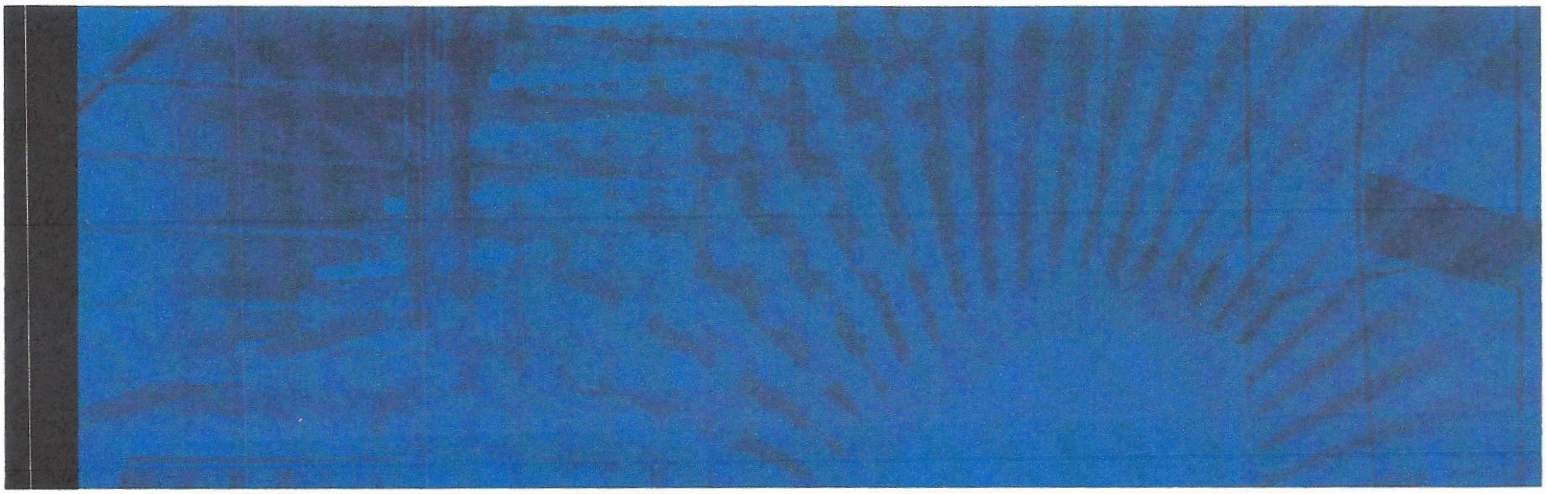
E-Header/Sill™

Cold-Formed Insulated Composite Structural Elements

Engineering/Analysis Report



January 2012

kpff Consulting Engineers

kpff Consulting Engineers

February 28, 2012

Mr. Duane Den Adel
Evolution 1, LLC
309 Noble Cliff
Langley, WA 98260

Subject: E-Header/Sill Testing Report

Dear Duane:

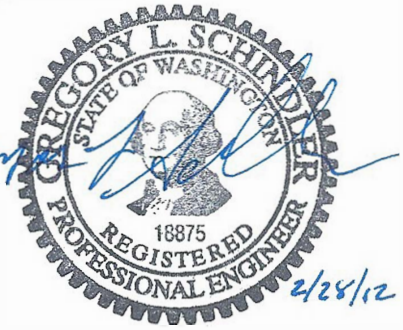
This is our engineering report, which documents the testing program conducted at Mayes Testing Engineer Laboratories on December 6, 2011. The purpose of these tests was to establish the capacities of the E-Beam HD cold-formed, pre-insulated, header elements.

The appendix of the report includes the table of section properties and bending strengths, as established by this testing program.

Our report may be used in conjunction with the Mayes Testing report, dated December 6, 2011.

We appreciate the opportunity to assist you in the effort. If you have any questions, please call me at (206) 622-5822.

Sincerely,



Greg Schindler, SE
Associate

KKH:kls

Enclosure

111003.20

1601 Fifth Avenue Suite 1600 Seattle, WA 98101 (206) 622-5822 Fax (206) 622-8130

Seattle Everett Tacoma Lacey Portland Eugene Sacramento San Francisco Walnut Creek Los Angeles Long Beach Pasadena Irvine
San Diego Boise Phoenix St. Louis New York International offices in: Amman, Jordan Abu Dhabi, UAE

kpff Consulting Engineers

January 12, 2012

Mr. Duane Den Adel
Evolution 1, LLC
309 Noble Cliff
Langley, WA 98260

Subject: E-Header/Sill Testing Report

Dear Duane:

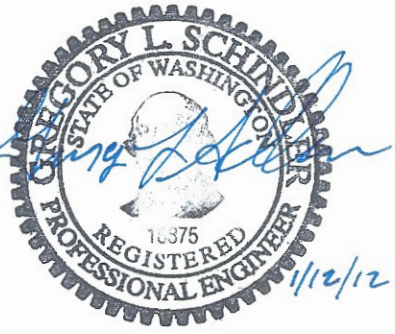
Enclosed is our engineering report which documents the testing program conducted at Mayes Testing Engineer Laboratories on December 6, 2011. The purpose of these tests was to establish the bending strength of the E-Header/Sill cold-formed, pre-insulated header and sill elements.

The appendix of the report includes the table of section properties and bending strengths as established by this testing program.

Our report may be used in conjunction with the Mayes Testing report dated December 6, 2011.

We appreciate the opportunity to assist you in the effort. If you have any questions, please call me at (206) 622-5822.

Sincerely,



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Engineering/Analysis Report

January 2012

Prepared for:
Evolution 1, LLC
309 Noble Cliff
Langley, WA 98260

Prepared by:
KPFF Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, WA 98101
(206) 622-5822
KPFF Job No. 111003.20

Introduction

The E-Header/Sill™, as manufactured by Evolution 1, LLC, is a pre-insulated boxed member made of a gauge metal structural shell surrounding a core of polystyrene insulation. The two outer track-like cold-formed steel sections are adhered to the foam core with glue and are attached to each other along their length with either pneumatic drive pins or steel rivets at 10" on center. The resulting composite member exhibits increased strength over that provided by the individual steel sections alone. Figure 1 in the Appendix depicts the standard E-Header/Sill shapes that were tested.

The purpose of this product is to provide an insulated single piece member as a substitution for built-up beams, typically used for window header and sill members in cold-formed framed structures. Field assembled built-up beams are typically not insulated and since the hollow cells created within built-up elements are not accessible to the insulation installer, this results in a thermal gap in the exterior wall of structures where they are used. E-Header/Sill head and sill members provide a one-piece structural element that does not require the build up and connection of individual cold-formed studs and the labor involved with field insulating them.

Purpose of Testing

Since the E-Header/Sill is a custom shaped structural element that is not made of standard shapes established in the cold-formed industry, the design section properties must be established by calculation or testing. The purpose of the beam testing program was to establish the bending strength of these elements and to document the effect that the foam core has in increasing the available strength of these sections, which can be derived from calculation alone. The results of this testing program were then used to develop a methodology to determine, by calculation, the section properties, and bending strengths of the whole family of E-Header/Sill shapes.

Testing Setup

The tests were configured in accordance with the American Iron and Steel Institute Testing Standard AISI 911-08 and were conducted by Mayes Testing Engineers, Inc. at their lab in Lynnwood, Washington. Refer to the Mayes Testing Report dated December 6, 2011. The test specimens consisted of 8-foot-6-inch-long E-Header/Sill sections of varying steel gauges. Two types of members were tested; the standard section with a 1-1/2-inch inner flange and 3-1/2-inch outer flange, and the Heavy Duty "HD" section with a 2-inch inner flange and 3-1/2-inch outer flange.

The specimens were placed in a hydraulic compression testing machine (see Figure 2 in the Appendix) so as to have an 8-foot-0-inch span between the centers of the support bearings. Those bearings consisted of a rocker bearing of a round bar. The beams were loaded in a two-point configuration with steel plate and round bar bearings at the load points which were set 22 inches apart, straddling the mid-span of the member. The beams were tested in both the strong and weak axis. A steel spreader beam spanned

between the load points and was in turn loaded at a single mid-point location with a 30,000 pound capacity load cell. A dial gauge was used to determine the deflection of the beam at mid-span. This configuration develops a constant bending moment in the center area between load points.

The beams were loaded continuously until failure, while load and deflection readings were taken at 200 pound increments of load. Failure was indicated when the beam would no longer resist increasing load. Load/deflection curves were then plotted in the Mayes Testing report.

Three identical specimens were tested for each of the strong axis bending and weak axis bending configurations for the standard section in two steel gauges, 33 mil (33 ksi steel) and 54 mil (50 ksi steel). A single 54 mil 50 ksi HD section was tested for each of the strong axis and weak axis bending configurations. A total of 14 beams were tested.

To control lateral deflection and torsional distortion, lateral bracing was provided near the two load points and at the end supports. At the load points, this bracing consisted of vertical rollers so as to prevent resistance to vertical movement.

Test Results

Strong axis bending is about the x-x axis as shown in Figures 1 and 6, located in the Appendix. In a typical window head type installation this bending direction would resist out-of-plane loading on the wall, such as wind loading. Weak axis bending is about the y-y axis and would typically result from vertical gravity loading of the wall above an opening. Figure 3 shows a test of bending in the weak axis direction.

For bending in the weak axis direction, all E-Header/Sill test specimens exhibited the same mode of distortion and failure. When loaded, the outer compression flanges yielded and buckled between the fasteners (see Figure 4 in the Appendix). Failure occurred in all specimens when the web of the inner member buckled into the foam core (see Figure 5 in the Appendix). All specimens failed in flexure within or at the start of the constant bending moment region of the beam.

For bending in the strong axis direction, all E-Header/Sill test specimens exhibited the same mode of distortion and failure. When loaded, the outer compression flange yielded and buckled between the fasteners. Failure occurred in all specimens when the compression flange of the inner member buckled into the foam core (see Figure 7 in the Appendix). At the failure plane, distortion also occurred in the web of both the inner member and the outer member (see Figure 8 in the Appendix).

Use of Test Results

The North American Specification of the Design of Cold-Formed Steel Structural Members (AISI S100-2007) sets forth in Section F a methodology by which testing results can be used to establish member strength. The average of the three failure loads for each group of specimens was used as the representative loading capacity at failure. The failure moment was then determined from that load

and the beam loading configuration. The HD specimens were for comparison only and the results were not used to develop the capacity charts.

The effective moment for the different test specimens was developed based on Section F1.2 of the AISI S100-2007 code: Allowable Strength Design by reducing the tested failure moment by a safety factor. The safety factor of 1.85 was determined in accordance with Eq F1.2-2. Effective section properties producing allowable moments were then calculated for the individual pieces considering them as track type elements with stiffened flanges. The plate buckling coefficient, k, for each flange of the composite structural elements was established such that the allowable moment would not exceed the effective moment from testing. Sets of k values for the inner and outer flanges were determined individually for the strong axis bending and weak axis bending of the 33 mil and 54 mil specimens. These were then used to determine the allowable section properties and bending moments for three thicknesses (33 mil, 43 mil, and 54 mil) for 4-inch, 6-inch, and 8-inch deep members. The test data showed that the E-Header/Sill members are stronger than an equivalent shape with no foam core.

Table A in the Appendix provides the summary of the gross and effective section properties including Allowable Moment (Ma) and Allowable Shear (Va) capacities of the entire family of E-Header/Sill sections in 4-inch, 6-inch, and 8-inch depths.

Conclusions

This testing program established the bending moment capacity at failure of 12 E-Header/Sill beam specimens and two HD E-Header/Sill beam specimens. The failure modes were very consistent with all members failing in the same manner – compression yielding/buckling. The load deflection curves were very linear until close to failure. While only limited data is available for the HD sections, it does not appear that the HD section is significantly stronger than the standard section.

The test results were used to establish allowable moments for 4-inch, 6-inch, and 8-inch sections. This moment capacity was compared to the calculated allowable moment for 4-inch, 6-inch, and 8-inch sections composed of bare, disconnected steel shapes with no foam core. In all cases, the moment capacity of the E-Header/Sill sections exceeded that of the bare steel shapes. This indicates that an increase in strength is provided by the combination of the foam core and the overlapped and fastened flanges by delaying the onset of compression bucking. The increase in strength is greater for the 33-mil and 43-mil 33 ksi shapes than for the 54-mil 50 ksi shapes. This indicates that the foam provides more benefit to a thinner, weaker metal section, but the foam is less beneficial as the metal section becomes thicker and stronger.

The test results also indicate that in the weak axis direction, for all gauges and strengths, the shape is acting as a structural composite shape and the increase in strength provided by the combination of the foam core and the overlapped and fastened flanges is even more significant than the increase in the strong axis direction.

Appendix

Figures, Photographs, and Tables

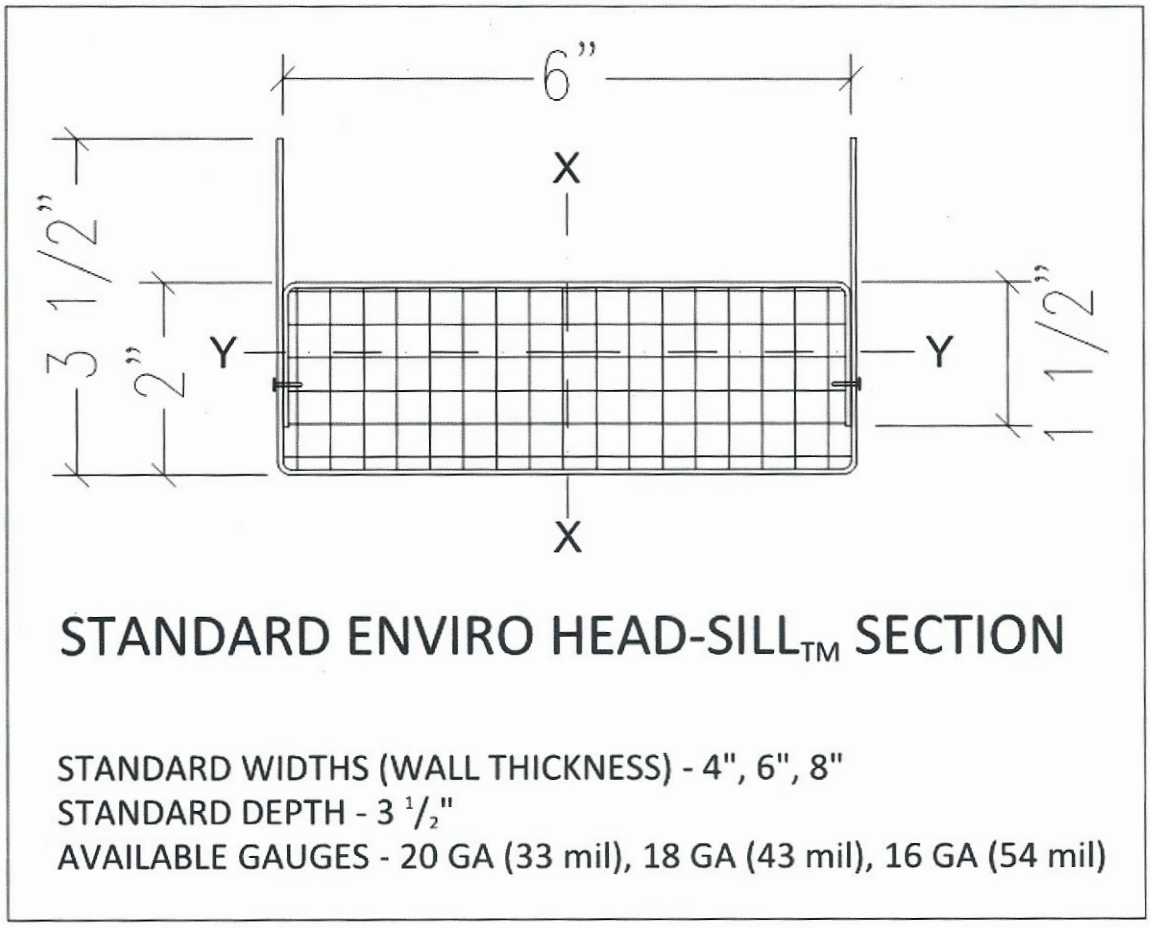

6"
X
3 1/2"
2"
Y
Y
1 1/2"
X
STANDARD ENVIRO HEAD-SILL™ SECTION
STANDARD WIDTHS (WALL THICKNESS) - 4", 6", 8"
STANDARD DEPTH - 3 1/2"
AVAILABLE GAUGES - 20 GA (33 mil), 18 GA (43 mil), 16 GA (54 mil)

Figure 1

Figure 2 – Testing Setup

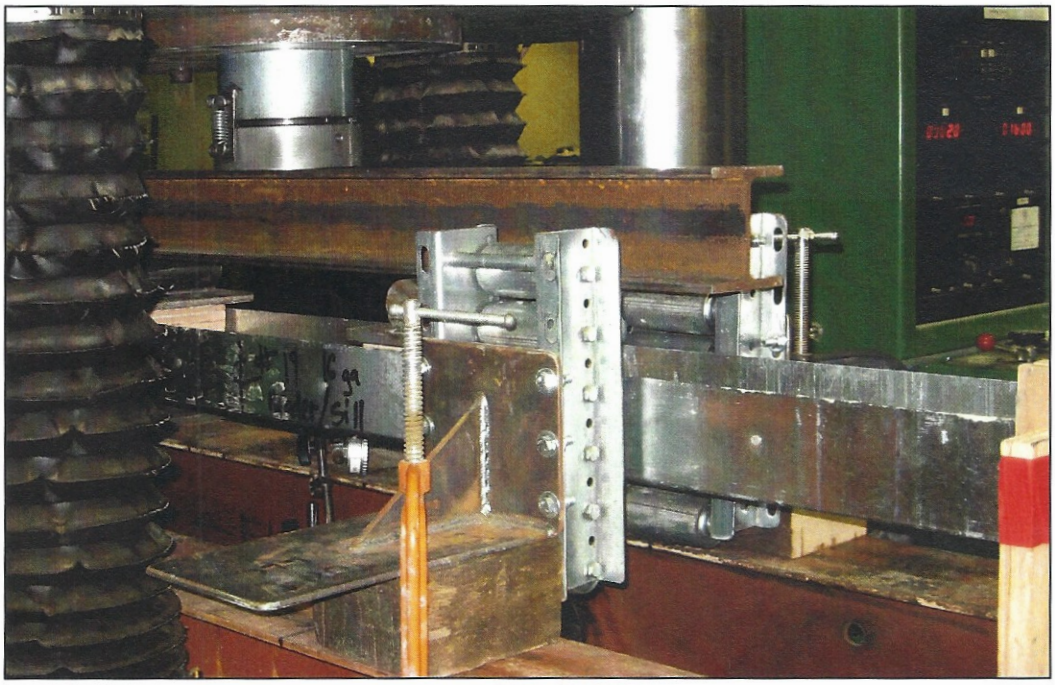


Figure 3 – Weak Axis Bending Test before Loading

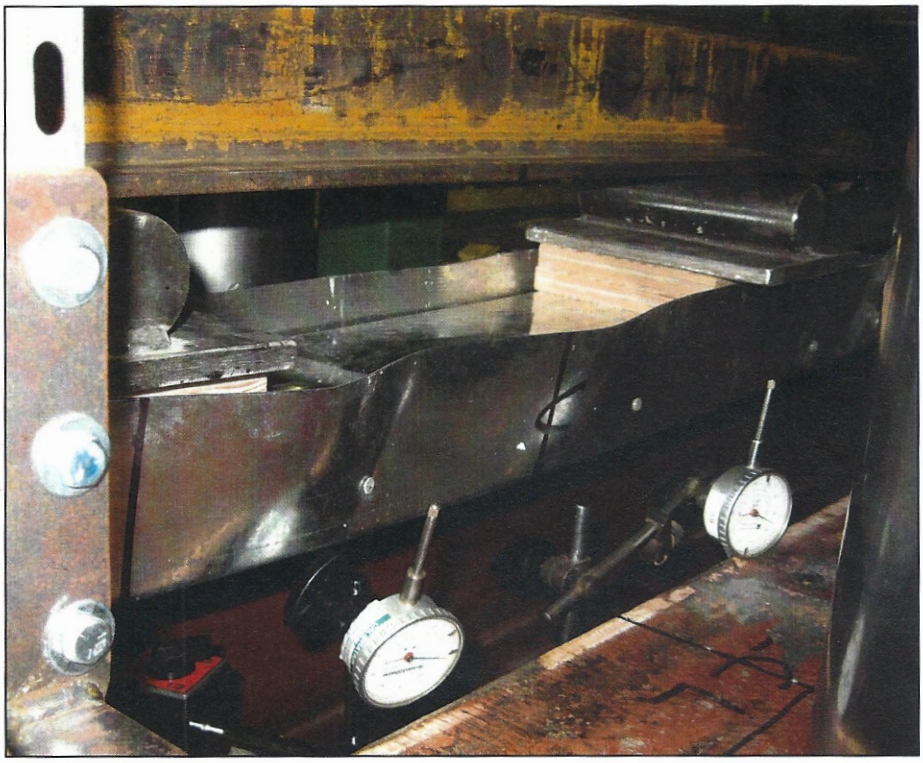


Figure 4 – Weak Axis Bending, Outer Flange Buckling

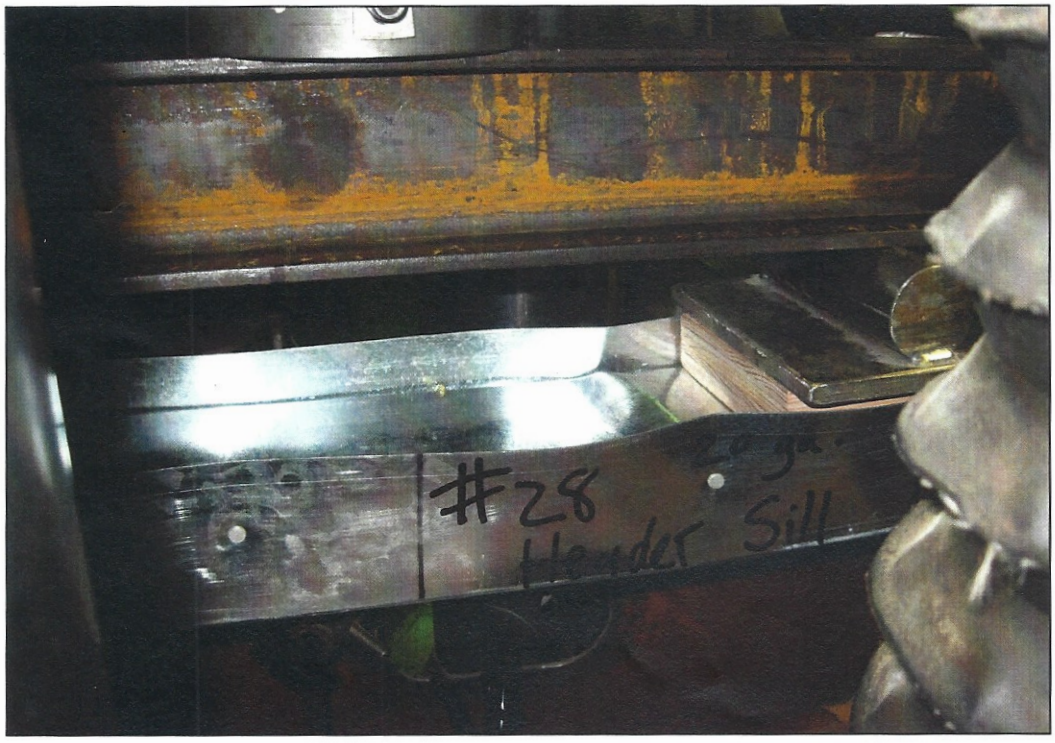


Figure 5 – Weak Axis Bending, Web at Failure

Figure 6 – Strong Axis Bending Test before Loading

Figure 7 – Strong Axis Bending, Flange at Failure

Figure 8 – Strong Axis Bending, Web Distortion at Failure Plane

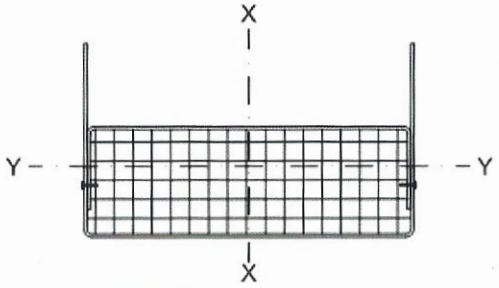
Table A – Section Properties

ENVIRO HEAD-SILL$_{TM}$ SECTION PROPERTIES TABLE

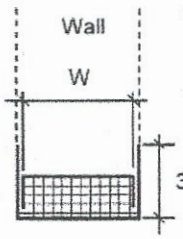
		Design Thickness	Gross Properties									Effective Properties										
			Fy	Area	Weight	I_x	S_x	R_x	I_y	S_{y+}	S_{y-}	R_y	I_{xe}	S_{xe}	M_{ax}	V_{ax}	I_{ye+}	S_{ye+}	M_{ay+}	I_{ye-}	S_{ye-}	M_{ay-}	V_{ay}
		(in)	(ksi)	(in^2)	(lb/ft)	(in^4)	(in^3)	(in)	(in^4)	(in^3)	(in^3)	(in)	(in^4)	(in^3)	(k-in)	(lbs)	(in^4)	(in^3)	(k-in)	(in^4)	(in^3)	(k-in)	(lbs)
4" WALL	EHS4-3.5-33	0.0346	33	0.615	2.091	1.731	0.851	1.678	0.600	0.277	0.450	0.988	1.313	0.467	9.231	2886	0.600	0.246	4.869	0.510	0.237	4.679	1899
	EHS4-3.5-43	0.0451	33	0.800	2.722	2.256	1.103	1.679	0.779	0.359	0.584	0.986	1.861	0.710	14.022	4901	0.779	0.354	6.991	0.648	0.324	6.411	3438
	EHS4-3.5-54	0.0566	50	1.001	3.405	2.824	1.373	1.679	0.970	0.447	0.727	0.984	2.342	0.896	2.834	9471	0.970	0.442	13.238	0.904	0.407	12.179	6643
6" WALL	EHS6-3.5-33	0.0346	33	0.753	2.561	4.302	1.418	2.390	0.747	0.335	0.587	0.996	3.192	0.717	14.159	2886	0.720	0.266	5.263	0.513	0.253	4.992	1253
	EHS6-3.5-43	0.0451	33	0.981	3.335	5.605	1.841	2.391	0.967	0.434	0.761	0.993	4.759	1.146	22.651	4901	0.958	0.397	7.848	0.742	0.350	6.910	2766
	EHS6-3.5-54	0.0566	50	1.228	4.175	7.014	2.295	2.390	1.204	0.540	0.947	0.990	5.982	1.468	43.961	9471	1.196	0.497	14.886	0.936	0.439	13.140	5481
8" WALL	EHS8-3.5-33	0.0346	33	0.892	3.032	8.380	2.077	3.066	0.889	0.392	0.723	0.999	5.706	0.964	19.043	2886	0.811	0.279	5.506	0.510	0.265	5.233	935
	EHS8-3.5-43	0.0451	33	1.161	3.948	10.916	2.699	3.066	1.151	0.507	0.936	0.996	9.129	1.548	30.582	4901	1.091	0.427	8.444	0.742	0.369	7.290	2066
	EHS8-3.5-54	0.0566	50	1.454	4.944	13.659	3.367	3.065	1.432	0.631	1.165	0.992	11.586	1.986	59.472	9471	1.363	0.535	16.030	0.937	0.463	13.868	4091

Notes:

1. Section properties are based on direct testing in accordance with AISI 911-08 and the AISI S100-2007 Specification. k values used are representative of the direct testing. For strong axis bending, k (inside flange) = 1.2 and k (outside flange) = 0.8. For weak axis bending, k (inside flange) = 4.0 and k (outside flange) = 4.0
2. User should check end reaction for web crippling based on project loading requirements.
3. Bending capacities are based on the assumption that the compression flange is adequately laterally braced on both sides.
4. Allowable Moment and Shear Values are calculated assuming a negligible axial load.
5. Strength increase due to cold work of forming has not been incorporated.
6. The effective Moment of Inertia for deflection has been calculated using Procedure 1 of the AISI S100-2007 Specification for serviceability determination.
7. The distortional buckling limit state is not considered in this table. Consideration of distortional buckling may result in lower strengths when restraint against distortional buckling is not provided.
8. User should check interaction between bending and shear based on project loading requirements.



E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-3.2 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	14 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	20 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits: Δ=L/		180		180		240		360		480		600		720	
Horizontal deflection limits: Δ=L/		120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	7.48	- / 0.411	7.48	- / 0.411	7.48	- / 0.411	7.48	- / 0.411	7.48	- / 0.411	7.48	- / 0.411	7.20	- / 0.396
4 inches	EHS4-3.5-43	9.22	- / 0.507	9.22	- / 0.507	9.22	- / 0.507	9.22	- / 0.507	9.22	- / 0.507	8.59	- / 0.472	8.08	- / 0.445
4 inches	EHS4-3.5-54 (50ksi)	12.75	- / 0.701	12.75	- / 0.701	12.59	- / 0.692	11.00	- / 0.605	9.99	- / 0.549	9.27	- / 0.510	8.73	- / 0.480
6 inches	EHS6-3.5-33	9.26	- / 0.509	9.26	- / 0.509	9.26	- / 0.509	9.26	- / 0.509	9.26	- / 0.509	9.26	- / 0.509	9.26	- / 0.509
6 inches	EHS6-3.5-43	11.69	- / 0.643	11.69	- / 0.643	11.69	- / 0.643	11.69	- / 0.643	11.69	- / 0.643	11.69	- / 0.643	11.05	- / 0.608
6 inches	EHS6-3.5-54 (50ksi)	16.32	- / 0.898	16.32	- / 0.898	16.32	- / 0.898	15.03	- / 0.827	13.66	- / 0.751	12.68	- / 0.697	11.93	- / 0.656
8 inches	EHS8-3.5-33	10.60	- / 0.583	10.60	- / 0.583	10.60	- / 0.583	10.60	- / 0.583	10.60	- / 0.583	10.60	- / 0.583	10.60	- / 0.583
8 inches	EHS8-3.5-43	13.61	- / 0.749	13.61	- / 0.749	13.61	- / 0.749	13.61	- / 0.749	13.61	- / 0.749	13.61	- / 0.749	13.61	- / 0.749
8 inches	EHS8-3.5-54 (50ksi)	18.99	- / 1.044	18.99	- / 1.044	18.99	- / 1.044	18.73	- / 1.030	17.02	- / 0.936	15.80	- / 0.869	14.87	- / 0.818

Notes:

1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 20 psf

Wall height: 14 ft

Wall construction: Depth 8 inches with total wall dead weight of 18 psf

Horizontal Deflection Limits: L/360

SILL span = 14 ft, Header height = 9 feet, SILL height = 3 ft

Use: EHS8-3.5-54 (50ksi): Allowable SILL Span = 18.73 ft which is greater than 14 ft.

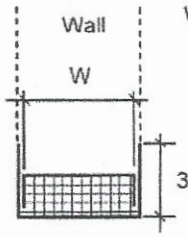
Maximum horizontal reactions to jambs at each end = 1.030 kips

ENVIRO-BEAM ™

A PRODUCT OF EVOLUTON 1 LLC

www.envirobeam.com 206-455-1978

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-3.1 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	12 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	20 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits: Δ=L/		180		180		240		360		480		600		720	
Horizontal deflection limits: Δ=L/		120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	8.27	- / 0.372	8.27	- / 0.372	8.27	- / 0.372	8.27	- / 0.372	8.27	- / 0.372	8.18	- / 0.368	7.69	- / 0.346
4 inches	EHS4-3.5-43	10.19	- / 0.459	10.19	- / 0.459	10.19	- / 0.459	10.19	- / 0.459	9.89	- / 0.445	9.18	- / 0.413	8.64	- / 0.389
4 inches	EHS4-3.5-54 (50ksi)	14.10	- / 0.634	14.10	- / 0.634	13.46	- / 0.606	11.76	- / 0.529	10.68	- / 0.481	9.92	- / 0.446	9.33	- / 0.420
6 inches	EHS6-3.5-33	10.24	- / 0.461	10.24	- / 0.461	10.24	- / 0.461	10.24	- / 0.461	10.24	- / 0.461	10.24	- / 0.461	10.24	- / 0.461
6 inches	EHS6-3.5-43	12.93	- / 0.582	12.93	- / 0.582	12.93	- / 0.582	12.93	- / 0.582	12.93	- / 0.582	12.56	- / 0.565	11.82	- / 0.532
6 inches	EHS6-3.5-54 (50ksi)	18.05	- / 0.812	18.05	- / 0.812	18.05	- / 0.812	16.07	- / 0.723	14.60	- / 0.657	13.55	- / 0.610	12.75	- / 0.574
8 inches	EHS8-3.5-33	11.72	- / 0.527	11.72	- / 0.527	11.72	- / 0.527	11.72	- / 0.527	11.72	- / 0.527	11.72	- / 0.527	11.72	- / 0.527
8 inches	EHS8-3.5-43	15.05	- / 0.677	15.05	- / 0.677	15.05	- / 0.677	15.05	- / 0.677	15.05	- / 0.677	15.05	- / 0.677	14.68	- / 0.661
8 inches	EHS8-3.5-54 (50ksi)	20.99	- / 0.944	20.99	- / 0.944	20.99	- / 0.944	20.03	- / 0.901	18.20	- / 0.819	16.89	- / 0.760	15.90	- / 0.715

Notes:

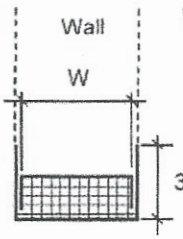
1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 20 psf
Wall height: 12 ft
Wall construction: Depth 8 inches with total wall dead weight of 18 psf
Horizontal Deflection Limits: L/480
SILL span = 14 feet, Header height = 9 feet, SILL height = 3 ft

Use: EHS8-3.5-43: Allowable SILL Span = 15.05 ft which is greater than 14 ft.
Maximum horizontal reactions to jambs at each end = 0.667 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-3.0 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	10 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	20 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits: Δ=L/		180		180		240		360		480		600		720	
Horizontal deflection limits: Δ=L/		120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	9.38	- / 0.328	9.38	- / 0.328	9.38	- / 0.328	9.38	- / 0.328	9.38	- / 0.328	8.89	- / 0.311	8.37	- / 0.293
4 inches	EHS4-3.5-43	11.56	- / 0.404	11.56	- / 0.404	11.56	- / 0.404	11.56	- / 0.404	10.76	- / 0.377	9.99	- / 0.350	9.40	- / 0.329
4 inches	EHS4-3.5-54 (50ksi)	15.99	- / 0.560	15.99	- / 0.560	14.63	- / 0.512	12.78	- / 0.447	11.61	- / 0.406	10.78	- / 0.377	10.15	- / 0.355
6 inches	EHS6-3.5-33	11.61	- / 0.406	11.61	- / 0.406	11.61	- / 0.406	11.61	- / 0.406	11.61	- / 0.406	11.61	- / 0.406	11.25	- / 0.394
6 inches	EHS6-3.5-43	14.66	- / 0.513	14.66	- / 0.513	14.66	- / 0.513	14.66	- / 0.513	14.66	- / 0.513	13.66	- / 0.478	12.85	- / 0.450
6 inches	EHS6-3.5-54 (50ksi)	20.46	- / 0.716	20.46	- / 0.716	20.00	- / 0.700	17.47	- / 0.612	15.88	- / 0.556	14.74	- / 0.516	13.87	- / 0.485
8 inches	EHS8-3.5-33	13.29	- / 0.465	13.29	- / 0.465	13.29	- / 0.465	13.29	- / 0.465	13.29	- / 0.465	13.29	- / 0.465	13.29	- / 0.465
8 inches	EHS8-3.5-43	17.07	- / 0.597	17.07	- / 0.597	17.07	- / 0.597	17.07	- / 0.597	17.07	- / 0.597	16.97	- / 0.594	15.97	- / 0.559
8 inches	EHS8-3.5-54 (50ksi)	23.80	- / 0.833	23.80	- / 0.833	23.80	- / 0.833	21.78	- / 0.762	19.79	- / 0.693	18.37	- / 0.643	17.29	- / 0.605

Notes:

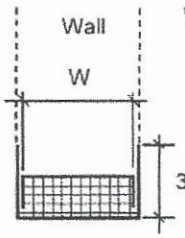
1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 20 psf
Wall height: 10 ft
Wall construction: Depth 8 inches with total wall dead weight of 18 psf
Horizontal Deflection Limits: L/600
SILL span = 13 feet, Header height = 9 feet, SILL height = 3 ft

Use: EHS8-3.5-33: Allowable SILL Span = 13.29 ft which is greater than 13 ft.
Maximum horizontal reactions to jambs at each end = 0.465 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-2.2 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	14 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	15 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits:	Δ=L/	180		180		240		360		480		600		720	
Horizontal deflection limits:	Δ=L/	120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	8.64	- / 0.356	8.64	- / 0.356	8.64	- / 0.356	8.64	- / 0.356	8.64	- / 0.356	8.42	- / 0.347	7.92	- / 0.327
4 inches	EHS4-3.5-43	10.64	- / 0.439	10.64	- / 0.439	10.64	- / 0.439	10.64	- / 0.439	10.18	- / 0.420	9.45	- / 0.390	8.90	- / 0.367
4 inches	EHS4-3.5-54 (50ksi)	14.73	- / 0.607	14.73	- / 0.607	13.85	- / 0.571	12.10	- / 0.499	11.00	- / 0.454	10.21	- / 0.421	9.61	- / 0.396
6 inches	EHS6-3.5-33	10.70	- / 0.441	10.70	- / 0.441	10.70	- / 0.441	10.70	- / 0.441	10.70	- / 0.441	10.70	- / 0.441	10.65	- / 0.439
6 inches	EHS6-3.5-43	13.50	- / 0.557	13.50	- / 0.557	13.50	- / 0.557	13.50	- / 0.557	13.50	- / 0.557	12.93	- / 0.533	12.17	- / 0.502
6 inches	EHS6-3.5-54 (50ksi)	18.85	- / 0.777	18.85	- / 0.777	18.85	- / 0.777	16.54	- / 0.682	15.03	- / 0.620	13.95	- / 0.576	13.13	- / 0.542
8 inches	EHS8-3.5-33	12.24	- / 0.505	12.24	- / 0.505	12.24	- / 0.505	12.24	- / 0.505	12.24	- / 0.505	12.24	- / 0.505	12.24	- / 0.505
8 inches	EHS8-3.5-43	15.72	- / 0.648	15.72	- / 0.648	15.72	- / 0.648	15.72	- / 0.648	15.72	- / 0.648	15.72	- / 0.648	15.12	- / 0.624
8 inches	EHS8-3.5-54 (50ksi)	21.92	- / 0.904	21.92	- / 0.904	21.92	- / 0.904	20.62	- / 0.851	18.73	- / 0.773	17.39	- / 0.717	16.37	- / 0.675

Notes:

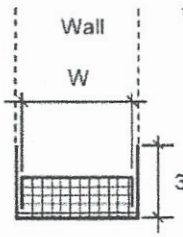
1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 15 psf
Wall height: 10 ft
Wall construction: Depth 6 inches with total wall dead weight of 12 psf
Horizontal Deflection Limits: L/360
SILL span = 16 feet, Header height = 9 feet, SILL height = 3 ft

Use: EHS6-3.5-54 (50ksi): Allowable SILL Span = 16.54 ft which is greater than 16 ft.
Maximum horizontal reactions to jambs at each end = 0.682 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-2.1 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	12 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	15 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits: Δ=L/	180		180		240		360		480		600		720	
Horizontal deflection limits: Δ=L/	120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips												
4 inches	EHS4-3.5-33	9.55	- / 0.322	9.55	- / 0.322	9.55	- / 0.322	9.55	- / 0.322	9.55	- / 0.322	9.00	- / 0.304	8.47	- / 0.286
4 inches	EHS4-3.5-43	11.77	- / 0.397	11.77	- / 0.397	11.77	- / 0.397	11.77	- / 0.397	10.89	- / 0.367	10.11	- / 0.341	9.51	- / 0.321
4 inches	EHS4-3.5-54 (50ksi)	16.28	- / 0.549	16.28	- / 0.549	14.81	- / 0.500	12.94	- / 0.437	11.76	- / 0.397	10.91	- / 0.368	10.27	- / 0.347
6 inches	EHS6-3.5-33	11.83	- / 0.399	11.83	- / 0.399	11.83	- / 0.399	11.83	- / 0.399	11.83	- / 0.399	11.83	- / 0.399	11.39	- / 0.384
6 inches	EHS6-3.5-43	14.93	- / 0.504	14.93	- / 0.504	14.93	- / 0.504	14.93	- / 0.504	14.89	- / 0.503	13.82	- / 0.467	13.01	- / 0.439
6 inches	EHS6-3.5-54 (50ksi)	20.84	- / 0.703	20.84	- / 0.703	20.25	- / 0.683	17.69	- / 0.597	16.07	- / 0.542	14.92	- / 0.503	14.04	- / 0.474
8 inches	EHS8-3.5-33	13.54	- / 0.457	13.54	- / 0.457	13.54	- / 0.457	13.54	- / 0.457	13.54	- / 0.457	13.54	- / 0.457	13.54	- / 0.457
8 inches	EHS8-3.5-43	17.38	- / 0.587	17.38	- / 0.587	17.38	- / 0.587	17.38	- / 0.587	17.38	- / 0.587	17.18	- / 0.580	16.16	- / 0.545
8 inches	EHS8-3.5-54 (50ksi)	24.24	- / 0.818	24.24	- / 0.818	24.24	- / 0.818	22.05	- / 0.744	20.03	- / 0.676	18.60	- / 0.628	17.50	- / 0.591

Notes:

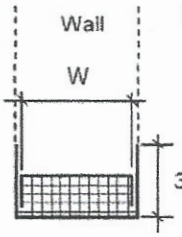
1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 15 psf
Wall height: 12 ft
Wall construction: Depth 6 inches with total wall dead weight of 12 psf
Horizontal Deflection Limits: L/240
SILL span = 12 feet, Header height = 9 feet, SILL height = 3 ft

Use: EHS6-3.5-43: Allowable SILL Span = 14.93 ft which is greater than 12 ft.
Maximum horizontal reactions to jambs at each end = 0.504 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-2.0 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	10 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	15 psf
Wind Deflection Factor: DF =	0.7

Vertical deflection limits: Δ=L/	180	180	240	360	480	600	720
Horizontal deflection limits: Δ=L/	120	180	240	360	480	600	720

Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	10.83	- / 0.284	10.83	- / 0.284	10.83	- / 0.284	10.83	- / 0.284	10.54	- / 0.277	9.78	- / 0.257	9.21	- / 0.242
4 inches	EHS4-3.5-43	13.34	- / 0.350	13.34	- / 0.350	13.34	- / 0.350	13.03	- / 0.342	11.84	- / 0.311	10.99	- / 0.289	10.34	- / 0.272
4 inches	EHS4-3.5-54 (50ksi)	18.46	- / 0.485	17.73	- / 0.465	16.11	- / 0.423	14.07	- / 0.369	12.78	- / 0.336	11.87	- / 0.312	11.17	- / 0.293
6 inches	EHS6-3.5-33	13.41	- / 0.352	13.41	- / 0.352	13.41	- / 0.352	13.41	- / 0.352	13.41	- / 0.352	13.16	- / 0.345	12.38	- / 0.325
6 inches	EHS6-3.5-43	16.93	- / 0.444	16.93	- / 0.444	16.93	- / 0.444	16.93	- / 0.444	16.19	- / 0.425	15.03	- / 0.395	14.14	- / 0.371
6 inches	EHS6-3.5-54 (50ksi)	23.63	- / 0.620	23.63	- / 0.620	22.02	- / 0.578	19.23	- / 0.505	17.47	- / 0.459	16.22	- / 0.426	15.26	- / 0.401
8 inches	EHS8-3.5-33	15.35	- / 0.403	15.35	- / 0.403	15.35	- / 0.403	15.35	- / 0.403	15.35	- / 0.403	15.35	- / 0.403	15.03	- / 0.394
8 inches	EHS8-3.5-43	19.71	- / 0.517	19.71	- / 0.517	19.71	- / 0.517	19.71	- / 0.517	19.71	- / 0.517	18.68	- / 0.490	17.57	- / 0.461
8 inches	EHS8-3.5-54 (50ksi)	27.48	- / 0.721	27.48	- / 0.721	27.44	- / 0.720	23.97	- / 0.629	21.78	- / 0.572	20.22	- / 0.531	19.03	- / 0.499

Notes:

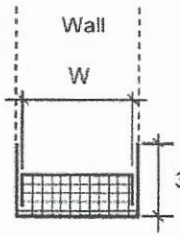
1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Exterior wall with Lateral Load of 15 psf
Wall height: 12 ft
Wall construction: Depth 6 inches with total wall dead weight of 12 psf
Horizontal Deflection Limits: L/240
SILL span = 13'-0", Header height = 9 feet, SILL height = 3 ft

Use: EHS6-3.5-33: Allowable SILL Span = 13.41 ft which is greater than 13'-0".
Maximum horizontal reactions to jambs at each end = 0.352 kips

E-HEADER/SILL$_{TM}$ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-1.2 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL$_{TM}$

Design Criteria:

Wall height:	14 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	5 psf
Wind Deflection Factor: DF =	1.0

Vertical deflection limits: Δ=L/	180		180		240		360		480		600		720	
Horizontal deflection limits: Δ=L/	120		180		240		360		480		600		720	
Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips												
4 inches	EHS4-3.5-33	14.96	- / 0.206	14.96	- / 0.206	14.63	- / 0.201	12.78	- / 0.176	11.61	- / 0.160	10.78	- / 0.148	10.14	- / 0.139
4 inches	EHS4-3.5-43	18.44	- / 0.254	18.09	- / 0.249	16.43	- / 0.226	14.35	- / 0.197	13.04	- / 0.179	12.11	- / 0.166	11.39	- / 0.157
4 inches	EHS4-3.5-54 (50ksi)	22.35	- / 0.307	19.53	- / 0.268	17.74	- / 0.244	15.50	- / 0.213	14.08	- / 0.194	13.07	- / 0.180	12.30	- / 0.169
6 inches	EHS6-3.5-33	18.53	- / 0.255	18.53	- / 0.255	18.53	- / 0.255	17.18	- / 0.236	15.61	- / 0.215	14.49	- / 0.199	13.64	- / 0.188
6 inches	EHS6-3.5-43	23.39	- / 0.322	23.39	- / 0.322	22.47	- / 0.309	19.63	- / 0.270	17.83	- / 0.245	16.56	- / 0.228	15.58	- / 0.214
6 inches	EHS6-3.5-54 (50ksi)	30.55	- / 0.420	26.69	- / 0.367	24.25	- / 0.333	21.18	- / 0.291	19.25	- / 0.265	17.87	- / 0.246	16.81	- / 0.231
8 inches	EHS8-3.5-33	21.21	- / 0.292	21.21	- / 0.292	21.21	- / 0.292	20.85	- / 0.287	18.95	- / 0.261	17.59	- / 0.242	16.55	- / 0.228
8 inches	EHS8-3.5-43	27.23	- / 0.374	27.23	- / 0.374	27.23	- / 0.374	24.39	- / 0.335	22.16	- / 0.305	20.57	- / 0.283	19.36	- / 0.266
8 inches	EHS8-3.5-54 (50ksi)	37.97	- / 0.522	33.27	- / 0.457	30.23	- / 0.416	26.41	- / 0.363	23.99	- / 0.330	22.27	- / 0.306	20.96	- / 0.288

Notes:

1. See E-HEADER/SILL$_{TM}$ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL$_{TM}$ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Interior wall minimum lateral load 5 psf

Wall height: 14 ft

Wall construction: Depth 4 inches with two layers 0.625" gypsum board, total dead load including infill studs 6 psf

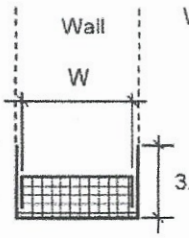
Horizontal Deflection Limits: L/240

SILL span = 16'-6", Header height = 9 feet, SILL height = 3 ft

Use: EHS4-3.5-54 (50ksi): Allowable SILL Span = 17.74 ft which is greater than 16'-6".

Maximum horizontal reactions to jambs at each end = 0.244 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-1.1 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	12 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	5 psf
Wind Deflection Factor: DF =	1.0

Vertical deflection limits: Δ=*L/*	180	180	240	360	480	600	720
Horizontal deflection limits: Δ=L/	120	180	240	360	480	600	720

Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	16.54	- / 0.186	16.54	- / 0.186	15.64	- / 0.176	13.66	- / 0.154	12.41	- / 0.140	11.52	- / 0.130	10.84	- / 0.122
4 inches	EHS4-3.5-43	20.38	- / 0.229	19.34	- / 0.218	17.57	- / 0.198	15.35	- / 0.173	13.94	- / 0.157	12.94	- / 0.146	12.18	- / 0.137
4 inches	EHS4-3.5-54 (50ksi)	23.90	- / 0.269	20.88	- / 0.235	18.97	- / 0.213	16.57	- / 0.186	15.05	- / 0.169	13.98	- / 0.157	13.15	- / 0.148
6 inches	EHS6-3.5-33	20.48	- / 0.230	20.48	- / 0.230	20.48	- / 0.230	18.37	- / 0.207	16.69	- / 0.188	15.49	- / 0.174	14.58	- / 0.164
6 inches	EHS6-3.5-43	25.85	- / 0.291	25.85	- / 0.291	24.02	- / 0.270	20.99	- / 0.236	19.07	- / 0.215	17.70	- / 0.199	16.66	- / 0.187
6 inches	EHS6-3.5-54 (50ksi)	32.67	- / 0.367	28.54	- / 0.321	25.93	- / 0.292	22.65	- / 0.255	20.58	- / 0.232	19.10	- / 0.215	17.98	- / 0.202
8 inches	EHS8-3.5-33	23.44	- / 0.264	23.44	- / 0.264	23.44	- / 0.264	22.30	- / 0.251	20.26	- / 0.228	18.80	- / 0.212	17.70	- / 0.199
8 inches	EHS8-3.5-43	30.10	- / 0.339	30.10	- / 0.339	29.85	- / 0.336	26.08	- / 0.293	23.69	- / 0.267	21.99	- / 0.247	20.70	- / 0.233
8 inches	EHS8-3.5-54 (50ksi)	40.72	- / 0.458	35.57	- / 0.400	32.32	- / 0.364	28.23	- / 0.318	25.65	- / 0.289	23.81	- / 0.268	22.41	- / 0.252

Notes:

1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Interior wall minimum lateral load 5 psf

Wall height: 12 ft

Wall construction: Depth 4 inches with two layers 0.625" gypsum board, total dead load including infill studs 6 psf

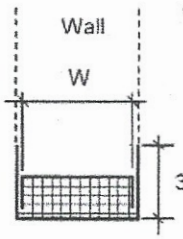
Horizontal Deflection Limits: L/360

SILL span = 14 ft, Header height = 9 feet, SILL height = 3 ft

Use: EHS4-3.5-43: Allowable SILL Span = 15.35 ft which is greater than 14 ft.

Maximum horizontal reactions to jambs at each end = 0.173 kips

E-HEADER/SILL™ NOMENCLATURE



W (Wall Thickness) — Depth of Part

EHS 6 - 3.5 - 43

Mil / ga.

Example E-Header/Sill Size Designation

The designer should specify the wall thickness (W) and the metal thickness (mil) for E-Header/Sill

Standard depth is 3.5". Custom depths are available.

Structural section properties are per the E- Header/Sill Section Properties Table.

The designer is responsible for determining the adequacy of the sections for their intended use.

TABLE S-1.0 ALLOWABLE SILL SPANS for ENVIRO E-HEADER/SILL™

Design Criteria:

Wall height:	10 ft
Header height:	9 ft
SILL height:	3 ft
Lateral Wind Load: WL =	5 psf
Wind Deflection Factor: DF =	1.0

Vertical deflection limits: Δ=L/	180	180	240	360	480	600	720
Horizontal deflection limits: Δ=L/	120	180	240	360	480	600	720

Wall Thick.	Member Identification	ALLOWABLE SILL SPANS, ft, & HORIZONTAL REACTIONS, kips													
4 inches	EHS4-3.5-33	18.75	- / 0.164	18.72	- / 0.164	17.01	- / 0.149	14.86	- / 0.130	13.50	- / 0.118	12.53	- / 0.110	11.79	- / 0.103
4 inches	EHS4-3.5-43	23.11	- / 0.202	21.03	- / 0.184	19.10	- / 0.167	16.69	- / 0.146	15.16	- / 0.133	14.08	- / 0.123	13.25	- / 0.116
4 inches	EHS4-3.5-54 (50ksi)	25.99	- / 0.227	22.70	- / 0.199	20.62	- / 0.180	18.02	- / 0.158	16.37	- / 0.143	15.20	- / 0.133	14.30	- / 0.125
6 inches	EHS6-3.5-33	23.22	- / 0.203	23.22	- / 0.203	22.87	- / 0.200	19.98	- / 0.175	18.15	- / 0.159	16.85	- / 0.147	15.86	- / 0.139
6 inches	EHS6-3.5-43	29.32	- / 0.257	28.75	- / 0.252	26.12	- / 0.229	22.82	- / 0.200	20.73	- / 0.181	19.25	- / 0.168	18.11	- / 0.158
6 inches	EHS6-3.5-54 (50ksi)	35.52	- / 0.311	31.03	- / 0.272	28.19	- / 0.247	24.63	- / 0.216	22.38	- / 0.196	20.77	- / 0.182	19.55	- / 0.171
8 inches	EHS8-3.5-33	26.58	- / 0.233	26.58	- / 0.233	26.58	- / 0.233	24.24	- / 0.212	22.03	- / 0.193	20.45	- / 0.179	19.24	- / 0.168
8 inches	EHS8-3.5-43	34.13	- / 0.299	34.13	- / 0.299	32.46	- / 0.284	28.36	- / 0.248	25.76	- / 0.225	23.92	- / 0.209	22.51	- / 0.197
8 inches	EHS8-3.5-54 (50ksi)	44.28	- / 0.387	38.68	- / 0.338	35.14	- / 0.307	30.70	- / 0.269	27.89	- / 0.244	25.89	- / 0.227	24.37	- / 0.213

Notes:

1. See E-HEADER/SILL™ SECTION PROPERTIES TABLE for additional notes and details.
2. See DETAIL 4 - SHEET SK-4, ENVIRO HEADER/SILL™ WALL ELEVATION for Loading Information.
3. Top - indicates no vertical reaction. Bottom number indicates SILL horizontal reaction

Design Example:

Interior wall minimum lateral load 5 psf

Wall height: 10 ft

Wall construction: Depth 4 inches with two layers 0.625" gypsum board, total dead load including infill studs 6 psf

Horizontal Deflection Limit: L/480

SILL span = 12 feet, Header height = 9 feet, SILL height = 3 ft

Use: EHS4-3.5-33: Allowable SILL Span = 13.50 ft which is greater than 12 ft.

Maximum horizontal reactions to jambs at each end = 0.118 kips

ENVIRO-BEAM ™

A PRODUCT OF EVOLUTON 1 LLC

www.envirobeam.com 206-455-1978

SECTION 054023
THERMALLY INSULATED COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured, structurally engineered, thermally insulated, thermally-broken, cold-formed metal framing boxed channel assemblies for exterior perimeter wall framing, parapets, and roof curbs.

1. Insulated, thermally broken box header framing.
2. Insulated king boxed stud framing.
3. Insulated boxed header & sill framing
4. Connection plates.
5. Insulated boxed roof parapet and roof curb units and pre-insulated Skylight curbs.

B. Related Requirements:

1.	Section 054000	-	Cold-Formed Metal Framing: For installation of work of this Section
2.	Section 072113	-	Rigid Foam Board Insulation
3.	Section 072115	-	Semi-Rigid Mineral Board Insulation

1.2 REFERENCES

A. Reference Standards: Conform to provision of Section [014219 -] .

B. American Iron and Steel Institute (AISI): http://www.steel.org/

1.	AISI S100	-	North American Specification for the Design of Cold-Formed Steel Structural Members
2.	AISI S200	-	North American Cold-Formed Steel Framing Standard - General Provisions
3.	AISI S211	-	North American Cold-Formed Steel Framing Standard - Wall Stud Design
4.	AISI S212	-	North American Standard for Cold-Formed Steel Framing - Header Design
5.	AISI S213	-	North American Standard for Cold-Formed Steel Framing - Lateral Design
6.	AISI 911-08	-	Testing by Mayes Testing Laboratory, Lynnwood, WA.

C. ASTM International (ASTM): http://www.astm.org/

1.	ASTM A123	-	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2.	ASTM A653	-	Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
3.	ASTM A792	-	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4.	ASTM A875	-	Standard Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.
5.	ASTM A1003	-	Standard Specification for Steel Sheet, Carbon, Metallic- and –Nonmetallic-Coated for Cold-Formed Framing Members.
6.	ASTM C272	-	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
7.	ASTM C203	-	Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
8.	ASTM C303	-	Standard Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation

9. ASTM C518 - Standard Test Method for Steady-State Thermal Means of the Heat Flow Meter Apparatus
10. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
11. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
12. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
13. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
14. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics
15. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
16. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

1.3 International Code Commission (ICC) Evaluation Services:

1. ICC ES AC46 - Acceptance Criteria for Cold-Formed Framing Members
2. ICC ES AC261 - Acceptance Criteria for Connectors used with Cold-Formed Steel Structural Members

B. Steel Stud Manufacturers Association (SSMA): Product Technical Information. http://www.ssma.com

1. SSMA ICC-ES Legacy Report ER-4943P, Revised Aug 2003 after revision.
2. SSMA Product Technical Information.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Conform to Section 013113 for coordination with work of related Sections.

1. Section 054000 for integrating and installing thermally insulated framing specified by this Section into cold-formed metal framing systems

1.5 SUBMITTALS

A. Conform to submittal requirements of Section 013300.

B. Product Data:

1. Detailed description and fabrication drawings showing configurations, and design criteria for each manufactured product specified by this Section (See website; envirobeam.com for drawings of Installation Instructions for each individual Enviro-Component).
2. Accessories: Include connection plates, and anchoring devices.
3. Light Gage Steel
4. Block Foam & Insulation filler material
5. Adhesive
6. Connection devices

C. Test Results: Include:

1. Structural: Base on AISI S100 Section F methodology by independent testing laboratory. Stamp and sign written report by licensed professional engineer, registered with [the State of Washington] (See Mayes Testing Test Reports included in KPFF Engineering Reports)
    a. Strong Axis in Bending.
    b. Weak Axis in Bending.
2. Thermal Resistance (R-Value) per Insulation Mfg published test data.

D. Structural Design Calculations: Stamp and sign by licensed professional engineer, registered with [the State of Washington].
1. Comprehensive analysis of design loads,

E. Thermal Resistance (R-Value): Insulation type and thermal properties for each fabricated assembly.

F. Manufacturer's Instructions: Include installation instructions, special procedures, and conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Employ licensed professional engineering personnel experienced in work of this Section and registered in State of Washington.
2. Maintain locally available technical product representation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Conform to provisions of Section 016510 and manufacturers instructions.

B. Ordering: Conform to manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials on manufacturer’s pallets with identification labels intact.

D. Deliver in bundles, clearly identified with manufacturer's labels intact. Verify undamaged conditions.

E. Store off ground and handle to keep clean, dry, and protected from damage due to weather and construction activities.

1.8 [FIELD CONDITIONS

A. Site Environmental Requirements: Do not install materials until site conditions conform to manufacturer installation instructions.]

B. Installers must strictly adhere to Manufactures written Installation Instructions

1.9 [WARRANTY

A. Cold Formed Framing: Manufacturer’s standard 20-year materials warranty covering defective materials of cold-formed metal framing members.]

B. Installers must strictly adhere to Manufactures written Installation Instructions

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Evolution 1, Envirobeam, specified as basis of design.
1. Cell (206) 455-1978, Email duane@envirobeam.com (Duane Den Adel, Operations Manager)
2. Cell (425) 344-1371, Email ron@envirobeam.com (Ron Den Adel, Production Manager)

3. Website http://www.envirobeam.com

B. Substitution Requests: Conform to provisions of Section 012500. Submit product data indicating conformance to specified provisions of this Section.

2.2 PERFORMANCE / DESIGN CRITERIA

A. See KPFF Engineering Reports ; Enviro-King June 2011, E-Header / Sill January 2012, E-Beam HD February 2012.

B. Thermal Insulation: [Semi-rigid mineral insulation board] [Expanded polystyrene insulation board (EPS)] [Extruded polystyrene insulation board (XPS)] Polyisosanurate insulation board.

1. Design thickness and type of insulation into system assembly.
2. Thermal analysis to be determined by thermal U-factor published by individual Mfg.Iinsulation type .

C. Load Bearing Cold Rolled Steel Framing Members: ASTM C955.

1. Minimum Effective Physical and Structural Properties: As published by the Steel Stud Manufactures Association (SSMA) Product Technical Information, conforming to ICC ER-4943P.
2. Grades:

a. ASTM A1003, Structural Grade 50 Type H (ST50H) (F_y = 50 ksi) for 97, 68, and 54 mil (12, 14 and 16 gauge) framing members.
b. ASTM A1003, [ASTM A792, or ASTM A875] Structural Grade 33 Type H (ST33) (F_y = 33 ksi) for 43 and 33 mil (18 and 20 gauge) framing members.

D. Hot-Dip Aluminum-Zinc Alloy-Coating: Galvanized ASTM A653 G60 [Hot-Dip Aluminum-Zinc Alloy-Coating: ASTM A792, Structural Steel (SS), Grade 50, Class 1 or 4, Coating Destination AZ55].

2.3 THERMALLY INSULATED COLD-FRAMED STEEL WALL PRODUCTS

A. Refer to Enviro-Beam Span Load Tables, suggested installation instructions, and parts list section properties.

1. Thermal Resistance (R-Value): Approximately R-4 per inch of wall thickness

B. E-Beam HD - Pre-Insulated Steel Header Beam:

1. Standard Widths: 6 and 8 inch.
2. Standard Depths: Varies.
3. Available Steel Thickness: 18 gauge (43 mil) through 12 gauge (97 mil).

C. E-Header Sill – Pre-Insulated Steel Header Sill: A lighter duty option to the E-Beam HD

D. E-King – Pre-Insulated Alternative To Standard Dual Stud:

1. Standard Depths: For 4, 6, and 8 inch wall depths.
2. Standard Width: 3 ¼”inch.
3. Available Steel Thickness: 20 gauge (33 mil) through 12 gauge (97 mil).

E. Connection Plate – Connection Plate with Pre-Punched Holes: Refer to manufacturer’s table.

1. Steel Grade: Minimum 33,000 psi.
2. Punched Holes: 25 each plate for No. 10 and No. 8 self-drilling, self-tapping screws.
3. Capacities: As published by manufacturer and as determined by professional engineer of record. [694 pounds to 2836 pounds, two plates on each side of header depending on screw placement, designed to AISI S100 (NAS) 2001 <2012 is current edition> Section E4.3 (Shear).]
4. Thickness: 16 or 14 gauge (54 or 68 mils).

5. Width: 7-1/2 inch.
6. Height: 5-1/2 and 7-1/2 inch.

2.4 THERMALLY INSULATED COLD-FRAMED ROOFING PRODUCTS

A. E-Roof Curb:

B. E-Skylight Curb:

C. E - Mechanical Curb.

2.5 FASTENERS, , CONNECTORS, ANCHORAGE, AND ACCESSORIES

A. Steel Drill Screws: Corrosion-resistant with minimum 3/8 minimum penetration into steel members.

1. Steel Tapping Screws: ASTM C1513 for steel framing connections.
2. Steel Drill Screws: ASTM C954 for connections of gypsum panel products to steel framing members

B. Connector and Anchorage Devices:

1. Power driven and powder actuated anchors, bolts, nuts, and washers [as shown on Structural Drawings, or] as accepted for transfer of design loads, conforming to ICC ES AC308.
2. Galvanize to 1.25 ounce psf conforming to ASTM A123.

2.6 THERMAL INSULATION CORE

A. Semi-Rigid Mineral Insulation Board:

Property	Result	Test Method
Density	4 psf [8 psf] [13 PSF]	ASTM C303
Thermal Resistance (R-Value) at 75 degrees F	R - 4.3 per inch	ASTM C518
Water Vapor Transmission (desiccant method)	30 - 50 perms	ASTM E96
Combustion Characteristics	Non-Combustible	ASTM E136
Surface Burning Characteristics	UL 723 / IBC Class A	ASTM E84
Flame Spread	0	
Smoke Developed	0	
Moisture Resistance	Non-hydroscopic (does not absorb/hold water)	
Sorption	0.03 percent[1] or less	ASTM C1104
Absorption	1.0 percent or less	ASTM E136
Fungi and Bacteria	Does not promote growth	ASTM C1338
Corrosion Resistance	Passes	ASTM C665

[1] ASTM C1104 specifies less than 1 percent.

****OR****

B. Expanded Polystyrene (EPS) Insulation Board: ASTM C578, Type IX.

Property	Result	Test Method
Compressive Resistance	25 psi	ASTM D1621
Thermal Resistance (R-Value) @ 75 degrees F	4.2 per inch	ASTM D518 or ASTM C177
Flexural Strength	50 psi	ASTM C203
Water Vapor Permeance	2.5 perms	ASTM E96
Water Absorption	2 percent	ASTM C272
Dimensional Stability	2 percent max	ASTM D2126
Density	1.60 pcf	ASTM C303
Flame Spread	Less than 20	ASTM E84

Smoke Developed	150-300	ASTM E84

****OR****

C. Extruded Polystyrene (XPS) Insulation Board: ASTM C578, Type IV.

Property	Result	Test Method
Compressive Resistance	25 psi	ASTM D1621
Thermal Resistance (R-Value) @ 75 degrees F	5.0 per inch	ASTM D518 or ASTM C177
Flexural Strength	50 psi	ASTM C203
Water Vapor Permeance	1.5 perms	ASTM E96
Water Absorption	0.3 percent	ASTM D2842
Dimensional Stability	2 percent max	ASTM D2126
Density	1.55 pcf	ASTM C303
Maximum Use Temperature	165 degrees F	

2.7 ACCESSORIES

A. Typically for Field conditions encountered and the responsibility of the installer of Evolution 1 / Enviro-Beam Components. Evolution 1 LLC is not responsible for these conditions. The Field Installer is required to strictly adhere to Evolution 1 Installation Instructions for each individual Enviro-Component published on the envirobeam.com web site

B. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

C. [Insulation Board Joint Tape: Dow Chemical Company, WEATHERMATE, 6 inch and 9 inch wide butyl adhesive tape, or equal and as instructed by manufacturer.]

D. [Insulation Board Gap Filler: Dow Chemical Company, FROTH-PAK, two-component, quick-cure polyurethane foam, or equal and as instructed by manufacturer.]

E. See Installation Instructions for Enviro-Roof Curbs regarding sheet metal covers for safety rail posts and exposed corner conditions.

2.8 SOURCE QUALITY CONTROL

A. Single Source Responsibility: Furnish engineered design and fabrication by or under direct responsibility of single manufacturer; Evolution 1 LLC.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditions ready to receive work of this Section before beginning.

3.2 PREPARATION

A. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.3 INSTALLATION

A. Conform to manufacturer's instructions, ASTM C1007, and provisions of Contract Documents.

B. Strictly Adhere to Evolution 1 LLC Installation Instructions published on envirobeam.com web site for each individual Enviro-Component.

C. Touch-up shop-applied protective coatings damaged during handling and installation.

3.4 ERECTION TOLERANCES

A. Maximum Framing Member Variation from True Position: 1/8 inch.

B. Maximum Framing Member Variation from Plane:

1. Individual Framing Members: Do not exceed 1/8 inch in 10 foot.
2. Accumulative Over-all Variation for Wall and Floor System: Do not exceed 1/8 inch.

C. Conformance subject to Project Architect and General Contractor for Individual Projects

3.5 FIELD QUALITY CONTROL

A. Manufacturer’s Field Technical Service:.

1. Evolution 1 Field Technical Service available on request for site visits to be paid for by the requester, typically the General Contractor, Project Architect or the Owners Rep.

3.6 ADJUSTING

A. Inspect and adjust after installation. Replace or repair defective work.

END OF SECTION