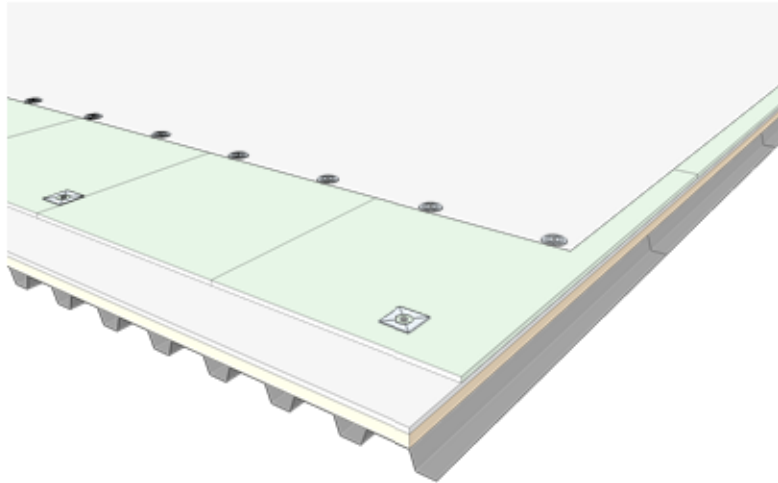


Alpena County

719 W. Chislom
Alpena, MI 48450

Annex Building



Duro-Last Roof Assembly Description

- **Duro-Last® PVC thermoplastic membrane**
Membrane Thickness: 50 mil
Color: White
Attachment: Attached with mechanical fasteners
- **Duro-Guard® XPS Fan Fold - A**
Thickness: 3/8 inch
Attachment: Attached with mechanical fasteners
- **Single-Ply: PVC**
- **Steel Roof Deck**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Remove existing pvc roof membrane and edge metal.
- B. Duro-Last® PVC thermoplastic membrane attached with mechanical fasteners.
- C. Duro-Guard® XPS Fan Fold - A, attached with mechanical fasteners.
- D. Prefabricated flashings, corners, parapets, stacks, vents, and related details.
- E. Fasteners, adhesives, and other accessories required for a complete roofing installation.
- F. Traffic Protection.

1.2 REFERENCES

- A. NRCA - The NRCA Roofing and Waterproofing Manual.
- B. ASCE 7 - Minimum Design Loads For Buildings And Other Structures.
- C. UL - Roofing Materials and Systems Directory, Roofing Systems (TGFU.R10128).
- D. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- E. ASTM D 751 - Standard Test Methods for Coated Fabrics.
- F. ASTM D 4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.
- G. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
- H. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SYSTEM DESCRIPTION

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Physical Properties:
 - 1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D 4434 and must meet or exceed the following physical properties.
 - 2. Thickness: 50 mil, nominal, in accordance with ASTM D 751.
 - 3. Thickness Over Scrim: ≥ 28 mil in accordance with ASTM D 751.
 - 4. Breaking Strengths: ≥ 390 lbf. (MD) and ≥ 438 lbf. (XMD) in accordance with ASTM D 751, Grab Method.
 - 5. Elongation at Break: $\geq 31\%$ (MD) and $\geq 31\%$ (XMD) in accordance with ASTM D 751, Grab Method.
 - 6. Heat Aging in accordance with ASTM D 3045: 176 °F for 56 days. No sign of cracking, chipping or crazing. (In accordance with ASTM D 4434).

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7. Factory Seam Strength: ≥ 417 lbf. in accordance with ASTM D 751, Grab Method.
8. Tearing Strength: ≥ 132 lbf. (MD) and ≥ 163 lbf. (XMD) in accordance with ASTM D 751, Procedure B.
9. Low Temperature Bend (Flexibility): Pass at -40 °F in accordance with ASTM D 2136.
10. Accelerated Weathering: No cracking, checking, crazing, erosion or chalking after 5,000 hours in accordance with ASTM G 154.
11. Linear Dimensional Change: $< 0.5\%$ in accordance with ASTM D 1204 at 176 ± 2 °F for 6 hours.
12. Water Absorption: $< 1.7\%$ in accordance with ASTM D 570 at 158 °F for 166 hours.
13. Static Puncture Resistance: ≥ 56 lbs. in accordance with ASTM D 5602.
14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D 5635.

D. Cool Roof Rating Council (CRRC):

1. Membrane must be listed on CRRC website.
 - a. Initial Solar Reflectance: $\geq 88\%$
 - b. Initial Solar Reflective Index (SRI): ≥ 111
 - c. 3-Year Aged Solar Reflectance: $\geq 68\%$
 - d. 3-Year Aged Thermal Emittance: $\geq 84\%$
 - e. 3-Year Aged Solar Reflective Index (SRI): ≥ 82

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Duro-Last data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
 4. Maintenance requirements.
- C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.
- D. Verification Samples: For each product specified, two samples, representing actual product, color, and finish.
 1. 4 inch by 6 inch sample of roofing membrane, of color specified.
 2. 4 inch by 6 inch sample of walkway pad.
 3. Termination bar, fascia bar with cover, drip edge and gravel stop if to be used.
 4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.

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- E. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's installation instructions.
- B. Manufacturer Qualifications: A manufacturer specializing in the production of PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.
- C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.
- D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.
- E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for roof assembly wind uplift and fire hazard requirements.
- B. Fire Exposure: Provide membrane roofing materials with the following fire-test-response characteristics. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure:
 - a. Class A; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire-Resistance Ratings: Comply with ASTM E 119 for fire-resistance-rated roof assemblies of which roofing system is a part.
 - 3. Conform to applicable code for roof assembly fire hazard requirements.
- C. Wind Uplift:
 - 1. Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of the ASCE-7 Specification *Minimum Design Loads for Buildings And Other Structures*.

1.7 PRE-INSTALLATION MEETING

- A. Convene meeting not less than one week before starting work of this section.
- B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

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2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

- A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the warranty issued by the manufacturer.
- B. Manufacturer's Warranty: Must be no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition the warranty must meet the following criteria:
 1. Warranty Period: 20 years from date issued by the manufacturer.
 2. Must provide positive drainage.
 3. No exclusion for damage caused by biological growth.
 4. Issued direct from and serviced by the roof membrane manufacturer.
 5. Transferable for the full term of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

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- A. Manufacturer: Duro-Last Roofing, Inc., which is located at: 525 Morley Drive, Saginaw, MI 48601. Telephone: 800-248-0280.
- B. All roofing system components to be provided or approved by Duro-Last Roofing, Inc.
- C. Substitutions: Not permitted.

2.2 ROOFING SYSTEM COMPONENTS

- A. Roofing Membrane: Duro-Last® PVC thermoplastic membrane conforming to ASTM D 4434, type III, fabric-reinforced, PVC, NSF/ANSI 347 Gold or Platinum Certification, and a product-specific third-party verified Environmental Product Declaration. Membrane properties as follows:
 - 1. Thickness:
 - a. 50 mil.
 - 2. Exposed Face Color:
 - a. White.
 - 3. Minimum recycle content 7% post-industrial and 0% post-consumer.
 - 4. Recycled at end of life into resilient flooring or concrete expansion joints.
- B. Accessory Materials: Provide accessory materials supplied by or approved for use by Duro-Last Roofing, Inc.
 - 1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
 - 2. Duro-Last Factory Prefabricated Flashings: manufactured using Manufacturer's standard reinforced PVC membrane.
 - a. Stack Flashings.
 - b. Curb Flashings.
 - c. Inside and Outside Corners.
 - 3. Sealants and Adhesives: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
 - a. Duro-Caulk® Plus.
 - b. Strip Mastic.
 - 4. Slip Sheet: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
 - 5. Fasteners and Plates: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by Duro-Last Roofing, Inc.
 - a. #14 Heavy Duty Fasteners.
 - b. Cleat Plates.
 - c. 3 inch Metal Plates.
 - 6. PV Anchors
 - 7. Termination and Edge Details: Supplied by Duro-Last Roofing, Inc.-Must meet ES-1
 - a. Termination Bar.
 - b. Universal 2-Piece Compression Metal System.

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8. Vinyl Coated Metal: Supplied by Duro-Last Roofing, Inc. 24 gauge, hot-dipped galvanized, grade 90 metal with a minimum of 17 mil of Duro-Last membrane laminated to one side.
 9. Two-Way Roof Vents: Supplied by Duro-Last Roofing, Inc. Install a minimum of 1 vent for each 1,000 ft² (93 m²) of roof area.
- C. Underlayment Board:
1. Duro-Guard® XPS Fan Fold - A.
 - a. 3/8 inch thick.
- D. Walkways:
1. Provide non-skid, maintenance-free walkway pads in areas of heavy foot traffic and around mechanical equipment.
 - a. Duro-Last Roof Trak® III Walkway Pad.
 - 1.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of standing water, ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set.
- F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.
- G. Prior to re-covering an existing roofing system, conduct an inspection of the roof system accompanied by a representative of the membrane manufacturer or an authorized contractor.
 1. Determine required fastener type, length, and spacing.
 2. Verify that moisture content of existing roofing is within acceptable limits.
 3. Identify damaged areas requiring repair before installation of new roofing.
 4. Conduct core cuts as required to verify information required.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.
- D. Re-Roofing Over Existing Single-Ply System:
 1. Remove all loose or high fasteners.
 2. Membrane contaminated with bitumen must be immediately cleaned. If cleaning does not remove the bitumen, the contaminated membrane must be replaced, or covered with both a

slip sheet and new membrane.

3. Blisters, buckles and other surface irregularities must be repaired or removed. If the damage is extensive, an approved rigid board insulation or a cover board must be installed.
4. When the system is smooth or granular-surfaced, any approved slip sheet, insulation or cover board may be used to provide separation of the roof system and new membrane. Duro-Guard fan folds may be used if the surface is pea gravel or crushed stone which is $\frac{1}{4}$ to $\frac{3}{8}$ inch in size and has been leveled and maintained at 4 psf. For larger rock/gravel, utilize an approved rigid insulation or cover board.
5. If rock/gravel surfacing is removed, an approved fan fold, rigid insulation or cover board must be used. If embedded rock/gravel remains that protrudes out of the deck more than $\frac{1}{4}$ inch, do not use fan fold board. Instead, use an approved cover board or rigid insulation.
6. When installing polystyrene insulation over coal tar pitch or asphalt-based roof systems, a slip sheet must be used between the insulation and existing roof.

3.3 INSTALLATION

- A. Install insulation in accordance with the roof manufacturer's requirements.
- B. Separation Board: Duro-Guard® XPS Fan Fold - A.
 1. Use only fasteners, stress plates and fastening patterns accepted for use by the roof manufacturer. Fastening patterns must meet applicable design requirements.
 - a. Install fasteners in accordance with the roof manufacturer's requirements. Fasteners that are improperly installed must be replaced or corrected.
 - b. Attach boards in parallel courses with end joints staggered 50% and adjacent boards butted together with no gaps greater than $\frac{1}{4}$ inch.
- C. Roof Membrane: 50 mil, Duro-Last® PVC thermoplastic membrane.
 1. Use only fasteners, stress plates and fastening patterns accepted for use by the roof manufacturer. Fastening patterns must meet the applicable design requirements.
 2. Install fasteners in accordance with the roof manufacturer's requirements. Fasteners that are improperly installed shall be replaced or corrected.
 3. Mechanically fasten membrane to the structural deck utilizing fasteners and fastening patterns that in accordance with the roof manufacturer's requirements.
 4. Cut membrane to fit neatly around all penetrations and roof projections.
 5. Unroll roofing membrane and positioned with a minimum 6 inch overlap.
- D. Seaming:
 1. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.
 2. Check field welded seams for continuity and integrity and repair all imperfections by the end of each work day.
- E. Membrane Termination/Securement: All membrane terminations shall be completed in accordance with the membrane manufacturer's requirements.
 1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 2. Provide securement at any angle change where the slope or combined slopes exceeds two

inches in one horizontal foot.

- F. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer's requirements.
1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 - a. Do not apply flashing over existing thru-wall flashings or weep holes.
 - b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.
 - c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.
 - d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).
 2. Penetrations:
 - a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
 - b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.
 - c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
 3. Pipe Clusters and Unusual Shapes:
 - a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.
 - b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
 - c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.
- G. Roof Drains:
1. Coordinate installation of roof drains and vents specified in Section 15146 - Plumbing Specialties.
 2. Remove existing flashing and asphalt at existing drains in preparation for sealant and membrane.
 3. Provide a smooth clean surface on the mating surface between the clamping ring and the drain base.
- H. Edge Details:
1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.
 2. Join individual sections in accordance with the membrane manufacturer's requirements.
 3. Coordinate installation of metal flashing and counter flashing specified in Section 07620.
 4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies specified in Section 07710.

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- I. Walkways:
 - 1. Install walkways in accordance with the membrane manufacturer's requirements.
 - 2. Provide walkways where indicated on the Drawings.
 - 3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
 - 4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.
- J. Water cut-offs:
 - 1. Provide water cut-offs on a daily basis at the completion of work and at the onset of inclement weather.
 - 2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
 - 3. Remove water cut-offs prior to the resumption of work.
 - 4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
 - 5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

- A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.

3.5 PROTECTION

- A. Protect installed roofing products from construction operations until completion of project.
- B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.
- C. Repair or replace damaged products after work is completed.

END OF SECTION