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Legacy report on the 1997 *Uniform Building Code*[™] and the 2000 *International Building Code*[®]

DIVISION: 05—METALS

Section: 05090—Metal Fastenings

ATTEXOR SPOT CLINCH[®] CONNECTION OF COLD-FORMED STRUCTURAL MEMBERS

ATTEXOR, INC.
90 CARANDO DRIVE
SPRINGFIELD, MASSACHUSETTS 01104

1.0 SUBJECT

ATTEXOR SPOT CLINCH[®] Connection of Cold-formed Structural Members.

2.0 DESCRIPTION

2.1 General:

The spot-clinched connection of cold-formed steel members is formed by means of a special proprietary clinching tool. The clinching tool forms an interlocking joint connection between two sheets of metal, transmitting shear or tension forces, or both, between the connected members. The clinched connection may be used as a connector for shear walls framed with cold-formed steel studs. The proprietary Attexor clinch equipment consists of a workhead, connected to an air-over-oil-pressure-intensifier, a booster, connected to compressed air. The clinched connection is formed through the interaction of a tool kit, which consists of a die, a punch and a stripper, as shown in Figure 1. The clinched connection is available in two configurations: round and rectangular. The clinched connection is measured using the dimensions of the residual bottom thickness (ST), the button diameter (\varnothing D) or the button width (W), as shown in Figure 2, and noted in Table 1.

2.2 Materials:

The clinched connection is formed into the round or rectangular configuration using the SR504 or ST432 "tool kit," respectively. The tool kits have a maximum total uncoated steel thickness capacity of 0.125 inch (3.2 mm). The No. 16, No. 18 and No. 20 gage steel shall have a minimum uncoated steel thickness of 0.0625 inch, 0.050 inch and 0.0375 inch (1.6 mm, 1.3 mm and 1.0 mm), respectively. The No. 16 gage steel shall comply with ASTM A 653 HSLAS Type A Grade 50, with a minimum yield strength of 50,000 psi (345 MPa) and an ultimate tensile strength of 65,000 psi (448 MPa). The No. 18 and No. 20 gage steel shall comply with ASTM A 653 SS Grade 33, with a minimum yield strength of 33,000 psi (228 MPa) and an ultimate tensile strength of 45,000 psi (320 MPa). The steel used in shear walls, described in Section

2.3.2 of this report, shall have a minimum uncoated base-metal thickness of 0.033 inch (0.84 mm), as noted in Section 2220.3 of the 1997 *Uniform Building Code*[™] (UBC). The cold-formed steel structural members must conform to Chapter 22, Division VI or VII, of the UBC, Section 2211 of the 2000 *International Building Code*[®] (IBC), or the Specification for the Design of Cold-formed Steel Structural Members, 1996, published by the American Iron and Steel Institute (AISI).

2.3 Design:

2.3.1 General: Spot-clinched connections installed with the specified tool kit and with the material thickness specified in Table 1 of this report have the corresponding allowable loads shown in Table 1; the loads are based on connecting two metal sheets of the same thickness. The minimum edge distance of the clinched connection is 0.24 inch (6.09 mm); the minimum end distance is 0.20 inch (5.08 mm) and the minimum distance between clinched connections is 0.47 inch (11.9 mm).

2.3.2 Shear Walls: The nominal shear values for resisting wind forces or seismic forces, for shear walls framed with steel studs and either Structural 1 sheathing or OSB, are as noted in Tables 3 and 4. The steel studs described in Tables 3 and 4 are installed at a maximum spacing of 24 inches (610 mm) on center. The stud and top and bottom runner tracks are fastened using a spot-clinched connection made with the SR504 tool kit, described in Section 2.1.

Each Structural 1 sheathing or OSB facing panel shall be screw-fastened to the framing at spacings indicated in Tables 3 and 4. Where the facing material edges are screw-fastened less than 6 inches (152 mm) on center, the shear wall panel shall consist of double end-studs. The fasteners at the edges of each panel shall be staggered between the studs of the double-end-stud framing. The connection of the double end-studs for the shear wall panels having the double-end-stud framing shall be designed to transfer the shear forces from one shear wall panel to an adjacent shear wall panel. Wood structural sheathing material shall comply with Section 2219.1 of the UBC or Section 2211.3.1 of the IBC; the remainder of the shear wall shall be installed as described in Section 2219 of the UBC or Section 2211 of the IBC. Shear walls in Seismic Zone 3 or 4 under the UBC shall comply with Section 2220 of the code. Shear walls in Seismic Design Category D, E or F of the IBC shall comply with Section 2211.7 of the code.

The allowable shear value or design shear value for wind forces or seismic forces shall be determined using the safety factor or strength reduction factor noted in Section 2219.3 of the UBC or Section 2211.1 of the IBC.



2.4 Special Inspection:

Periodic special inspection in accordance with Section 1701.6.2 of the UBC or Section 1704 of the IBC is required for site-fabricated clinched connections. The special inspector need not be present continuously during the fabrication of clinched connections, provided the data required to demonstrate that the performance of the clinched connections is consistent with the performance recognized in this report are submitted to and approved by the local building official. The special inspector needs to ensure that a field quality control manual is available at the jobsite at all times, and that the required qualifying tests outlined in the manual are provided.

The qualifying tests shall provide verification of minimum steel thickness and minimum distances noted in Section 2.3 of this report. The measurement of either the residual bottom thickness (ST), or the button width (W), or the button diameter (ØD), at a frequency of one connection out of every one hundred, must be performed and submitted to the building official. The inspector shall verify the identification of each tool kit.

2.5 Identification:

Each die, punch and stripper contained in the tool kit is identified with the ATTEXOR SPOT CLINCH logo and the ATTEXOR SPOT CLINCH part number (see Table 2). Each tool kit is identified with the designation "No. SR504" or "No. ST432."

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICBO ES Acceptance Criteria for Clinched Connections of Cold-formed Steel Structural Members (AC137), dated January 1999.

4.0 FINDINGS

That the ATTEXOR SPOT CLINCH® Connection of Cold-formed Structural Members described in this report complies with the 1997 *Uniform Building Code*™ and the 2000 *International Building Code*®, subject to the following conditions:

- 4.1 The clinched connections are formed, and the tool kit is identified, in accordance with this report and the manufacturer's field quality control manual.
- 4.2 Only the clinched connection types and tool kits noted in Tables 1 and 2 are recognized in this report.
- 4.3 The clinched connection allowable tension and shear loads are noted in Table 1.
- 4.4 Nominal shear loads of the assemblies using the clinched connections to resist wind and seismic loads, including those for Seismic Zones 3 and 4, are found in Tables 3 and 4 of this report.
- 4.5 Site fabrications using the spot-clinched connection require special inspection in accordance with Section 2.4 of this report.
- 4.6 Factory-fabricated clinched connections shall be fabricated at facilities operated by fabricators approved in an ICBO ES fabrication listing.
- 4.7 For jobsite fabrications, a field quality control manual shall be available to the contractor at the jobsite at all times.

This report is subject to re-examination in one year.

TABLE 1—CLINCHED CONNECTION ALLOWABLE LOADS

MATERIAL THICKNESS (inch)	TOOL KIT TYPE	TYPE OF CLINCH (punch)	RESIDUAL BOTTOM THICKNESS (ST) (inch)	BUTTON DIAMETER (ØD) (inch)	BUTTON WIDTH (W) (inch)	ALLOWABLE LOADS (pounds) ¹	
						Tension	Shear
0.0625	SR504	Round	0.028	0.315	N/A	—	220
0.05	SR504	Round	0.030	0.293	N/A	65	225
0.0375	SR504	Round	0.015	0.278	N/A	55	137
0.0625	ST432	Rectangular	0.044	N/A	0.261	—	300 ²
0.05	ST432	Rectangular	0.048	N/A	0.249	—	260 ²

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N.

N/A = Not applicable.

¹Allowable loads are based on the clinched connection of two metal sheets of the same thickness.

²Allowable shear load for the rectangular punch is based on the load being applied across the short dimension of the punch.

TABLE 2—TOOK KIT PART IDENTIFICATION

TOOL KIT TYPE	TYPE OF CLINCH (punch)	PUNCH PART NUMBER	ANVIL (STRIPPER) PART NUMBER	DIE PART NUMBER
SR504	Round	9231120	9231710	9231021
ST432	Rectangular	9231190	9231711	9231057

TABLE 3—NOMINAL SHEAR VALUES FOR WIND FORCES IN POUND PER FOOT FOR SHEAR WALLS FRAMED WITH COLD-FORMED STEEL STUDS^{1,2,3,4}

ASSEMBLY DESCRIPTION	FASTENER SPACING AT PANEL EDGES ^{5,6}				STUD FRAMING SPACING (inches on center)
	6 inches	4 inches	3 inches	2 inches	
¹⁵ / ₃₂ -inch Structural 1 sheathing (four-ply) one side	1,065 ⁷	—	—	—	24
⁷ / ₁₆ -inch rated sheathing (OSB) one side	910 ⁷	1,410	1,735	1,910	24

For **SI**: 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

¹Nominal shear values shall be multiplied by a 0.45 strength reduction factor, ϕ , to determine design shear value, or divided by a safety factor, W , of 3.0, to determine allowable shear values as set forth in Section 2219.3 of the code.

²Unless otherwise shown, studs shall be a minimum ¹/₈ inches by ³/₂ inches, with a ³/₈-inch return lip. Track shall be a minimum of ¹/₄ inches by ³/₂ inches. Both studs and track shall have a minimum uncoated base-metal thickness of 0.033 inch and shall be ASTM A 653, SS, Grade 33. Plywood and OSB screws shall be a minimum of No. 8 by 1-inch, flat-head screws, with a minimum head diameter of 0.292 inch. Screw fasteners along the edge shall not be less than ³/₈ inch from the plywood or OSB panel edge. Stud spacings shown are maximums.

³Each stud-to-track connection is clinch-connected using the SR504 tool kit.

⁴The shear wall height-to-length ratio shall not exceed 2:1.

⁵Screws in the field of the panel shall be installed 12 inches on center, unless otherwise indicated.

⁶Plywood fastened with fasteners at a spacing of less than 6 inches shall be installed with fasteners staggered between the double-end-stud framing.

⁷Where fully blocked gypsum board is applied to the opposite side of this assembly, in accordance with Table 22-VIII-B of the UBC or Table 2211.1 (2) of the IBC, these nominal values may be increased by 30 percent.

TABLE 4—NOMINAL SHEAR VALUES FOR SEISMIC FORCES IN POUNDS PER FOOT FOR SHEAR WALLS WITH COLD-FORMED STEEL STUDS^{1,2,3,4}

ASSEMBLY DESCRIPTION	FASTENER SPACING AT PANEL EDGES ^{5,6}				STUD FRAMING SPACING (inches on center)
	6 inches	4 inches	3 inches	2 inches	
¹⁵ / ₃₂ -inch Structural 1 sheathing (four-ply) one side	780	990	1,465	1,625	24

For **SI**: 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

¹Nominal shear values shall be multiplied by a 0.55 strength reduction factor, ϕ , to determine design shear value, or divided by a safety factor, Ω , of 2.5 to determine allowable shear values as set forth in Section 2219.3 of the code.

²Unless otherwise shown, studs shall be a minimum ¹/₈ inches by ³/₂ inches, with a ³/₈-inch return lip. Track shall be a minimum of ¹/₄ inches by ³/₂ inches. Both studs and track shall have a minimum uncoated base-metal thickness of 0.033 inch and shall not have a base-metal thickness greater than 0.043 inch, and shall be ASTM A 653, SS, Grade 33. Stud spacings shown are maximums. Plywood screws shall be approved and shall be a minimum of No. 8 by 1-inch, flat-head screws, with a minimum head diameter of 0.292 inch. Screw fasteners along the edge shall not be less than ³/₈ inch from the plywood or OSB panel edge.

³Each stud-to-track connection is clinch-connected using the SR504 tool kit.

⁴The shear wall height-to-length ratio shall not exceed 2:1.

⁵Screws in the field of the panel shall be installed 12 inches on center, unless otherwise indicated.

⁶Plywood fastened with fasteners at a spacing of less than 6 inches shall be installed with fasteners staggered between the double-end-stud framing.

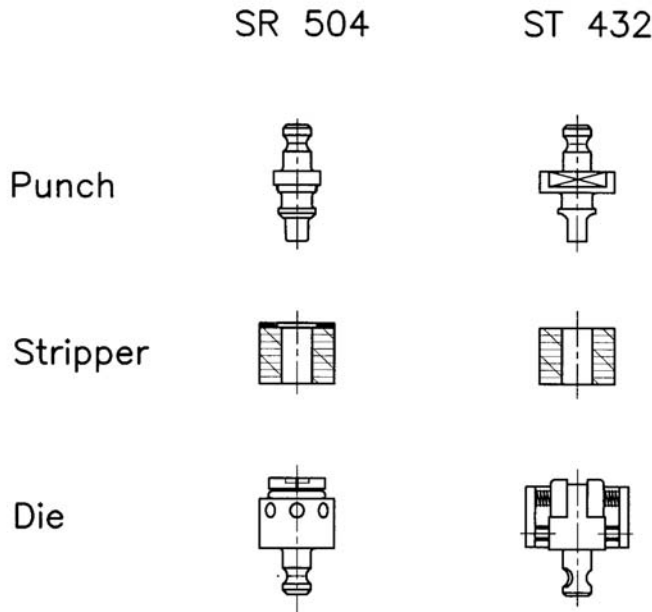


FIGURE 1—TOOL KIT

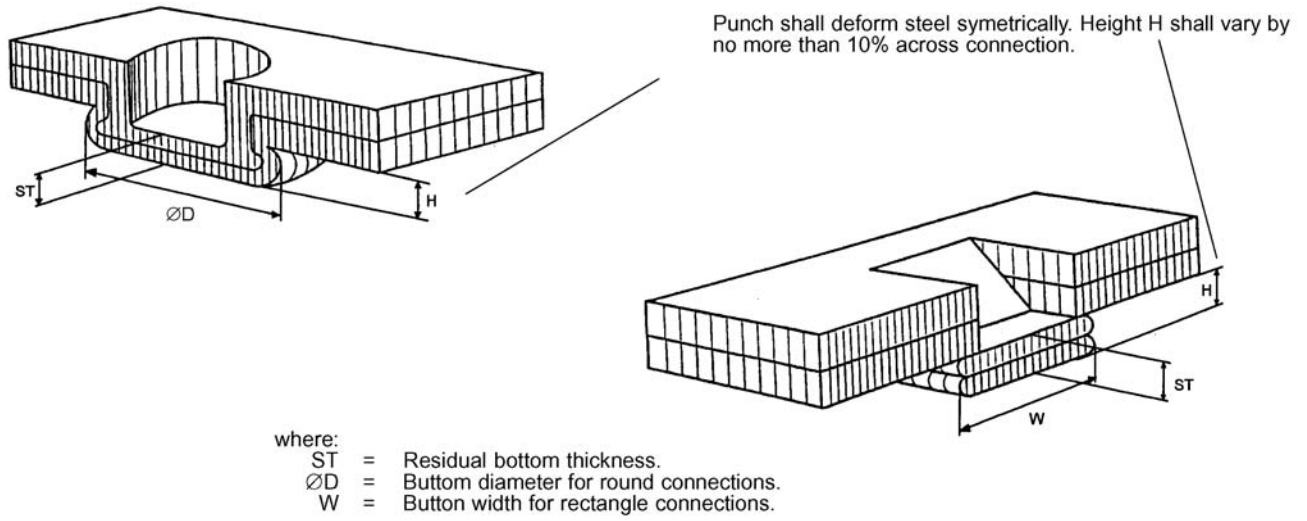


FIGURE 2—TYPICAL CLINCHED CONNECTIONS