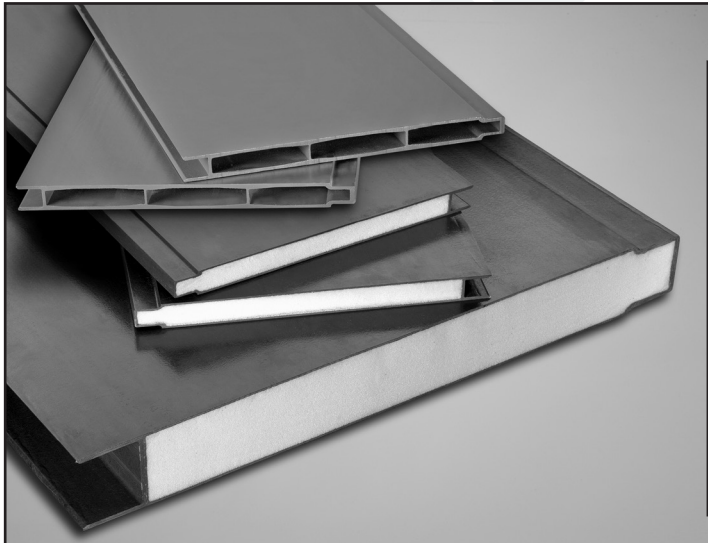


SECTION 14

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.

SYMBOLS FOR DURASHIELD® FOAM CORE PANELS

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



DURASHIELD® FIBERGLASS FOAM CORE BUILDING PANELS

FEATURES

The **DURASHIELD®** panel is a tongue-and-groove fiberglass pultruded panel comprised of a pultruded skin over a foam core. The panel provides these features:

- Integral Insulation
- Light Weight
- Strength
- Corrosion Resistance
- Non-Conductive
- Flame Retardant
- Transparent to Electromagnetic Emissions

SIZES

DURASHIELD® panels are currently available in 1" x 12" and 3" x 24" sizes. Special thicknesses or widths are possible if the quantity warrants. The panels can be produced in any length that is practical. Typical lengths would be in the 12' to 32' range.

MATERIALS OF CONSTRUCTION

The pultruded fiberglass skin is available in either an isophthalic polyester or vinyl ester resin. Both resin systems provide flame retardance (UL94 VO). The 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 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



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	.8	*138	*136	.4	*138	*136	.27	90	88
5	1.0	*88	*86	.5	72	70	.33	40	38
6	1.2	*61	*59	.6	38	36	.40	20	18
7	1.4	45	43	.7	22	20	.47	12	10
8	1.6	32	30	.8	14	12	.53	8	6
9	1.8	22	20	.9	8	6	.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	.6	289	285	.4	190	186
7	1.4	*246	*242	.7	188	184	.47	124	120
8	1.6	*189	*185	.8	129	125	.53	85	81
9	1.8	*150	*146	.9	93	89	.60	61	57
10	2.0	*121	*117	1.0	69	65	.67	45	41
11	2.2	100	96	1.1	53	49	.73	35	31
12	2.4	84	80	1.2	41	37	.80	27	23
13	2.6	67	63	1.3	33	29	.87	22	18
14	2.8	55	51	1.4	27	23	.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.

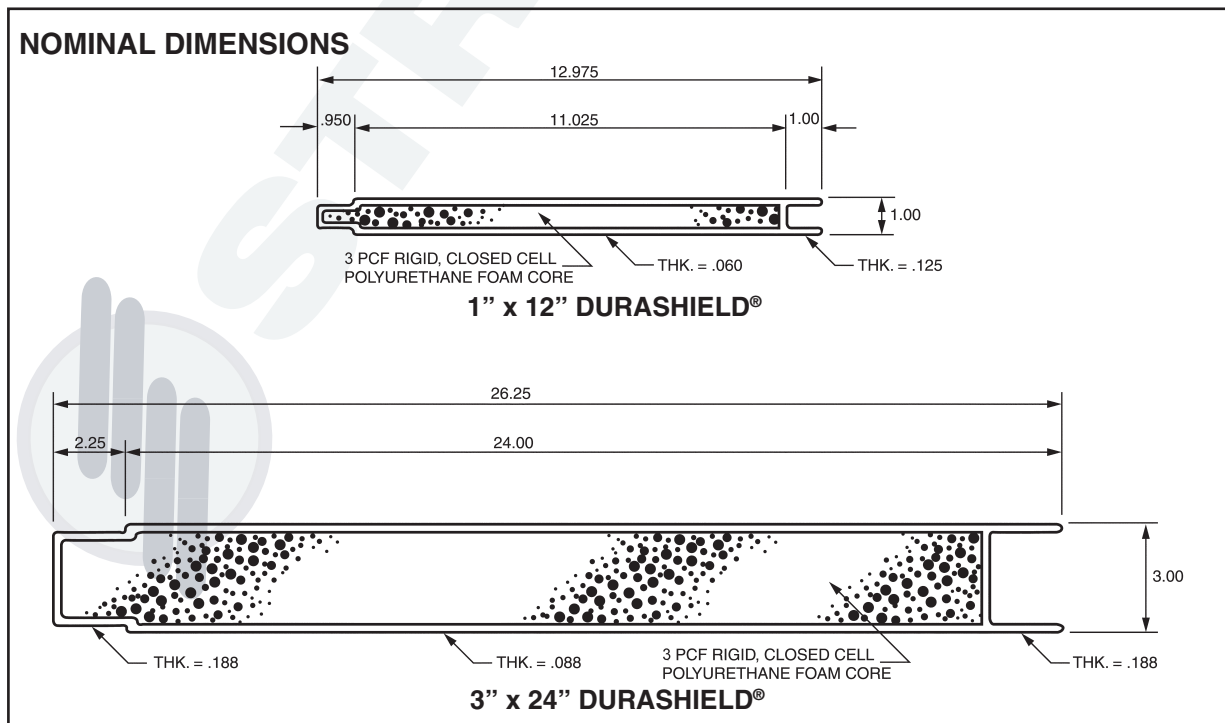
**Values are typical.

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.

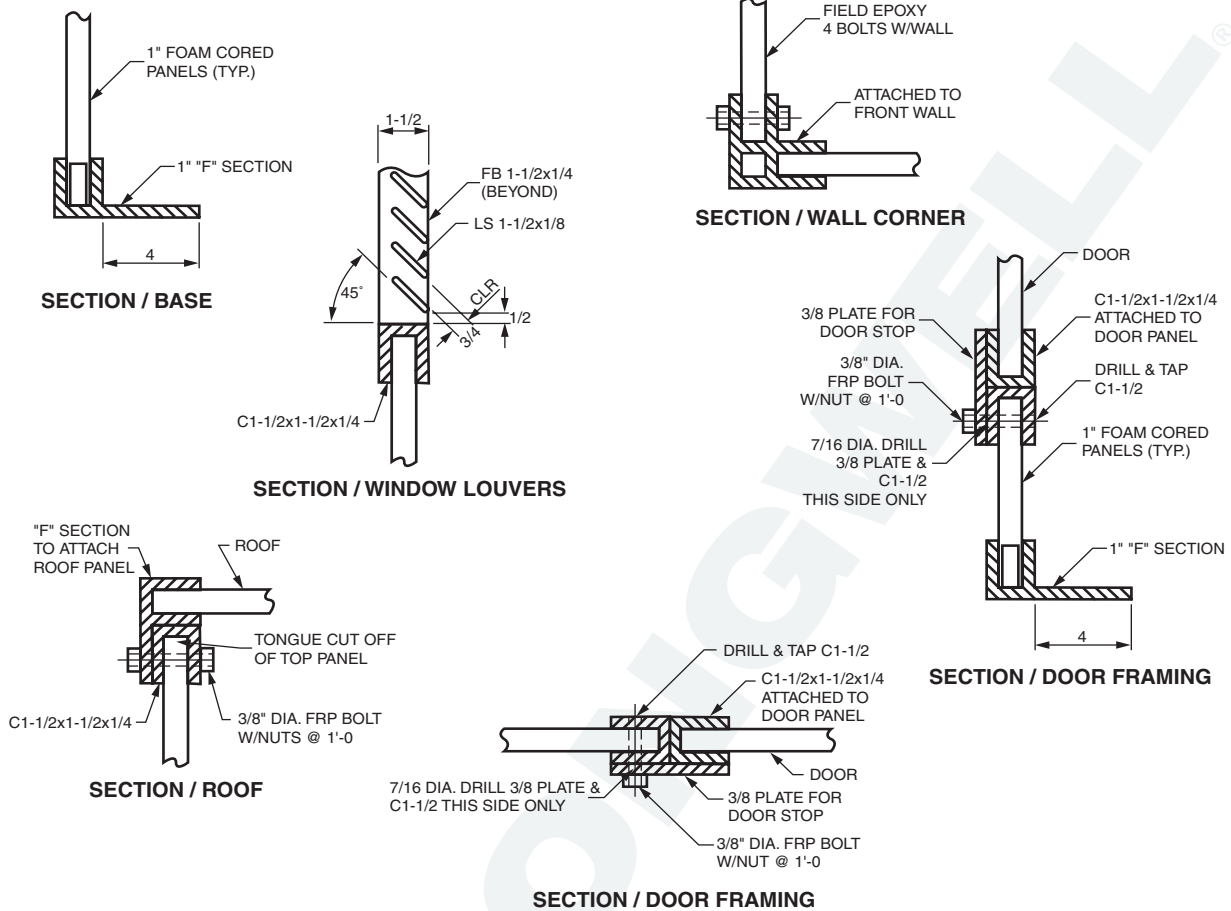
DURASHIELD® PROPERTIES AND DIMENSIONS

PHYSICAL PROPERTIES (NOMINAL)		
PROPERTY	1" PANEL	3" PANEL
Weight (lbs/linear ft.)	1.99	7.85
Panel Width (in.)	12	24
'R' Factor	5	17
Foam Density (lbs/cu. ft.)	4	4
Min. thickness FRP composite skin (in.)	.060	.088
Flame Spread Rating		
• Fiberglass Composite skin	MAX 25	MAX 25
• Foam	MAX 25	MAX 25
Water Absorption	<.3% if properly sealed	<.3% if properly sealed
UL94	VO	VO

MECHANICAL PROPERTIES (NOMINAL)		
PROPERTY	1" PANEL	3" PANEL
Flexural Strength (psi)	1,750	869
Flexural Modulus (10 ⁶ psi)	.2	.17
Short Beam Shear (psi)	113	90
Coefficient of Thermal Exp. 10 ⁻⁶ in/in/°F	5.2	5.2
Pullout Test (pull through) (lbs.)		
• Std. washer (1" dia. with 3/8" hole)	650	730
• Fender washer (2" dia. with 1/2" hole)	1,300	1,620
Crush Test (6" x 6" load plate) (lbs.)	5,600	6,750
Crush Test (full width) (lbs.)		
• 1" dia. bar	5,200	
• 2-1/2" dia. bar		18,800



TYPICAL DURASHIELD® ASSEMBLY SECTIONS



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. Typical additional supporting shapes are shown below.

Use	1" PANEL SUPPORTING SHAPES	3" PANEL SUPPORTING SHAPES
	Shape Description	Shape Description
SECTION/BASE	5-1/2" x 1-1/2" X 1/4" F Section	Standard EXTREN® Angle
CORNER POST	3-1/4"x 1/4" Custom Corner Post	Standard EXTREN® Angles Inside & Outside
ROOF JOINER	5-1/2" x 1-1/2" x 1/4" F Section 1-1/2" x 1-1/2" x 1/4" EXTREN® Channel	90° Custom Angle
DOOR FRAMING	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel	3-1/2" x 2" x 7/32" EXTREN® Channel
WINDOW LOUVERS	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel	3-1/2" x 2" x 7/32" EXTREN® Channel
FASTENERS	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-factor technique is a simple way to estimate the heat flow and to compare insulating materials and approaches for **DURASHIELD®**.

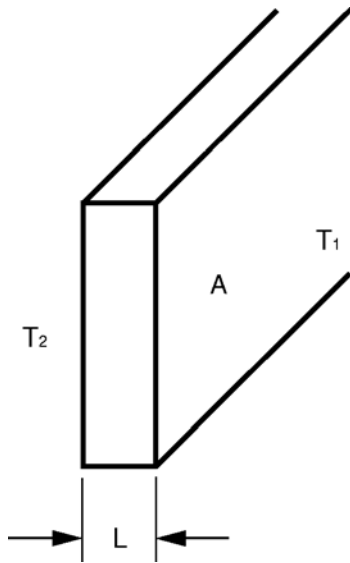
The R-Factors for **DURASHIELD®** are:

1" **DURASHIELD®**: R = 5

3" **DURASHIELD®**: R = 17

The R-Factors 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-Factor 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" DURASHIELD®	For the 3" DURASHIELD®
$Q = A \frac{\Delta T}{5}$	$Q = A \frac{\Delta T}{17}$
$\frac{Q}{A}$ = heat flow per unit area = q = BTU/Ft ² .Hr. That is, "q" is the number of BTU's that flow through one square foot in one hour. For the Strongwell DURASHIELD® :	
$\frac{Q}{A} = q = \frac{\Delta T}{5}$ (1)	$\frac{Q}{A} = q = \frac{\Delta T}{17}$ (2)

DURASHIELD® HEAT FLOW SAMPLE CALCULATIONS

EXAMPLES

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

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

for a 24 hour time period

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

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

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

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

- 3) Outside Temperature = 0°F 1" DURASHIELD®
 Inside Temperature = 180°F

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

$$q_{24} = 864 \text{ BTU/hr.}$$

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

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

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 ft² 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, ΔT, equaled 80°F for an area of 40 ft.²

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

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 ² - 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



DURASHIELD HC® FIBERGLASS HOLLOW CORE BUILDING PANELS**FEATURES**

The **DURASHIELD HC®** panel is a tongue-and-groove hollow fiberglass pultruded panel. The panel is a sensible choice for any type of roofing, flooring, enclosures or screening that does not require insulation. The panel provides these features:

- Lightweight
- Strength
- Low in Conductivity
- Low Maintenance
- Easy to Install
- Rot, Rust & Mildew Resistance
- Flame Retardant

SIZES

DURASHIELD® panels are currently available in standard 1" x 12" panels. The panels can be produced in any length that is practical. Typical lengths would be in the 12' to 32' range.

MATERIALS OF CONSTRUCTION

The pultruded fiberglass skin is available in either an isophthalic polyester or vinyl ester resin. Both resin systems provide flame retardance (UL94 VO). The 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. Both resin systems include flame retardants and meet the requirements of a Class 1 flame spread per ASTM E84 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® ROOFING AND SIDING LOAD TABLES

1" PANEL ALLOWABLE UNIFORM LOAD (psf) **

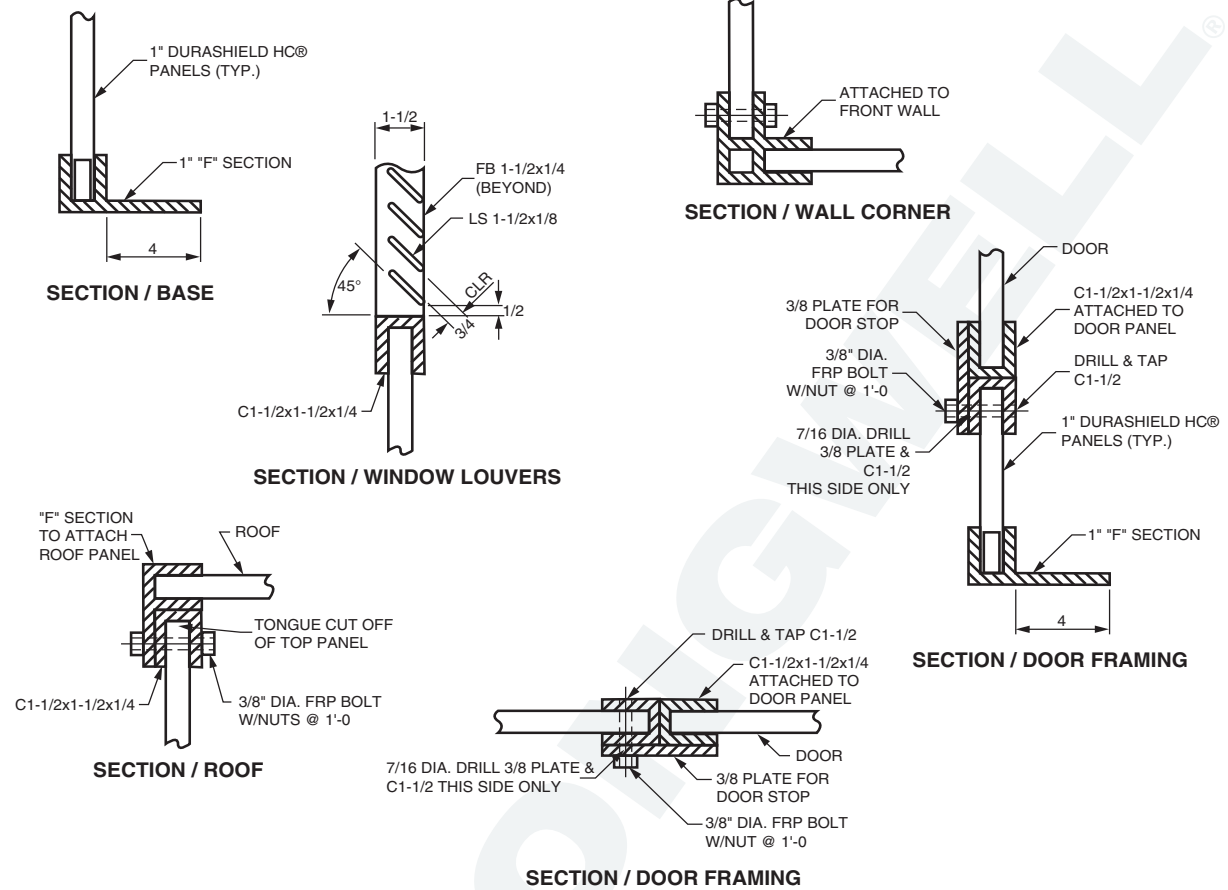
SPAN (ft.)	@Δ=span/60		@Δ=span/120		@Δ=span/180		@Δ=span/240		@Δ=span/300		@Δ=span/360	
	LOAD (lbs/ft ²)	Δ (IN.)	LOAD (lbs/ft ²)	Δ (IN.)	LOAD (lbs/ft ²)	Δ (IN.)	LOAD (lbs/ft ²)	Δ (IN.)	LOAD (lbs/ft ²)	Δ (IN.)	LOAD (lbs/ft ²)	Δ (IN.)
2.0	1727	0.40	863	0.20	576	0.13	432	0.10	345	0.08	288	0.07
2.5	1045	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.

TYPICAL DURASHIELD HC® ASSEMBLY SECTIONS



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. Typical additional supporting shapes are shown below.

	1" PANEL SUPPORTING SHAPES
<i>Use</i>	<i>Shape Description</i>
SECTION/BASE	5-1/2" x 1-1/2" X 1/4" F Section
CORNER POST	3-1/4"x 1/4" Custom Corner Post
ROOF JOINER	5-1/2" x 1-1/2" x 1/4" F Section 1-1/2" x 1-1/2" x 1/4" EXTREN® Channel
DOOR FRAMING	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel
WINDOW LOUVERS	1-1/2" x 1-1/2" x 1/4" EXTREN® Channel
FASTENERS	3/8" dia. FIBREBOLT® Stud & Nut Stainless Steel (optional)

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