Perimeter Flood Protection Barrier System

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1. Company Facts

Established: 1998 Norway

Headquarters: AquaFence AS, Nedre Skøyen Vei 3, 0277 Oslo, Norway

Factory: AquaFence Latvia SIA, Dzirnavu 73-2, LV-1011, Riga, Latvia

AquaFence Flood Protecting Barriers V1200 are FM Approved

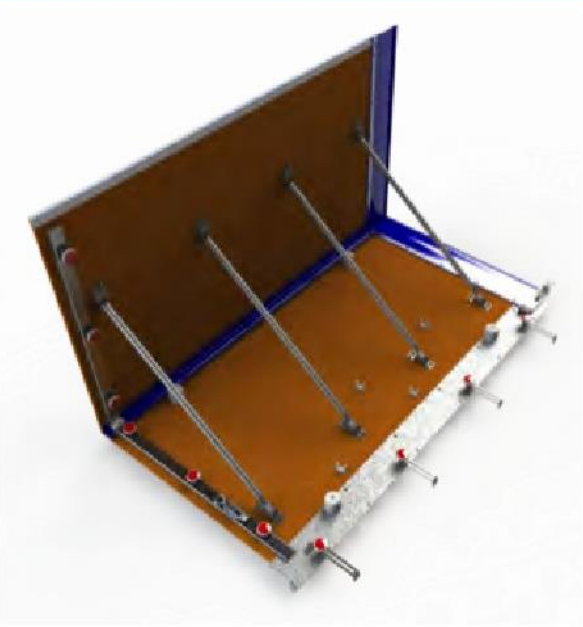
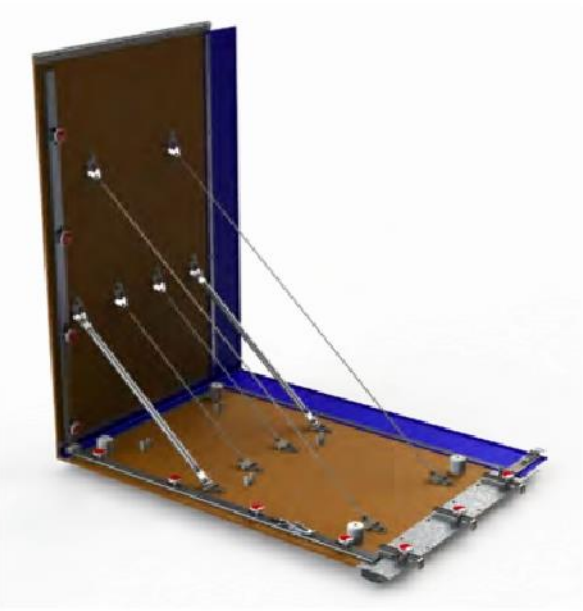
2. Description of The Product

The AquaFence Flood Protection Barrier System is designed for rapid deployment around a building or opening within hours of a pending flood event. Constructed of marine grade laminate, stainless steel, aluminum and reinforced PVC canvas, AquaFence systems are engineered such that the application of floodwater pressure consolidates and strengthens the systems rather than weakening them. A unique design feature allows for egress from a building until the last possible moment, providing safe evacuation of all building occupants (Fig. 2-1). A temporary walkway can be created by lowering the vertical elements of one or more panels and then quickly raised and secured in just a few minutes.

Fig.2-1 V1800 Perimeter barriers with a temporary egress opening

Fig. 2 -2 V2100 Barriers at The Pump Testing Deployment

3. Product Portfolio

Nr.	Type of Panel	Width	Height	Photo
1	V1200 (6.89ft) (3.94 ft)	2,10 m	1,20 m	
2	V1800 (3.94 ft) (5.91 ft)	1,20 m	1,80 m	

Nr.	Type of Panel	Width	Height	Photo
3	V2100 (3.94 ft) (6.89 ft)	1,20 m	2,10 m	
4	V2400* (3.94 ft) (7.87 ft)	1,20 m	2,40 m	

3.1.Flexsible Design

The unique design of the AquaFence perimeter flood protection barrier provides flexibility to navigate around obstacles. Adjacent (straight) panels can be articulated slightly to create gradual curves.

- V1200 - 5 degree articulation between adjacent panels
- V1800 - 2.5 to 2.7 degrees
- V2100 - 2.5 to 2.7 degrees

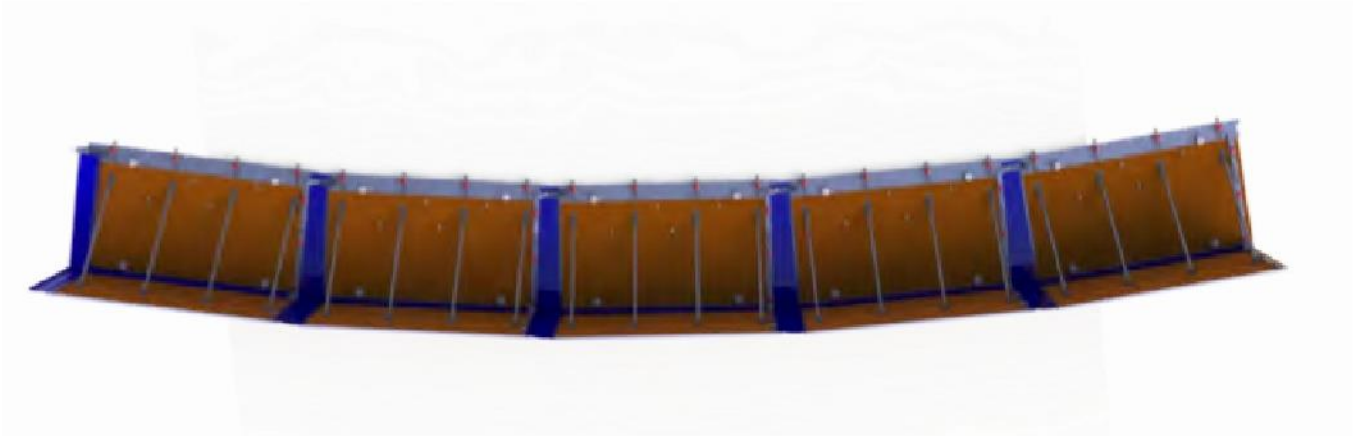


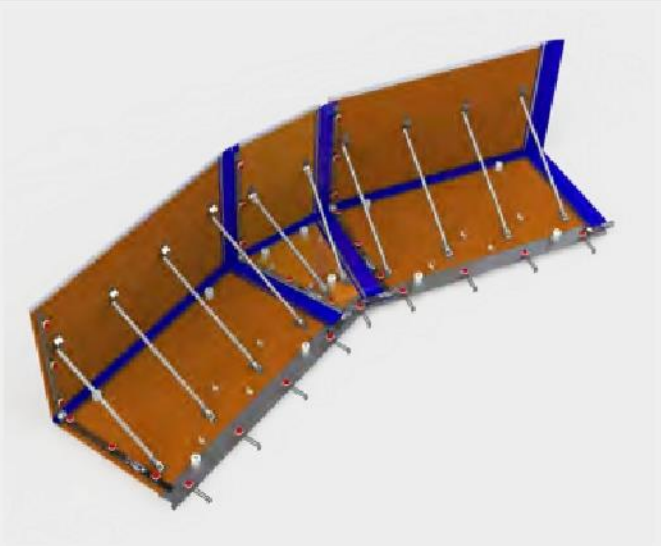
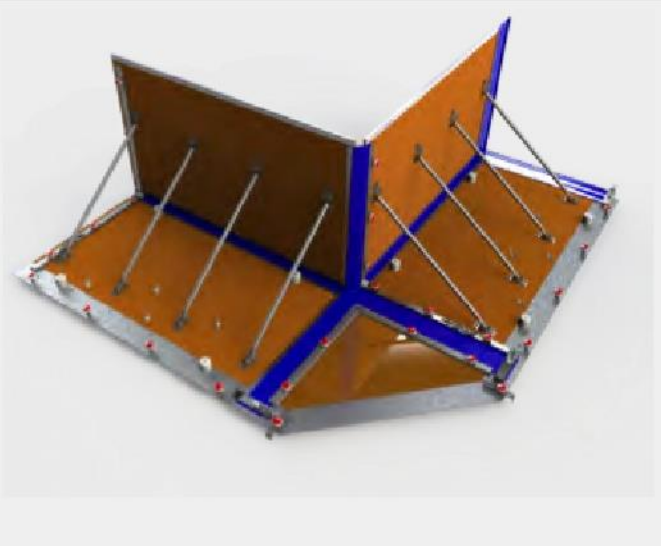
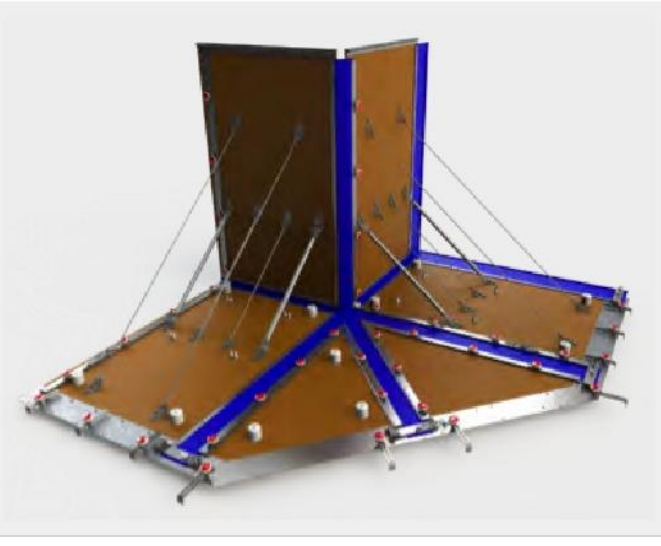
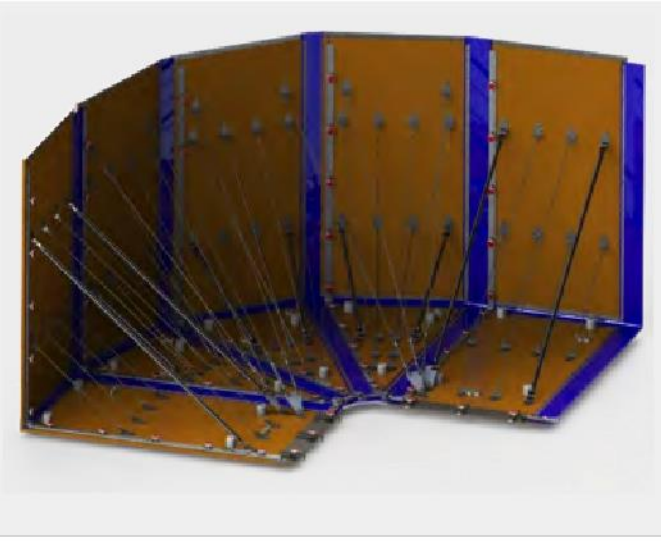
Fig. 3-1 V1200 curved

3.2.Available Corners

Corner panels of 30°, 45, 60° and 90° allow for sharp turns from one direction to another.

Outside Corner		30º		45º		60º		90º	
Barrier Type	V1200	Y	Y	Y	Y	Y	Y	Y	Y
	V1800	Y	Y	N	Y	Y	Y	Y	Y
	V2100	Y	Y	N	Y	Y	Y	Y	Y
	V2400	Y	Y	N	Y	Y	Y	Y	Y
Inside Corner		30º		45º		60º		90º	

*Special corner panels can be produced upon request to accommodate unique angular requirements.

V1200 INSIDE CORNER 45 DEGREES	V1200 OUTSIDE CORNER 90 DEGREES
	
V1800 INSIDE CORNER 90 DEGREES	**V2100 OUTSIDE CORNER 90 DEGREES**
	

V2100 OUTSIDE 90 DEGREE - NEW YORK CITY

3.3.Standard Corner Assemblies

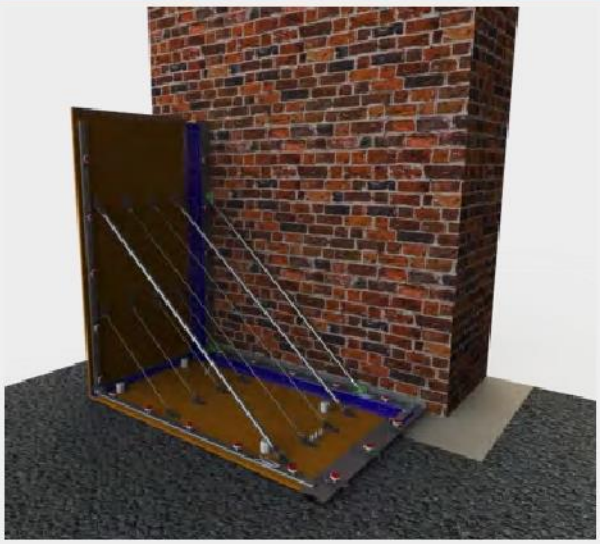
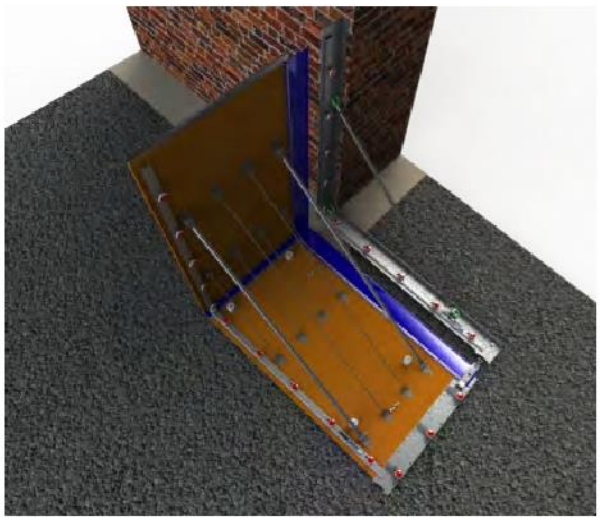
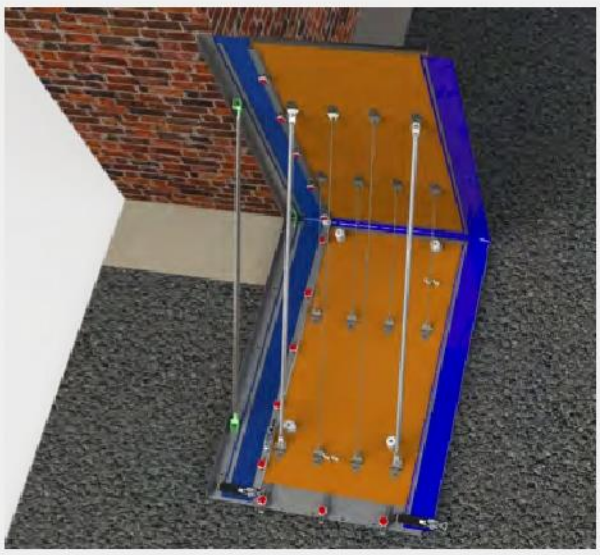
3.4.Standard Side Closers

Side closures connect flood barriers to a wall or fixed surface. Left and right side closure panels provide effective close-off to a fixed surface and a starting point for a string of panels in a barrier system. Standard side closures are shown Table 5. Custom design solutions can also be incorporated
depending on the configuration of the surface to which it joins.

Nr	Type of Panel	Width	Height	Photo
1	V1200 (0.77 ft) (3.94 ft)	0,235 m	1,2 m	

Nr.	Type of Panel	Width	Height	Photo
2	V1800 (0.77 ft) (5.91 ft)	0,235 m	1,8 m	
3	V2100 (0.77 ft) (6.89 ft)	0,235 m	2,1 m	

3.5.Side Closer Connection Options

Photo	Description
	Side closures has to be anchored with fasteners to the ground and to the wall in most of the cases.
	An example of a flush mount that starts a barrier 90 degrees to the wall.
	This view shows a barrier starting adjacent to a wall. Side closures can also be secured without fasteners to the wall, instead using a specially - designed push rod. Both options provide a flush connection, sealed with gaskets.

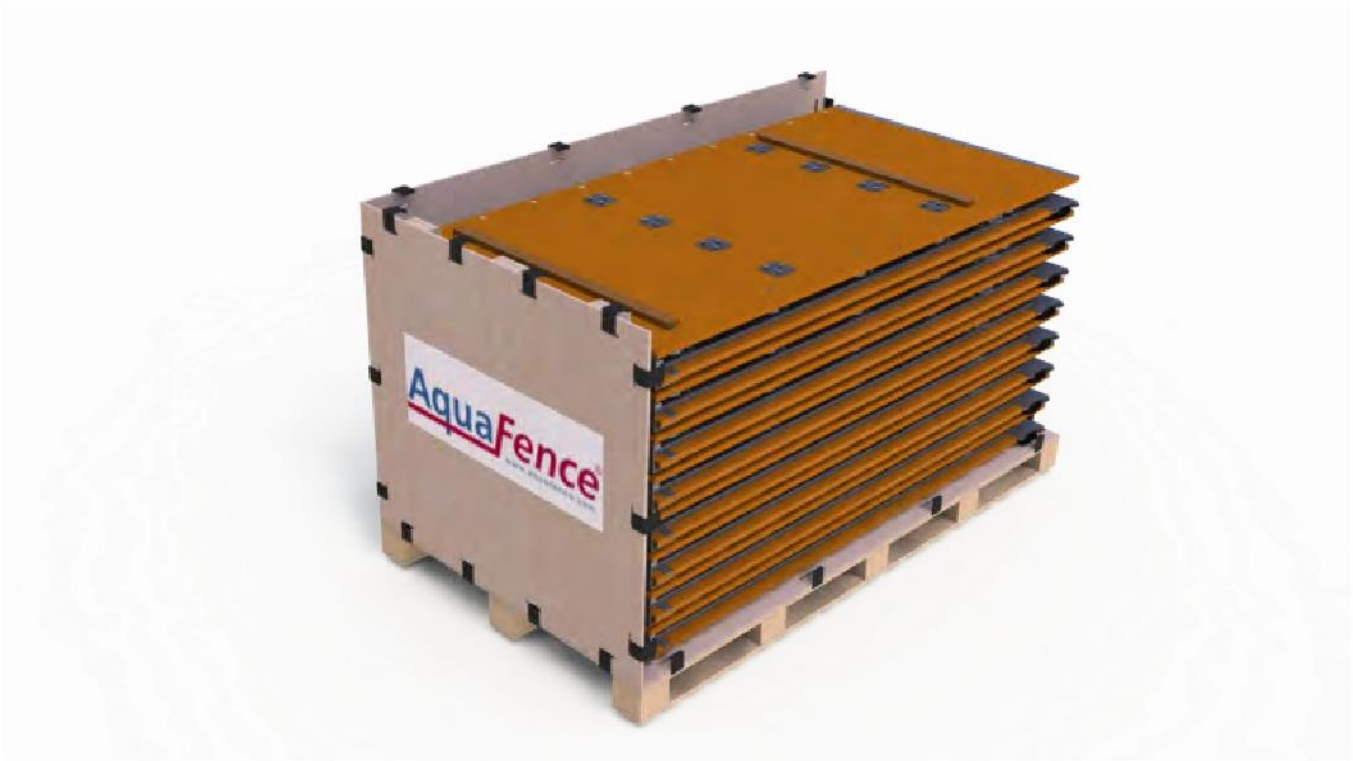
4. Packing

AquaFence barriers are stored in custom-designed wooden stackable crates. During storage, they can be stacked in columns of 4 crates.

4.1.Panels per Crate

Type of Panels	Panels per Crate	Linear Meters of Barrier per Crate
V1200	9	18,9 m (62 ft)
V1800	9	10,8 m (35.43 ft)
V2100	8	9,6 m (31.5 ft)
V2400*	8	9,6 m (31.5 ft)

* These are specially prepared V2100 barriers with a designed extension part. You can load in one crate 75 pcs extension pieces.



5. Storage

Dimensions and weights of panels in folded state:

Type of Panels	Length	Width	Height
V1200	2100 mm (82.7 in)	1200 mm (47.2 in)	130 mm (5.1 in)
V1800	1800 mm (70.9 in)	1200 mm (47.2 in)	130 mm (5.1 in)
V2100	2100 mm (82.7 in)	1200 mm (47.2 in)	140 mm (5.5 in)
V2400*	2100 mm (82.7 in)	1200 mm (47.2 in)	130 mm (5.1 in)

Empty Crate

Crate	Length	Width	Height
Assembled	2250 mm (88.6 in)	1264 mm (49.8 in)	1260 mm (50.2 in)
Flat packed	2250 mm (88.6 in)	1264 mm (49.8 in)	230 mm (49.8 in)

The panels should be stored in crates within a warehouse, a trailer or other secure vessel. Panels can withstand temperature extremes. The main material is wood however, so panels should be kept from direct sunlight for any extended period. Additional measures should be taken to keep panels dry while in storage and protected from animals such as mice and rats. After a deployment, the panels should be cleaned and dried for storage and future use.

5.1.Storage Space Required

Panel Type	Protection Line Distance	Number of Crates	Required Storage Space m2
V1200	100 m (328.08 ft)	6	5,72
	250 m (820.21 ft)	14	11,44
	500 m (1 640.42 ft)	27	20,02
	1000 m (3 280.84 ft)	53	40,04
V1800	100 m (328.08 ft)	10	8,58
	250 m (820.21 ft)	24	17,16
	500 m (1 640.42 ft)	47	34,32
	1000 m (3 280.84 ft)	93	68,64
V2100 V2400	100 m (328.08 ft)	11	8,58
	250 m (820.21 ft)	27	20,02
	500 m (1 640.42 ft)	53	40,04
	1000 m (3 280.84 ft)	105	77,22

*Calculations are done with an assumption that the crates are stacked 4 in one column.

6. Transportation

Transportation is commonly performed using 40' High Cube Containers.
Size of container (Inside)

Length	Width	Height	Weight When Fully Loaded
12,032 m (39.48 ft)	2,350 m (7.71 ft)	2,695 m (8.84 ft)	+/- 20 000 kg (46 297.08 lbs)

One container can house 18 crates

Type of Panels	Quantity per Container
V1200	162 panels
V1800	162 panels
V2100	144 panels
V2400*	144 panels

7. Performance Considerations

7.1.Installation

Rechargeable drills (with spare batteries) and plastic nut adapters will significantly enhance the speed with which the systems are fastened down. Each crate contains 2 plastic nut adapters. Please refer to the installation manual for further information.

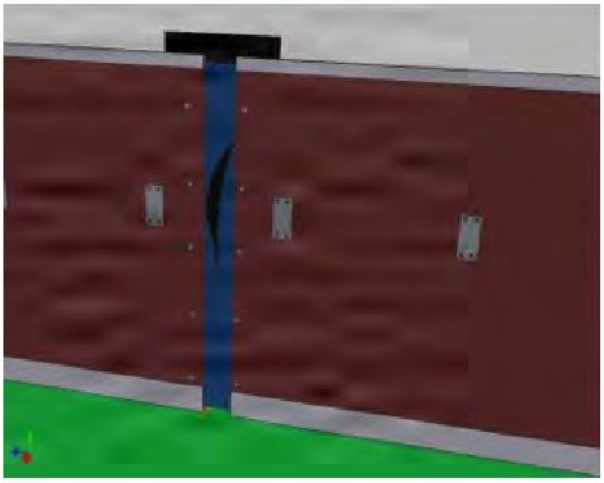
The design has been created to minimize the likelihood of assembly errors. The "Step-by-Step" installation manual provides easy guidance for the installation crew. For added measure, at least 2 well-trained supervisors should be assigned to oversee the installation and double-check the deployment once complete. A check sheet is included in the installation manual.

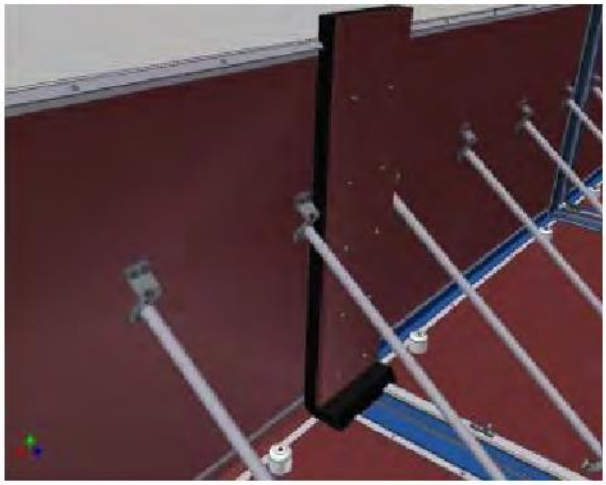
7.2. If the surface is not even

(*) A mobile solution with an extra gasket is available to put up AquaFence on limited, sloping surfaces, or irregular surfaces like cobblestones.

7.3.Repairs During Service

If damage occurs to the PVC canvas while in service, thick soft-cell rubber material stuffed in the damaged canvas and a wooden board can be installed from the water side of the system. The water will in this case apply force against the patch in the direction of the element, holding it in place and reducing the leakage. The panel can be further supported with wood screws from water side of the wooden patch.



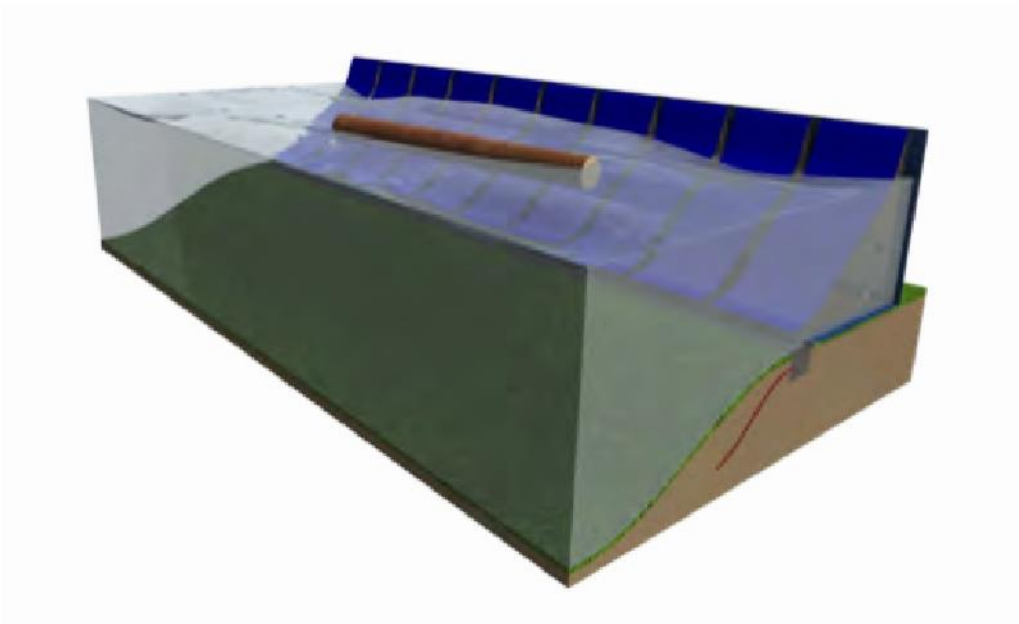


In case the canvas damage is not significant, there may be applied underwater glue to glue over the hole a new canvas piece.

In case of an emergency, it is recommended that at least one ladder with railing and platform be on site for evacuation or emergency personnel needing

7.4.Protective Shields

The AquaFence system is designed to withstand impact from floating debris.



Damage to individual components may occur but without system failure. In order to minimise damage, some customers choose to purchase systems with installed protective shields.

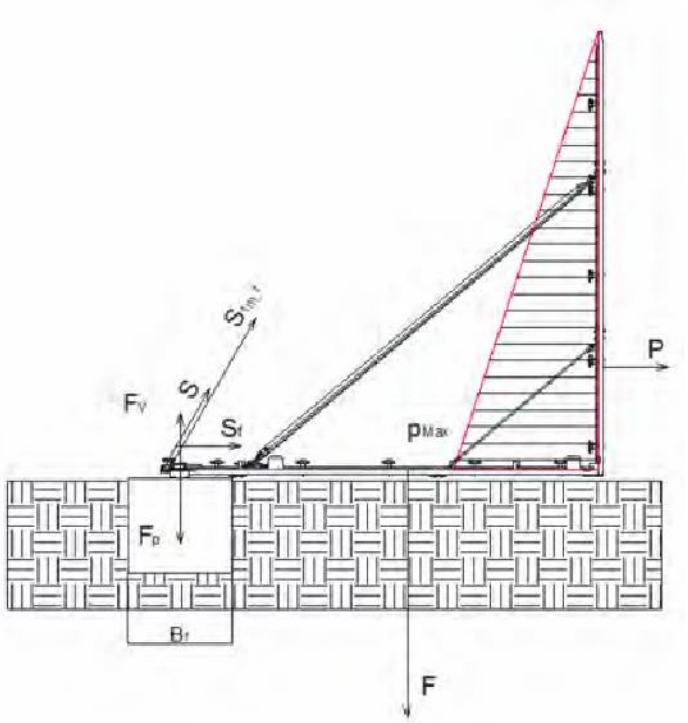
8. Material Data

Materials used in the production of flood protecting barriers.

Nr.	Material	Description
1	Marine Plywood	Marine Class Laminated Plywood Riga Ply Density 650 to 750 kg/m3, moisture content 8 +/- 2%
2	Stainless Steel	1.4307 Type 304L, A224, Tolerances EN ISO 9445-2
3	Aluminum	6005 - T6, 6082 - T6, 6063 - T6
4	Canvas	Polymer DIN ISO 2076, EN ISO 2060
5	Gasket	LD29 Plastazone, EV50
6	Silicone	0892 530 1 - Neutral Silicone
7	Glue	0890 100 1 - Bond + Seal White
8	Spray Glue	Scotch - Weld Spray 90 High Strength Adhesive
9	Screws, Bolts and Nuts	Stainless Steel A2

9. Technical Data

9.1.Foundation Loads



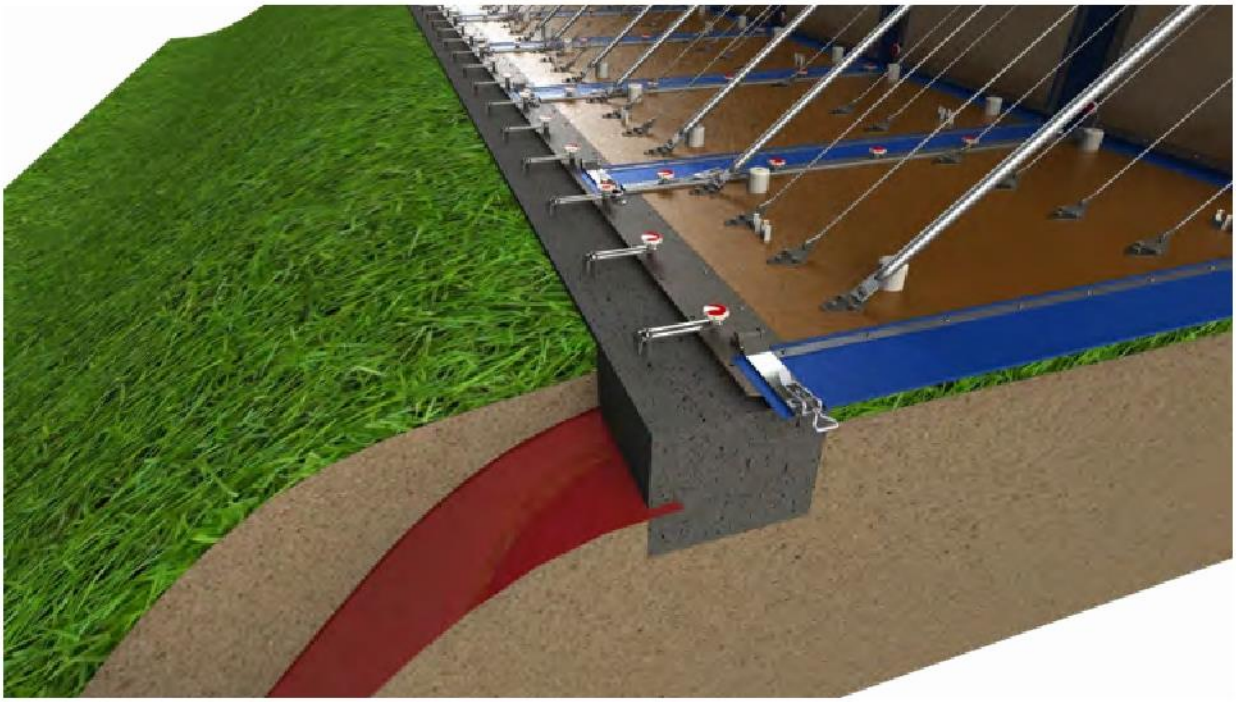
*Friction Coefficient 0.4

Nr.	Type of Panel	Maximum Foundation Load on 1 m Long Section
1	V1200	4.2365 kN
2	V1800	9.5321 kN
3	V2100	13.3449 kN
4	V2400	26.5369 kN

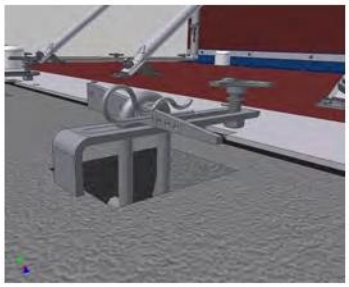
9.2.Anchoring

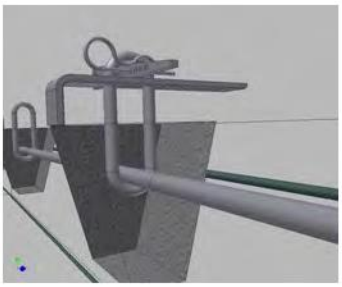
Although not mandatory, AquaFence flood protection barrier systems perform most effectively when anchored to the ground. A concrete bearing surface is preferred. When the primary bearing surface is not concrete (for example, packed soil), a concrete base can be installed in which the system can anchored by various methods.

One option is to install a bearing channel into the concrete base. The panels are attached using special anchor-screws. The concrete base/channel can be left in the ground in which case the channel is filled with polystyrene.



Another option involves using snap hooks attached to steel tubes encased in the concrete base.





9.2.1. Anchor Strength

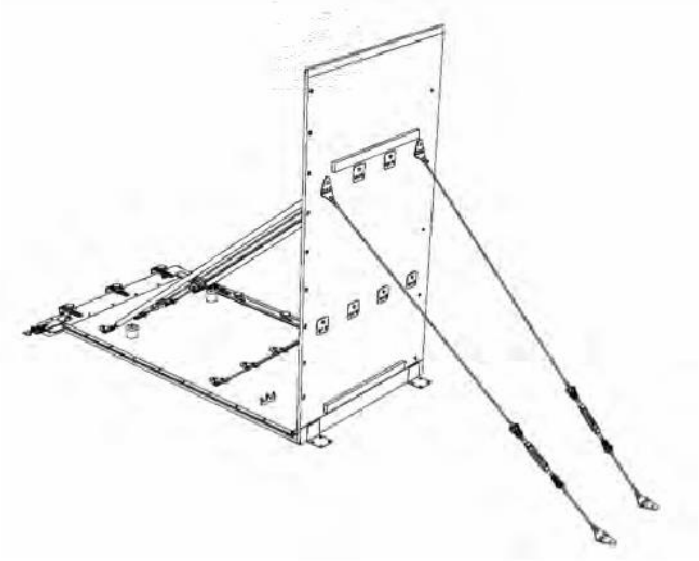
Calculations are done with the following assumptions:

Anchor Safety Coefficient 1.5 / Friction Coefficient 0.4 / Max water level, no significant waves, water stream 2.13 m/s (meters per second)

Nr.	Type of Panel	Recommended Anchor Strength Should be
1	V1200	10 kN
2	V1800	15 kN
3	V2100	15 kN
4	V2400	15 kN

9.3.Wind Load

When strong winds are expected, anchoring is again optional but strongly encouraged. A minimum of two but preferably three Hilti bolts (3/8" diameter, 3-1/2" long) are recommended to anchor each panel.



In addition, tie wires and/or base plates can be installed to provide additional support against wind forces. If high winds are accompanied by flooding, the water pressure further enhances the overall performance of the system.

9.4.Waves

AquaFence barrier systems perform very well as an inland line of flood defense including situations where highly-turbulent weather conditions cause waves to crash over the top of the panels. AquaFence barrier systems have been tested by the US Army Corps of Engineers and certified by the German Technical University of Hamburg Harburg (TUHH) and Factory.

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