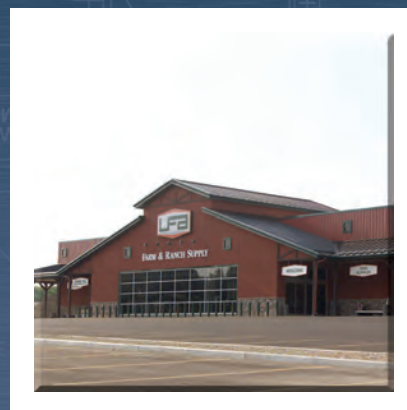
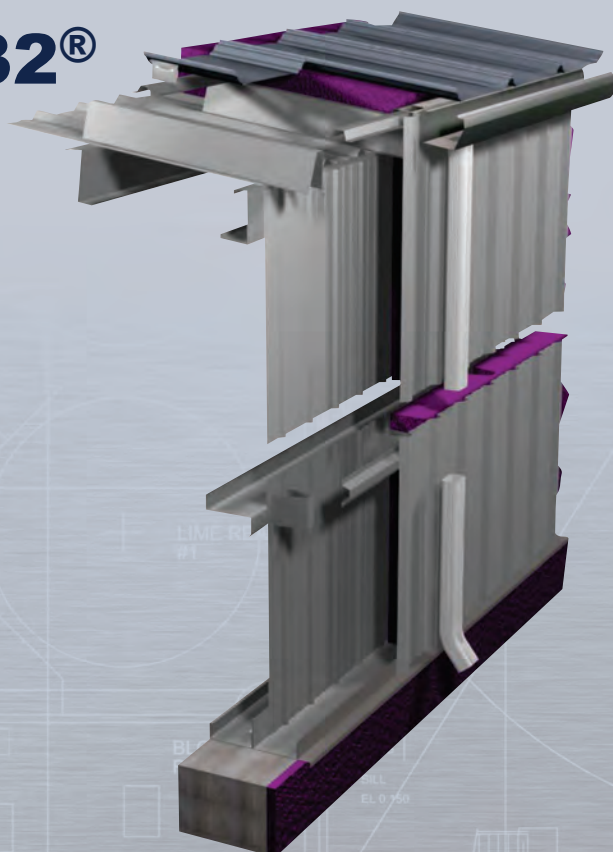




Thermal Systems Design Guide

**Thermalguard®
& Vapourguard 32®**



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BEHLEN Thermal Assemblies are designed to optimize the thermal performance of any steel structure. Easily combined with a steel building system or post & beam steel the Thermalguard® and Vapourguard 32® systems provide maximum space for the installation of insulation.

Both the Thermalguard® and Vapourguard 32® are available in various depths to allow the system to be customized to the energy efficiency needs of the tenant.

Retrofit Applications

The demand for maximum thermal performance in existing buildings is ever growing. Thermalguard® and Vapourguard 32® are systems assemblies that can be easily and economically applied to existing structures.

Sustainable Construction

The environmental impact of construction and construction materials is an increasingly important consideration in the design of any building. BEHLEN systems are fabricated from steel. The steel industry has a long and enviable history of using recycled material.

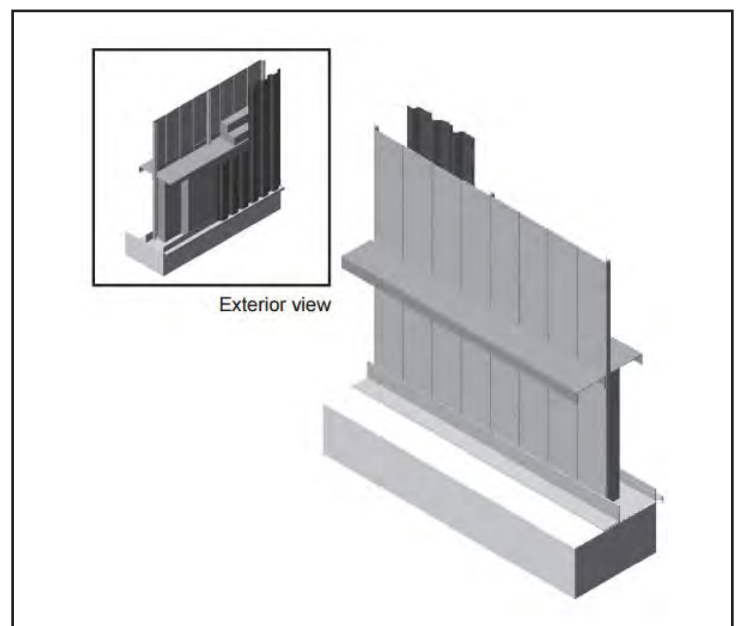
Thermalguard® and Vapourguard 32® systems feature factory made precision components which provide for speed of construction with virtually no construction site waste.

BEHLEN insulation systems are adaptable and can be designed to optimize the performance of HVAC systems. The result is a reduction in energy costs and less consumption of non-renewable resources.

We hope this manual will provide members of the design community with sufficient data to acquaint themselves with the Thermalguard® and Vapourguard 32® insulation systems by BEHLEN Industries, and to be an aid in planning a structure utilizing the systems to their fullest advantage.



Thermalguard®



Exterior view

Vapourguard 32® - Interior View



Thermalguard® Insulation System

The System

An insulation system which incorporates all the benefits of liner panel while providing the advantages of superior thermal efficiency, condensation control and noise reduction. The system comprises a steel liner complete with sealant at all joints and laps to act as a vapour retarder. This liner gives the interior an attractive finish and is insulated from the exterior. The insulation cavity can be supplied to accommodate up to 12" (300mm) of insulation. The roof cavity is created using thermal hat clips typically spaced at 4' O.C. that support a 2" hat bar. Thermal hat clips are available in heights from 2" to 10" to create varying cavity depths. Wall cavity is created using a thermal Zee clip typically spaced at 4' O.C. that support a 1-3/4" hat bar. This provides the ultimate thermal barrier for energy efficient roof and wall construction. The system metal liner can be combined with a range of exterior panels and colours and profiles to complete the look of the building. On the roof the SSR24, standing seam panels are installed to provide a weather resistant system without the use of fasteners penetrating the drainage plane.

Performance Advantages

- Thermalguard® provides a cavity where insulation in multiple layers, can be added in varying thickness through R40. The insulation is uncompressed and provides superior insulating capability. Conventional insulation systems compress the insulation at the purlin and reduce the effective R value of the system.
- The thermal clip and hat bar system provides an effective thermal break reducing the transmission of heat through the thermal system. Varying heights can be economically provided to allow insulation up to R40.

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- The liner panel provides superior vapour control to protect the insulation. The steel liner panel is easily cleaned and resistant to abuse. The steel liner is not subject to mechanical puncturing that plastic vapour barriers can suffer from. It also serves as an attractive finish on the interior of the building. The liner can act as a diaphragm to reduce bracing requirements for purlins and girts.
- The liner is installed with self-drilling screws and offers a rapidly built enclosure to protect the interior against weather. Once the liner panel is installed on a roof it can be used as a work surface which allows easy installation of the remaining thermal system components.
- The complete system will reduce noise transmission through the assembly.

Appearance

The dsystem liner provides a clean attractive finished appearance to the interior of the building. Available unpainted or pre painted steel, the panel is easily cleaned and resists wear.

Insulation Comparison

Insulation thickness and assembly	R-Theoretical	R-Actual
6" Compressed Vinyl Faced	20.0	11.0
6" Compressed Vinyl Faced c/w 1" Thermal Block	20.0	14.0
6" unfaced insulation with Notched Zee Bar/Metal Liner	20.0	13.0
10" unfaced insulation with Notched Zee Bar/Metal Liner	34.5	19.0
6" unfaced c/w 1" thermal block and Notched Zee Bar/Liner	20.7	14.0
10" unfaced c/w 1" thermal block and Notched Zee Bar/Liner	34.6	25.0
6" unfaced insulation with 4" thermal clip and 2" Hat Bar	20.7	18.0
10" unfaced insulation with 8" thermal clip and 2" Hat	34.6	30.0

Thermalguard® Insulation System Specifications

1. General

1.1 The insulation system shall be the Thermalguard® System as furnished by BEHLEN Industries LP and installed in accordance with the manufacturer's instructions.

2. Component Description

2.1 Thermalguard® Sub-Structural System

2.1.1 The sub-structural system shall consist of 2" nominal hat shaped member with thickness to suit load for the specific roof system being installed. Thermal clips of either 2", 4", 6", 8", or 10" heigh provide space between the hat bar and the building structure for various thickness of insulation (see insulation/R-Value Chart). The thermal clips are installed with self-drilling screws.

2.2 Liner Panel

2.2.1 The interior liner panel

2.2.2 The panel shall be nominal 36" wide with corrugation 1 1/4" high, 1/2" on centres; panels shall be factory cut to required length.

2.2.3. Unpainted liner panel shall be (GALVALUME®) aluminum-zinc alloy coated steel per ASTM A792 AZ150.

2.2.4 Painted liner panel shall be Galvalume® coated steel conforming to ASTM specification A792 and 8000 series silicone polyester paint on the exposed side (minimum) non-colour controlled wash coat primer on unexposed side.

2.3 Vapour Retarded

2.3.1 The vapour retarder shall consist of the liner panel with sidelaps and endlaps sealed with betyl tape sealant to prevent vapour transmission between the sheets. A foam closure shall also be used at terminating ends of the liner panel to seal the corrugations of the panel.

2.4 Insulation

2.4.1 All unfaced insulation shall meet GGSB.51-GPLIM type 1 Standard.

2.4.2 The top layer of blanket insulation shall consist of insulation furnished in rolls (widths of 3', 4', 5', or 6' to be determined by customer).

2.4.3 The bottom layer(s) shall consist of blanket insulation in rolls (widths of 3', 4', 5', or 6' to be determined by customer). The thickness of the bottom layer(s) vary dependent on overall thermal performance of system desired.

3. System Design

3.1 All components of the Thermalguard® System shall be designed in accordance with sound engineering methods and practices.

3.2 Neither the liner panel nor the roof system panel shall be considered to be a safe work platform until completely secured to the structural system. Therefore, walkboards or other safety equipment, as required by safety standards, shall be provided by the erecting contractor for worker safety during installation.

4. Fasteners

4.1 The sub-structurals and liner panel shall be installed with 1/4" diameter self-drilling screws for attachment.

4.2 See roof system specifications for roof attachment fasteners.

5. Provision of Expansion/Contraction

5.1 Provision for thermal expansion and contraction movement shall be accomplished in the roof system. See specific roof system specifications.

6. Performance Testing

6.1 See specific roof system specifications.

QUALITY COMMITMENT - GUARANTEED

Every material, coating, part and process that is used in your new building is tested to ensure strict compliance with exacting standards. Every supplier is rigorously tested on an ongoing basis. BEHLEN is the only manufacturer in the industry with that kind of commitment to quality.

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Thermal Clips - Load Per Thermal Clip (lbs)

Nominal Height (in)		4					6					8					10				
Nominal Gauge		18	16	14	13	12	18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
	B	518.1	889.1	1163	1817	2061	390.7	514.3	940.2	1359	1818	290.2	371.1	689.5	959.5	1136	103.7	173.7	480.2	692.7	764.5
	U	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380

2'-0" Thermal Clip Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4					6					8					10				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	130	222	291	454	515	98	129	235	340	455	73	93	172	240	284	26	43	120	173	191
		U	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95
	2'-6"	B	104	178	233	363	412	78	103	188	272	364	58	74	138	192	227	21	35	96	139	153
		U	-43	-53	-64	-76	-76	-43	-53	-64	-76	-76	-43	-53	-64	-76	-76	-43	-53	-64	-76	-76
	3'-0"	B	86	148	194	303	344	65	86	157	227	303		62	115	160	189	17	29	80	115	127
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	3'-6"	B	74	127	166	260	294	56	73	134	194	260	41	53	98	137	162	15	25	69	99	109
		U	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54
	4'-0"	B	65	111	145	227	258	49	64	118	170	227	36	46	86	120	142	13	22	60	87	96
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	4'-6"	B	58	99	129	202	229	43	57	104	151	202	32	41	77	107	126	12	19	53	77	85
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	5'-0"	B	52	89	116	182	206	39	51	94	136	182	29	37	69	96	114	10	17	48	69	76
		U	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38

3'-0" Thermal Clip Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4					6					8					10				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	86	148	194	303	344	65	86	157	227	303	48	62	115	160	189	17	29	80	115	127
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	2'-6"	B	69	119	155	242	275	52	69	125	181	242	39	49	92	128	151	14	23	64	92	102
		U	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51
	3'-0"	B	58	99	129	202	229	43	57	104	151	202	32	41	77	107	126	12	19	53	77	85
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	3'-6"	B	49	85	111	173	196	37	49	90	129	173	28	35	66	91	108	10	17	46	66	73
		U	-21	-25	-31	-36	-36	-21	-25	-31	-36	-36	-21	-25	-31	-36	-36	-21	-25	-31	-36	-36
	4'-0"	B	43	74	97	151	172	33	43	78	113	152	24	31	57	80	95	9	14	40	58	64
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	4'-6"	B	38	66	86	135	153	29	38	70	101	135	21	27	51	71	84	8	13	36	51	57
		U	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28
	5'-0"	B	35	59	78	121	137	26	34	63	91	121	19	25	46	64	76	7	12	32	46	51
		U	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25

4'-0" Thermal Clip Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4					6					8					10				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	65	111	145	227	258	49	64	118	170	227	36	46	86	120	142	13	22	60	87	96
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	2'-6"	B	52	89	116	182	206	39	51	94	136	182	29	37	69	96	114	10	17	48	69	76
		U	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38
	3'-0"	B	43	74	97	151	172	33	43	78	113	152	24	31	57	80	95	9	14	40	58	64
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	3'-6"	B	37	64	83	130	147	28	37	67	97	130	21	27	49	69	81	7	12	34	49	55
		U	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27
	4'-0"	B	32	56	73	114	129	24	32	59	85	114	18	23	43	60	71	6	11	30	43	48
		U	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24
	4'-6"	B	29	49	65	101	115	22	29	52	76	101	16	21	38	53	63	6	10	27	38	42
		U	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21
	5'-0"	B	26	44	58	91	103	20	26	47	68	91	15	19	34	48	57	5	9	24	35	38
		U	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19

Thermal Zees - Load Per Thermal Zee (lbs)

Nominal Height (in)		2					2 13/16					4				
Nominal Gauge		18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
	B	450.09	689.77	896.9	1043	1286.8	411.17	654.77	836.27	1069.9	110.6	311.46	594.7	908.85	1148.7	1115.1
	U	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380

2'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			2					2 13-16					4				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	113	172	224	261	322	103	164	209	267	278	78	149	227	287	279
		U	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95
	2'-6"	B	90	138	179	209	257	82	131	167	214	222	62	119	182	230	223
		U	-43	-53	-64	-76	-76	-43	-53	-64	-79	-79	-43	-53	-64	-76	-76
	3'-0"	B	75	115	149	174	214	69	109	139	178	185	52	99	151	191	186
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	3'-6"	B	64	99	128	149	184	59	94	119	153	159	44	85	130	164	159
		U	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54
	4'-0"	B	56	86	112	130	161	51	82	105	134	139	39	74	114	144	139
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	4'-6"	B	50	77	100	116	143	46	73	93	119	123	35	66	101	128	124
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	5'-0"	B	45	69	90	104	129	41	65	84	107	111	31	59	91	115	112
		U	-22	-26	-32	-38	-38	-22	-26	-35	-38	-38	-22	-26	-35	-38	-38

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3'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			2					2 13-16					4				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	75	115	149	174	214	69	109	139	178	185	52	99	151	191	186
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	2'-6"	B	60	92	120	139	172	55	87	112	143	148	42	79	121	153	149
		U	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51
	3'-0"	B	50	77	100	116	143	46	73	93	119	123	35	66	101	128	124
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	3'-6"	B	43	66	85	99	123	39	62	80	102	106	30	57	87	109	106
		U	-21	-25	-31	-36	-36	-21	-25	-31	-36	-36	-21	-25	-31	-36	-36
	4'-0"	B	38	57	75	87	107	34	55	70	89	93	26	50	76	96	93
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	4'-6"	B	33	51	66	77	95	30	49	62	79	82	23	44	67	85	83
		U	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28
	5'-0"	B	30	46	60	70	86	27	44	56	71	74	21	40	61	77	74
		U	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25

4'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			2					2 13-16					4				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	56	86	112	130	161	51	82	105	134	139	39	74	114	144	139
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	2'-6"	B	45	69	90	104	129	41	65	84	107	111	31	59	91	115	112
		U	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38
	3'-0"	B	38	57	75	87	107	34	55	70	89	93	26	50	76	96	93
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	3'-6"	B	32	49	64	75	92	29	47	60	76	79	22	42	65	82	80
		U	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27
	4'-0"	B	28	43	56	65	80	26	41	52	67	69	19	37	57	72	70
		U	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24
	4'-6"	B	25	38	50	58	71	23	36	46	59	62	17	33	50	64	62
		U	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21
	5'-0"	B	23	34	45	52	64	21	33	42	53	56	16	30	45	57	56
		U	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19

1. Thermal Clip/Zee loads are based on Grade 33 steel with a minimum yield stress of 33,000 psi and minimum tensile strength of 45,000 psi.
2. Figures in Row B indicate the load capacity based on compression strength. Strength capacity B should be checked against [Specified Live Load] + [0.833 x Specified Dead Load].
3. Figures in Row U indicate the uplift capacity based on fastener pull-out and pull-over. Uplift capacity should be checked against specific load(s).
4. Uplift assumptions: All fasteners are 1/4" nominal diameter with 1/2" head diameter. Two fasteners connecting hat channel to thermal clip and two fasteners connecting Thermal Clip/Zee to 16 Ga. purlins with tensile strength of 65,000 psi.
5. All values based on CSA Standard S136-01.

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Thermal Zees - Load Per Thermal Zee (lbs)

Nominal Height (in)		4 13/16					6					6 13/16				
Nominal Gauge		18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
	B	284.4	441.16	630.92	911.72	987.07	231.68	401.77	581.84	833.62	999.27	159.06	299.13	470.91	595.02	696.36
	U	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380	-216	-263	-322	-380	-380

2'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4 13/16					6					6 13/16				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	71	110	158	228	249	58	100	145	208	250	40	75	118	149	174
		U	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95	-54	-66	-81	-95	-95
	2'-6"	B	57	88	126	182	197	46	80	116	167	200	32	60	94	119	139
		U	-43	-53	-64	-76	-76	-43	-53	-64	-76	-76	-43	-53	-64	-76	-76
	3'-0"	B	47	74	105	152	165	39	67	97	139	167	27	50	78	99	116
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	3'-6"	B	41	63	90	130	141	33	57	83	119	143	23	43	67	85	99
		U	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54	-31	-38	-46	-54	-54
	4'-0"	B	36	55	79	114	123	29	50	73	104	125	20	37	59	74	87
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	4'-6"	B	32	49	70	101	110	26	45	65	93	111	18	33	52	66	77
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	5'-0"	B	28	44	63	91	99	23	40	58	83	100	16	30	47	60	70
		U	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38

3'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4 13/16					6					6 13/16				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	47	74	105	152	165	39	67	97	139	167	27	50	78	99	116
		U	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63	-36	-44	-54	-63	-63
	2'-6"	B	38	59	84	122	132	31	54	78	111	133	21	40	63	79	93
		U	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51	-29	-35	-43	-51	-51
	3'-0"	B	32	49	70	101	110	26	45	65	93	111	18	33	52	66	77
		U	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42	-24	-29	-36	-42	-42
	3'-6"	B	20	32	45	65	71	17	29	42	60	71	11	21	34	43	50
		U	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27
	4'-0"	B	24	37	53	76	82	19	33	48	69	83	13	25	39	50	58
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	4'-6"	B	21	33	47	68	73	17	30	43	62	74	12	22	35	44	52
		U	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28	-16	-19	-24	-28	-28
	5'-0"	B	19	29	42	61	66	15	27	39	56	67	11	20	31	40	46
		U	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25	-14	-18	-21	-25	-25

4'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			4 13/16					6					6 13/16				
Nominal Gauge			18	16	14	13	12	18	16	14	13	12	18	16	14	13	12
Hat Channel Spacing	2'-0"	B	36	55	79	114	123	29	50	73	104	125	20	37	59	74	87
		U	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48	-27	-33	-40	-48	-48
	2'-6"	B	28	44	63	91	99	23	40	58	83	100	16	30	47	60	70
		U	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38	-22	-26	-32	-38	-38
	3'-0"	B	24	37	53	76	82	19	33	48	69	83	13	25	39	50	58
		U	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32	-18	-22	-27	-32	-32
	3'-6"	B	20	32	45	65	71	17	29	42	60	71	11	21	34	43	50
		U	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27	-15	-19	-23	-27	-27
	4'-0"	B	18	28	39	57	62	14	25	36	52	62	10	19	29	37	44
		U	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24	-14	-16	-20	-24	-24
	4'-6"	B	16	25	35	51	55	13	22	32	46	56	9	17	26	33	39
		U	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21	-12	-15	-18	-21	-21
	5'-0"	B	14	22	32	46	49	12	20	29	42	50	8	15	24	30	35
		U	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19	-11	-13	-16	-19	-19

1. Thermal Clip/Zee loads are based on Grade 33 steel with a minimum yield stress of 33,000 psi and minimum tensile strength of 45,000 psi.
2. Figures in Row B indicate the load capacity based on compression strength. Strength capacity B should be checked against [Specified Live Load] + [0.833 x Specified Dead Load].
3. Figures in Row U indicate the uplift capacity based on fastener pull-out and pull-over. Uplift capacity should be checked against specific load(s).
4. Uplift assumptions: All fasteners are 1/4" nominal diameter with 1/2" head diameter. Two fasteners connecting hat channel to thermal clip and two fasteners connecting Thermal Clip/Zee to 16 Ga. purlins with tensile strength of 65,000 psi.
5. All values based on CSA Standard S136-01.

Notes
1. Properties and loads are based on Grade 33 steel with a minimum yield of 33,000 psi.
2. Figures in Row B indicate the load capacity based on strength. Strength capacity B should be checked against [Specified Live Load]+[0.833xSpecified Dead Load].
3. Figures in Row D indicate the load capacity based on deflection of 1/240th span. For allowable deflection of 1/180th span values in Row D may be multiplied by 1.333, but capacity must not exceed the value in Row B. Deflection capacity should be checked against Specified load(s).
4. Positive bending indicates top in compression. Negative bending indicates bottom in compression.
5. Uplift resistance of the fastening system should be considered in addition to values in this table.
6. All values based on CSA Standard S 136-01.

1 3/16" Hat Channel

Table with 5 main columns: Ga., Physical Properties, Effective Section Modulus, Effective Moment of Inertia. Rows include properties for 20, 18, 16, and 14 gauge channels.

1 3/16" Hat Channel - Uniformly Distributed Loads (plf)

Table with 12 columns: Base Thickness (in), Single Span, Two Span, Three Span. Rows include Support Spacing (ft) and Base Thickness (in) for various spans.

1 3/16" Hat Channel - Uniformly Distributed Loads (psf)

Table with 12 columns: Base Thickness (in), Single Span, Two Span, Three Span. Rows include Support Spacing (ft) and Base Thickness (in) for various spans.

2” Hat Channel

Physical Properties			Effective Section Modulus		Effective Moment of Inertia		
Ga.	Base Thickness (in)	Coated Thickness (in)	Coated Mass (lbs/ft)	Positive Bending (in3)	Negative Bending (in3)	Positive Bending (in4)	Negative Bending (in4)
20	0.0380	0.0395	1.06	0.185	0.161	0.195	0.177
18	0.0510	0.0525	1.40	0.253	0.237	0.265	0.249
16	0.0620	0.0635	1.73	0.303	0.301	0.319	0.312
14	0.0760	0.0775	2.09	0.365	0.365	0.386	0.386

2” Hat Channel - Uniformly Distributed Loads (plf)

Base Thickness (in)		Single Span						Two Span						Three Span																
Thickness (in)		t=0.038		t=0.051		t=0.062		t=0.076		t=0.038		t=0.051		t=0.062		t=0.076		t=0.038		t=0.051		t=0.062		t=0.076						
Support Spacing (ft)	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0			
	611	271	152	834	371	208	1000	444	250	1203	534	300	268	150	97	454	248	157	631	339	213	798	427	262	166	665	358	225	841	452
D	1596	473	199	2167	642	270	2612	774	325	3166	938	395	2259	669	282	3068	909	383	3696	1095	462	4482	1328	560						

2” Hat Channel - Uniformly Distributed Loads (psf)

Base Thickness (in)		Single Span						Two Span						Three Span															
		t=0.038		t=0.051		t=0.062		t=0.076		t=0.038		t=0.051		t=0.062		t=0.076		t=0.038		t=0.051		t=0.062		t=0.076					
Support Spacing (ft)		2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	2.0	3.0	4.0	
2'-0"	B	306	136	76	417	186	104	500	222	125	602	267	150	134	75	49	227	124	79	316	170	107	399	214	131	83	333	179	113
	D	798	237	100	1084	321	135	1306	387	163	1583	469	198	1130	335	141	1534	455	192	1849	548	231	2241	664	280	1153	445	192	1849
2'-6"	B	244	108	61	334	148	83	400	178	100	481	214	120	107	60	39	182	99	63	252	136	85	319	171	105	66	266	143	90
	D	638	189	80	867	257	108	1045	310	130	1266	375	158	904	268	113	1227	364	153	1479	438	185	1793	531	224	904	268	113	1227
3'-0"	B	204	90	51	278	124	69	333	148	83	401	178	100	89	50	32	151	83	52	210	113	71	266	142	87	94	53	34	159
	D	532	158	66	722	214	90	871	258	109	1055	313	132	753	223	94	1023	303	128	1233	365	154	1494	443	187	753	223	94	1023
3'-6"	B	175	77	43	238	106	59	286	127	71	344	153	86	77	43	28	130	71	45	180	97	61	228	122	75	81	45	29	137
	D	456	135	57	619	183	77	746	221	93	905	268	113	645	191	81	877	260	109	1057	313	132	1281	379	160	645	191	81	877
4'-0"	B	153	68	38	209	93	52	250	111	63	301	134	75	67	38	24	114	62	39	158	85	53	200	107	66	71	40	26	120
	D	399	118	50	542	161	68	653	194	82	792	235	99	565	167	71	767	227	96	925	274	116	1121	332	140	565	167	71	767
4'-6"	B	136	60	34	185	82	46	222	99	56	267	119	67	60	33	22	101	55	35	140	75	47	177	95	58	63	35	23	106
	D	355	105	44	482	143	60	580	172	72	704	208	88	502	149	63	682	202	85	822	243	103	996	295	124	502	149	63	682
5'-0"	B	122	54	30	167	74	42	200	89	50	241	107	60	54	30	19	91	50	31	126	68	43	160	85	52	56	32	20	96
	D	319	95	40	433	128	54	522	155	65	633	188	79	452	134	56	614	182	77	740	219	92	896	266	112	452	134	56	614

Vapourguard® Notched Zee Bar

The System

An insulation system which incorporates all the benefits of smooth liner panel while providing the advantages of superior thermal efficiency, condensation control and noise reduction. The system comprises the Vapourguard 32® steel liner complete with factory applied sealant at laps (field applied on the ends) to act as vapour retarder. This liner gives the interior an attractive finish and is insulated from the exterior. The insulation cavity can be supplied to accommodate up to 8" (200mm) of insulation. The wall cavity is created using a notched zee bar typically spaced at support spacing. Notched Zee Bars in heights from 3-1/2" to 8" to create varying cavity depths. This provides the ultimate thermal barrier for energy efficient roof and wall construction. The system metal liner can be combined with a range of exterior panel colours and profiles to complete the look of the building.

Performance Advantages

- The system provides a cavity where semi-rigid insulation in multiple layers can be added in varying thickness through R32. The insulation is uncompressed and provides superior insulating capability. Conventional insulation systems compress the insulation at the purlin and reduce the effective insulation value of the system.
- The notched zee bar provides an effective thermal break reducing the transmission of heat through the thermal system. The zee bar also provides support to the insulation and prevents it from sagging and compressing on the wall.
- The liner panel provides superior vapour control to protect the insulation. The steel liner panel is easily cleaned and resistant to abuse. The steel liner is not subject to mechanical puncturing that plastic vapour barriers are prone to. It also serves as an attractive interior finish to the building. The liner can act as a diaphragm to reduce bracing requirements on purlins and girts.
- The liner is installed with self-drilling screws and offers a quick temporary enclosure to protect the interior against weather. Once the liner panel is installed it will keep out the elements while work continues on the interior space.
- The complete system will reduce noise transmission through the assembly.
- The liner panel can be supplied with perforations as part of a noise control system.

Appearance

The system liner provides a clean attractive finished appearance to the interior of the building. Available unpainted or pre-coat painted steel, the panel is easily cleaned and resists wear.

Vapourguard 32® Insulation System Specifications

1. General

1.1 The insulation system shall be the Vapourguard 32® System as furnished by Behlen Industries and installed in accordance with the manufacturer's instructions.

2. Component Description

2.1 Vapourguard 32® Sub-Structural System

2.1.1 The sub-structural system shall consist of notched zee shaped member (thickness to suit loading), notched to suit Vapourguard 32® panel being installed. Either 3 1/2", 4", 6", or 8" height provide space between the exterior and the building structure for various thickness of insulation (see insulation/R-Value Chart). The notched zee bars are installed with self-drilling screws through the interior liner panel and the building structure.

2.2 Vapourguard 32® Liner Panel

2.2.1 The Vapourguard 32® interior liner panel shall be formed from 0.018" - 0.036" coated steel with minimum yield strength of 33,000 psi.

2.2.2 The panel shall be nominal 32" wide with a 1 1/4" seam rib & stiff ribs @ 8" O.C.; panel shall be factory cut to required length.

2.2.3 Unpainted liner panel shall be G80 Galvanized steel conforming to ASTM A653 (G90).

2.2.4 Painted liner panel shall be G90 galvanized steel conforming to ASTM specification A653 (G90) and 8000 series silicone polyester paint on the exposed side and non-colour controlled wash coat primer on unexposed side.

2.3 Vapour Retarder

2.3.1 The Vapour Retarder shall consist of the liner panel with sidelaps sealed with factory applied sika 901 and butyl tape sealer on ends to prevent vapour transmission between sheets.

2.4 Insulation

2.4.1 All unfaced semi-rigid insulation shall meet CAN/CGSB-51-11-92 Standard.

2.4.2 The layer(s) shall consist of insulation in rolls (widths of 3', 4', 5', or 6' to be determined by customer). The thickness of the layer(s) vary dependent on overall thermal performance of system desired.

3. System Design

3.1 All components of the Vapourguard 32® System shall be designed in accordance with sound engineering methods and practices.

4. System Installation

4.1 The complete Vapourguard 32® System shall be installed on structural girts and installed as per manufacturer's instructions.

5. Fasteners

5.1 The sub-structurals and liner panel shall be installed with 1/4" diameter self-drilling screws for attachment.

5.2 See roof system specifications for roof attachment fasteners.

QUALITY COMMITMENT - GUARANTEED

Every material, coating, part and process that is used in your new building is tested to ensure strict compliance with exacting standards. Every supplier is rigorously tested on an ongoing basis. BEHLEN is the only manufacturer in the industry with that kind of commitment to quality.

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Thermal Zees - Load Per Thermal Zee (lbs)

Nominal Height (in)	3 1/2			4			5			6			8		
Nominal Gauge	18	16	14	18	16	14	18	16	14	18	16	14	18	16	14
B	596	1139	1740	596	1139	1740	544	845	1208	443	769	1114	100	333	467
U	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254

2'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Height (in)			3 1/2			4			5			6			8		
Nominal Gauge			18	16	14	18	16	14	18	16	14	18	16	14	18	16	14
	2'-0"	B	298	570	870	298	570	870	272	423	604	222	385	557	50	167	234
		U	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127	-127
	2'-6"	B	238	456	696	238	456	696	218	338	483	177	308	446	40	133	187
		U	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102	-102
	3'-0"	B	199	380	580	199	380	580	181	282	403	148	256	371	33	111	156
		U	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85
	3'-6"	B	170	325	497	170	325	497	155	241	345	127	220	318	29	95	133
		U	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73	-73
	4'-0"	B	149	285	435	149	285	435	136	211	302	111	192	279	25	83	117
		U	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64	-64
	4'-6"	B	132	253	387	132	253	387	121	188	268	98	171	248	22	74	104
		U	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56	-56
	5'-0"	B	119	228	348	119	228	348	109	169	242	89	154	223	20	67	93
		U	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51	-51
	5'-6"	B	108	207	316	108	207	316	99	154	220	81	140	203	18	61	85
		U	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46
	6'-0"	B	99	190	290	99	190	290	91	141	201	74	128	186	17	56	78
		U	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42	-42
	6'-6"	B	92	175	268	92	175	268	84	130	186	68	118	171	15	51	72
		U	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39
	7'-0"	B	85	163	249	85	163	249	78	121	173	63	110	159	14	48	67
		U	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36
	7'-6"	B	79	152	232	79	152	232	73	113	161	59	103	149	13	44	62
		U	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	8'-0"	B	75	142	218	75	142	218	68	106	151	55	96	139	13	42	58
		U	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32

4'-0" Thermal Zee Spacing - Uniformly Distributed Loads (psf)

Nominal Screw Size (in)		Base Steel Gauge					
Thread Diameter	Decimal Equivalent	20	18	16	14	13	12
#12	0.21	90	121	148	181	221	257
1/4	0.24	103	139	169	207	253	270



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