

STRUCTURAL DESIGN GUIDE | ACS THERMAL CLIP



COMPLÉMENTS
ACCESSORY PRODUCTS



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1 Introduction

This structural design guide is intended to aid with properly specifying the attachment and spacing of the patented ACS Thermal Clips for supporting exterior cladding assemblies and is to be used in conjunction with Morrison Hershfield's (MH) thermal analysis reports or SOPREMA'S BUILD BETTER guide for energy-related objectives in building codes.

The ACS Thermal clips are stainless steel z-clips that are components of a combination exterior thermal break and may be used in rain-screen cladding systems. The clips are typically attached via self-drilling/self-tapping screws through exterior drywall to exterior steel stud framing and have an Aerogel™ thermal break between the clip and the drywall. Other applications may include attaching the clips to wood framing, to concrete construction, or to structural steel framing.

Typically, the outstanding leg of the clip would support a continuous z-girt spanning either vertically or horizontally between clips; this continuous z-girt would receive the specified cladding product.

The ACS A-Clip is designed to be adjustable, allowing the installer to create an accurate plane for receiving the specified cladding. Most cladding systems have little tolerance for uneven support, requiring either very accurate structural framing, or extensive shimming by the cladding contractor. With the A-Clip, after attaching the inner leg to the building, the outer leg is slid over the inner leg, to the desired plane, and then fixed by installing two screws through both the inner and outer webs.

The ACS S-Clip is a fixed (non-adjustable) z-clip thermally similar to the A-Clip but may be used where construction tolerances are small enough in the wall plane to not be an issue for the proposed cladding assembly.

2 Structural Concept

Structurally, the clips resist gravity load (cladding assembly self-weight), and transverse loads (wind/seismic). Clip length, spacing, and attachment to the substructure is determined based on the combination of thermal and structural requirements of the assembly.

Gravity load creates both a rotational force and a direct shear in each clip, while wind/seismic forces create a direct tension (or compression) force through each clip. The gravity rotational force is resisted by screw tension in the upper attachment screw and the lower compression region of the clip for the rotational force, and by both screws in direct shear/bearing in the case of direct shear, while wind/seismic forces are resisted by direct screw tension.

While the Aerogel™ thermal break between the z-clip and the structure is a minimally compressive material when correctly installed, the overall system installation guidelines have been limited by permissible strain in the Aerogel™/clip rotation. Clip spacing is also limited by attachment screw capacity, steel clip capacity, and A-Clip adjustment termination screw capacity (see below for full definitions). These values were calculated and subsequently verified by an independent testing lab with the following tests:

Independent Testing (Test reports available for download from ACS site):

- ICC-ES AC308, *Acceptance Criteria for Exterior Wall Coverings of Steel-Backed Veneer Panels Attached to Walls Utilizing Steel Framing and Brackets*, Approved October 2008 – Section 3.8.2 Gravity Loads
- ASTM E330/E330M-14, *Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*
- *4 in., 8 in. and 10 in. S-Clips – Stress-Strain Load Testing to Failure*

The following structural design information is provided as a convenience for the user to determine the general suitability of the clips as part of an overall cladding system. Fastener values are based on one manufacturer's test data and are representative of that manufacturer's fasteners, steel section used, and test apparatus. These values may not be applicable for other screw manufacturers, or to different structural support members.

Due to the number of variables inherent in the design of exterior cladding, structural review of cladding installations is required on any project. These variables include, but are not limited to, building height, building exposure, design wind pressure, cladding weight, cladding flexibility/brittleness, cladding fastening requirements, cladding assembly depth, substructure construction tolerances, and substructure material type. As a result of the large number of variables involved with cladding design, a project structural engineer (independent of ACS) is required to review and provide the necessary design/assurance that the overall system is structurally acceptable.

Additionally, cladding which is inherently prone to cracking such as stucco or some types of stone veneer, may require more onerous structural constraints or safety factors over and above those indicated here to reduce the probability of cracking during the design life of the wall assembly.

3 Recommended Clip Spacing & Fastener Data

Tabulated spacing indicated is based on least of:

- Maximum 1/8" (3.2 mm) deflection due to cladding gravity load (equivalent to 20 lbs of cladding weight on nominal 11" wall assembly depth)
- ASD screw pullout/tension, shear/bearing, and combined tension/shear interaction (FS = 3)
- For adjustable (A-Clip): adjustment screws (2 - #12-14 x 3/4" TEKS, Vallow = 2 x 184 = 368 lbs)
- Other limiting conditions such as, but not limited to: Sub-structure girt strength/deflection, cladding span/connections to sub-girt assembly, and all load-path screw connections.

NOTE: Charts Represent Wall Assembly Depth, which is defined as the distance from face of support wall/contact of ACS clip to Center of Gravity (C.O.G.) of Cladding:

Wall Assembly Depth = [Clip Depth] + [Sub-Girt(s) Depth] + [Outer Girt to Cladding C.O.G. (Cladding C.O.G. is Typically 1/2 cladding product depth)]

Example: 6" ACS S-Clip, 2 - 1" z-girts (vertical & horizontal girts), 1 1/2" Composite System
 Total Wall Assembly Depth = 6" + 2 x 1" + 0.5 x 1 1/2" = 8 3/4" - Use 9" Wall Assembly Chart

Steel Stud/Concrete Wall Substructure

- For 30 psf tables - all assemblies require 3 - 1/4" x 14 #3 screws (or 3 - 1/4" Titen concrete screws) for assemblies 9" and deeper; assemblies 8" and less require two (2) screws per clip, to be installed in the outermost holes in the clip flange, omitting the center hole screw.
- For 50 psf tables - all assemblies require 3 - 1/4" x 14 #3 self-drilling/self-tapping screws (or 3 - 1/4" Titen concrete screws) per clip
- Attachment to 18-ga. or 20 ga. steel studs - screw length must penetrate beyond the metal structure a minimum of 3 pitches of thread
- Attachment to 4000 psi (28 MPa) concrete - based on Simpson Strong-tie Titen Stainless Steel Screws, 1/4" dia. x min. 1 1/2" embed - typically require 2 1/4" (or longer) fasteners

Steel Stud/Concrete Wall Substructure - Up to 30 psf Specified Wind - 12" to 3" Load

Tables:

12" Wall Assembly - Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	47	31
4	48	32	40	27
5	46	31	35	23
6	41	27	31	20
7	37	24	28	18
8	33	22	25	17
10	28	18	21	14
15	20	13	15	10

Steel Stud/Concrete Wall Substructure - Up to 30 psf Specified Wind

10" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	45	30
5	48	32	39	26
6	46	31	35	23
7	42	28	32	21
8	38	25	29	19
10	32	21	24	16
15	23	15	18	12

9" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	47	31
5	48	32	42	28
6	48	32	37	25
7	45	30	34	22
8	41	27	31	20
10	35	23	26	17
15	25	17	19	13

8" Wall Assembly – Vertical Clip Spacing (inches) - 2 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	44	29
4	48	32	40	26
5	48	32	36	24
6	44	29	33	22
7	40	27	31	20
8	38	25	29	19
10	33	22	25	16
15	25	17	19	13

[Steel Stud/Concrete Wall Substructure - Up to 30 psf Specified Wind](#)

[7" Wall Assembly – Vertical Clip Spacing \(inches\) - 2 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	46	31
4	48	32	42	28
5	48	32	38	25
6	47	31	35	23
7	43	29	33	22
8	40	27	31	20
10	36	24	27	18
15	28	18	21	14

[6" Wall Assembly – Vertical Clip Spacing \(inches\) - 2 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	44	29
5	48	32	41	27
6	48	32	38	25
7	47	31	35	23
8	44	29	33	22
10	39	26	30	20
15	31	20	23	15

[5" Wall Assembly – Vertical Clip Spacing \(inches\) - 2 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	47	31
5	48	32	44	29
6	48	32	41	27
7	48	32	38	25
8	48	32	36	24
10	43	28	33	22
15	34	23	26	17

Steel Stud/Concrete Wall Substructure - Up to 30 psf Specified Wind

4" Wall Assembly – Vertical Clip Spacing (inches) - 2 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	47	31
6	48	32	44	29
7	48	32	42	28
8	48	32	40	26
10	48	32	36	24
15	39	26	30	20

3" Wall Assembly – Vertical Clip Spacing (inches) - 2 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	46	31
8	48	32	44	29
10	48	32	41	27
15	45	30	34	23

Steel Stud/Concrete Wall Substructure - Up to 50 psf Specified Wind

- 12" to 3" Load Tables:

12" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	46	31	36	24
4	41	27	31	21
5	37	25	28	19
6	34	22	25	17
7	31	20	23	15
8	28	19	21	14
10	24	16	18	12
15	18	12	14	9

10" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	36	25
4	45	30	34	23
5	41	27	31	20
6	37	25	28	19
7	34	23	26	17
8	32	21	24	16
10	27	18	21	14
15	21	14	16	10

9" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	40	26
4	47	31	36	24
5	43	28	32	21
6	39	26	30	20
7	36	24	27	18
8	34	22	25	17
10	29	19	22	15
15	22	15	17	11

[Steel Stud/Concrete Wall Substructure - Up to 50 psf Specified Wind](#)

[8" Wall Assembly – Vertical Clip Spacing \(inches\) - 3 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	41	27
4	48	32	37	25
5	45	30	34	23
6	41	27	31	21
7	38	25	29	19
8	36	24	27	18
10	32	21	24	16
15	24	16	18	12

[7" Wall Assembly – Vertical Clip Spacing \(inches\) - 3 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	42	28
4	48	32	39	26
5	47	31	36	24
6	44	29	33	22
7	41	27	31	21
8	38	25	29	19
10	34	23	26	17
15	27	18	20	13

[6" Wall Assembly – Vertical Clip Spacing \(inches\) - 3 attachment screws](#)

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	44	29
4	48	32	41	27
5	48	32	38	25
6	47	31	36	24
7	44	29	33	22
8	41	27	31	21
10	37	25	28	29
15	29	19	22	15

Steel Stud/Concrete Wall Substructure - Up to 50 psf Specified Wind

5" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	46	31
4	48	32	43	29
5	48	32	41	27
6	48	32	38	25
7	47	31	36	24
8	45	30	34	23
10	41	27	31	20
15	33	22	25	16

4" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	46	30
5	48	32	43	29
6	48	32	41	27
7	48	32	39	26
8	48	32	37	25
10	45	30	34	23
15	37	25	28	19

3" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	18 Ga. Steel Studs/Concrete		20 Ga. Steel Studs	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	46	30
6	48	32	44	29
7	48	32	43	28
8	48	32	41	27
10	48	32	38	25
15	43	28	32	21

Wood Stud Substructure – up to 50 psf Specified Wind

– 12” to 3” Load Tables:

Attachment Spacing (H" x V") of ACS A-Clips/S-Clips based on:

- Either DF/SP or SPF/HF Wood Studs using ¼" Simpson Strong-Tie SDS Screws
- All assemblies 5" and greater require 3 - ¼" Simpson Strong-Tie SDS Screws or Equal
- Assemblies 4" and less require 2 - ¼" Simpson Strong-Tie SDS Screws or Equal, to be installed in the outermost holes in the clip flange, omitting the center hole screw.

Note: Minimum 1 ½" Penetration into Main Member - Plywood Attachment Only is not Sufficient

12" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	45	30
6	48	32	40	27
7	48	32	37	24
8	48	32	34	22
10	44	27	29	19
15	33	20	21	14

10" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	44	29
7	48	32	41	27
8	48	32	37	25
10	46	31	32	21
15	34	23	24	16

Wood Stud Substructure – up to 50 psf Specified Wind

9" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	47	31
7	48	32	43	28
8	48	32	40	26
10	48	32	34	23
15	37	24	26	17

8" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	45	30
8	48	32	42	28
10	48	32	37	24
15	40	26	28	19

7" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	48	32
8	48	32	45	30
10	48	32	39	26
15	42	29	30	20

Wood Stud Substructure – up to 50 psf Specified Wind

6" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	48	32
8	48	32	48	32
10	48	32	43	28
15	38	25	33	22

5" Wall Assembly – Vertical Clip Spacing (inches) - 3 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	48	32
8	48	32	48	32
10	48	32	46	31
15	42	28	37	24

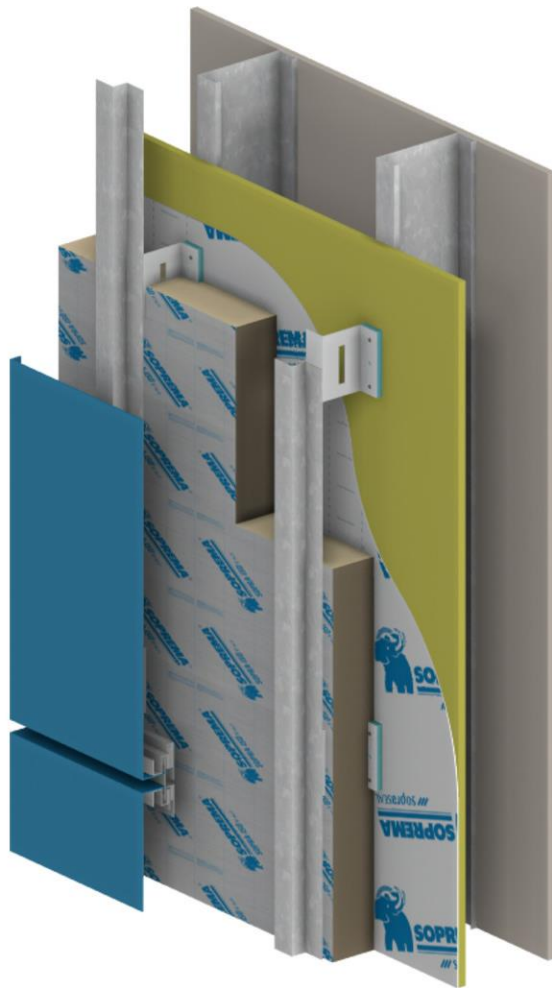
4" Wall Assembly – Vertical Clip Spacing (inches) - 2 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	46	31
7	48	32	44	29
8	48	32	42	28
10	48	32	39	26
15	45	30	32	21

Wood Stud Substructure – up to 50 psf Specified Wind

3" Wall Assembly – Vertical Clip Spacing (inches) - 2 attachment screws

Cladding Weight (psf)	DF/SP		SPF/HF	
	16" Horizontal Spacing	24" Horizontal Spacing	16" Horizontal Spacing	24" Horizontal Spacing
3	48	32	48	32
4	48	32	48	32
5	48	32	48	32
6	48	32	48	32
7	48	32	47	31
8	48	32	45	30
10	48	32	42	28
15	48	32	35	23



Vertical Grit Detail



Horizontal Grit Detail

4 Fastener Data

Steel Stud Framing Screws:

1/4"-14 #3 Self-Drilling/Self Tapping Screw (Leland Industries)			
Stud Gauge	20	18	16
Nominal Thickness (in)	0.0346	0.0451	0.0566
Tensile Capacity (lbs)	394	613	883
Allowable Tensile (lbs)	110	144	294
Ultimate Shear (lbs)	930	1442	2100
Allowable Shear (lbs)	203	302	573

Note – ASD Factor of Safety = 3 For Shear & Tension; values have been limited to the lesser of 1) Manufacturer Test Values Divided by SF = 3, or 2) S136 North American Specification for the Design of Cold-Formed Steel Structural Members, J4.3 Shear and J4.4 Tension in Screw Connections

Concrete Wall Support Screws:

Simpson Strong-Tie Titen Stainless Steel Screws 1/4" dia. x nominal 1 1/2" embedment		
Concrete Strength (psi)	2500	4000
Concrete Tensile Capacity (lbs)	1040	1760
Allowable Tension (lbs)	260	440
Concrete Shear Capacity (lbs)	810	810
Allowable Shear (lbs)	200	200

Based on 2021 Simpson Strong-Tie Anchoring, Fastening, Restoration and Strengthening Systems for Concrete & Masonry, Uncracked Concrete, Non-Seismic Design, No Supplementary Reinforcement, Greater Than Critical Edge Distance/Spacing

Wood Stud Support Screws:

Simpson Strong-Tie SDS Wood Screws - 1/4" dia. x 2 1/2" lg.		
Wood Species	DF/SP	SPF/HF
Allowable Tension (lbs)	258	182
Allowable Shear (lbs)	250	180

Note – Factor of Safety from Simpson Strong-Tie for 16 ga. Steel Side Plates, & assumes at least 1 1/2" penetration into main member, with allowable withdrawal load for DF/SP = 172 lb/in, and for SPF/HF = 121 lb/in

5 Kolot Structural Engineering Ltd.

18 March 2022

ACS Composite Systems Inc.
35 – 7450 Butler Road
Sooke, BC V9Z 1N1

Dear ACS Composite Systems-

KSEL is pleased to provide the attached ACS Structural Design Guide. This document relates to the ACS Thermal Clips (A-Clips & S-Clips) installed on steel stud walls, concrete walls, and wood stud walls.

The thermal clip design has been based on a combination of analytical design, structural verification from an accredited third-party testing agency, as well as manufacturer data for fasteners for the above-mentioned structural backup assemblies.

It should be noted that due to the complexity of cladding/sub-girt types, local/national building codes, wind/seismic loads due to building location, shape, and size, the design of the complete wall assembly is outside the scope of this structural manual. Each project generally requires a cladding specialty engineer (structural engineer) independent of ACS and KSEL, competent in the design of cladding/wall assemblies, and registered in the region that the cladding assembly is to be installed.

ACS Thermal Clips must be installed in accordance with this Structural Design Guide and any amendments hereto. Failure to do so could lead to failure of the clips and/or damage to or loss of support of the cladding and, furthermore, would render void any warranty and liability of ACS or KSEL, including any liability for resulting loss, damage, or costs. Thus, it is very important for the installation to be carried out in accordance with the specifications and instructions herein and with reliance upon an independent project structural engineer as noted in the said Guide.

Best regards,

Doug Kolot, P. Eng., Struct. Eng.
Kolot Structural Engineering Ltd. (KSEL)