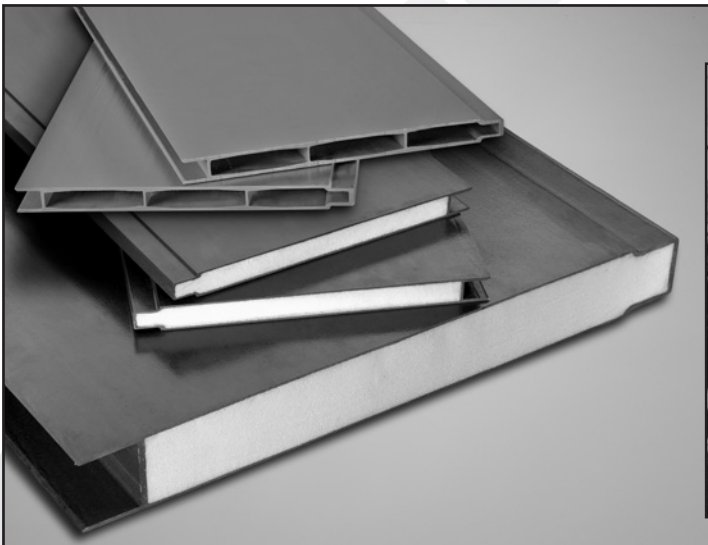


# **SECTION 14**

## **DURASHIELD® FIBERGLASS FOAM CORE BUILDING PANELS & DURASHIELD HC® FIBERGLASS HOLLOW CORE BUILDING PANELS**



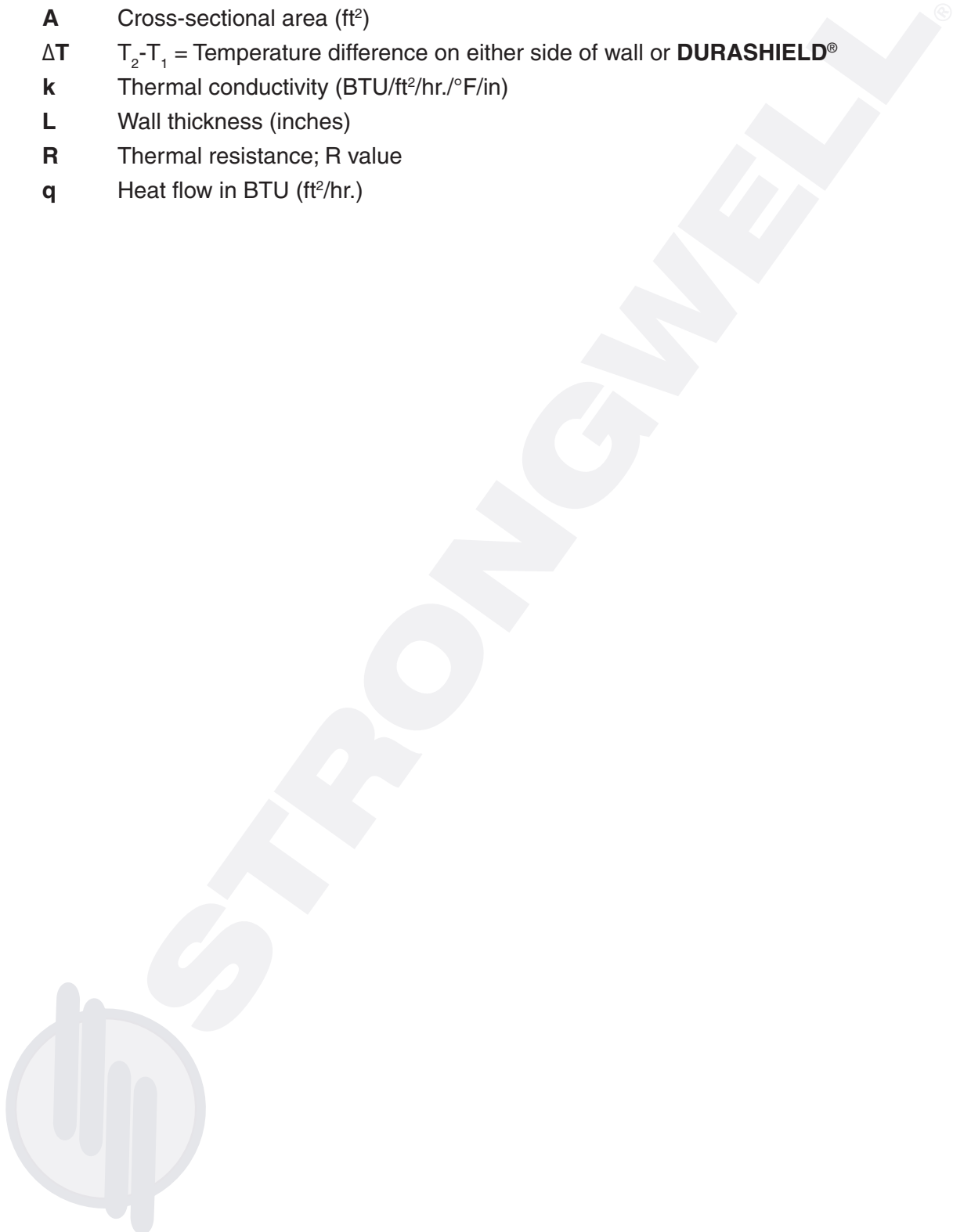
Look for this blue line in the left margin of the Design Manual documents. This line shows you where the latest update has been made.

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**SYMBOLS FOR DURASHIELD® FOAM CORE PANELS**

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- Q** Heat flow (BTU)
- A** Cross-sectional area (ft<sup>2</sup>)
- ΔT**  $T_2 - T_1$  = Temperature difference on either side of wall or **DURASHIELD®**
- k** Thermal conductivity (BTU/ft<sup>2</sup>/hr./°F/in)
- L** Wall thickness (inches)
- R** Thermal resistance; R value
- q** Heat flow in BTU (ft<sup>2</sup>/hr.)



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## DURASHIELD® FIBERGLASS FOAM CORE BUILDING PANELS

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### FEATURES

**DURASHIELD®** is a tongue-and-groove fiberglass pultruded panel comprised of a pultruded skin over a foam core. The exclusively made in the U.S.A. panel provides these features:

- Integral Insulation
- Lightweight
- High Strength
- Corrosion Resistant
- Low in Conductivity
- Flame Retardant
- Transparent to Electromagnetic Emissions

### SIZES

**DURASHIELD®** panels are available in 1" thick x 12" wide and 3" thick x 24" wide sizes. The panels can be produced in any practical length.

### MATERIALS OF CONSTRUCTION

The pultruded fiberglass skin of **DURASHIELD®** is available in either a premium polyester or a vinyl ester resin. Both resin systems provide flame retardance (UL 94 V-0). Vinyl ester is utilized in extreme corrosive applications. A synthetic surfacing veil is incorporated into the skin to improve weathering, corrosion resistance, and resistance to degradation from ultraviolet rays. Resistance to weathering can be further enhanced by the application of a polyurethane paint.

The core material, which provides the insulation value of **DURASHIELD®**, is a rigid closed-cell urethane foam. The ends of the panels must be encapsulated or coated with a resin similar to the skin resin to maintain the corrosion and weather resistant qualities of the total panel.

### APPLICATIONS

**DURASHIELD®** panels are designed to be used as walls, roofs, and covers. Typical applications are:

- Radar, Microwave, Radio, and TV Antenna Enclosures
- Enclosures for Electrical Equipment
- Enclosures of Chemical Processing Operations
- Buildings for EMI Testing (Computer Testing)
- Chemical Pit Covers
- Roofs on Wet-End Pulp and Paper Manufacturing
- Modular Buildings
- Walls/Flooring for Food Processing Operations

**DURASHIELD® PROPERTIES AND DIMENSIONS**

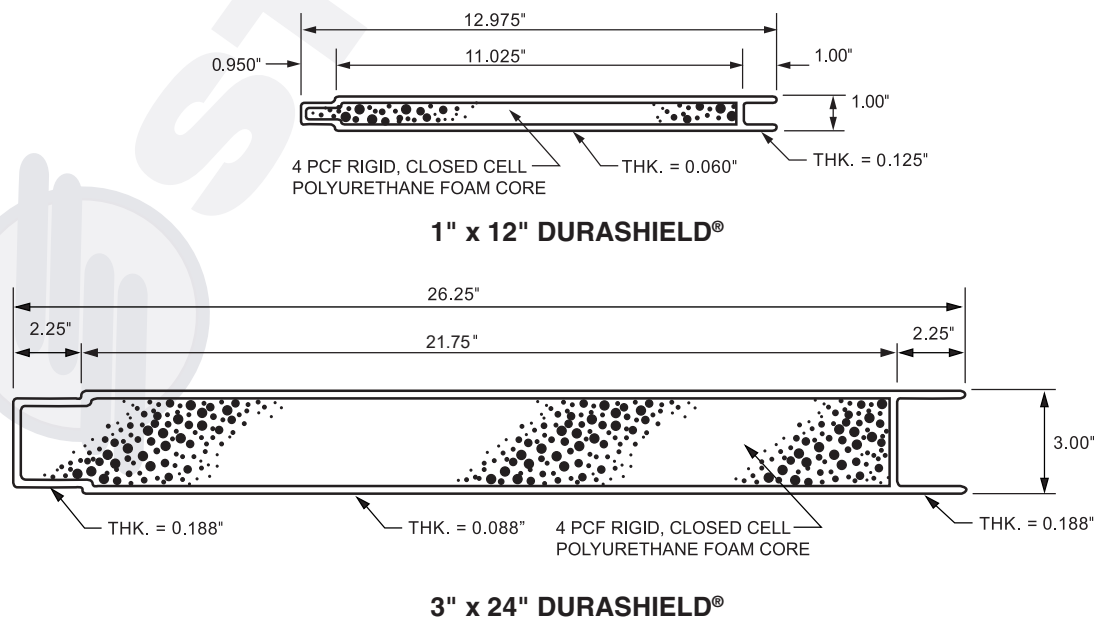
**PHYSICAL PROPERTIES (NOMINAL)**

PROPERTY	1" PANEL	3" PANEL
Weight (lbs/linear ft)	2.2	7.85
Panel Width (in)	12	24
'R' value ((hr ft °F)/BTU)	5	17
Foam Density (lbs/cu. ft)	4	4
Min. thickness FRP composite skin (in)	0.060	0.088
Coefficient of Thermal Exp. (10 <sup>-6</sup> in/in/°F)	5.2	5.2
Flame Spread Rating: <ul style="list-style-type: none"> <li>Fiberglass Composite Skin</li> <li>Foam</li> </ul>	MAX 25 MAX 25	MAX 25 MAX 25
Water Absorption	<0.3% if properly sealed	<0.3% if properly sealed
UL 94	V-0	V-0

**MECHANICAL PROPERTIES (NOMINAL)**

PROPERTY	1" PANEL	3" PANEL
LW Flexural Strength (psi)	1,750	869
LW Flexural Modulus (10 <sup>6</sup> psi)	0.2	0.17
LW Short Beam Shear (psi)	113	90
Pullout Test (pull through) (lbs) <ul style="list-style-type: none"> <li>Std. washer (1" dia. with 3/8" hole)</li> <li>Fender washer (2" dia. with 1/2" hole)</li> </ul>	650 1,300	730 1,620
Crush Test (6" x 6" load plate) (lbs)	5,600	6,750
Crush Test (full width) (lbs) <ul style="list-style-type: none"> <li>1" dia. bar</li> <li>2-1/2" dia. bar</li> </ul>	5,200 —	— 18,800

**NOMINAL DIMENSIONS**



**ROOFING AND SIDING LOAD TABLES**

**1" PANEL ALLOWABLE UNIFORM LOAD (PSF)\*\***

SPAN (ft)	@Δ = span/60			@Δ = span/120			@Δ = span/180		
	Δ (in)	Siding	Roofing	Δ (in)	Siding	Roofing	Δ (in)	Siding	Roofing
4	0.8	*138	*136	0.4	*138	*136	0.27	90	88
5	1.0	*88	*86	0.5	72	70	0.33	40	38
6	1.2	*61	*59	0.6	38	36	0.40	20	18
7	1.4	45	43	0.7	22	20	0.47	12	10
8	1.6	32	30	0.8	14	12	0.53	8	6
9	1.8	22	20	0.9	8	6	0.60	4	2
10	2.0	14	12	1.0	6	4	–	–	–
11	2.2	10	8	1.1	4	2	–	–	–
12	2.4	8	6	–	–	–	–	–	–

**3" PANEL ALLOWABLE UNIFORM LOAD (PSF)\*\***

SPAN (ft)	@Δ = span/60			@Δ = span/120			@Δ = span/180		
	Δ (in)	Siding	Roofing	Δ (in)	Siding	Roofing	Δ (in)	Siding	Roofing
6	1.2	*340	*336	0.6	289	285	0.40	190	186
7	1.4	*246	*242	0.7	188	184	0.47	124	120
8	1.6	*189	*185	0.8	129	125	0.53	85	81
9	1.8	*150	*146	0.9	93	89	0.60	61	57
10	2.0	*121	*117	1.0	69	65	0.67	45	41
11	2.2	100	96	1.1	53	49	0.73	35	31
12	2.4	84	80	1.2	41	37	0.80	27	23
13	2.6	67	63	1.3	33	29	0.87	22	18
14	2.8	55	51	1.4	27	23	0.93	18	14
15	3.0	45	41	1.5	22	18	1.00	15	11
16	3.2	38	34	1.6	18	14	1.07	12	8
17	3.4	32	28	1.7	16	12	1.13	10	6
18	3.6	27	23	1.8	13	9	1.20	9	5
19	3.8	23	19	1.9	11	7	1.27	8	4
20	4.0	20	16	2.0	10	6	1.33	7	3

\*Controlled by stress with a factor of safety of 1.50.

\*\*Values are typical.

**PERFORMANCE:** These tables are offered as a guide only. The effects of sustained impact or dynamic loads, the particular corrosive environment and/or elevated temperatures have not been factored into these tables.

**SUPPORTING FIBERGLASS STRUCTURAL SHAPES**

DURASHIELD® panels are made for use with Strongwell's EXTREN® line of structural shapes. EXTREN® is available in over 100 standard shapes. Common additional supporting shapes are listed below.

USE	1" PANEL SUPPORTING SHAPES	3" PANEL SUPPORTING SHAPES
	SHAPE DESCRIPTION	SHAPE DESCRIPTION
<b>SECTION/BASE</b>	Standard EXTREN® Angle	Standard EXTREN® Angle
<b>CORNER POST</b>	Standard EXTREN® Angles Inside & Outside	Standard EXTREN® Angles Inside & Outside
<b>ROOF JOINER</b>	90° Custom Angle	90° Custom Angle
<b>DOOR FRAMING</b>	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel	3-1/2" x 2" x 7/32" EXTREN® Channel
<b>WINDOW LOUVERS</b>	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel	3-1/2" x 2" x 7/32" EXTREN® Channel
<b>FASTENERS</b>	3/8" dia. FIBREBOLT® Stud & Nut Stainless Steel (optional)	1/2" dia. FIBREBOLT® Stud & Nut Stainless Steel (optional)

**NOTE:**

These connections and supporting shapes can also be used with DURASHIELD HC®. See 14-10 for more information about DURASHIELD HC®.



**DURASHIELD® HEAT FLOW ESTIMATES**

The R-value technique is a simple way to estimate the heat flow and to compare insulating materials and approaches for **DURASHIELD®**.

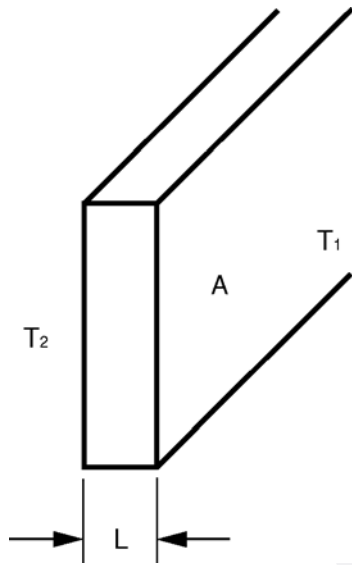
The R-value for **DURASHIELD®** are:

1" **DURASHIELD®**:  $R = 5 \text{ (ft}^2 \cdot \text{°F} \cdot \text{hr.)} / \text{BTU}$

3" **DURASHIELD®**:  $R = 17 \text{ (ft}^2 \cdot \text{°F} \cdot \text{hr.)} / \text{BTU}$

The R-values will be used by considering heat flowing through a wall on a straight line.

The heat flow equation for one dimensional heat transfer through a wall of thickness "L" is given by:



$$Q = kA \frac{\Delta T}{L} = \frac{\Delta T}{R} A = \frac{T_2 - T_1}{R} A$$

The R-value approach becomes a simplified way to write the heat flow equation. The above sketch does not indicate whether  $T_2$  or  $T_1$  is inside or outside of the wall. Heat flows from the hotter to the colder location.

For the 1" <b>DURASHIELD®</b>	For the 3" <b>DURASHIELD®</b>
$Q = A \frac{\Delta T}{5}$	$Q = A \frac{\Delta T}{17}$
$\frac{Q}{A}$ = heat flow per unit area = $q$ = BTU/ft <sup>2</sup> hr. That is, "q" is the number of BTU's that flow through one square foot in one hour. For the Strongwell <b>DURASHIELD®</b> :	
$\frac{Q}{A} = q = \frac{\Delta T}{5} \quad (1)$	$\frac{Q}{A} = q = \frac{\Delta T}{17} \quad (2)$

**DURASHIELD® HEAT FLOW SAMPLE CALCULATIONS**

**EXAMPLES**

- 1) Outside Temperature = 100° F  
Inside Temperature = 180° F  
For the 1" **DURASHIELD®**, from equation (1)

1" **DURASHIELD®**

$$q = \frac{180 - 100}{5} = \frac{80}{5} = 16.0 \frac{\text{BTU}}{\text{hr. ft}^2}$$

for a 24 hour time period

$$q_{24} = 16.0 \times 24 = 384 \frac{\text{BTU}}{\text{ft}^2}$$

- 2) Outside Temperature = 0° F  
Inside Temperature = 180° F  
For the 3" **DURASHIELD®**, from equation (2)

3" **DURASHIELD®**

$$q = \frac{180 - 0}{17} = \frac{180}{17} = 10.6 \frac{\text{BTU}}{\text{hr. ft}^2}$$

$$q_{24} = 24 \text{ hour heat flow} = 10.6 \times 24 = 254 \text{ BTU/ft}^2$$

- 3) Outside Temperature = 0° F  
Inside Temperature = 180° F

1" **DURASHIELD®**

$$q = \frac{180 - 0}{5} = 36 \frac{\text{BTU}}{\text{hr. ft}^2}$$

$$q_{24} = 864 \text{ BTU/ft}^2$$

**NOTE:** The above calculations assume: One dimensional heat flow. This is rarely a strictly valid assumption but is used as a first order approximation. The heat flow will generally be in all directions from a heat source.

**GENERAL RULES FOR THE DURASHIELD® CALCULATION:**

- 1) Calculate heat flow using

$$q = \frac{\Delta T}{R} \quad (3) \quad \begin{array}{l} R = 5; 1" \text{ DURASHIELD}^{\circledR} \\ R = 17; 3" \text{ DURASHIELD}^{\circledR} \end{array}$$

This is the BTU's per hour per cross sectional area.

- 2) Determine the desired time interval. Often, either a one hour or 24 hour time period is selected.

$$q_{24} = 24 \frac{\Delta T}{R} = 24 \text{ hour heat flow. (4)}$$

To obtain the heat flow for any time period, multiply the results of equation (3) by the time in hours.

- 3) To obtain the heat flow for any cross sectional area multiply equation (3) by the area. Thus, a 40 ft<sup>2</sup> subjected to this type of heat flow for a 3" **DURASHIELD®** system would have a total heat flow given by:

$$Q = A \frac{\Delta T}{R} = 40 \times \frac{\Delta T}{17}$$

As an example, if the temperature difference,  $\Delta T$ , equaled 80°F for an area of 40 ft<sup>2</sup>

$$Q = 40 \times \frac{80}{17} = 188.2 \frac{\text{BTU}}{\text{hr.}}$$

and for 24 hours:  $Q_{24} = 24 \times 188.2 = 4517 \text{ BTU}$



**DURASHIELD® HEAT FLOW CHART**

Using the same one dimensional heat flow assumption, a quick reference chart is presented for a building constructed of **DURASHIELD®** and maintained at a constant 75°F temperature on the inside:

HEAT FLOW	OUTSIDE TEMPERATURE (°F)	BTU/FT <sup>2</sup> - One Day	
		1" DURASHIELD®	3" DURASHIELD®
HEAT OUT OF ROOM	-50	600	176.5
	-25	480	141.2
	0	360	105.9
	25	240	70.6
	50	120	35.3
	75	0	0
HEAT INTO ROOM	100	120	35.3
	125	240	70.6
	150	360	105.9
	175	480	141.2
	200	600	176.5

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## DURASHIELD HC® FIBERGLASS HOLLOW CORE BUILDING PANELS

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### FEATURES

**DURASHIELD HC®** is a non-insulated alternative to standard **DURASHIELD®**. The hollow core panel is a sensible choice for any type of roofing, flooring, enclosures, or screening that does not require insulation. As a tongue-and-groove building panel, it offers quick assembly and easy installation in various applications. Made exclusively in the U.S.A., **DURASHIELD HC®** panel provides these features:

- Lightweight
- Rot, Rust, and Mildew Resistant
- High Strength
- Low in Maintenance
- Easy to Install
- Low in Conductivity
- Flame Retardant

The pultruded panel's unique hollow core and intermediate ribs provide extra stiffness for uses such as decking, cladding, or tank covers. The panels can be bonded together with standard adhesives and attached to structural shapes with bolts or screw fasteners. Panels will not rot, rust, or mildew, which makes them ideal for high moisture environments including saltwater.

### SIZES

**DURASHIELD HC®** is available as a 1" thick x 12" wide panel. The panels can be produced in any practical length.

### MATERIALS OF CONSTRUCTION

A synthetic veil is incorporated into the surface to improve weathering, corrosion, and UV resistance. The standard resin system of **DURASHIELD HC®** is polyester; however, it can be custom ordered with a vinyl ester resin for highly corrosive applications. Both resin systems include flame retardants and meet the requirements of a Class 1 flame spread per ASTM E-84 and the self-extinguishing requirements of ASTM D-635.

### APPLICATIONS

**DURASHIELD HC®** panels are designed to be used as walls, roofs, and covers. Typical applications are:

- Cladding
- Decking
- Cellular Enclosures and Screening
- Tank Covers
- Cooling Tower Partition Walls
- Buildings and Enclosures when Insulation is Not Required

**DURASHIELD HC® PROPERTIES AND DIMENSIONS**

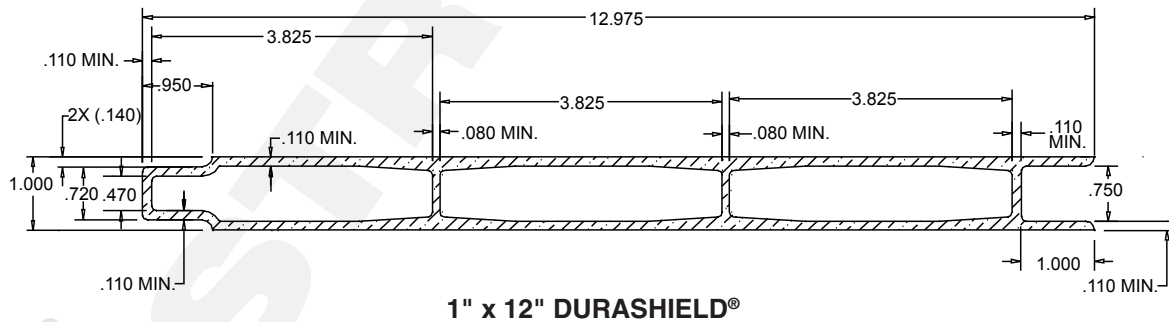
**PHYSICAL PROPERTIES (NOMINAL)**

PROPERTY	1" PANEL
Depth (in)	1
Panel Width (in)	12
Weight (lbs/linear ft)	3.27
Area (in )	3.914
Section Modulus (SX) (in /ft of width)	1.312
Moment of Inertia (IX) (in <sup>4</sup> /ft of width)	0.656
Coefficient of Thermal Exp. (10 <sup>-6</sup> in/in/°F)	7.0
Flame Spread Rating (ASTM E-84)	MAX 25
Water Absorption	<0.6%
UL 94	V-0

**MECHANICAL PROPERTIES (NOMINAL)**

PROPERTY	ASTM	1" PANEL
LW Compressive Strength (psi)	D695	50,000
LW Compressive Modulus (10 <sup>6</sup> psi)	D695	3.5
LW Tensile Strength (psi)	D638	58,000
LW Tensile Modulus (10 <sup>6</sup> psi)	D638	3.5
LW Short Beam Shear (psi)	D2344	4,500

**NOMINAL DIMENSIONS**



**DURASHIELD HC® ROOFING AND SIDING LOAD TABLES**

**1" PANEL ALLOWABLE UNIFORM LOAD (PSF)\*\***

SPAN (ft)	@Δ = span/60		@Δ = span/120		@Δ = span/180		@Δ = span/240		@Δ = span/300		@Δ = span/360	
	LOAD (lbs/ft <sup>2</sup> )	Δ (in)	LOAD (lbs/ft <sup>2</sup> )	Δ (in)	LOAD (lbs/ft <sup>2</sup> )	Δ (in)	LOAD (lbs/ft <sup>2</sup> )	Δ (in)	LOAD (lbs/ft <sup>2</sup> )	Δ (in)	LOAD (lbs/ft <sup>2</sup> )	Δ (in)
2.0	1727	0.40	863	0.20	576	0.13	432	0.10	345	0.08	288	0.07
2.5	1045	0.50	523	0.25	348	0.17	261	0.13	209	0.10	174	0.08
3.0	671	0.60	335	0.30	224	0.20	168	0.15	134	0.12	112	0.10
3.5	451	0.70	225	0.35	150	0.23	113	0.18	90	0.14	75	0.12
4.0	315	0.80	157	0.40	105	0.27	79	0.20	63	0.16	52	0.13
4.5	226	0.90	113	0.45	75	0.30	57	0.23	45	0.18	38	0.15
5.0	168	1.00	84	0.50	56	0.33	42	0.25	34	0.20	28	0.17
5.5	127	1.10	64	0.55	42	0.37	32	0.28	25	0.22	21	0.18
6.0	99	1.20	49	0.60	33	0.40	25	0.30	20	0.24	16	0.20
6.5	78	1.30	39	0.65	26	0.43	20	0.33	16	0.26	13	0.22
7.0	63	1.40	31	0.70	21	0.47	16	0.35	13	0.28	10	0.23
7.5	51	1.50	26	0.75	17	0.50	13	0.38	10	0.30	9	0.25
8.0	43	1.60	21	0.80	14	0.53	11	0.40	9	0.32	7	0.27

**NOTE: Controlled by stress with a factor of safety of 1.50.**

**\*\*Values are typical.**

**PERFORMANCE:** These tables are offered as a guide only. The effects of sustained impact or dynamic loads, the particular corrosive environment and/or elevated temperatures have not been factored into these tables.

**SUPPORTING FIBERGLASS STRUCTURAL SHAPES**

DURASHIELD HC® panels are made for use with Strongwell’s **EXTREN®** line of structural shapes. **EXTREN®** is available in over 100 standard shapes. Common additional supporting shapes are listed below.

USE	1" PANEL SUPPORTING SHAPES
	SHAPE DESCRIPTION
<b>SECTION/BASE</b>	Standard EXTREN® Angle
<b>CORNER POST</b>	Standard EXTREN® Angles Inside & Outside
<b>ROOF JOINER</b>	90° Custom Angle
<b>DOOR FRAMING</b>	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel
<b>WINDOW LOUVERS</b>	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel
<b>FASTENERS</b>	3/8" dia. FIBREBOLT® Stud & Nut Stainless Steel (optional)

**NOTE:**  
 These connections and supporting shapes can also be used with DURASHIELD®.