

Filing Category: DESIGN—Concrete (038)

**METALSTUDCRETE® (MSC)—SHEAR TRANSFER STRIP  
COMPOSITE BUILDING SYSTEMS, INC.  
199 SOUTH HUDSON AVENUE  
PASADENA, CALIFORNIA 91101**

## 1.0 SUBJECT

MetalStudCrete® (MSC)—Shear Transfer Strip.

## 2.0 DESCRIPTION

### 2.1 General:

MetalStudCrete is a light-gage steel connector strip used to transfer shear stresses in composite panel systems used as floors and walls. The composite panels consist of light-gage steel studs and a reinforced concrete facing or topping on one side of the studs, with the MetalStudCrete metal connector providing a shear-flow connection between the steel studs and the concrete. See Figure 1 for a typical panel constructed with the MetalStudCrete connector strip.

### 2.2 Materials:

**2.2.1 Steel Studs:** Where the MetalStudCrete connector is used, steel studs in composite panels must be recognized in a current ICBO ES evaluation report. Physical and section properties are found in the evaluation report on the steel stud. Minimum steel thickness and yield strength for the studs must comply with Table 1 of this report.

**2.2.2 MetalStudCrete Connector:** The MetalStudCrete connector transfers shear stresses between the concrete facing and the light-gage steel stud. The strip is fastened to the web or flange of the stud and the flange of the track, and the strip/flange is then embedded into the concrete facing. The strip is fabricated from No. 18 gage thick [0.047 inch (1.19 mm)] steel, complying either with ASTM A 653 SS, Grade 33, or with ASTM A 570, Grade 33. The galvanized coating complies with ASTM A 924. See Figure 2 for dimensions of the MetalStudCrete connector.

**2.2.3 Concrete:** The concrete facing or topping is normal-weight concrete having a minimum compressive strength of 2,500 psi (17.2 MPa) at 28 days. Concrete materials must comply with Section 1903 of the 1997 *Uniform Building Code*™ (UBC).

**2.2.4 Steel Reinforcement:** Concrete panels must be reinforced in accordance with the structural design, and the steel reinforcement must comply with the UBC.

**2.2.5 Screws:** The MetalStudCrete connector must be attached to the stud using galvanized, self-drilling, self-tapping sheet metal screws conforming to SAE J78 and AISI CF 92-1 standards. Table 1 shows calculated allowable shear values for various screw sizes for the stud strip attached to various stud thicknesses. The values have been calculated using a factor of safety of 3.0 and the general fastener formulas given in the 1996 edition of the AISI cold formed steel design manual, "The Specification for the Design of Cold Formed Steel

Structural Members—Part V." Screw manufacturer's design values must be developed using the test provisions of the specification. The design engineer must calculate the shear, pullout and tension requirements and select a screw which has sufficient capacity.

### 2.3 Design:

The panels are designed using the accepted engineering principles of transformed section properties and allowable stress design. The design must include consideration of light-gage steel design requirements specified in Chapter 22, Division VII, of the UBC or the Specification for Design of Cold-formed Steel Structural Members, 1986 edition, published by the American Iron and Steel Institute. Additionally, the design must consider the shear flow capacity,  $q$ , of the connection between the MetalStudCrete connector and the steel stud, and the shear flow capacity,  $q$ , of the connection between the MetalStudCrete connector and the concrete. The design must also consider the strength and serviceability of the concrete.

The shear flow capacity of the MetalStudCrete connector embedded in minimum-2,500-psi (17.2 MPa) concrete, having a minimum thickness of 1½ inches (38 mm), is 620 pounds per lineal foot (9052 N/m). Refer to Table 2 for shear flow capacity,  $q$ , of the MetalStudCrete connector embedded in concrete of other strengths. Refer to Table 1 for the shear flow capacity,  $q$ , of the MetalStudCrete connector fastened to the steel stud.

The pull-out capacity of the MetalStudCrete connector embedded in concrete having a minimum thickness of 1½ inches (38 mm) is shown in Table 3.

The axial-load capacity of the composite panel must be a function of the capacity of the steel studs only. The transverse load capacity of the composite panel is based on the transformed section of the composite steel stud and concrete. The in-plane shear capacity of the panel is a function of the concrete facing only, and must comply with the concrete shear wall and diaphragm requirements specified in Section 1921.6 of the UBC.

Concrete protection for reinforcement must comply with Section 1907.7 of the UBC.

### 2.4 Fabrication:

The panels are permitted to be fabricated at the jobsite or at manufacturing locations approved by Composite Building Systems, Inc., and the approved independent quality control agency.

The MetalStudCrete shear transfer connectors are fabricated at manufacturing locations approved by Composite Building Systems, Inc., and the approved independent quality control agency.

Fabrication of panels at the jobsite must be witnessed by a special inspector approved by the building official in accordance with Section 1701.4 of the UBC. Alternatively, periodic

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special inspection is permitted in accordance with Section 1701.6.2 of the UBC. In either case, the special inspector must submit a final signed report to the building official, stating that the work requiring special inspection was done in conformance with the approved plans and specifications, and the applicable workmanship provisions of the UBC.

Offsite fabrication of panels must be by approved fabricators complying with Section 1701.7 of the UBC.

### 2.5 Installation:

The panels are installed in accordance with the approved design drawings and specifications.

### 2.6 Identification:

The steel studs are identified in accordance with their respective ICBO ES evaluation reports. When the MetalStudCrete connector is delivered to the jobsite for field fabrication of the panels, the strip bears a stamp identifying the product as MetalStudCrete, and the manufacturer as Composite Building

Systems, Inc. The stamp also includes the ICBO ES evaluation report number (ICBO ES ER-5446).

### 3.0 EVIDENCE SUBMITTED

Reports of structural load tests; calculations; and literature.

### 4.0 FINDINGS

**That the MetalStudCrete® (MSC)–Shear Transfer Strip connector described in this report complies with the 1997 Uniform Building Code™, subject to the following conditions:**

- 4.1 Calculations and plans for the composite panels are submitted to the building official for approval.
- 4.2 Composite panels are installed in accordance with the approved design drawings and specifications.
- 4.3 Composite panels are fabricated in accordance with Section 2.4 of this evaluation report.

**This report is subject to re-examination in two years.**

**TABLE 1—ALLOWABLE SHEAR FLOW FOR THE CONNECTION BETWEEN THE METAL-STUD-CRETE CONNECTOR AND THE LIGHT-GAGE METAL STUD**

SCREW SIZE	METAL STUD		CAPACITY PER SCREW (pounds)	ALLOWABLE SHEAR FLOW (plf)			
	Yield Strength, $F_y$ (ksi)	Thickness (inch)		12 inches o.c.	8 inches o.c.	6 inches o.c.	4 inches o.c.
Self-drilling, self-tapping sheet metal screw (0.164-inch shank diameter)	33	0.0283	121	121	182	242	363
	33	0.0346	164	164	246	328	492
	33	0.0451	244	244	366	488	732
	50	0.0566	300	300	450	600	900
	50	0.0713	300	300	450	600	900
	50	0.1017	300	300	450	600	900
Self-drilling, self-tapping sheet metal screw (0.190-inch shank diameter)	33	0.0283	131	131	197	262	393
	33	0.0346	177	177	266	354	531
	33	0.0451	263	263	395	526	789
	50	0.0566	347	347	521	694	1,041
	50	0.0713	347	347	521	694	1,041
	50	0.1017	347	347	521	694	1,041

For SI: 1 inch = 25.4 mm, 1 pound/foot = 14.6 N/m, 1 ksi = 6.89 MPa, 1 pound = 4.45 N.

**TABLE 2—ALLOWABLE SHEAR FLOW CAPACITY FOR THE CONNECTION BETWEEN THE METAL-STUD-CRETE CONNECTOR AND THE CONCRETE PANEL**

CONCRETE COMPRESSIVE STRENGTH, $f_c$ (psi)	ALLOWABLE SHEAR FLOW, $q$ (plf)
2,500	620
3,000	680
3,500	735
4,000	785
4,500	830
5,000	875
5,500	920
6,000	960
6,500	1,000
7,000	1,040
8,000	1,110
9,000	1,175
10,000	1,240

For SI: 1 psi = 6.89 kPa, 1 pound/foot = 14.6 N/m.

**TABLE 3—ALLOWABLE PULL-OUT CAPACITY OF THE METAL-STUD-CRETE CONNECTOR FROM THE CONCRETE PANEL**

CONCRETE COMPRESSIVE STRENGTH, $f_c$ (psi)	ALLOWABLE PULL-OUT CAPACITY (plf)
2,500	150
3,000	165
3,500	185
4,000	200
4,500	220

For SI: 1 psi = 6.89 kPa, 1 pound/foot = 14.6 N/m.

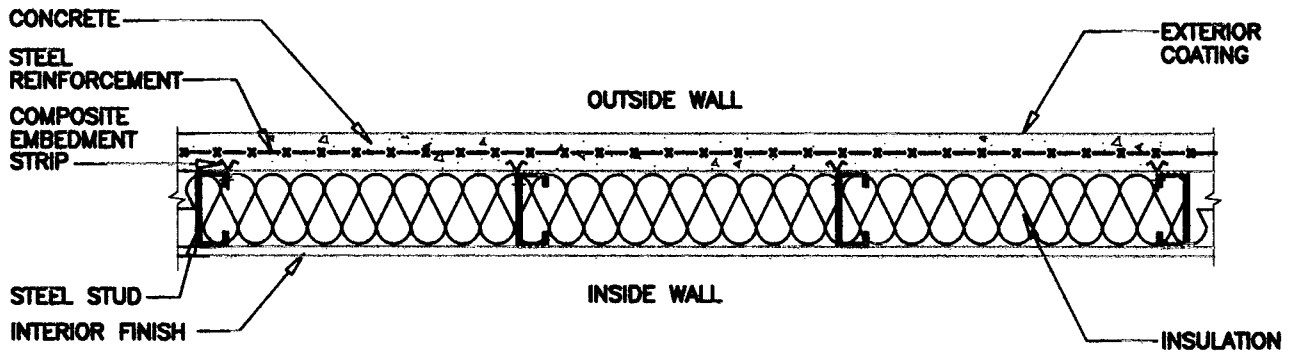


FIGURE 1—PLAN VIEW OF A TYPICAL METALSTUDCRETE WALL SYSTEM

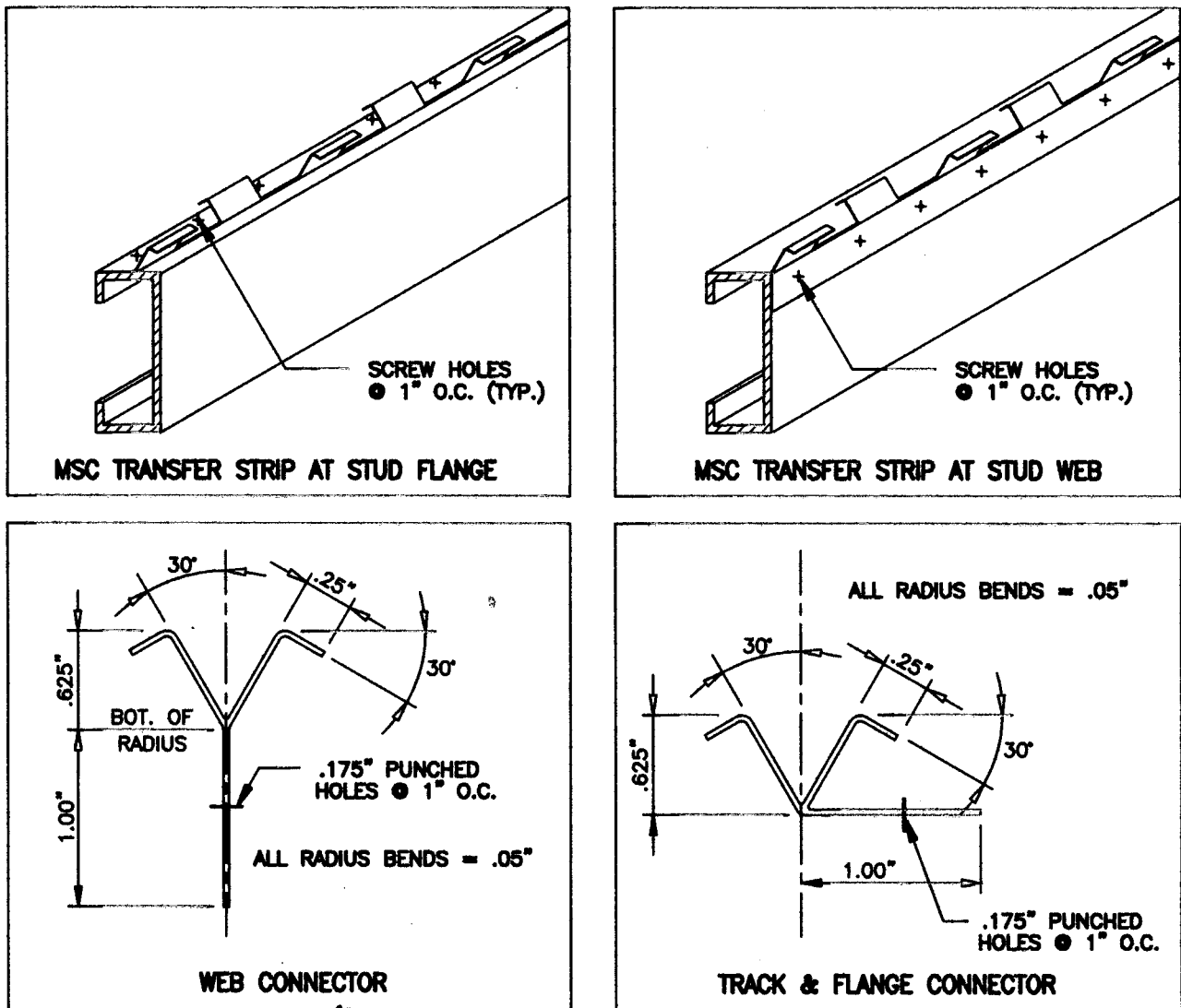


FIGURE 2—METALSTUDCRETE CONNECTOR