

This specification is intended to be used as a guideline for Architects and Engineers as they establish the requirements for a project, and may be modified as deemed appropriate and with the agreement of the Manufacturer.

### GENERAL DESCRIPTION

The ILC Dover Flex-Wall® is an economical and reliable system for dry flood protection where all components are stored at the point of use. This feature and the systems' compact nature facilitates rapid deployment and retraction and assurance that all components are available when needed. It is simple to operate and can be deployed in a few minutes by one or two people. The system is scalable for a wide range of water loading and associated floating debris impact loads.

### Configurations

The Flex-Wall® can be configured to protect many types of building openings or perimeters. This includes single/double personnel doors, windows, vehicle entrances, glass store-fronts, building perimeters, etc.

There are two primary types of Flex-Wall® flood barriers. These include the Side Deployed and Vertically Deployed configurations. Custom configurations can also be provided.

System components can be externally mounted to buildings, internally mounted (hallways or entrances), or embedded within the structure to hide them for minimal architectural and aesthetic impact.

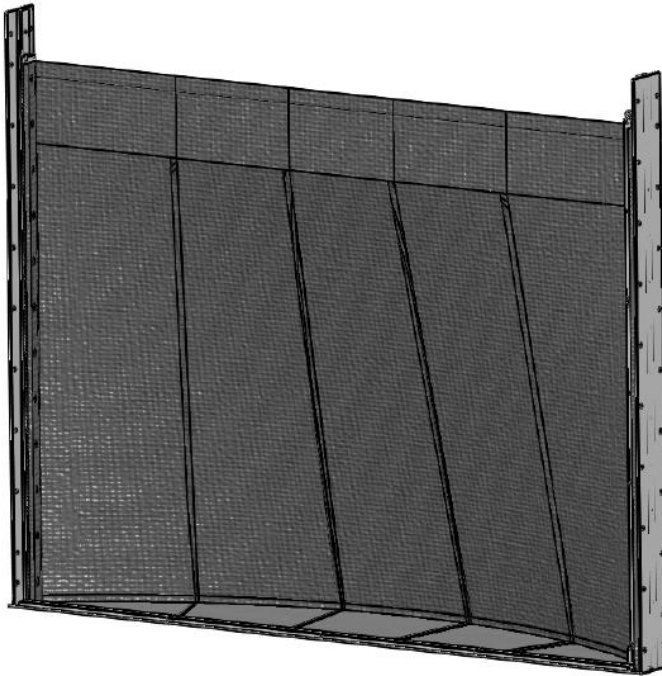
All colors and finishes can be tailored to meet client needs.

### Typical Side Deployed Configuration

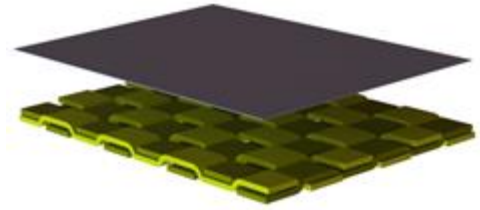
The Side Deployed Flex-Wall® is deployed by extending the flexible wall from its above grade container, pulling it across the opening to be protected, bolting it or clamping it to a pre-installed receiver, and positioning the integral ground interface skirt. The fabric wall is easily removable for cleaning or maintenance as necessary. The integral skirt can be "secured" to the ground via factory installed weighted bags or by clamping to preinstalled anchors.

### Robust Materials

The Side Deployed Flex-Wall® is manufactured from high-quality industry standard materials. All metal components are made from A36 steel which are painted or powder coated to meet ASTM B117 Salt Spray Exposure unless otherwise specified as in the case where manufacture with stainless steel is required on some Federally funded projects for example. The flexible wall's load carrying layer is manufactured from high strength Kevlar® and Polyester® textile webbings, and the water retention layer is a PVC coated Polyester®. All textile and membrane materials are highly durable and have been proven in long-term use in other industries including building coverings, trucking, and oil & gas production.



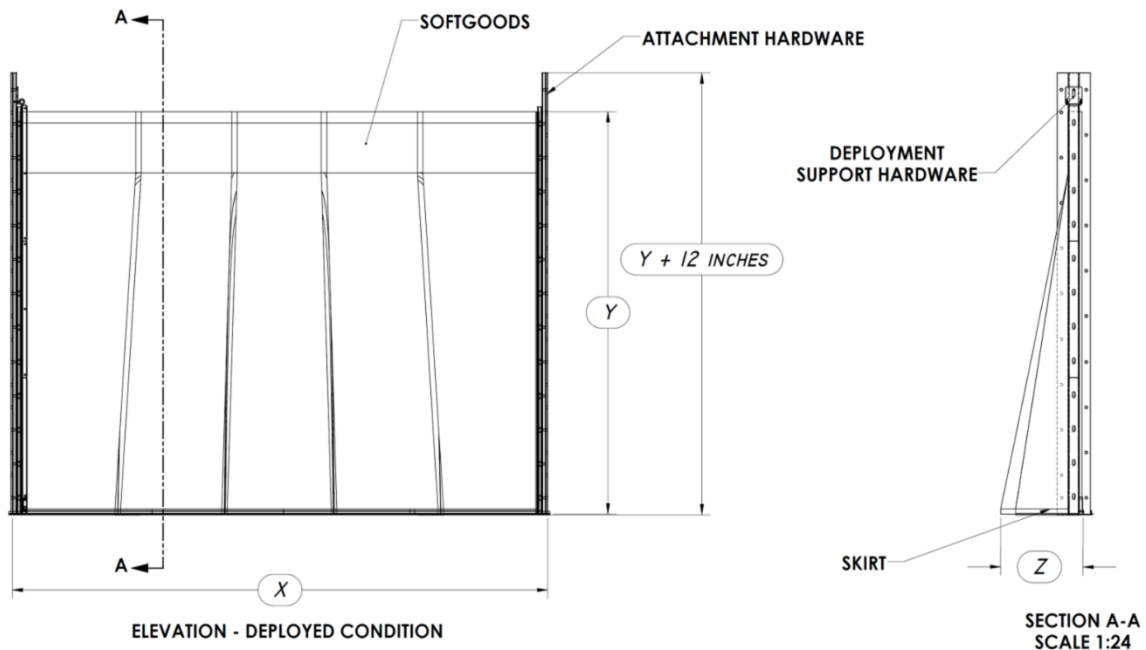
Water Retention Layer – PVC Coated Polyester (water side)



Structural Layer - High-Strength Kevlar Webbing (air side)

Patent US 9,453,316

Example of a Side Deployed Flex-Wall Configuration® (water side shown)



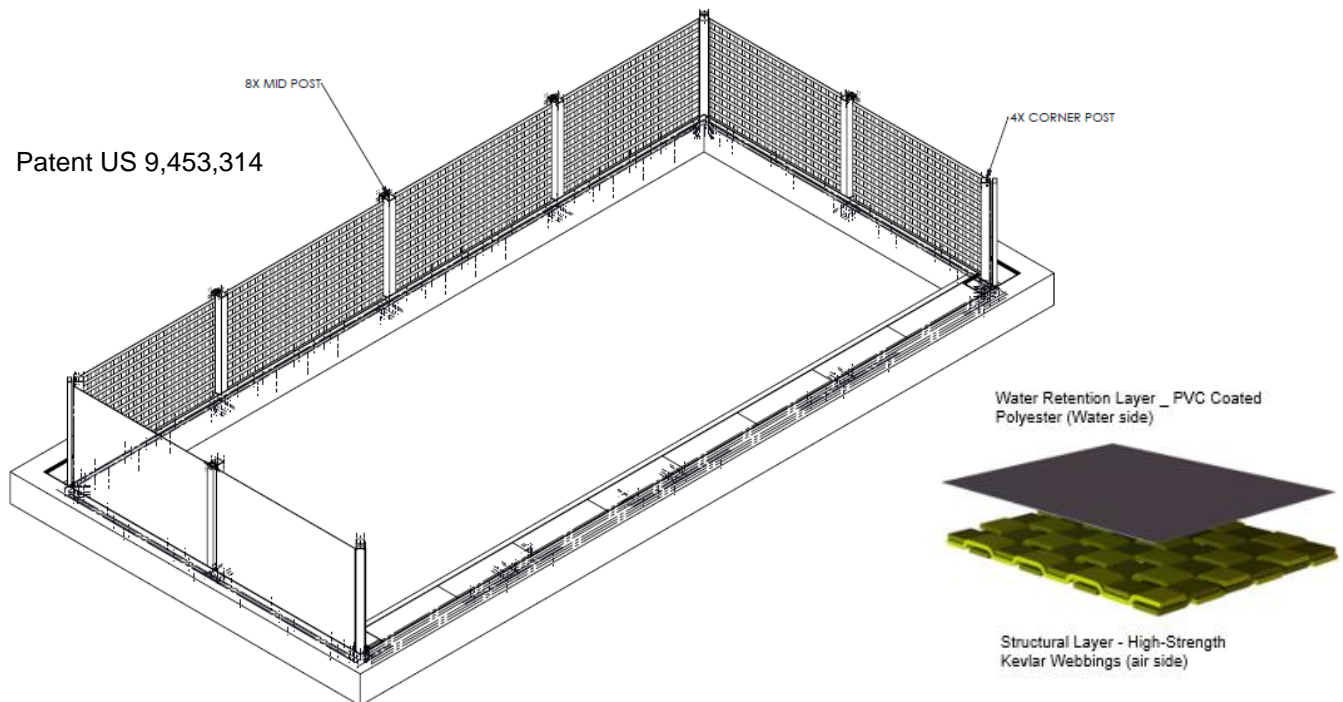
Deployed and Stowed sections of a typical Side Deployed Flex-Wall®

### Typical Vertically Deployed Configuration

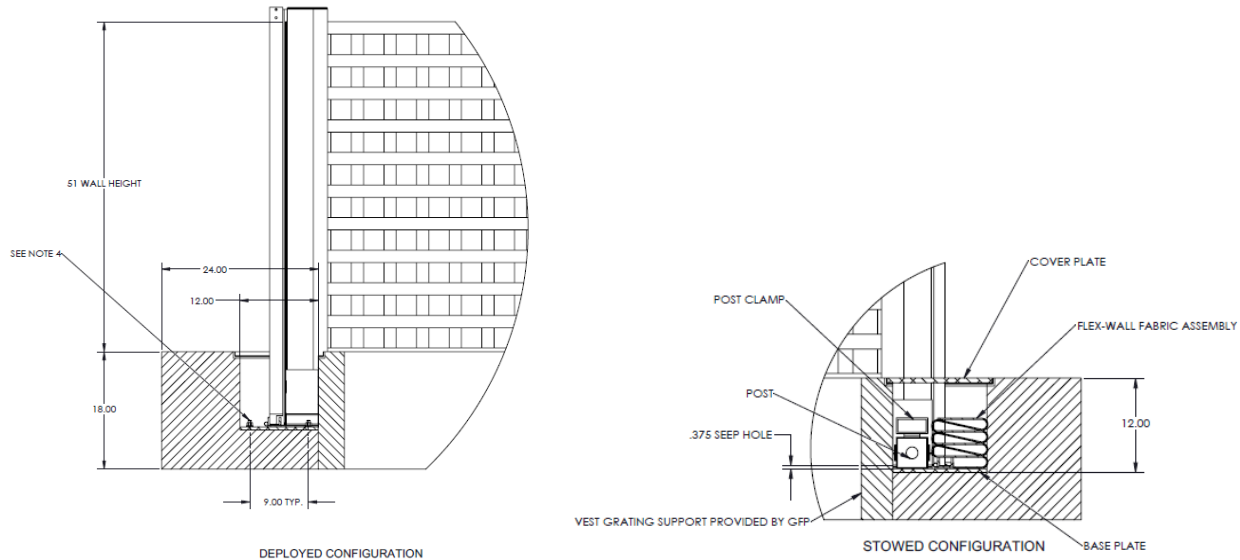
The Vertically Deployed Flex-Wall® is deployed by removing the trench container cover, installing the support posts into their holders, and then lifting the fabric wall onto hooks on the posts. Smaller walls are easily deployed by a single person. The fabric wall is easily removable for cleaning or maintenance as necessary.

### Robust Materials

The Vertically Deployed Flex-Wall® is manufactured from high-quality industry standard materials. All metal components are made from aluminum to be lightweight and for environmental resistance unless otherwise specified as in the case where manufacture with stainless steel is required on some Federally funded projects for example. The flexible wall's load carrying layer is manufactured from high strength Kevlar® and Polyester® textile webbings, and the water retention layer is a PVC coated Polyester®. All textile and membrane materials are highly durable and have been proven in long-term use in other industries including building coverings, trucking, and oil & gas production.



Example of a Vertically Deployed Flex-Wall® Configuration



Typical sections of a Deployed and Stowed Vertically Deployed Flex-Wall®

### 1. GENERAL CONDITIONS

**1.1. SCOPE.** The flood barrier supplied under this section shall be as manufactured by ILC Dover or approved equivalent by the engineer of record.

**1.2. GENERAL.** The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer unless exceptions are noted by the engineer of record. The flood barrier shall be supplied with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation, and shall be the latest product of a manufacturer regularly engaged in the production of flexible flood barriers.

### 1.3. QUALITY ASSURANCE

- 1.3.1 All work shall, as far as practical, be built-up, assembled, and finished in the shop and shall conform to the actual measurements taken by the Contractor at the Work Site.
- 1.3.2 The fully assembled flood barrier shall be shop inspected before shipping. Full Shop Tests and/or Acceptance Testing shall be performed in accordance with specific client requirements.
- 1.3.3 The manufacturer shall be ISO 9001 certified.
- 1.3.4 The manufacturer shall have a quality program in effect at their facility.
- 1.3.5 Installer qualifications: An employer of workers trained and approved by the manufacturer.

- 1.3.6 Manufacturer qualifications: Manufacturer shall present evidence attesting to a minimum of ten (10) years of successful experience in the design and manufacturing of tensioned fabric structures.
- 1.3.7 Third Party Test Witness: The Manufacturer shall provide a Certificate of Conformance or Test Report showing that a representative system has been tested successfully by a qualified third-party witness test lab.
- 1.3.8 The manufacturer will properly isolate all dissimilar metals to prevent galvanic action.
- 1.3.9 The manufacturer will provide access to the Designer to shop facilities for inspection of materials, testing, and workmanship.
- 1.3.10 The manufacturer shall demonstrate that they have similar systems installed.
- 1.3.11 The Manufacturer shall provide details confirming supply of products on federally funded projects in order to demonstrate experience with applicable site-specific procurement requirements or "Buy America" clauses.

**1.4. SUBMITTALS.** The manufacturer shall submit, for approval by the purchaser, drawings showing the principal dimensions, general construction and materials used in the flood barriers. Other items and/or submittals required to indicate conformance with the Contract Documents shall be available for the Engineer's inspection.

- 1.4.1 Manufacturers Data: Submit installation, operations and maintenance instructions for the flood barriers.
- 1.4.2 Shop Drawings: Submit shop drawings for the flood barriers including dimensioned plans, sections, finishes, connections and anchorage, and a parts list as required by the Client.
- 1.4.3 Calculations: Submit engineering calculations to verify the barrier's ability to withstand the design water loading and impact loading as required by the Client.
- 1.4.4 Third Party Operational Verification: Submit Test Reports to verify key operational features are met by the system. Key among these are seepage rate and deployment time. Should specific site requirements have not been tested with third party witness, similar test reports and documentation shall be submitted on an "as equal" basis from the manufacturer for similar items.
- 1.4.5 Operational and Maintenance Manuals: Operational and Maintenance (O&M) Manuals will be provided.
- 1.4.6 Installation Documentation: Installation process information will be provided to the Contractor. While the Contractor will perform all installation services, the Manufacturer will provide direct on-site support by the Manufacturer's in-house Engineering staff.

### 1.5 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

- A. ASTM A 1008/A36 - Standard Specifications for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy, and High-Strength Low-Alloy with Improved Formability
- B. ASTM A 554 – Standard Specification for Structural Stainless Steel
- C. ASTM A 480 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
- D. American Institute of Steel Construction (AISC) Steel Construction Manual, 13th Edition
- E. ASME Structural Welding Code Section IX.
- F. FEMA Technical Bulletin 3-93, 102 Requirements for Certification and Guidelines for Non-Residential Structures
- G. ASCE 24-14 – Flood Resistant Design and Construction
- H. ASCE 7-10 - Minimum Design Loads for Buildings and Other Structures.
- I. U.S. Army Corps of Engineers, EP 1165-2-314 - Flood Proofing Regulations, 15 December 1995.
- J. ANSI/FM 2510 – Flood Abatement Equipment
- K. MTA DG 312 – Design Guidelines
- L. ASTM G 154 – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
- M. ASTM D 5035 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
- N. ASTM D 751 - Standard Test Methods for Coated Fabrics
- O. FED-STD-191 - TEXTILE TEST METHODS
- P. FMVSS 302 - Federal Motor Vehicle Safety Standard 302
- Q. ASTM D 4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- R. NASA-STD-6001 - Flammability, Offgassing, and Compatibility Requirements and Test Procedures
- S. ASTM D 2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

## 2. PERFORMANCE

**2.1. Leakage:** The flood barrier shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.5 U.S. gallon per minute per foot (6.2 l/min per meter) of wetted periphery for the rated head for the weighted Side Deployed configuration. Leakage shall not exceed 0.1 U.S. gallon per minute per foot (0.4 l/min per meter) of periphery for the rated head for the clamped Side Deployed and Vertically Deployed configurations.

This value can be substantially reduced with special provisions to bring the seepage rate into compliance with ANSI/FM 2510 of 0.08 gallons per hour per linear foot of wetted seal perimeter length.

**2.2. Design Head:** For the purpose of these specifications, the system shall be defined as meeting the structural requirements at maximum water level as defined in the contract documents.

## 3. PRODUCT

**3.1 Acceptable Manufacturers:** ILC Dover, Frederica, DE.

**3.2 Service Life:** Documentation related to an anticipated 20 year Service Life as supported by Industry Standard Test Data/Supplier Data Sheets will be provided upon request. Specific product testing may be performed with data provided to the end Client upon request.

**3.3 Structural Puncture Resistance:** Puncture Resistance shall be provided so as to eliminate propagation of the tear under load conditions. This shall be shown via demonstration to include impact testing per Section 3.4 of this specification.

**3.4 Structural Impact Resistance:** The Manufacturer will demonstrate Impact Resistance by ASCE 7 Chapter 5 Commentary or ANSI 2510.

**3.5 Minimized Structural Loads:** The system design configuration shall be optimized based on the Water Load Calculations for the site-specific Design Flood Elevation (DFE) to minimize loads on the building being protected or the foundations required for the flood barrier. ASCE 7 Chapter 5 will be the guiding document for combining hydrostatic, hydrodynamic, wind, and impact loads. Local site-specific Design Guides, like the Metropolitan Transportation Authorities (MTA) Design Guide DG312 will also be considered as applicable by site specific procurement documents.

**3.6 Local Codes:** Specific local codes will be considered and included in the system configuration as applicable.

**3.7 Deployment and Training Documentation:** The Manufacturer will provide deployment and Training Documentation for the system. Training will also be provided as required by the specific Site Procurement documents.

**3.8 Structural Steel.** Structural steel for the frame assembly shall conform to ASTM A36 or other material based on Client requirements.

**3.9 Components.** All material for fabric, stiffeners, hardware, gaskets, opening and closure mechanisms, and embedded frame pieces shall be selected and supplied by the manufacturer based on the submitted design calculations to meet the design loads and performance criteria.

**3.10 Environmental Durability.** The Softgoods materials will have no more than a 10% reduction in strength after 1000 hours exposure per ASTM G 154.

- 3.11 **Strength and Durability.** A minimum of 200 pounds per linear inch (pli) will be demonstrated either by the Manufacturer's test or that of the supplier for the water barrier layer per ASTM D 5035 or equivalent test method. Test results will be demonstrated in the Warp and Fill directions. The Structural layer will be tested to the same test standard but with a minimum Tensile Strength of 6500 pli.
- 3.12 **Fiber Strength.** Structural materials will exhibit a minimum of 20 grams/denier tenacity when tested to ASTM D 5035.
- 3.13 **Coating Adhesion.** Coated materials will have a minimum coating adhesion to the substrate of 10 pli tensile strength per ASTM D 751 or FED-STD-191.
- 3.14 **Flammability Resistance.** The Barrier layer will not exhibit a flame propagation of more than four (4) inches maximum per FMVSS 302. The Structural layer will be self-extinguishing when tested to NASA-STD-6001, Test 1.
- 3.15 **Abrasion Resistance.** The materials will not exhibit more than 1% loss in fabric weight to replicate one (1) deployment and repacking per year for 20 years when tested in accordance with ASTM D 4060 when using an H-18 wheel.
- 3.16 **Blocking.** The materials will exhibit a Blocking rating of 1 at 140°F per FED-STD-191A.
- 3.17 **Seam Integrity.** Welded seams will maintain their integrity at a minimum of 140°F at 90% Relative Humidity over two (2) weeks with a minimum Dead Load result of 70 pli. Stitched Seam Durability will result in a minimum of 85% of the Tensile Strength of the base fabric when tested to ASTM D 5035.
- 3.18 **Decomposition Temperature.** The Structural layer of the system will meet a minimum decomposition temperature of 540°F.
- 3.19 **Creep/Rupture Resistance.** The Structural layer will be tested in accordance with ASTM D 2990 and show no permanent deformation at 140°F over 72 hours.

#### 4. EXECUTION

**4.1. INSTALLATION.** The flood barrier shall be handled and installed in accordance with the manufacturer's recommendations.

- 4.1.1 The manufacturer will supply all components of the flood barrier system to be installed by the Contractor. Contractor shall coordinate the location of these components with all required project trades and submit a composite shop drawing for review and approval.
- 4.1.2 Barrier calculations and Shop Drawings can be submitted for review prior to the construction of the supporting frame; however, the final barrier dimensions and fabrication must be based on an as-built survey of the constructed frame to ensure proper size, fit-up, and closure.

**4.2 TESTING.** The flood barrier will be tested to ensure performance as specified by the Client's Bid Specification.

- 4.2.1 If required, the Manufacturer will perform Shop Testing and production Acceptance Testing on the deliverable system and/or a system installed and tested but not delivered as agreed with the Client.



- 4.2.2 If required, the Contractor shall conduct a full-size field test on system(s) that will be installed on the project.
- 4.2.3 If no testing is required by the Client's Contract, a Test Report from the Manufacturer may be provided for a configuration that is representative of the most common conditions present in the final design.
- 4.2.4 It is acceptable to conduct the test at the project site using similar boundary conditions.
- 4.2.5 The test leakage rate must be less than or equal to the leakage rates of water per minute per linear foot of sealed perimeter as defined above.
- 4.2.6 Verify proper deployment & retraction after product installation.

## 5. WARRANTY

**5.1 WARRANTY.** The Manufacturer warrants the product against defects, workmanship and materials for one year from the date of Shipment. Extended Warranties will be negotiated and provided based on Client requirements.