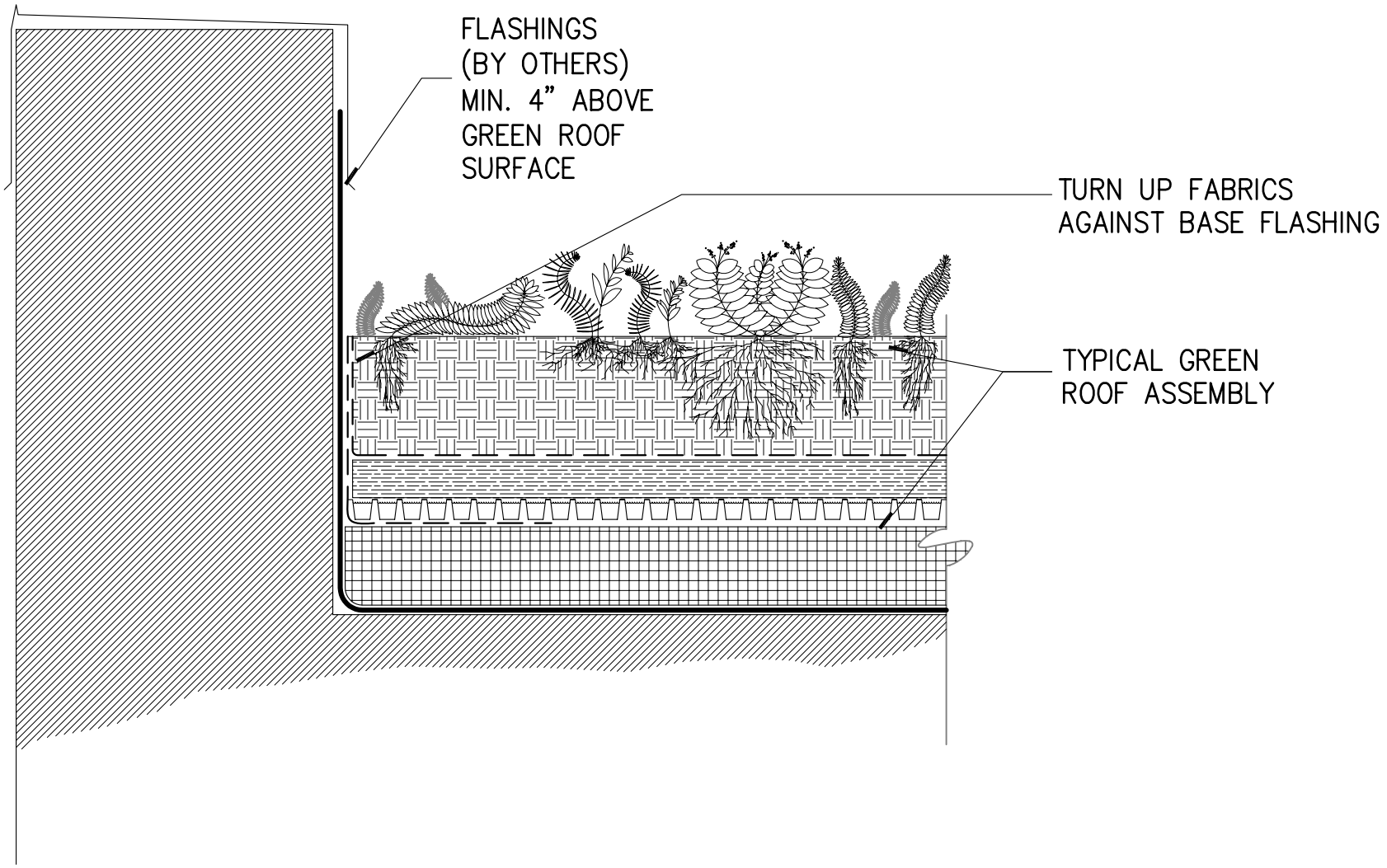
EcoCline

Scale:
N.T.S.

Date:

Green Roof at Roof Penetration



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Baltimore, MD 21225
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www.furbishco.com

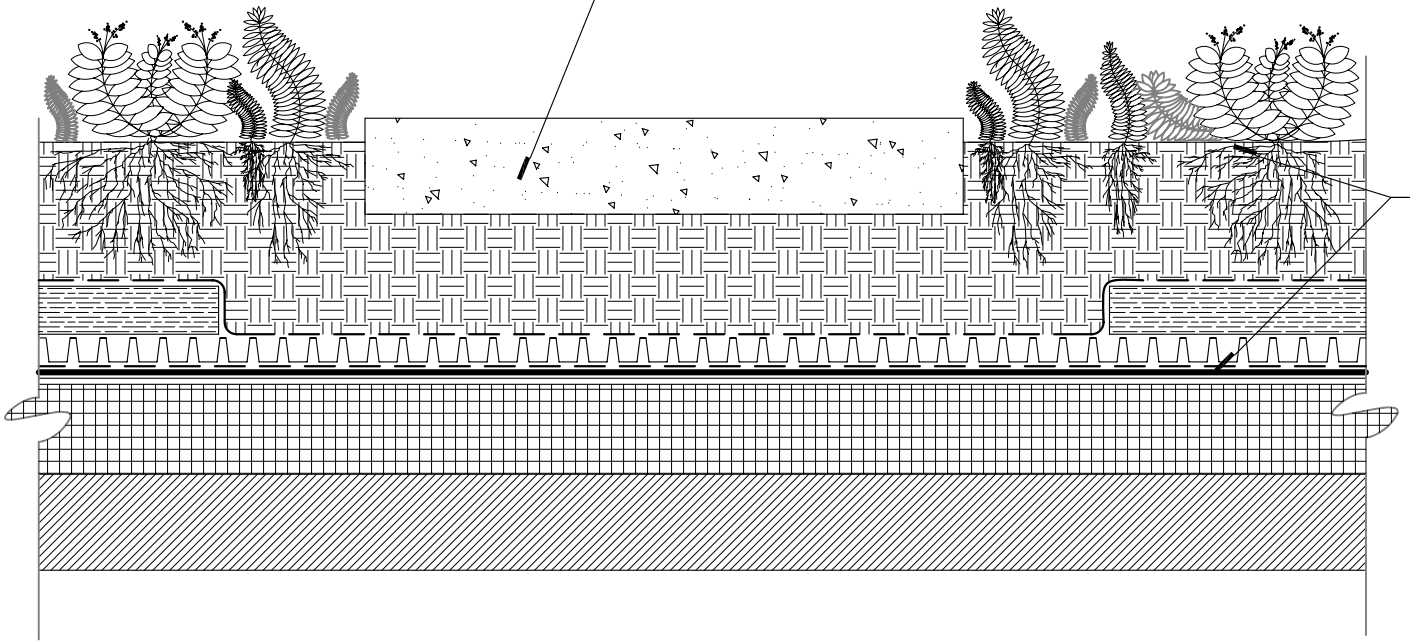
EcoCline

Scale:
N.T.S.

Date:

Green Roof at Wall
(High Flashing Condition)

PRECAST CONCRETE ROOF ACCESS
PAVERS AS SHOWN ON DRAWINGS.
SET DIRECTLY IN COMPACTED MEDIA,
1/2" ABOVE GRADE OF MEDIA.
OMIT MOISTURE RETENTION
LAYER WITHIN 4" OF PAVERS.



TYPICAL GREEN
ROOF ASSEMBLY

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Baltimore, MD 21225
(443) 874-7465
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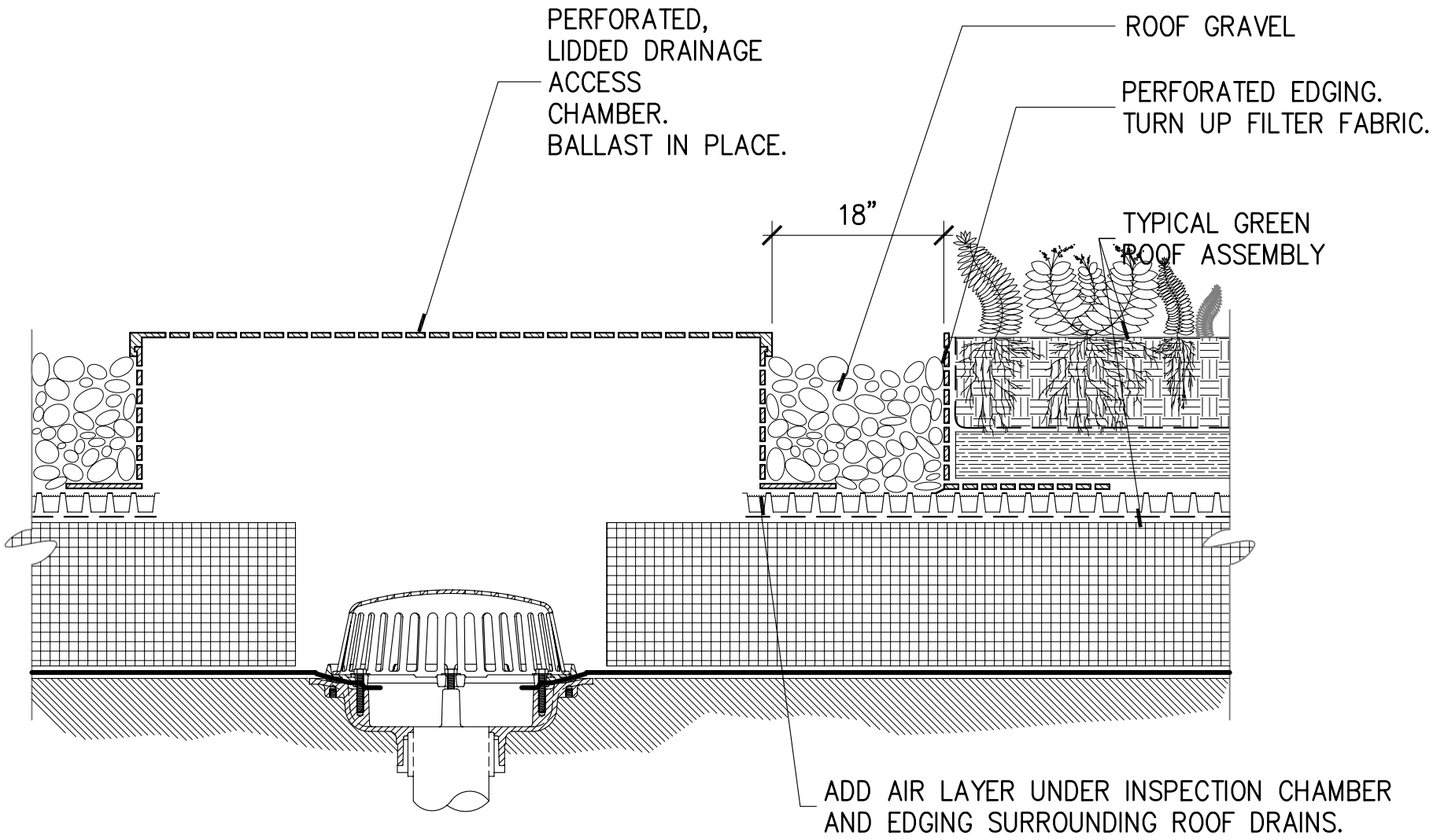
EcoCline

Scale:
N.T.S.

Date:

EcoCline Green Roof
at Rooftop Access Pavers



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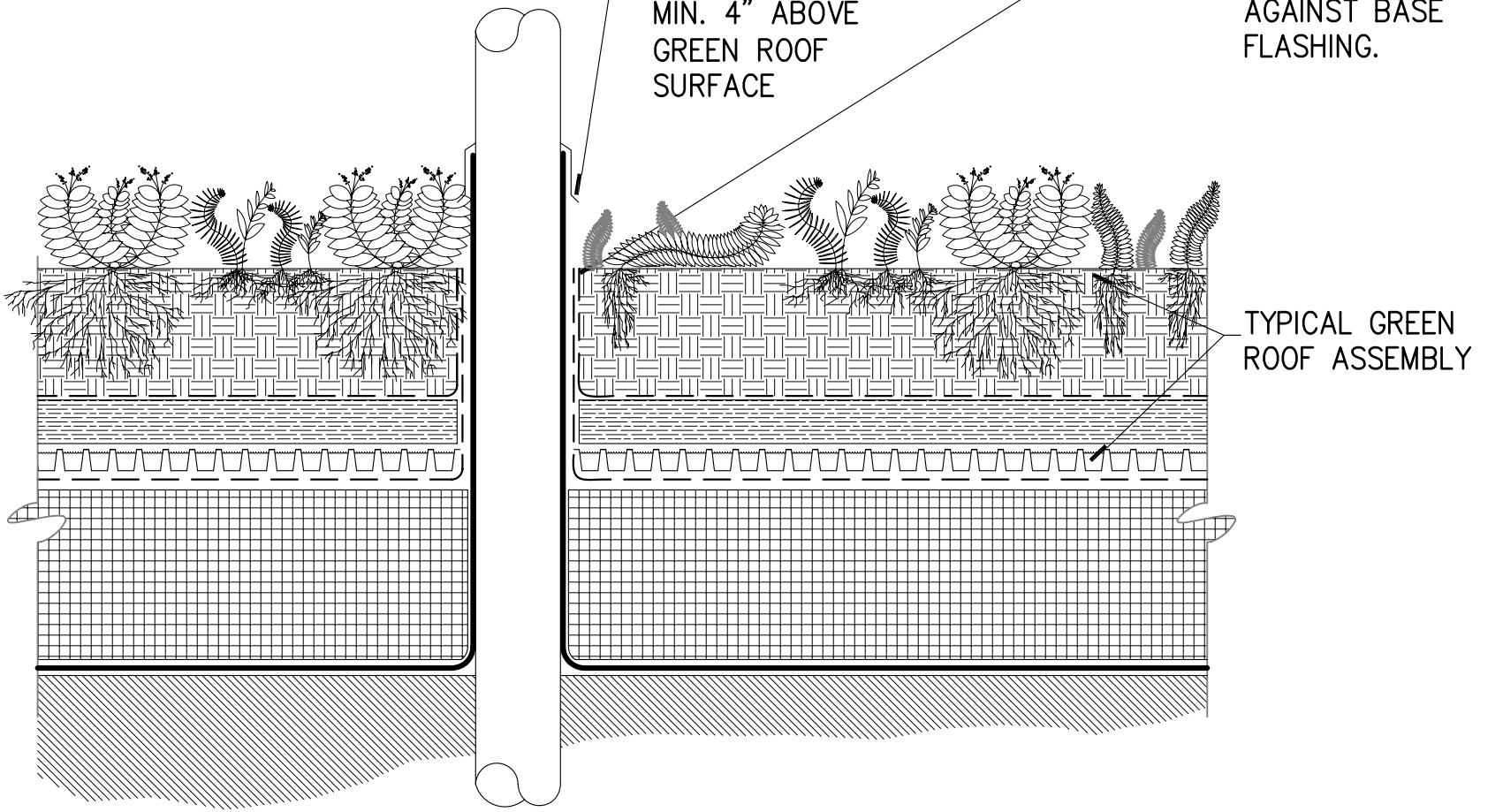
www.furbishco.com

EcoCline

Scale:
N.T.S.

Date:

Green Roof at Roof Drain



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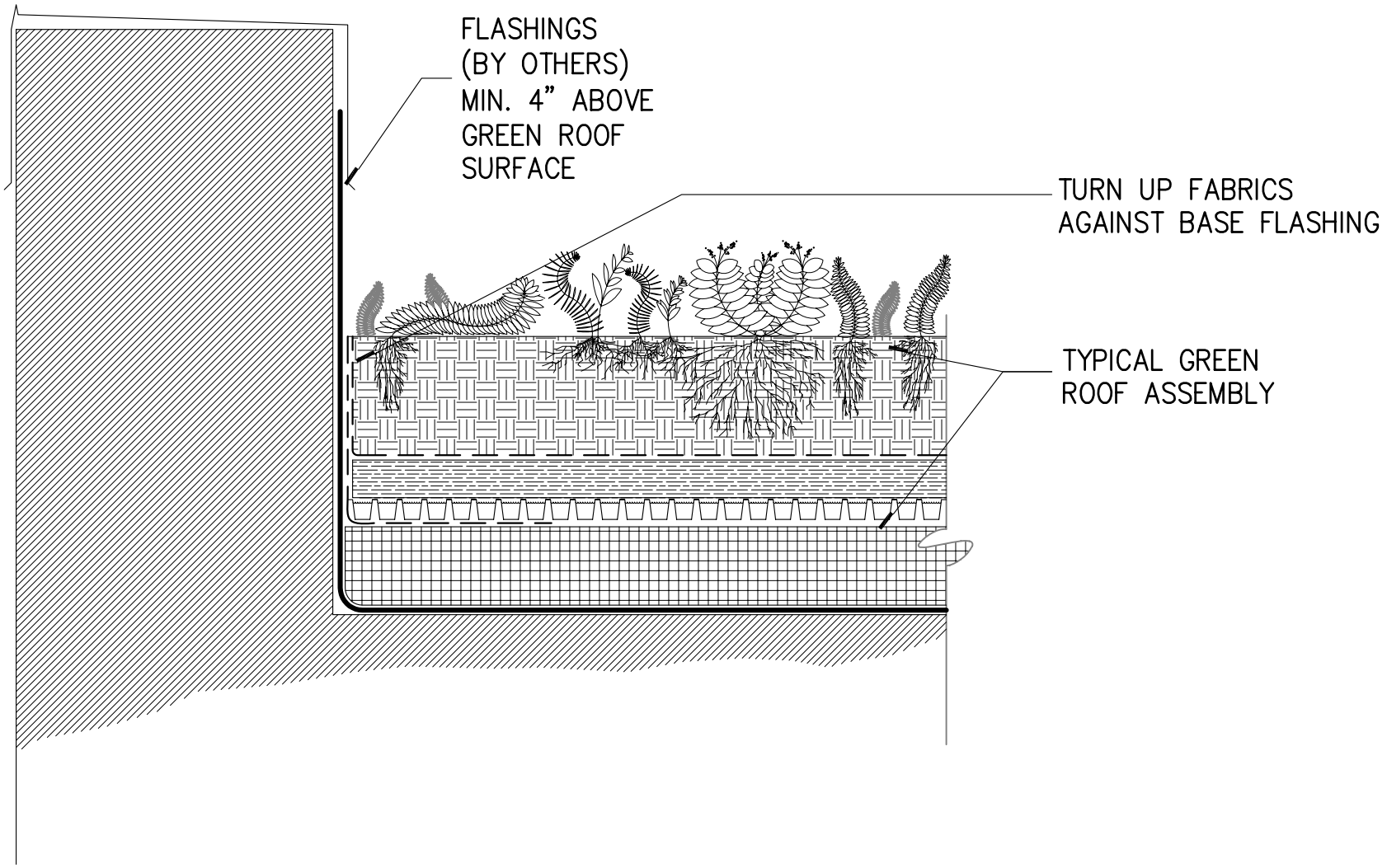
EcoCline

Scale:
N.T.S.

Date:

Green Roof at Roof Penetration



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www.furbishco.com

EcoCline

Scale:
N.T.S.

Date:

Green Roof at Wall
(High Flashing Condition)

SECTION 07 33 64 HIGH PERFORMANCE VEGETATED ROOF COVERING

Specifications are available as a MS Word document upon request.
Call Furbish at 443.874.7465 or email info@furbishco.com and let us know
the type of green roof you want, and the type of membrane you plan to use,
and we will provide an pre-edited and editable specification within one business day.

PART 1: GENERAL

Note to specifier: Keep and edit 'Related Documents' below, or delete 'Related Documents' in entirety.

1.01. RELATED DOCUMENTS

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

Note to specifier: Complete text below. Furbish can also provide a single specification for EcoCline in combination with PVC, KEE, TPO, or HRA membranes.

B. Related requirements specified elsewhere include:
   1. Roofing system: Division 07 Section _____.

1.02. SUMMARY

Note to specifier: Edit "extensive" if needed. See definitions.

A. This Section includes a complete extensive vegetated roof covering system, as shown on the Drawings and described herein. The complete vegetated roof covering system includes all layers and associated accessories placed over the top of roofing membrane in areas designated to receive a vegetated roof covering.

Note to specifier: Keep and edit 'Profiles' below, or delete 'Profiles in entirety. We recommend listing the profile with all layers, as done below, to remove any ambiguity from the specifications.

B. Profiles:

Note to specifier: The first profile example is an EcoCline extensive assembly. List as many or as few profiles as needed.

1. Typical Profile consists of, from top to bottom:

Growth and Retention Assembly

a. Plants
b. Biodegradable wind protection

Note to specifier: The two 1-inch numbers below represent 2 inches of media. The media is blended to striate into two distinct layers after placement. Edit these two numbers based on the thickness of media selected. Media thickness can be fractional inches.

c. 1-inch thick weed-suppressing layer
d. 1-inch thick nutrient zone layer
e. Filter fabric

Note to specifier: Edit the number below based on the thickness of water retention layer selected. Use 1-inch increments.

f. 2-inch thick water retention layer

Note to specifier: Use one of the following groups below based on membrane requirements. The protection layer group immediately below is most common over a PVC, KEE, and some TPO membranes.

Membrane Protection Layers

g. Geotextile Protection layer

Note to specifier: The protection layer group immediately below is common over modified bitumen, EPDM, and some TPO membranes.

Membrane Protection Layers

g. Air layer

h. Geotextile Protection layer

Note to specifier: The protection layer group immediately below is most common over an HRA membrane in an IRMA configuration.

Membrane Protection Layers & Insulation

f. Insulation (Division 07 "_____")

g. Root barrier

Membrane

j. Roofing membrane (Division 07 "_____")

Note to specifier: The profile example below is an EcoCline intensive assembly. List as many or as few profiles as needed.

2. Typical Intensive Profile consists of, from top to bottom:

Growth and Retention Assembly

a. Plants

c. Growth media (depth varies per drawings)

d. Filter fabric

Note to specifier: Select one of the two options below. We generally prefer drainage media for intensive assemblies. Coordinate with Part 2.

e. Drainage media

e. Composite drainage layer

Note to specifier: The protection layer group immediately below is most common over an HRA membrane in an IRMA configuration. These layers may vary.

Membrane Protection Layers & Insulation

f. Insulation (Division 07 "_____")

g. Root barrier

Membrane

h. Roofing membrane (Division 07 "_____")

Note to specifier: List other accessories that are integral to the green roof.

C. This Section includes the following vegetated roof covering accessories:

1. Edging
2. Drainage Accessories
3. Gravel Roof Ballast

Note to specifier: Keep 'Rooftop Pavers' or delete in entirety.

4. Rooftop Pavers

D. This Section includes warranty of the Vegetative Roof Covering.

1.03. PERFORMANCE REQUIREMENTS:

Vegetated roof covering system shall:

Note to specifier: Edit the two numbers below based on the EcoCline brochure or EcoCline data sheets for weight and retention. The example below is for an EcoCline 2+2 system. Consult the project civil engineer.

1. Retain at least 1.50 gallons of captured water per square foot.
2. Weigh not more than 30 lbs per square foot, fully saturated.

Note to specifier: Use one or both of the two lines below or delete in entirety. If editing, enter the regulatory approval or agency in the blanks. For example, the runoff curve number of 77 is the Maryland Department of the Environment's rating for an EcoCline +2 system. Consult the project civil engineer.

3. Conform with _____.
3. Be rated for a runoff curve number of 77 or better per _____

Note to specifier: Compliance with wind uplift requires both system design by the specifier and product compliance. Be sure to design to comply.

4. Comply with wind uplift standard ANSP/SPRI RP-14.

Note to specifier: Compliance with fire code requires both system design by the specifier and product compliance. Be sure to design to comply.

5. Comply with ANSI VF-1 and attain a Class A fire rating per ASTM E-108 or UL 790-04.
6. Support a perennial plant landscape.
7. Provide efficient drainage of moisture that is in excess of moisture required for the vigorous growth of the installed vegetation.
8. Protect roofing materials from damage caused by exposure to ultraviolet radiation, physical abuse, and rapid temperature fluctuations.

1.04. DEFINITIONS

A. Standard Definitions

1. Captured Water: Water that is retained within the vegetated roof covering system after new water additions have ceased and that cannot escape the system except through evaporation or plant transpiration.
2. Extensive Green Roof: Vegetated roof covering with a total media thickness of 6 inches or less.
3. Green Roof: Synonymous with vegetated roof covering.
4. Intensive Green Roof: Vegetated roof covering with a total media thickness of 12 inches or more.
5. Semi-Intensive Green Roof: vegetated roof covering with a total media thickness of greater than 6 inches but less than 12 inches.
6. Vegetative Coverage: Coverage of the roof area by any part of living and rooted vegetation, measured as the percentage of media covered by vegetation. Full vegetative coverage is achieved when at least ninety percent (90%) of the media is covered by desirable species of vegetation during the period of greatest growth (typically May and June for extensive roofs), and at least seventy percent (70%) of the media is covered by desirable species of vegetation during periods of dormancy (such as winter or drought).
7. Vegetated Roof Covering: System of living plants, installed in a growing medium with drainage system over a roofing system. Vegetated roof covering system may include a protection layer, a root barrier and/or insulation as required for compatibility with the roofing system. Vegetated roof covering system may also include accessories such as edging, roof gravel, access pavers, drainage access chambers, or wind protection.
8. Vegetated System Installer: Company that installs the vegetated roof covering system. The Vegetated System Installer may be the same company as the Roofing Installer.
9. Vegetated System Manufacturer: Company that provides and warrants the vegetated roof covering system. Company that offers long-term support for the completed vegetated roof covering system.
10. Roofing Installer: Company that installs the building roofing system.
11. Roofing Manufacturer: Company that provides and warrants the building roofing system.

1.05. REFERENCES

A. The following standards are applicable to this section:
   1. ANSI VF 1: External Fire Design Standard for Vegetative Roofs
   2. ANSI/GRHC/SPRI VR-1: Procedure for Investigating Resistance to Root Penetration on Vegetative Roofs
   3. ANSI/SPRI RP-14 Wind Design Standard for Vegetative Roofing Systems
   4. ASTM: American Society for Testing and Materials

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain the entire vegetated roof covering from the Vegetated System Manufacturer.

B. Vegetated System Installer shall:
   1. Perform all work of this section;
   2. Be certified by the Vegetated System Manufacturer to install the specified system;
   3. Provide full-time site supervision during all phases of installation; Site Supervisor must have a minimum of three (3) years documented experience in successful installation of projects of similar complexity and scale; Site Supervisor must be able to communicate effectively with Owner, Architect and installation crews; Site Supervisor must be a full-time employee of Vegetated System Installer; alternately, Vegetated System Installer may retain supervision services of the Vegetated System Manufacturer, if the Vegetated System Installer has fewer than 3 years documented experience.

C. Tests for media shall be conducted by an independent laboratory with experience in testing of green roof media.

D. Pre-Construction Meeting: At least one week prior to the commencement of work described under this section, the Roofing Installer, Vegetated System Installer and Vegetated System Manufacturer shall meet with the general contractor to discuss project sequence, procedures for methods for protecting the work, and review completed work for compliance with the specifications.

1.07. SUBMITTALS

A. Qualification Data of Vegetated System Installer, including resumes of key personnel assigned to this project. Include certification issued by the Vegetated System Manufacturer.

B. Product Data for the vegetated roof covering provided via a single full-system submittal prepared by the Vegetated System Manufacturer. Include MSDS sheets for all applicable materials.

C. Shop Drawings showing typical profile conditions and thicknesses, conditions at terminations, transitions, penetrations, roof drains, scuppers, or other unusual or project-specific details. Shop Drawings shall bear the approval of the Vegetated System Manufacturer as warrantable conditions.

Note to specifier: Edit or delete the item below in entirety. Slope stabilization is not typically required unless the surface of the roofing membrane has a slope in excess of 2:12. The item below delegates slope stabilization design to the installer, which we believe is preferred to manage costs and logistics; if delegating design, be sure this is prominent in the specifications and drawings so the installer does not miss this item. Alternately, full details of slope stabilization can be provided by the design team.

   1. Details of slope stabilization, including anchoring and calculations signed by an engineer licensed to practice in the State of _____.

D. Samples:

Note to specifier: Edit or delete the line below in entirety. Division 1 might already adequately cover quantity of samples.

   1. Provide three (3) sets of samples indicated below.
   2. Provide samples of the full system for each specified profile, assembled to the full depth specified. Assemble in a clear container at least 2 inches wide.
   3. Accessories: Six-inch linear samples of edging and other linear accessories. Six-inch by six-inch samples of any nonlinear accessories.

E. Warranty: Sample warranty. Include with the sample warranty options for the Owner to extend the terms of the warranty, and to transfer the warranty, if available. Include details of warranty phase Stewardship program.
F. Roofing Certification: Signed by the Roofing Manufacturer, certifying that the proposed vegetated roof covering system is fully compatible with the roofing system and that the roofing system is eligible for a warranty from the Roofing Manufacturer.
G. LEED Submittals:
   1. Product Data for Credit MRc4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MRc5: Documentation of percentages of materials of each product produced within 500 miles of the project site.
H. Warranty Submittals: Stewardship reports, media tests and other warranty phase submittals per Part 3 of this Section.

1.08. DELIVERY, HANDLING AND STORAGE

A. Deliver plants to the jobsite in undamaged boxes or pallets that are clearly marked with the project name, contractor name, Vegetative System Manufacturer's name, and plant species included.
B. Store plants in a sun-lit but shaded outdoor area. Irrigate as needed and in accordance with directions of the nursery. Install plants within 24 hours of receipt or unpackage and care for before installation.
C. Each delivery of bulk materials shall be accompanied by a delivery ticket indicating the specific product delivered, weight of delivery, name and address of manufacturer or place or origin, shipper, recipient, date and time of delivery, and project name. Unless installing bulk materials immediately upon receipt, place bulk materials on a tarp or in a container; cover with a tarp to minimize contamination, protect from weed seed infiltration, and maintain in a dry condition.
D. Maintain rolled and sheet goods in manufacturer's original packaging; store in a safe and secure location until installation.
E. Palletize and cover pavers and masonry materials; store in a safe and secure location until installation.

1.09. PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed when optimum results may be obtained. Apply products during favorable weather conditions according to Vegetated System Manufacturer's written instructions and warranty requirements. Do not plant herbaceous materials when planting media temperatures are below freezing or when ice or snow is present.

1.10. WARRANTY

Note to specifier: Keep or delete "and Roofing" below. Deleting "and Roofing" will allow separate green roof and membrane warranties without compromising warranty coverage of the underlying membrane. Keeping "and Roofing" below will provide a single warranty for both roofing and green roofing. EcoCline is available with a single source roofing warranty with TPO, PVC, KEE, and HRA membranes.

A. Provide a Single Source System Warranty, issued by the Vegetated System and Roofing Manufacturer direct to the Owner. Warranty shall include all coverages listed below.
B. Terms: All terms begin immediately upon installation and continue through Substantial Completion. Terms listed below are terms which commence upon Substantial Completion.
   Note to specifier: Edit the four numbers as needed. The most common terms are listed below. Plant performance should be coterminous with maintenance (stewardship).
   1. Workmanship Warranty: Two years
   2. System Warranty: Twenty years, coterminous with waterproofing membrane
   3. Overburden Warranty: Twenty years, coterminous with waterproofing membrane
   4. Plant Performance: Five years

C. Workmanship Warranty: Vegetated System Manufacturer agrees to repair or replace portions of the vegetated roof covering system that fail in workmanship within specified warranty period.
D. System Warranty: Vegetated System Manufacturer agrees to repair or replace portions of the vegetated roof covering system that fail in materials within specified warranty period.
   1. Failures include but are not limited to:
      a. Loss of system permeability or drainage capacity
      b. Development of conditions detrimental to plant growth
      c. Cracked or disintegration of pavers due to freeze-thaw cycling
   2. Limitations: Term of paver warranty is limited to ten (10) years.
E. Overburden Removal and Replacement Warranty: Vegetated System Manufacturer agrees to remove and replace portions of vegetated roof covering in order to allow access to the Roofing Membrane in order that leaks may be accessed for repairs.
F. Plant Performance: Vegetated System Manufacturer shall act as Steward of the vegetated roof covering system as described in Part 3.
   1. Vegetative Coverage:
      Note to specifier: Edit the numbers below based on initial planting density and project requirements. Allow a minimum of 12 months for cuttings, plugs and/or seed. If using pre-grown Sedum mats, edit "within 24 months" to be "upon".
      a. Achieve full vegetative coverage within 24 months of Substantial Completion.
      b Maintain full vegetative coverage for the duration of the warranty period. Replace or supplement plants in areas that do not achieve the specified coverages within the warranty period. Immediately remove dead plants and replace as soon as growing conditions permit.
   2. Failures include, but are not limited to, death and unsatisfactory growth except for defects resulting from abuse or incidents that are beyond Vegetated System Manufacturer's control.

PART 2: PRODUCTS

2.01. CONTINUOUS VEGETATED ROOF COVERING SYSTEM

Note to specifier: Edit the text below based on whether equivalents are allowed, and if so, which are pre-approved.

A. Subject to compliance with requirements, provide one of the following:
   1. EcoCline by Furbish
   2. Or Approved Equivalent. Any equivalent must comply with the "Performance Requirements" article and other project requirements as determined by the Architect.

2.02. PLANTS

Note to specifier: Edit the list below or delete in entirety. Furbish can provide a customized list with optimal species per profile per climatic/microclimatic zone. If listing species within the specification, either omit species from the drawings or ensure that species listed on the drawings are an exact match. If specific arrangement of species is required, it is preferable to omit species from the specifications and list on the drawings instead.

A. Species:
   1. As shown on drawings for intensive areas and per list below for extensive areas.
   2. For extensive areas, include at least 7 of the following species, and per approved submittals:
      - Allium cernuum
      - Allium schoenoprasum
      - Allium senescens ssp. montanum var. glaucum
      - Delosperma cooperi
      - Delosperma nubigenum
      - Dianthus carthusianorum
      - Phedimus takesimensis 'Golden Carpet'
      - Sedum acre
      - Sedum aizoon 'Euphorbiodes'

- Sedum album
- Sedum album ‘Murale’
- Sedum hybridum ‘Immergrunchen’
- Sedum kamtschaticum
- Sedum kamtschaticum var floriferum ‘Weihenstephaner Gold’
- Sedum pulchellum
- Sedum reflexum 'Blue Spruce'
- Sedum rupestre 'Angelina'
- Sedum sieboldii
- Sedum sexangulare
- Sedum spurium 'Fuldaglut' and other cultivars
- Talinum calycinum

Note to specifier: Select from the five most common options below. EcoCline is typically planted via a combination of cuttings, plugs, and seed. EcoCline may be planted with pre-grown mats for an additional cost. Bulbs are sometimes used for accent plants, if species such as Crocus are requested. Initial application rates are not listed below, as the specification is written as a performance specification, requiring a certain percentage of coverage within specified timeframes. If EcoCline is installed, Furbish will ensure that application rates and post-installation Stewardship will be performed to meet performance specifications. Plugs may be installed as low as 500 per 1000 SF, but should not be planted more densely than 3 per SF. Cuttings may be installed as low as 25 lbs per 1000 SF, but should be supplemented regularly during Stewardship.

B. Cuttings:
   1. Sedum species or other approved species that develop aerial roots that will rapidly root in-situ into growing media.
   2. Length: At least 0.75-inches.
   3. Not in bloom.
   4. Harvested on-demand.

Note to specifier: Plugs provide opportunity for the broadest species selection. Specify 50-cell or 32-cell plugs for some non-Sedum plants. Inquire with Furbish for details.

C. Plugs:
   1. Vigorous, well rooted, and established in the plug cells in which they are growing. Tops shall be of good quality. Root system shall be well-established root system and reaching the sides of the container to maintain a firm ball. Plants shall be free of disease.
   2 Size: 72-cell trays. Each plug shall measure 1-1/2 inches x 3 inches.

D. Bulbs: Top Size, including corresponding designation of "Jumbo", "Giant" or "Extra Large", per ANSI Z60.1.

E. Seed:
   1. Provide clean dry seed with a purity rate over 95%.
   2. Mix seeds with fine sand to allow even sowing at a rate of 1/8 oz. of seed per Gallon of sand.
   3. Sow seed at a rate of 1 oz. seed per 1000 SF of coverage.

Note to specifier: Pre-grown Sedum Mats are generally limited to approximately 12 species. See EcoCline data sheet.

F. Pre-Grown Sedum Mat:
   1. Provide pre-grown mats that are mature and ready to plant, free of weeds, with at least 95% vegetative coverage.

2.03. GROWTH AND RETENTION ASSEMBLY

Note to specifier: The selection of temporary wind protection may vary greatly depending upon season of initial planting, availability of temporary irrigation water, and site microclimate. Listing options below allows clarification via submittals.

A. Temporary Wind Protection:
   1. Material: Manufacturer’s standard organic tackifier, biodegradable jute netting, or temporary shade cloth.

B. Weed-Suppressing Layer: An engineered aggregate material designed to provide anchorage for plant roots and maintain a high percentage of macropore space which rapidly drains in order to minimize germination of weed seed.

Note to specifier: Choose one of the two options below for extensive profiles. The weed-suppressing layer is the top layer of the EcoCline profile. The first option is EcoCline Media B2. The second option is EcoCline Media R. See EcoCline data sheets.

1. Mineral Material: >60% post-industrial or demolition product crushed brick. Maximum particle size: 5/8".
1. Mineral Material: Locally quarried or re-used roof ballast. Maximum size: 2-1/2".
2. Organic Material: < 5% per volume.

Note to specifier: Always keep the nutrient zone below for any extensive EcoCline profile.

C. Nutrient Zone Layer: An engineered soil-like material designed to provide anchorage for plant roots, maintain a relatively high CEC for optimal nutrient availability to plants, and maintain a high percentage of micropore space which maintains moisture within the high-CEC zone.

1. Mineral Material: >90% post-industrial or demolition product crushed brick. Less than 2% of mass shall contain particle sizes smaller than 0.25 mm.
2. Organic Material: 100% post-industrial pine fines. Organic material shall not exceed 20% per volume of combined weed-suppressing and nutrient zone layers.

Note to specifier: Keep or delete the intensive media below.

D. Intensive Growth Media.

1. Primary components: Locally sourced aggregates, post- industrial and post-consumer compost, expanded slate.
2. Particle size ..... 90% <= 3/8"
   .....(FLL-compliant for intensive sites)
3. Maximum Water Retention.....40-45% ASTM E-2399
4. Bulk Density (dry) ..... 70-72 lbs/cf
5. Bulk Density (wet) ..... 92-97 lbs/cf
6. Water permeability ..... 0.08 in/min
7. Organic matter .....5-10% mass
8. pH 6-8.5
9. Soluble salts .....<= 0.07 mmhos/cm

Note to specifier: Keep the intensive drainage layer below if using intensive media above. Keep one of the two drainage options. Coordinate with Part 1.

E. Intensive Drainage Layer.

1. Locally sourced #57 stone, no fines.
1. Manufacturer's standard composite drainage layer.

D. Filter Fabric (Separation Fabric). Root-permeable, non-woven geotextile which is used to contain granular media layers. Inert to biological degradation and resistant to naturally occurring chemicals, alkalis and acids.

1. Material ..... Polypropylene
2. Unit Weight: ..... 3-5 oz/yd2 ..... ASTM-D3776
3. Grab tensile strength: ..... >= 60 lb ASTM-D4632
4. Grab tensile elongation: .....>= 50% ASTM-D4632
5. Trapezoid tear strength .....>= 50 lb ..... ASTM D4533
6. CBR puncture strength.....>= 70 lb ..... ASTM D6241
7. Permittivity: .....>= 0.9 sec-1 ..... ASTM-D4491
8. Flow rate .....>= 100 gpm / ft2 ..... ASTM D4491
9. UV Resistance at 500 hours .....>= 70% ..... ASTM D4355

Note to specifier: Keep the water retention layer below in combination with any EcoCline extensive profile. This is not normally needed for intensive profiles.

E. Water Retention Layer. A layer of root-permeable synthetic material engineered to retain over 80% of its volume in captured water. UV Resistant. Inert to biological degradation and resistant to naturally occurring chemicals, alkalis and acids. Able to withstand construction impacts and post-construction warranty phase pedestrian impact while retaining at least 95% of its retention capabilities.

1. Material ..... Mineral Wool or approved equivalent
2. Recycled content ..... >65%
3. In-Plane Flow per 1" width ..... >=0.05 gals/min/ft ..... ASTM D-4716
4. Density ..... Minimum 12 lbs/cubic foot ..... Dry density
5. Binder ..... Phenolic resin

2.04. MEMBRANE PROTECTION LAYERS

Note to specifier: Keep "Air Layer" or delete in entirety. Coordinate with Part 1.

A. Air Layer: Three-dimensional formed sheet with top surface in a single plane. Panel shall create an air space between vegetated roof covering and roofing membrane to allow any water below vegetated roof covering to freely flow to roof drains.
   1. Material: ..... Polypropylene
   2. Recycled Content ..... >40% post-industrial
   3. Flow (hydraulic gradient = 1): ..... >20 g/min/ft ..... ASTM D-4716
   4. System Thickness: ..... 0.25 - 0.65 in
   5. Compressive strength: ..... >= 15,000 lbs/sf ..... ASTM D-1621

Note to specifier: Keep only one of the protection layer options below and delete the rest in entirety. Coordinate with Part 1.

B. Geotextile Protection Fabric. Layer of non-woven geotextile designed to prevent mechanical damage to underlying layers during or after construction.
   1. Material ..... Polypropylene
   2. Recycled Content ..... >=90% post-industrial
   3. Weight ..... ≥ 12 oz/sy ASTM-D5261
   4. CBR Puncture Strength ..... ≥ 500 lbs ASTM-D6241
   5. Grab Tensile Strength ..... ≥ 200 lbs ASTM-D4632
   6. Trapezoidal Tear Strength ..... ≥ 70 lbs ..... ASTM D4533

B. Root Barrier and Protection Fabric: Layer of root-resistant material at the lowest level of the vegetated roof covering.
   1. Material ..... EPDM
   2. Thickness ..... 45 mils
   3. Seam tape and primer: As approved by Roofing Manufacturer

B. Root Barrier: Layer of root-resistant material at the lowest level of the vegetated roof covering.
   1. Material ..... HDPE
   2. Thickness ..... 30 mils

   Note to specifier: The Roofing Manufacturer might have specific root barrier requirements. Generally, taped, or even just 12-inch overlap, seams are less expensive and are generally acceptable for extensive assemblies. Heat-welded seams are preferred for intensive assemblies if using an HDPE root barrier.

   3. Seams: ... Taped as approved by Roofing Manufacturer
   3. Seams: ..... Heat-welded as approved by Roofing Mfg.

2.05. ACCESSORIES

Note to specifier: Standard extensive edging is shown below. Edit or replace as needed.

A. Edging
   1. Material: Formed Aluminum
   2. Mill finish.
   3. Recycled Content: >=40%
   4. Size: As shown on the drawings
   5. Configuration: L-shaped
   6. Wall Thickness: minimum 16 gauge (0.050 inches)
   7. Provide drainage openings to allow water to freely flow to roof drains.

B. Gravel Roof Ballast
   1. Locally quarried, no deleterious materials
   2. Organic Impurities: None
   3. Size: #4 or #2 (ASTM D7655 / ASTM D448)

Note to specifier: Standard extensive access chambers are shown below. Edit or replace as needed.

C. Roof Drain and Scupper Access Chambers: Open-ended box or cylinder that covers drains and/or scuppers and freely admit water at its base, and which has a removable lid to allow access and cleaning but which prevents debris from entering the chamber.
   1. Material: 0.125 gauge aluminum
   2. Recycled content: >=40%
   3. Color: Mill finish
   4. Height: Same as profile thickness, plus one inch
   5. Length: 15 inches (nominal)
   6. Width: 15 inches (nominal)
   7. Open area: at least 6 square inches per lineal foot of face

Note to specifier: Drainage conduit is not common. Delete if not using.

D. Drainage Conduit
   a. Material: PVC
   b. Recycled content: >90% combined pre- and post-consumer
   c. Dimensions: Rectangular 4-inch width x 2.25-inch height
   c. Dimensions: Rectangular 8-inch width x 1-inch height
   d. Open area: >=10%
   e. Perforated on bottom and sides

Note to specifier: Slope stabilization is not common. Delete if not required. Coordinate with Submittals in Part 1. Edit if using.

E. Slope Stabilization:

2.06. PAVERS

Note to specifier: Edit "Rooftop Pavers" or delete in entirety. The performance specifications below allow Hanover, Sunnybrook, Wausau Tile, or other common brands. Color selection might require a certain brand.

A. Rooftop Pavers: Pavers set within vegetated roof covering or as a border around vegetated roof covering.
   1. Material: Hydraulically pressed precast concrete
   2. Color: Manufacturer's standard gray
   3. Weight: 20-25 lb/sf
   4. Face Size: 24-inches by 24-inches (nominal). Bevel top edges 3/16 inch.
   5. Thickness: 2 inches (nominal)
   6. Absorption: Not greater than 5 percent per ASTM C 140
   7. Compressive Strength: >=7,500 psi (52 MPa) minimum when tested according to ASTM C 140
   8. No breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

Note to specifier: Keep one or both of the support options below. Delete both options below if pavers will only be set directly in media.

B. Low Supports: Manufacturer's standard standard SBR rubber, high-density polyethylene or polyurethane paver support assembly including fixed-height or stackable paver supports and shims.

C. Pedestals: Manufacturer's standard standard, high-density plastic paver support assembly including adjustable pedestals and shims.

3.01. EXAMINATION

A. Examine the completed roofing system for compliance with drawings, installation tolerances, and other conditions affecting performance.
B. Confirm that Roofing Manufacturer has tested roofing system and found it to be free of leaks prior to commencing installation.
C. Notify the Architect immediately if any conditions are present that may be detrimental to the performance of the Work. Proceed only after unsatisfactory conditions have been corrected.

3.02. GENERAL

A. Install vegetated roof covering system in accordance with approved submittals and the Contract Documents.
B. Until the first layer covering the roofing membrane has been installed, limit traffic over the working area to essential personnel, only.
C. Protect heavily traveled areas (e.g., corridors for transporting media to the working areas) in a manner approved by the Roofing System Manufacturer.
D. Protect lay down areas using protection fabric, ½-inch plywood or particle board over 1-inch sheets of insulation, or similar protective material approved by the Roofing System Manufacturer.
E. Protect all loose-laid fabrics from wind damage. Maintain overlaps, folds, turn-ups, and turn-downs by methods which will not damage the roofing system.

3.03. MEMBRANE PROTECTION LAYERS AND ACCESSORY INSTALLATION

Note to specifier: Keep one of the three protection layer options below. Coordinate with Part 1.

A. Protection Layer: Install in a continuous layer over all horizontal and vertical surfaces to receive vegetated roof covering, including against base flashings and roof penetrations. Overlap seams 4 to 6 inches. Keep underlying surface clean of all debris until protection layer is securely in-place.
A. Root Barrier and Protection Layer: Overlap 4 to 6 inches at seams. Tape securely.
A. Root Barrier: Overlap 4 inches at seams. Seal with hot-air welding gun. Check all seams with a probe.

Note to specifier: Keep the air layer if using, or delete in entirety. Coordinate with Part 1.

B. Air Layer: Starting at low points of the roof, install in a continuous layer. Overlap seams in a shingle formation to direct water within the water retention layer over the air layer toward roof drains, but prevent water in the water retention layer from flowing into the air layer. Ensure that air layer provides unobstructed flow to roof drains in all locations.
    1 Install air layer below drain access chambers, scupper access chambers and edging to allow free flow of water to roof drains.

Note to specifier: Keep all three below. Edging, drainage accessories, and gravel are almost always used, even if only around drains.

C. Edging: Install edging where indicated. Secure until permanently ballasted in place.
D. Drainage Accessories: Place drain access chambers, scupper access chambers, drainage conduit and other drainage accessories per drawings. Ensure unobstructed flow to roof drains. Secure until permanently ballasted in-place.
E. Gravel Roof Ballast: Install to thickness shown on drawings. Do not suddenly increase the load to the roof during gravel installation.

Note to specifier: Keep the paver text below if using pavers on pedestals or other supports. Delete in entirety if not using pavers, or if pavers are only being set directly in media.

F. Pavers on Pedestals or Low Supports: Set pavers on low supports over protection layer as indicated on drawings. Do not suddenly increase load to the roof during paver installation.
    1. Tolerances:
        a. Install pavers to vary not more than 1/16 inch in elevation between adjacent pavers and not more than 1/8 inch from surface plane elevation of individual paver.
        b. Maintain tolerances of paving installation within 1/4 inch in 10 feet of surface plane in any direction.

3.04. VEGETATIVE ROOF COVERING INSTALLATION

A. Water Retention Layer: Install with hand-tight joints. Ensure unobstructed flow of water retention layer to roof drains in all locations.

B. Filter Fabric: Install in continuous layers directly over water retention layer. Overlap joints at least 6 inches. Turn up filter fabric against edges so that granular media is contained.

C. Nutrient Zone Layer and Weed Suppressing Layer: Place media to the specified depth allowing for compaction. Do not suddenly increase the load to the roof during media installation. Place media in a single lift and allow to striate into two distinct layers.

Note to specifier: Keep the paver text below if using pavers set directly in media. Delete in entirety if not using pavers, or if pavers are only being set on pedestals.

D. Pavers in Media Zone: Set pavers directly in compacted media as shown on drawings. Omit water retention layer directly below pavers as indicated on drawings. . Do not suddenly increase load to the roof during paver installation.

3.05. PLANTING

A. Install plants in accordance with accepted horticultural practice, warranty requirements, the Contract Documents, and approved Submittals.

Note to specifier: Select one or more of the three options below. Delete options not used. Coordinate with Part 1.

B. Plant plugs at a uniform density to achieve specified coverages and as required per the Drawings.

C. Supplement plugs with cuttings and seed achieve the specified vegetative coverages. Cuttings and seed will be installed by the Vegetative System Manufacturer during the warranty period, as soon as practical following plug planting and as seasonally appropriate.

D. Install pre-grown Sedum mats edge-to-edge covering all areas shown.

E. Install temporary wind protection over the entire planted area.

F. Water plants and saturate media within one day of planting. Vegetative System Manufacturer will install temporary spray irrigation as needed during the first growing season. Vegetative System Manufacturer will remove irrigation within one year of planting.

3.06. PLANT PERFORMANCE WARRANTY (STEWARDSHIP)

A. General: During Stewardship period, care for plantings by cultivating, weeding, and performing other operations as required to establish healthy, viable plantings. Maintain continuous vegetative coverage, conforming with Warranty requirements. Use only products and methods acceptable to Roofing Manufacturer.

B. Facilitate natural adaptation of the plant palette to the unique microclimate of the project site.

1. As volunteer plant species emerge, distinguish between desirable species and weeds.
    a. Desirable plant species include:
        i. Plants that contribute toward a low-maintenance, continuous and year-round vegetative cover that is predominantly perennial in nature, but which may accommodate some annual plants.
        ii Plants that grow and spread at a pace that does not diminish species diversity and that does not require excessive maintenance.
    b. Weeds include:
        i. Plants which are aggressively spreading or very fast-growing that, if not removed would destabilize the plant community to diminish the quality or quantity of desirable species.
        ii. Plants that are considered noxious or invasive.
        iii Plants whose root systems are not suited for long-term growth within the growing media (e.g. tree saplings in a 4-inch depth media) or whose ultimate size or type would pose damage to the roofing membrane.
2. Remove weeds and facilitate growth of desirable species. Supplement desirable species as needed.

3. In areas where the existing plant palette is not performing optimally, determine the reason for poor performance, and suggest planting changes to the Owner. Implement planting changes.

C. Perform stewardship operations in compliance with Section 317 of the International Building Code, including removal of excess biomass at least twice annually, maintenance of vegetative free zones as required, and providing supplemental irrigation if required to minimize the presence of dry foliage.

D. Apply treatments as required to keep plants and growing medium free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

E. Replace growing medium that becomes displaced or eroded because of settling, wind or water scour, or other processes.

F. Inspect roof drains. Remove debris to ensure roof drains are not obstructed.

G. Test media annually for nutrient levels, salt levels, pH and other conditions as necessary. Maintain a permanent log of all test results. Include all vegetative roof areas. Ensure that nutrient, salt, organic matter, and pH levels remain within ranges suitable for optimal plant growth while minimizing nutrient runoff. Supplement or flush media as necessary.

H. Review the Roofing Provider's warranty and assist the Owner in compliance with said warranty. Do not use any materials or perform any work which would compromise any existing warranties.

I. Submit a written and photographic report to the Owner after each stewardship visit. Include test results, general plant coverage, problem areas or detrimental conditions encountered, and proposed solutions to problems.

New Cooling Tower Details

Manufacturer: SPX Cooling Technologies

Model: Marley NX1015

Material: Cooling Tower

Location: Installed in southeast corner of garage.

Features/Specs:

- Length: 8’
- Width: 12’-6”
- Height: 10’-6”
- Cooling Tons: 182-249
- Cools Approximately: 82,500-113,000 sf *(based on 455 sf/cooling ton)*

Cost: $74,500 ($50,000 per 200 cooling tons)

NX™ cooling tower

engineering data
and specifications

MARLEY®

Engineering Data

Sound Control 4
Water Quality 5
Schematics 6
Piping Connections 8
Support 11
Freeze Prevention 12

Specifications / Base

Base 13
Thermal Performance 13
Performance Warranty 13
Design Loading 14
Construction 14
Mechanical Equipment 15
Fill, Louvers and Drift Eliminators 16
Hot Water Distribution System 17
Casing, Fan Deck and Fan Guard 17
Access 17
Collection Basin 18
Scope of Work 18

Specifications / Options

Convenience and Safety Options
Guardrail and Ladder 19
Ladder Safety Cage 19
Access Door Ladder 20
Ladder Safety Gate 20

Miscellaneous Options
Sound Control 20
Hot Water Basin Covers 21
Steel Foundation Piers 21

NX cooling towers are fiberglass with galvanized steel sub-structure, field-erected, crossflow cooling towers, designed to serve air conditioning and refrigeration systems as well as light to medium industrial process loads on clean water. The Marley NX Fiberglass cooling tower has been designed specifically for sound control and tonnage density and incorporates field-proven, industrial-quality components.

The specifications portion of this publication not only relates the language to use in describing an appropriate NX Fiberglass cooling tower—but also defines why certain items and features are important enough to specify and to insist upon compliance by all bidders. The left hand column of pages 13 thru 21 provides appropriate text for the various specification paragraphs, whereas the right hand column comments on the meaning of the subject matter and explains its value.

Pages 13 thru 18 indicate those paragraphs which will result in the purchase of a basic cooling tower—one that accomplishes the specified thermal performance, but which will lack many operation—and maintenance-enhancing accessories and features that are usually desired by those persons who are responsible for the operation of the system. It will also incorporate those standard materials which testing and experience has proven to provide acceptable longevity in normal operating conditions.

Pages 19 thru 21 provide paragraphs intended to add those features, components and materials that will customize the cooling tower to meet the user's requirements.

THE NX–QUIET BY DESIGN

The NX is the result of extensive design studies focused on cooling tower sound control. These studies were complicated by the fact that the cooling tower market is typically driven by one of two powerful, yet often conflicting requirements. The most common is for a cooling tower that provides the required heat rejection capacity with a high level of reliability at low cost. Sound control, while important, is not the primary consideration for this application.

The other requirement, which is becoming ever more important in our crowded, fast-paced society, is driven by conditions that demand the lowest practical sound level. Energy efficiency, reliability, and ease of maintenance, while still extremely important, are not the highest priorities

In the first case, sound is important, while in the second case it is extremely important. To best satisfy these two competing market requirements we created choices through key mechanical equipment selections, to control sound.

The result is a line of towers capable of meeting all but the most restrictive noise limitations—and that will react favorably to natural attenuation. Where the tower has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance—by about 6 dBA each time the distance doubles.

All standard NX cooling towers are equipped with low sound fans. This in combination with zero-splash crossflow film-fill results in a line of towers capable of meeting most noise limitations.

ENCLOSURES

Occasionally, cooling towers are located inside architectural enclosures for aesthetic reasons. Although NX towers adapt well to enclosures, the designer must realize the potential impact of a poorly arranged enclosure on the tower's performance and operation. The designer must take care to provide generous air inlet paths, and the tower's fan cylinder discharge height should not be lower than the elevation of the top of the enclosure. *Marley Technical Report #H-004* "External Influences on Cooling Tower Performance" is available at spxcooling.com or from your Marley sales representative.

SYSTEM CLEANLINESS

Cooling towers are very effective air washers. Atmospheric dust able to pass through the relatively small louver openings will enter the circulating water system. Increased concentrations can intensify system maintenance by clogging screens and strainers—and smaller particulates can coat system heat transfer surfaces. In areas of low flow velocity—such as the cold water basin—sedimentary deposits can provide a breeding ground for bacteria.

In areas prone to dust and sedimentation, you should consider installing some means for keeping the cold water basin clean. Typical devices include side stream filters and a variety of filtration media.

WATER TREATMENT

To control the buildup of dissolved solids resulting from water evaporation, as well as airborne impurities and biological contaminants including Legionella, an effective consistent water treatment program is required. Simple blowdown may be adequate to control corrosion and scale, but biological contamination can only be controlled with biocides.

An acceptable water treatment program must be compatible with the variety of materials incorporated in a cooling tower—ideally the pH of the circulating water should fall between 6.5 and 8.0. Batch feeding of chemicals directly into the cooling tower is not a good practice since localized damage to the tower is possible. Specific startup instructions and additional water quality recommendations can be found in the NX User Manual which accompanies the tower and also is available from your local Marley sales representative. For complete water treatment recommendations, consult a competent, qualified water treatment supplier.

⚠ CAUTION

The cooling tower must be located at such distance and direction to avoid the possibility of contaminated discharge air being drawn into building fresh air intake ducts. The purchaser should obtain the services of a Licensed Professional Engineer or Registered Architect to certify that the location of the cooling tower is in compliance with applicable air pollution, fire and clean air codes.

TYPICAL APPLICATIONS

The NX tower is an excellent choice for normal applications requiring cold water for the dissipation of heat. This includes condenser water cooling for air conditioning, refrigeration, and thermal storage systems, as well as their utilization for free-cooling in all of those systems. The NX can also be used in the cooling of jacket water for engines and air compressors, and are widely applied to dissipate waste heat in a variety of industrial, power and manufacturing processes.

APPLICATIONS REQUIRING ALTERNATIVE COOLING TOWER SELECTIONS

Certain types of applications are incompatible with any cooling tower with film fill—whether NX or a competitive tower of similar manufacture. Film fill is subject to distortion in high water temperatures, and the narrow passages are easily clogged by turbid or debris-laden water. Some of the applications, which call for alternative tower designs are:

- Water temperatures exceeding 52°C—adversely affects the service life and performance of normal PVC fill.
- Ethylene glycol content—can plug fill passages as slime and algae accumulate to feed on the available organic materials.
- Fatty acid content—found in processes such as soap and detergent manufacturing and some food processing—fatty acids pose a serious threat for plugging fill passages.
- Particulate carry over—often found in steel mills and cement plants—can both cause fill plugging, and can build up to potentially damaging levels on tower structure.
- Pulp carry over—typical of the paper industry and food processing where vacuum pumps or barometric condensers are used. Causes fill plugging which may be intensified by algae.

ALTERNATIVE SELECTIONS

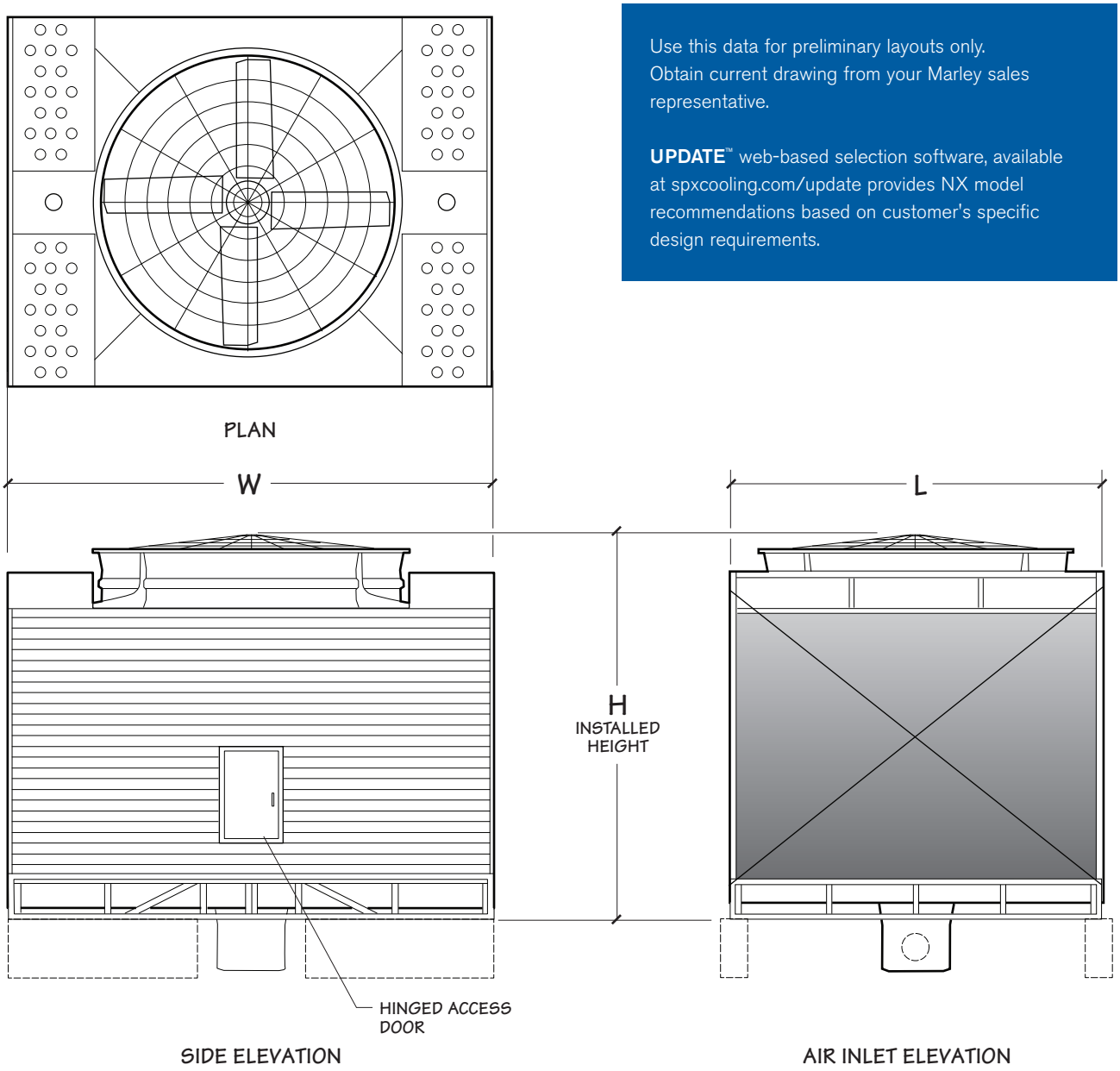
In addition to the NX, SPX Cooling Technologies offers a full scope of products in various designs and capacities to meet the special demands of specific applications.

spxcooling.com—visit us on the web for a complete list of products, services, publications and to find your nearest sales representative.

NX1000

Use this data for preliminary layouts only. Obtain current drawing from your Marley sales representative.

UPDATE™ web-based selection software, available at spxcooling.com/update provides NX model recommendations based on customer's specific design requirements.



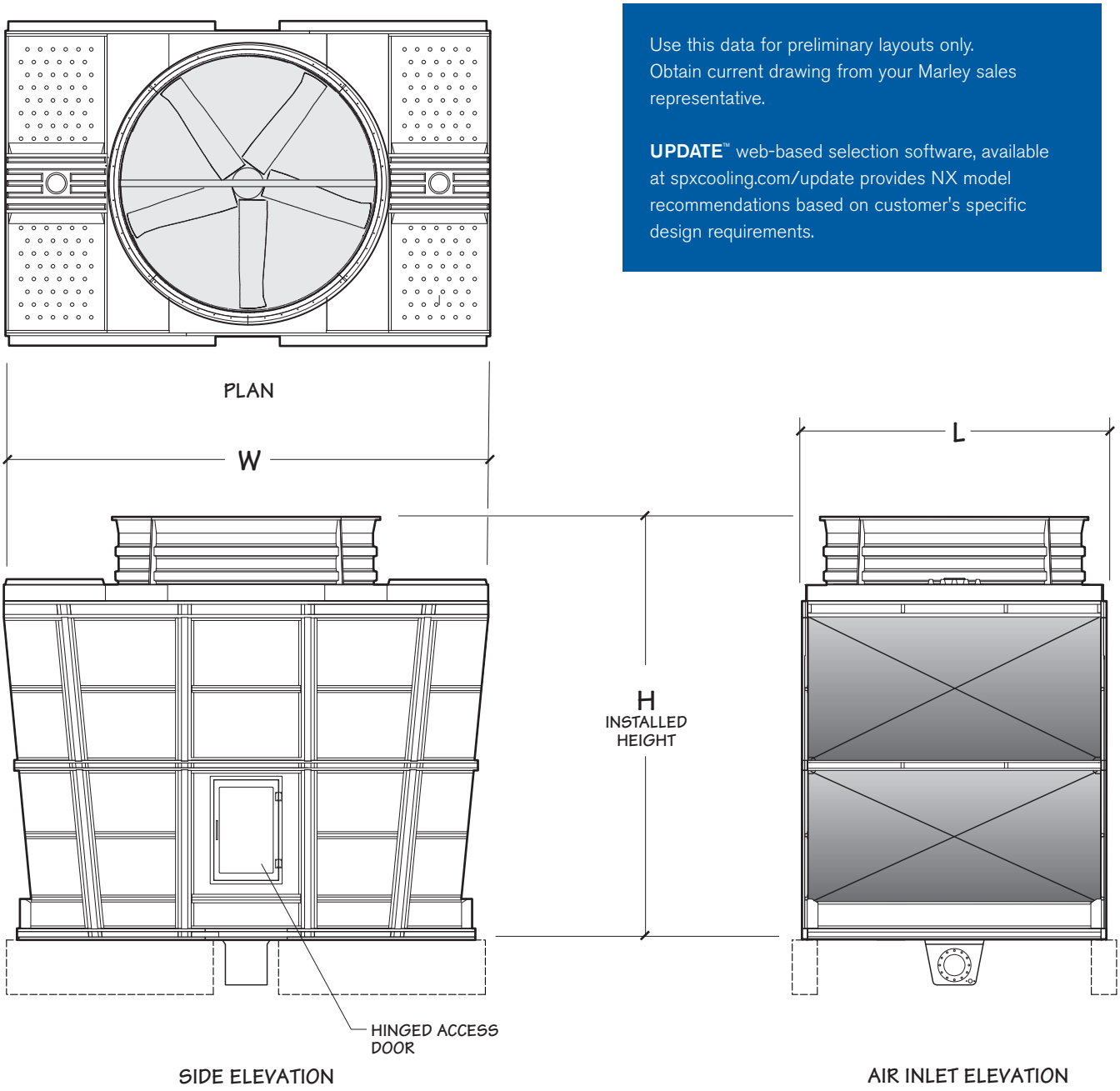
NX1000

Model note 2	Nominal Capacity tons note 3	Motor kW	Design Operating Weight kg	Dimensions mm		
				L	W	H
NX1010K-1	121	3.5	2271	1728	3244	3225
NX1010M-1	139	5.5				
NX1010N-1	154	7.5				
NX1010P-1	174	11				
NX1015K-1	182	4	3275	2522	3860	3302
NX1015M-1	200	5.5				
NX1015N-1	220	7.5				
NX1015P-1	249	11				
NX1020N1	243	7.5	4093	2808	4130	3528
NX1020P-1	286	11				
NX1020Q-1	317	15				
NX1025N-1	304	7.5	5259	3494	4504	3548
NX1025P-1	337	11				
NX1025Q-1	372	15				

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative. All table data is per cell.
2 Last numeral of model number indicates number of cells. Change as appropriate for your selection.
3 Nominal cooling capacity based upon 35°C HW, 29.4°C CW, 25.5°C WB and .68 m^3/hr per ton. The ***UPDATE*** web-based selection software provides NX model recommendations based on specific design requirements.
4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining.
5 Outlet sizes vary according to flow and arrangement. See page 10 for sump outlet sizes and details.
6 Makeup water connection is 1", see page 8 for additional information.
7 A 1" quick makeup connection is also included in the collection to allow for quick fill of the tower.

NX2000



Use this data for preliminary layouts only. Obtain current drawing from your Marley sales representative.

UPDATE™ web-based selection software, available at spxcooling.com/update provides NX model recommendations based on customer's specific design requirements.

NX2000

Model note 2	Nominal Capacity tons note 3	Motor kW	Design Operating Weight kg	Dimensions mm		
				L	W	H
NX2030P-1	355	11	7902	3470	5542	4016
NX2030Q-1	389	15				
NX2030R-1	415	18.5				
NX2030S-1	437	22				
NX2040P-1	447	11	9084	3641	5799	5050
NX2040Q-1	491	15				
NX2040R-1	524	18.5				
NX2040S-1	552	22				
NX2050Q-1	576	15	10617	3895	6049	5888
NX2050R-1	614	18.5				
NX2050S-1	646	22				
NX2060Q-1	637	15	12286	4143	6299	6526
NX2060R-1	680	18.5				
NX2060S-1	717	22				
NX2060T-1	788	30				

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative. All table data is per cell.
2 Last numeral of model number indicates number of cells. Change as appropriate for your selection.
3 Nominal cooling capacity based upon 35°C HW, 29.4°C CW, 25.5°C WB and .68 m^3/hr per ton. The ***UPDATE*** web-based selection software provides NX model recommendations based on specific design requirements.
4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining.
5 Outlet sizes vary according to flow and arrangement. See page 10 for sump outlet sizes and details.
6 Makeup water connection is 1", see page 8 for additional information.
7 A 1" quick makeup connection is also included in the collection to allow for quick fill of the tower.

Flanges are not required to make inlet connections. An appropriate sized opening with a sealing grommet is furnished on both inlet splash boxes. A single riser or dual riser may be used.

Every tower is equipped with an FRP outlet sump and that may be rotated 90° in order to line-up with customer's piping arrangement. The outlet is designed for a flanged connection that is field drilled to accommodate various universal piping standards. A drain connection is also located in the sump.

MAKEUP

The amount of water constantly evaporated from a cooling tower varies directly with the heat load applied. In addition to evaporation, water is normally lost to the blowdown (bleed-off) necessary to maintain dissolved solids concentration at an acceptable level in the circulating water system.

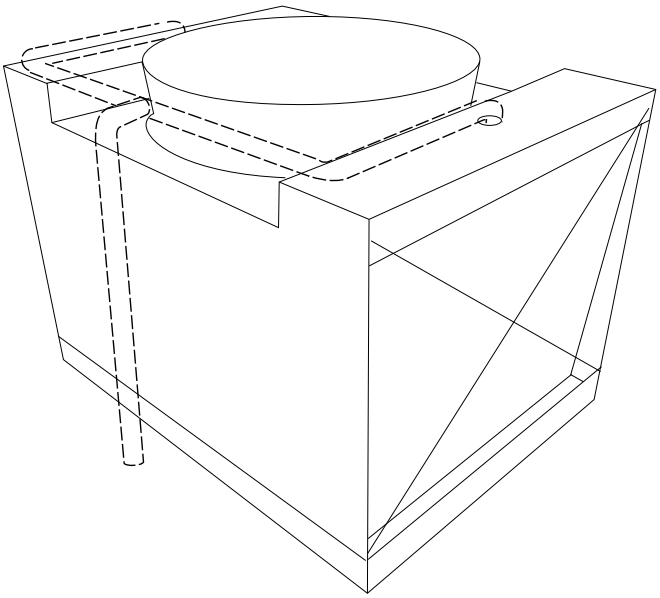
The NX is equipped with one or more float-operated, mechanical makeup valves to automatically replenish this lost water. The tables on this page, calculated for a concentration of 3 times normal, indicate the rate of water loss—and the size of valve(s) required. If your installation's cold water basin will drain by gravity to a remote storage tank—or if you plan a separate means of controlling makeup water—a price reduction is available for deleting the Marley valve(s).

An additional 1" quick makeup connection is provided to allow for quick fill of the tower. See NX User Manual for more information.

In most instances cooling towers will see the highest water usage at design heat load. Off design conditions (99% of the time) water usage will be less. For a better understanding of how much water your application will use throughout the year, consult our water usage calculator at:

spxcooling.com/watercalc

If too much water is still being consumed consult your Marley sales representative for water saving alternatives.



Makeup Water Flow Required – m³/hr to Maintain Three (3) Concentrations						
Tower m³/hr	Cooling "Range" (hot water minus cold water)					
	3°C	6°C	8°C	12°C	17°C	24°C
45	.5	.7	.9	1	2	2
91	.7	1	2	2	3	5
136	.9	2	3	3	5	7
182	1	2	3	5	7	9
227	2	3	4	6	9	11
341	2	4	7	9	13	17
454	3	6	9	11	17	23

NOTE

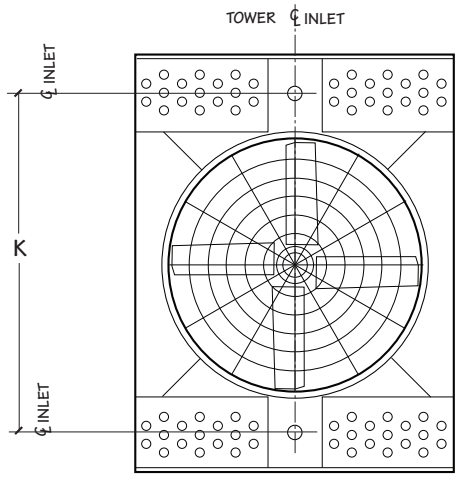
If circulating water is to be maintained at 2 concentrations instead of 3, multiply table m³/hr values by 1.36 before sizing makeup valve.

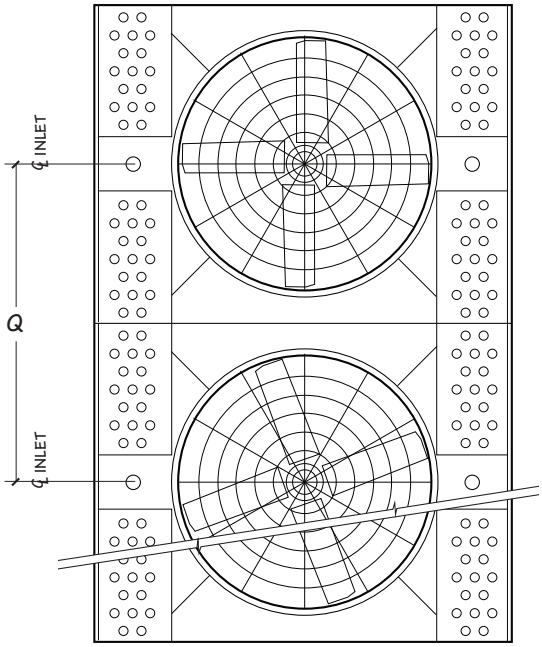
Makeup Valve Flow Capacities – m³/hr	
Pressure at Valve Inlet while flowing–kPa	1" Diameter Valve
69	13
138	18
207	21
276	24
345	27

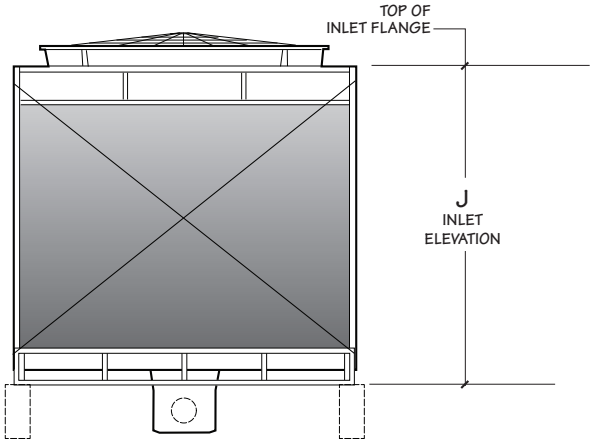
NOTE

- If makeup water pressure exceeds 345 kPa, use a pressure reducer ahead of valve.
- For flow requirements exceeding the above limitations, use multiples of the same size valve.

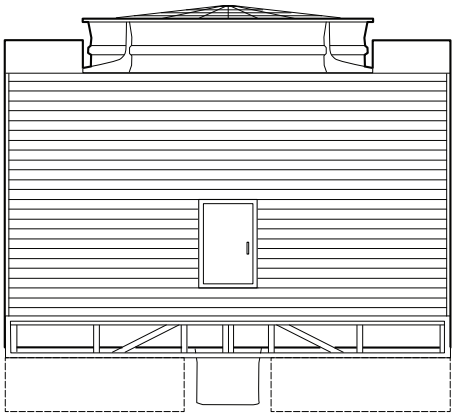
NX Cooling Tower – Piping Connections





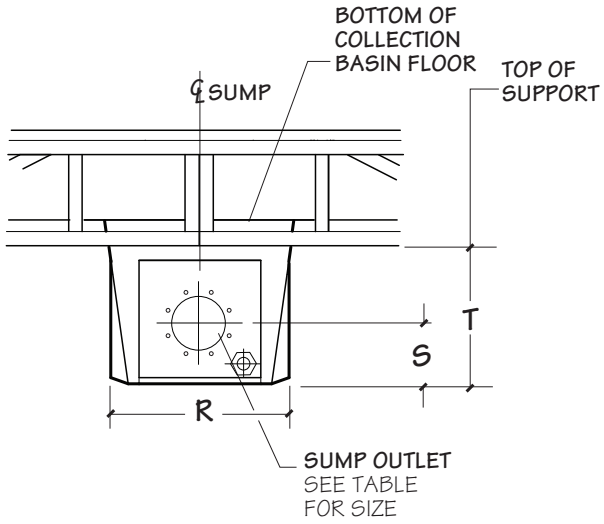


SINGLE CELL



MULTICELL

Model	Dimensions mm			Inlet Diameter
	J	K	Q	size inches
NX1010	2955	2454	1634	2 at 5"
NX1015	2975	3070	2428	2 at 5"
NX1020	3210	3340	2714	2 at 6"
NX1025	3230	3716	3390	2 at 6"
NX2030	3272	4316	3402	2 at 8"
NX2040	4306	4574	3573	2 at 8"
NX2050	5144	4824	3827	2 at 8"
NX2060	5782	5074	4075	2 at 8"

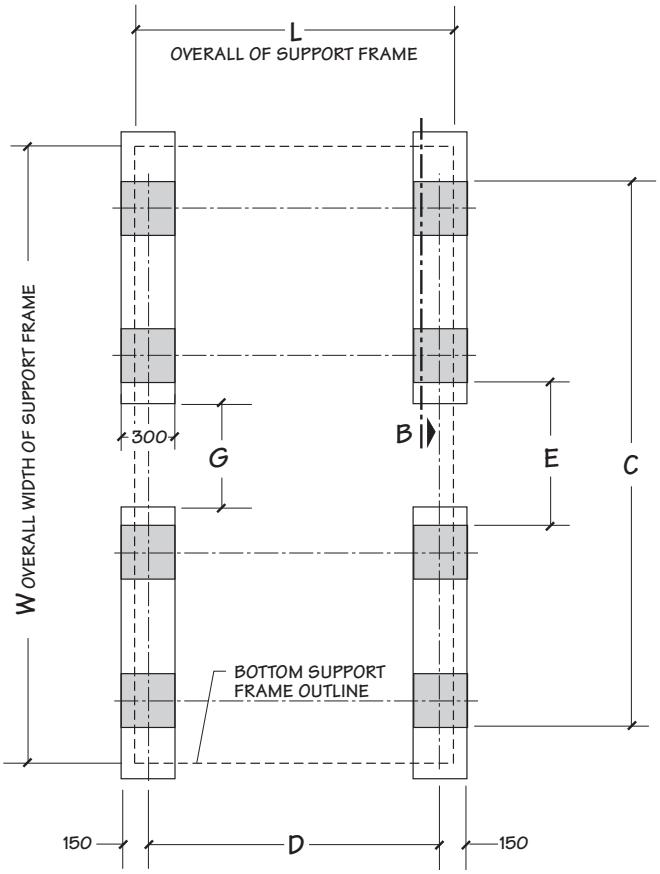


DEPRESSED SIDE-OUTLET
SUMP CONNECTION

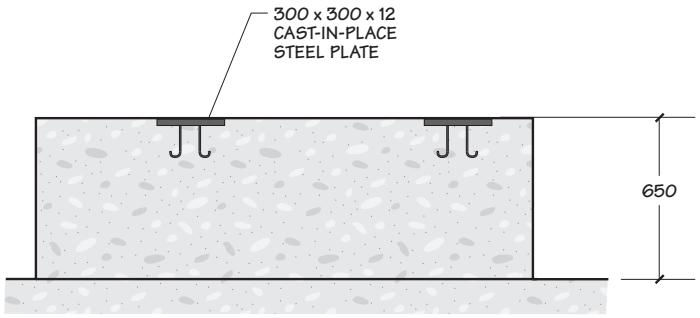
Model	Dimensions mm		
	R	S	T
NX1010	472	200	483
NX1015	472	200	463
NX1020	630	220	503
NX1025	630	220	483
NX2030	500	235	536
NX2040	500	235	536
NX2050	500	235	521
NX2060	500	235	501

Maximum Sump Flow Per Outlet Diameter m^3/hr				
Model	pump flow w/anti-vortex plate			
	6"	8"	10"	12"
NX1010 – NX1015	218			
NX1020 – NX1025		316		
NX2030		356		
NX2040 – NX2050			556	
NX2060				801

NOTE
- Flow rate may be limited by the maximum flow for unit size.



CONCRETE PIER SUPPORT
SINGLE CELL



SECTION B

Model	Dimensions mm						Design Operating Weight/Cell kg
	L	W	C	D	E	G	
NX1010	1674	3244	3504	1634	570	570	2271
NX1015	2468	3860	4120	2428	570	570	3275
NX1020	2754	4130	4390	2714	570	570	4093
NX1025	3440	4504	4754	3390	570	570	5259
NX2030	3470	5412	3959	3402	1056	770	7902
NX2040	3641	5472	4017	3573	1056	770	9084
NX2050	3895	5563	4110	3827	1056	770	10617
NX2060	4143	5694	4233	4075	1056	770	12286

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative for final design.
2 Piers should be level. Adequate clearance for piping and maintenance must be provided.
3 See page 21 for optional steel foundation piers.
4 Design operating weight occurs with collection basin full to overflow level. Actual operating weight varies with flow and piping scheme.
5 Obtain current drawings from your Marley sales representative for final dimensions.

When the ambient air temperature falls below 0°C, the water in a cooling tower can freeze. *Marley Technical Report #H-003* "Operating Cooling Towers in Freezing Weather" describes how to prevent freezing during operation. Available at spxcooling.com or ask your Marley sales representative for a copy.

During shutdown, water collects in the cold water basin and may freeze solid. You can prevent freezing by adding heat to the water left in the tower—or, you can drain the tower and all exposed pipework at shutdown.

INDOOR STORAGE TANK

With this type of system, water flows from an indoor tank, through the load system, and back to the tower, where it is cooled. The cooled water flows by gravity from the tower to the tank located in a heated space. At shutdown, all exposed water drains into the tank, where it is safe from freezing.

The table lists typical drain-down capacities for all NX tower models. Although we do not produce tanks, many of our representatives offer tanks supplied by reputable manufacturers.

The amount of water needed to successfully operate the system depends on the tower size and flow and on the volume of water contained in the piping system to and from the tower. You must select a tank large enough to contain those combined volumes—plus a level sufficient to maintain a flooded suction on your pump. Control makeup water according to the level where the tank stabilizes during operation.

NX Drain-Down Capacity		
Model	Range of Tower Design m^3/hr	Drain Down Maximum liters
NX1010	14-145	1275
NX1015	23-218	2222
NX1020	26-253	2775
NX1025	32-316	3672
NX2030	192-416	5080
NX2040	192-419	5707
NX2050	210-563	6524
NX2060	227-680	7743

NOTE

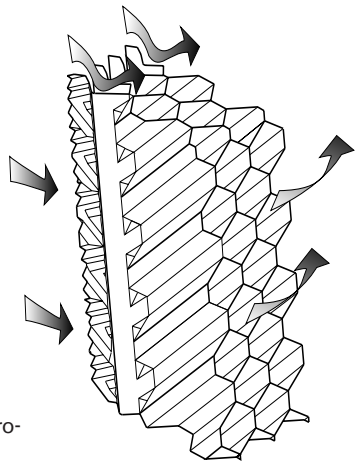
Volumes shown are maximums for the flow ranges indicated. Actual volumes will usually be less.
Contact your Marley sales representative for more specific information.

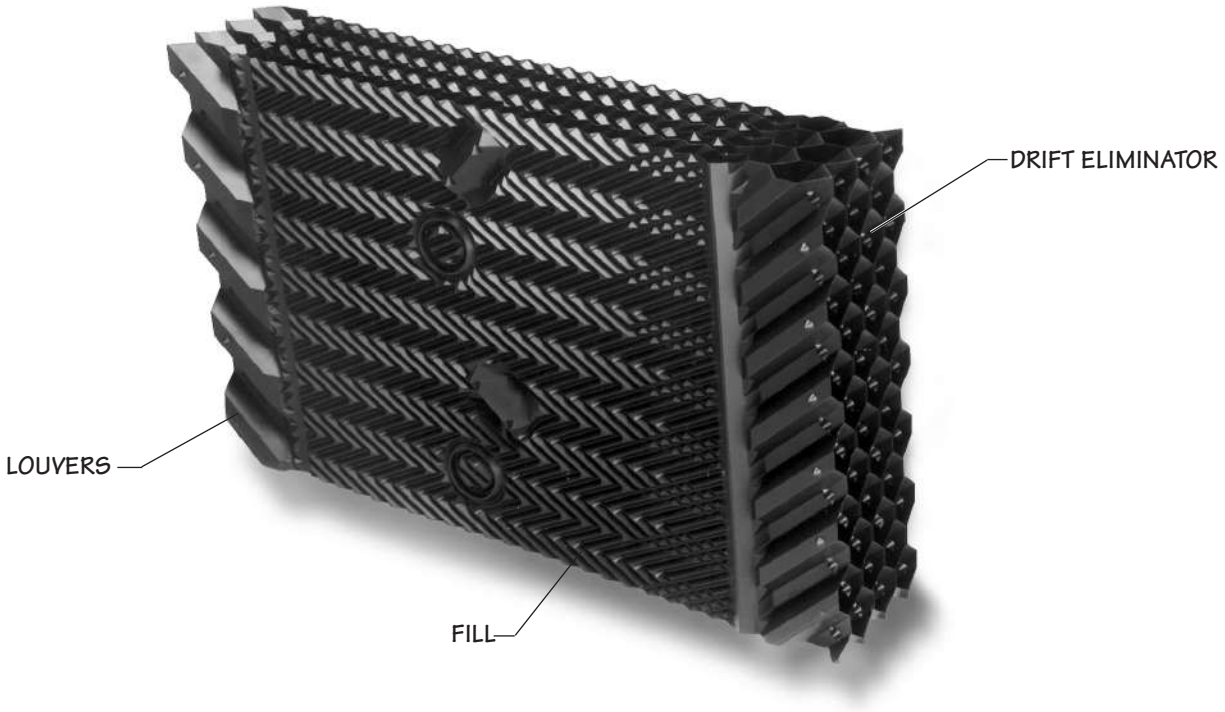
Specifications	Specification Value
1.0 **Base:**	
1.1 Provide an induced draft, crossflow type, field erected, film fill, industrial duty, fiberglass and hot dip galvanized steel cooling tower situated as shown on the plans. The limiting overall dimensions of the tower shall be _____ wide, _____ long, and _____ high. Total operating kW of all fans shall not exceed ____ kW, consisting of ___ @ _____ kW motor(s). Tower shall be similar and equal in all respects to Marley Model _____.	■ Your specification base establishes the type, configuration, base material and physical limitations of the cooling tower to be quoted. During the planning and layout stages of your project, you will have focused your attention on a cooling tower selection that fits your space allotment, and whose power usage is acceptable. Limitations on physical size and total operating kilowatts avoid the introduction of unforeseen operational and site-related influences. Specifying the number of cells and the maximum fan kW/cell will work to your advantage. The benefit of crossflow towers is that they are inherently easy to operate, access and maintain. Compared to counterflow towers, crossflow towers have a spacious plenum between banks of fill for easy access to all of the tower's internal components, plus the water distribution system is adjacent to the fan deck and can be maintained during operation.
2.0 **Thermal Performance and Efficiency:**	
2.1 The tower shall be capable of cooling _____ m^3/hr of water from ____ °C to _____ °C at a design entering air wet-bulb temperature of _____ °C, and its thermal rating shall be Certified by the Cooling Technology Institute.	■ CTI Certification means that the tower has been tested under operating conditions and found to perform as rated by the manufacturer under those circumstances. It assures the buyer that the tower is not intentionally or inadvertently undersized by the manufacturer.
2.2 The tower shall be capable of a minimum _____ m^3/hr per kW efficiency per ASHRAE Standard 90.1.	■ The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 12.24 m^3/hr per kW @ 35/29.5/23.9. There are no efficiency requirements for non-comfort cooling applications. If you want greater efficiency you can require it by specifying a higher ASHRAE Standard 90.1 m^3/hr per kW. ***Each model's ASHRAE Standard 90.1 rating can be viewed in our online sizing and selection software at spxcooling.com/update.***
3.0 **Performance Warranty:**	
3.1 CTI Certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the owner to compensate for the performance deficiency.	■ Certification alone is not sufficient to assure you that the tower will perform satisfactorily in your situation. Certification is established under relatively controlled conditions, and towers seldom operate under such ideal circumstances. They are affected by nearby structures, machinery, enclosures, effluent from other towers, etc. Responsible and knowledgeable bidders will take such site-specific effects into consideration in selecting the tower–but the specifier must insist by the written specification that the designer/manufacturer guarantee this "real world" performance. Any reluctance on the part of the bidder should cause you some concern.

Specifications	Specification Value
4.0 **Design Loading:**	
4.1 The tower structure, anchorage and all its components shall be designed by licensed structural engineers per the International Building Code to withstand a wind load of 49 kg/m^2 psf. The fan deck and hot water basin covers shall be designed for 2.4kPa live load or a 91kg concentrated load. Guardrails, where specified, shall be capable of withstanding a 450N concentrated live load in any direction. Conforms to ISO 14122 Aprt 3 standards 45 kgf.	■ It is important to understand the distinction between ***structure*** and ***anchorage***. Specifying that only the ***anchorage*** meet these requirements means the tower can become non-functional, even fall down, yet remain attached to the foundation. Specifying ***structure*** will require the tower to remain operational. The indicated design values are the minimums allowed under accepted design standards. They give you assurance that the tower can be operated in a normal cooling tower environment. Most NX models will withstand significantly higher wind and seismic loads. If your geographic location dictates higher wind load or seismic load values, please make the appropriate changes, after discussion with your Marley sales representative. **49 kg/m^2 windload**–applicable for most applications but consult the local code official for actual requirements. **2.4kPa live load, 450N concentrated load**–ensures the tower can be safely accessed for routine maintenance when a guardrail is installed as well ensuring the end user complies with government safety laws.
5.0 **Construction:**	
5.1 Except where otherwise specified, all components of the cooling tower shall be fabricated of fiberglass and heavy-gauge steel, protected against corrosion by hot dip galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 300 mg/L; a sulfate content (SO4) up to 250 mg/L; a calcium content (CaCO3) up to 500 mg/L; silica (SiO2) up to 150 mg/L; and design hot water temperatures up to 52°C. The circulating water shall contain no oil, grease, fatty acids or organic solvents.	■ In the history of cooling towers, no other coating for carbon steel has exhibited the success and longevity of galvanization in exposure to the normal cooling tower water quality defined at left. No paints, electrostatically-applied coatings or rubberized compounds, however exotic they may be, can approach galvanization's history of success. Except for those unusual operating situations where the circulating water may be so laden with suspended solids, algae, fatty acids, product fibers, active organisms reflected in BOD, and the like that plugging of the fill is a probability, reasonable attention to the construction materials and/or their coatings is all that is normally required.
5.2 The specifications, as written, are intended to indicate those materials that will be capable of withstanding the above water quality in continuing service, as well as the loads described in paragraph 4.1. They are to be regarded as minimum requirements. Where component materials peculiar to individual tower designs are not specified, the manufacturers shall take the above water quality and load carrying capabilities into account in the selection of their materials of manufacture.	

Specifications	Specification Value
6.0 **Mechanical Equipment**:	
6.1 Fan(s) shall be propeller-type, incorporating aluminum alloy blades and galvanized hubs. Blades shall be individually adjustable. Maximum fan tip speed shall be 66m/s. Fan(s) shall be driven through V-type belts, pulleys and fan shaft with tapered roller bearings with a minimum service factor of 1.0 based on full motor kW.	■ Propeller-type fans require only half the operating kW of blower-type fans. However, they should be readily adjustable to permit compensation for jobsite conditions.
6.2 Motor(s) shall be ____ kW maximum, TEAO, 1.0 service and specially insulated for cooling tower duty. Speed and electrical characteristics shall be _____ RPM, single-winding, ___ phase, ____ hertz, ____ volts. Motor shall operate in the shaft-vertical position, and nameplate kW shall not be exceeded at design operation.	
6.3 The complete mechanical equipment assembly for each cell shall be supported by a rigid steel structural support that resists misalignment between the motor and sheaves. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than eighteen (18) months following the date of tower shipment. This warranty is limited to the fan, fan shaft, bearings, sheaves and the mechanical equipment support. The electric motor, motor components and belt(s) are warranted by their manufacturer.	

Specifications	Specification Value
7.0 **Fill, Louvers and Drift Eliminators:**	
7.1 Fill shall be film type, thermoformed PVC, with louvers and eliminators formed as part of each fill sheet. Fill shall be suspended from hot dip galvanized structural tubing supported from the tower structure, and shall be elevated above the floor of the cold water basin to facilitate cleaning. Air inlet faces of the tower shall be free of water splash-out.	■ Louvers integral with the fill keep the flowing water within the confines of the fill. The separate external louvers used by others permit water to escape the fill and form ice or produce an unsightly situation adjacent to the tower and waste water. If you plan to use your tower in the wintertime, particularly for free cooling, integral louvers will put your operating concerns to rest. Integral louvers offer the best available technology for winter operation and water conservation.
7.2 Drift eliminators formed as part of each fill sheet shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.	■ Drift rate varies with design water loading and air rate, as well as drift eliminator depth and number of directional changes. A drift rate of 0.001% is readily available on many standard models. If a lower rate is required, please discuss with your Marley sales representative. Keep in mind… • Drift for towers with three-pass high efficiency eliminators constitute a small percentage of water usage. • Unlike thermal performance, drift rates are not certified and field drift tests are cost prohibitive for most applications. • Drift rates below 0.001 are difficult to measure in the field. • Certain water treatment chemicals can impact the drift rate.





Specifications	Specification Value
8.0 **Hot Water Distribution System:**	
8.1 Two open basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. The water distribution system shall be accessible and maintainable during tower fan and water operation.	■ Gravity-flow distribution basins are a feature of crossflow type towers, resulting in operating pump heads of 3 to 6 meters less than that encountered in counterflow towers with pressurized spray systems. Also, these basins are located where they can be easily inspected–even maintained–while the tower is in operation. Some manufacturers require shutting down the tower to clean the distribution system. Can you afford to do that?
8.2 Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow.	
9.0 **Casing, Fan Deck and Fan Guard:**	
9.1 The casing and fan deck shall be FRP with steel sub-structure, and shall be capable of withstanding the loads described in paragraph 4.1. The top of the fan cylinder shall be equipped with a conical, non-sagging, removable fan guard and hot dip galvanized after fabrication. Fan cylinders 1.5m in height and over shall not be required to have a fan guard.	
10.0 **Access:**	
10.1 A large fiberglass, rectangular access door shall be located on the cased faces for entry into the cold water basin. Doors shall provide access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system.	■ The access doors are 70cm wide by 115cm high. Small access doors are prohibitive and discourage maintenance, which in turn can impact your operation. Specifying the size of the door will cause some bidders to take exception, alerting you to a potential maintenance headache.
	

Specifications	Specification Value
11.0 **Cold Water Collection Basin**:	
11.1 The collection basin shall be fiberglass supported by a hot dip galvanized structure and shall include the number and type of outlet connections required to accommodate the out-flow piping system shown on the plans. Outlet connections shall be equipped with debris screens. A factory installed, float operated, mechanical make-up valve shall be included. Additionally a quick-fill makeup connection shall also be supplied to initially fill the tower. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate. Towers of more than one cell shall include flumes for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. A factory-installed, steel walkway extending from one endwall access door to the other endwall shall be provided. The top of the walkway shall be at or above the cold water overflow level.	
12.0 **Scope of Work**:	
12.1 The cooling tower manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site. Unless otherwise specified, all supply and return piping, pumps, controls and electrical wiring will be outside the cooling tower manufacturer's scope of work.	■ Please be clear in your specifications and inquiry documents regarding the full scope of work expected. That will help assure that your bid comparisons will be made on as equal a basis as possible–and will help to avoid any misunderstandings during the execution and implementation of the contracts.

Specifications	Specification Value
Convenience and Safety Options	
Guardrail and Ladder:	
10.2 ***Add the following paragraph in the Access section:*** The top of the tower shall be equipped with a sturdy guardrail, complete with kneerail and toeboard, designed according to ISO 14122 Part 3 standards. Posts, toprails and kneerails shall be 40mm x 25mm rectangular tubing. The guardrail assembly shall be hot dipped galvanized and capable of withstanding a 45 kgf concentrated live load in any direction. Posts shall be spaced on centers of 150cm or less. A 52cm wide HDG ladder shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.	■ The NX cooling tower has been designed to minimize the need for maintenance personnel to get on top of the tower to perform maintenance and inspections.
Ladder Extension:	
10.2 ***Add the following to the end of the above paragraph:*** Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the roof /grade level to the base of the tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the tower ladder; and anchoring it at its base.	■ Many towers are installed such that the base of the tower is 61cm or more above the roof or grade level. This makes it difficult to get up to the foot of the attached ladder. The ladder extension alleviates this problem. Marley ladder extensions are available in standard 1.5m and 3.3m lengths.
Ladder Safety Cage:	
10.3 ***Add the following paragraph in the Access section:*** A heavy gauge galvanized steel safety cage shall surround the ladder, extending from a point approximately 2.6m above the foot of the ladder to the top of the handrail.	■ To meet ISO guidelines, towers whose fan decks are 6m or more above roof or grade, and which are equipped with ladders, should have safety cages surrounding the ladders, but with approximately 2m clear headroom.

Specifications

Access Door Ladder

10.2 ***Add the following paragraph in the Access section:*** A 38cm wide HDG ladder shall be permanently attached from the access door to the base of the tower.

Ladder Safety Gate:

10.2 ***Add the following paragraph in the Access section:*** A welded galvanized steel, self-closing gate shall be provided at the guardrail level of the ladder.

Miscellaneous Options

Sound Control

1.2 ***Add the following paragraph under Base:*** The cooling tower shall be quiet operation, and shall produce an overall level of sound not higher than _____ dB(A) measured at _____ m from the locations in the table below.

Location	63	125	250	500	1000
Discharge					
Air Inlet					
Cased Face					

Location	2000	4000	8000	Overall dB(A)
Discharge				
Air Inlet				
Cased Face				

Specification Value

- A galvanized self-closing gate located at the guardrail level of the fan deck.

- Sound produced by a standard NX Cooling Tower operating in an unobstructed environment will meet all but the most restrictive noise limitations–and will react favorably to natural attenuation. Where the cooling tower has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance–by about 5 or 6 dB(A) each time the distance doubles.
  • Where only a slight reduction in noise will satisfy–and the source of concern is in a particular direction–merely turning the cooling tower may be the answer. Less sound emanates from the cased face of the cooling tower than does from the air intake face.

- Tip Speed–unlike thermal performance, no certification program exists for sound. While Marley conducts actual sound tests on all its configurations there are only a few ways for the client to ensure they get a quiet tower.

  • One is to conduct a field sound test after installation. On-site testing after installation can however be inaccurate depending on the environment.

  • Specifying fan blade tip speed is one way to physically force the tower selection to be quiet. Tip speed is easily checked by multiplying the fan rpm by the fan circumference at the blade tip (π fan dia). Over 61m/s is considered high by most people. 51-61 is considered typical and expected. 41-51 would be considered low noise. Below 41 is difficult to hear above the water noise.

Specifications	Specification Value
Hot Water Distribution Basin Covers:	
81 ***Add the following paragraph in the Hot Water Distribution System section:*** Each Basin shall be equipped with removable, fiberglass covers capable of withstanding the loads described in paragraph 4.1.	■ Hot water basin covers keep most air bourne debris out of the circulating water which can clog distribution nozzles. They also minimize algae growth in the basin.
Steel Foundation Piers:	
11.1 ***Add the following paragraph in the Cold Water Collection Basin section:*** Welded hot dip galvanized support piers shall be provided to support the cooling tower to adequately clear the bottom outlet sump.	■ Eliminates the need for cast in place support piers. See photo on adjacent page.

NX cooling tower

ENGINEERING DATA AND SPECIFICATIONS

SPX COOLING TECHNOLOGIES MALAYSIA SDN BHD
UNIT 505, BLOCK B, PHILEO DAMANSARA 2
NO. 15 JALAN 16/11 OFF JALAN DAMANSARA
46350 PETALING JAYA, MALAYSIA
60 3 7947 7800 | th.my.enquiry@spx.com
spxcooling.com

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