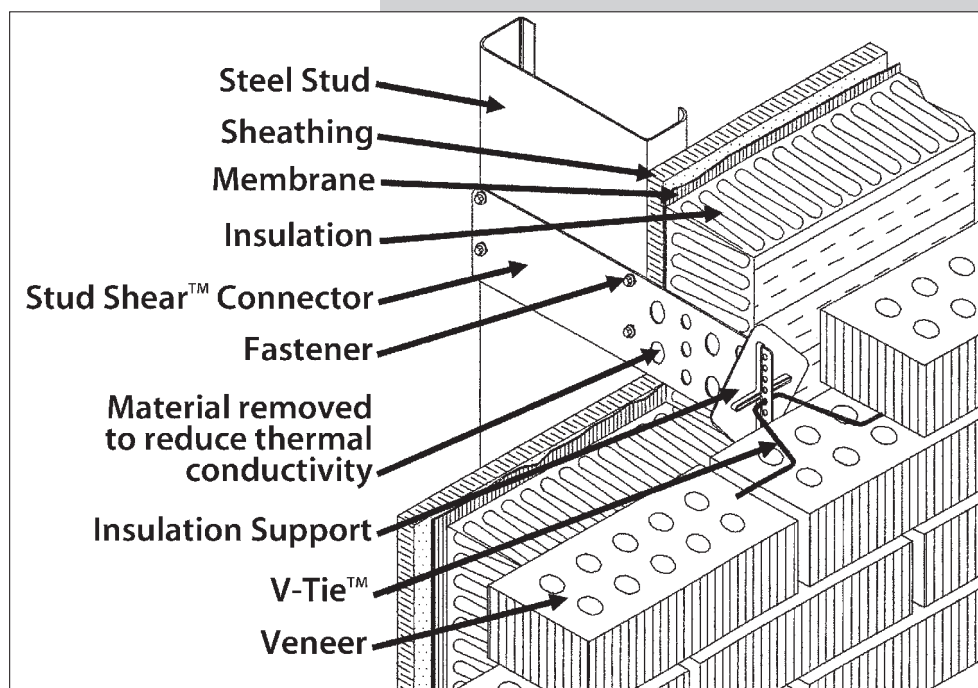


STUD SHEAR™ CONNECTOR



STUD SHEAR™ CONNECTOR APPLICATION



Introduction

Presently, exterior brick veneer on a building is used primarily for aesthetics and to provide a weathering surface. No consideration is given to the utilization of the veneer as a structural component. All lateral loads (i.e., wind and earthquake) acting on the brick veneer must be transferred to a backup wall system by means of appropriately designed ties. In many cases, the backup wall consists of steel studs or wood studs, and is designed to resist all of the applied loads.

The Stud Shear™ Connector was developed to transfer shear between the brick veneer and the backup wall. With the use of this shear resisting connector, composite load carrying action is achieved between the brick veneer and backup wall, resulting in a wall system with a changed and **improved load resisting capacity**.

Stud Shear™ Connector Description

Every Stud Shear™ Connector assembly consists of a Stud Shear™ Connector Plate, a V-Tie™, and an optional Insulation Support.

The Stud Shear™ Connector Plate component, presented in *Figure 1*, is manufactured from 16 gauge (1.61 mm [0.063"] thick) sheet metal conforming to ASTM Standard A570, and is available in hot dipped galvanized finish (conforming to CSA CAN3-A370 and ASTM A123 requirement of 401 g/m²/side [1.31 oz/ft²/side] of zinc coating), and stainless steel.

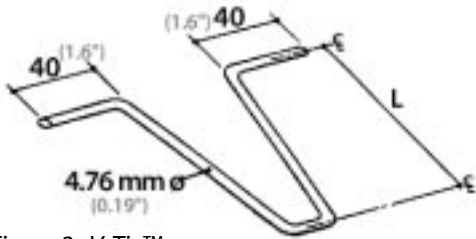


Figure 2 V-Tie™

The length of the Stud Shear™ Connector can vary to accommodate stud width (S), of 102 mm (4"), 152 mm (6"), and 203 mm (8"), insulation plus gypsum sheathing thickness (I+G), of 0 mm (0") and up, and air space width (A), of 25 mm (1") and greater.

Four, 6.0 mm (0.24") diameter screw holes in the stud width portion (S), of the Stud Shear™ Connector Plate provide for adequate fixity of the plate to the steel stud. Note that a minimum of two screws per connector is required to produce a moment connection. The shear mode connection of the screws is much more desirable than the corrosion susceptible tension mode connection.

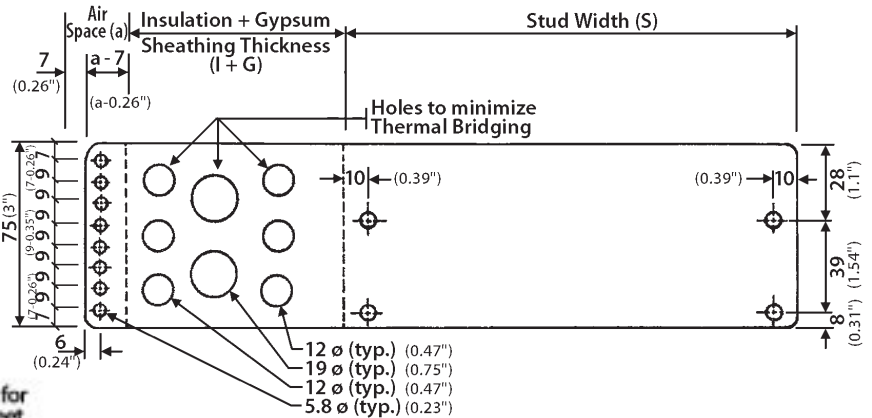


Figure 1 Stud Shear™ Connector Plate

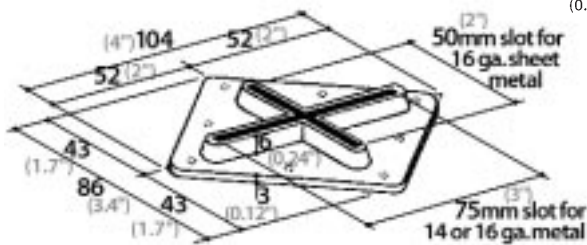


Figure 3 Insulation Support

Thermal bridging reducing holes are incorporated within the insulation thickness portion (I + G), of the Stud Shear™ Connector Plate.

A series of eight, 5.8 mm (0.23") diameter holes are utilized to attach the V-Tie™ component to the Stud Shear™ Connector Plate.

The V-Tie™, as shown in Figure 2, is manufactured from 4.76 mm (0.19") diameter wire conforming to CSA Standard G30.3, and is available in hot dipped galvanized finish (conforming to CSA CAN3-A370 and ASTM A123 requirement of 458 g/m²/side [1.5 oz/ft²/side] of zinc coating), or stainless steel.

The legs of the V-Tie™ are mortared into place at the centerline of the brick veneer. V-Tie™ sizes of 60 (2.4"), 80 (3.1"), 100 (3.9"), 120 (4.7"), 140 (5.5"), 160 (6.3"), 180 (7.1"), 200 (7.9"), 225 (8.9") and 250 mm (9.8") lengths are available.

The Insulation Support is manufactured from polyethylene and is optionally used to secure the sheet insulation in place.

A Stud Shear™ Connector assembly is shown in Figure 4, with an installation wall section given in Figure 5.

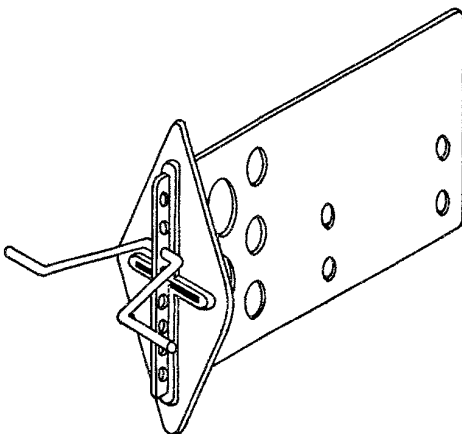
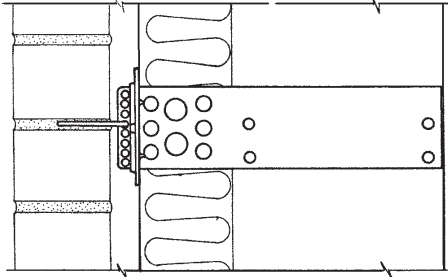


Figure 4 Stud Shear™ Connector

Figure 5 Stud Shear™ Connector Installation



The vertical orientation of the Plate, in conjunction with the positive moment connections between the stud and the Plate, and between the V-Tie™ and the brick veneer results in the ability of the Stud Shear™ Connector to transfer vertical shear forces from the masonry veneer to the structural stud backup wall system. This shear transfer capability results in an increased stiffness of the wall system, thereby reducing the lateral deflection of the wall, while at the same time increasing the load carrying capacity of the wall system.

Benefits

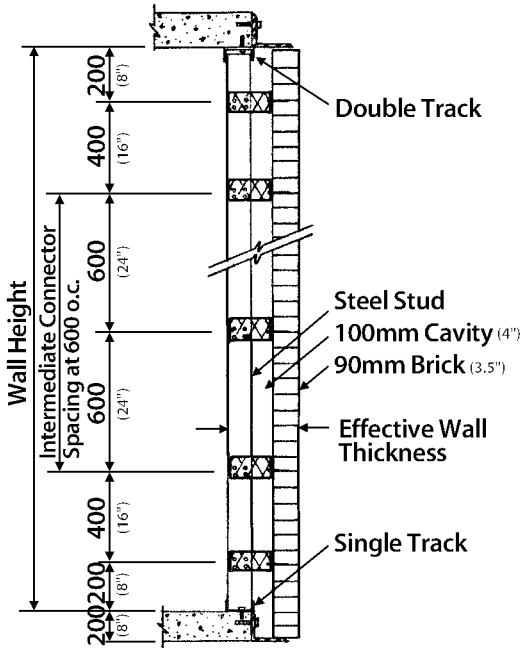


Figure 6 Stud Shear™ Connector Vertical Spacing

1. The Stud Shear™ Connector greatly increases the stiffness of the wall system through composite action, thereby significantly reducing the lateral deflection of the wall assembly.
2. By providing composite action between the brick veneer and the stud backup wall, the size and thickness of stud can both be reduced, thereby reducing the wall cost. These savings are again realized in greater useable floor space provided. Table 1 illustrates examples of the improved structural performance provided by the Stud Shear™ Connector wall system.
3. The Stud Shear™ Connector provides fixity to the sheet insulation in all three directions, minimizing separation at sheet insulation junctions

Table 1 Steel Stud Backup Wall Design Comparison

Wall Height H (mm)	Steel Stud Backup Wall Design Requirements	
	Conventional Design	Shear™ Connected Composite Design
3,000 (10')	152 mm (6") x 18 ga. @ 400 mm (16") o.c. (H/720 = 4.2 mm) (0.17")	102 mm (4") x 20 ga. @ 400 mm (16") o.c. (H/2098 = 1.4 mm) (0.055")
4,500 (15')	203 mm (8") x 16 ga. @ 400 mm (16") o.c. (H/720 = 6.3 mm) (0.25")	152 mm (6") x 18 ga. @ 400 mm (16") o.c. (H/2010 = 2.2 mm) (0.087")
6,000 (20')	203 mm (8") x 14 ga. @ 200 mm (8") o.c. (H/720 = 8.3 mm) (0.33")	203 mm (8") x 18 ga. @ 400 mm (16") o.c. (H/2000 = 3.0 mm) (0.12")

Notes:

- (i) Design lateral wind load = 1.0 kPa (20.8 psi) (pressure and suction).
- (ii) Design allowable deflection = H/720.
- (iii) Assumed deflection due to top and bottom connections, ties, stud twist, etc. = 1.0 mm (0.04").
- (iv) The maximum lateral wall deflections are given in parenthesis.
- (v) Assumed cavity width = 100 mm (4") .
- (vi) Stud Shear™ connectors spaced horizontally at 400 mm (16") o.c., and vertically as per Figure 6.
- (vii) Full bed, Type S mortar assumed with 90 mm (3.5") clay brick veneer.

Design Considerations

Although the Stud Shear™ Connector will increase the stiffness and lateral load resisting capacity of a wall assembly, to realize the optimum (most cost efficient) wall composition, the Stud Shear™ Connector wall system must be properly analyzed and engineered by qualified design professionals.

Recommended Design Load and Deflections (Conventional Tie Usage)

1. Free Play (maximum):	0.80 mm (0.031")	
2. 0.45 kN (100 lbs) Deflection		
- free play not included:	0.05 mm (0.002")	
- including free play:	0.85 mm (max) (0.033")	
3. Recommended Design Load:	1.29 kN (290 lbs)	
4. Recommended Design Load Deflection		
- free play not included:	0.20 mm (0.008")	
5. <u>Maximum</u> Recommended Spacing:	Horizontal:	Vertical:
	800 mm (32")	600 mm (24")

Notes

- (i) The above design load and deflections pertain to use of the Stud Shear™ Connector in conventional tie applications. For composite wall utilization, engineering analysis is required to determine allowable loads and deflections.
- (ii) The design values reflect both the windward and leeward capacity of the Stud Shear™ Connector tie system, with the governing values listed.
- (iii) The tie system recommended design load value was formulated following the procedures of CSA CAN3-A370-M94 "Connectors for Masonry", ACI/ASCE/TMS/518 and U.B.C. The value has been reduced to account for test result variation, and reflects a factor of safety of 2.25 (i.e., 75% of 3.0), as per Table 3 (A370).
- (iv) The allowable mortar pull-out or push-out design load for the V-Tie™ embedded at the centerline of 90 mm (3.5") brick veneer utilizing Type M, S or N mortar, exceeds or equals the recommended design load listed above.
- (v) The spacing of the Stud Shear™ Connector ties for composite walls will be governed by design, with decreased vertical spacing occurring at the top and bottom of the wall system.
- (vi) The above design values relate to the capacity of the FERRO tie components. Compatible fasteners capable of resisting the design loads must be selected.
- (vii) The above design values are based on tests utilizing a 127 mm (4.5") cavity (25 mm [1"] air space). No insulation or gypsum sheathing was used. Note that for smaller cavity widths and/or with the addition of insulation and gypsum sheathing providing lateral tie support, increased tie system design loads and reduced tie system deflections may be realized.
- (viii) Maximum recommended spacing reflects the maximum allowable by CSA-A370-94, ACI/ASCE/TMS/518 and U.B.C. Design will ultimately govern spacing.



Fero Corporation