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American
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Institute

AISI STANDARD

Supplement 1 to the 2016 Edition of the North American Specification for the Design of Cold-Formed Steel Structural Members

2018 Edition

DISCLAIMER

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With anticipated improvements in understanding of the behavior of cold-formed steel and the continuing development of new technology, this material may eventually become dated. It is anticipated that future editions of this *Specification* will update this material as new information becomes available, but this cannot be guaranteed.

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Supplement 1 to AISI S100-16:

1. Revise AISI S100-16 Section A3.3.2 first paragraph as shown below:

A3.3.2 Strength Increase From Cold Work of Forming

(Revise the first paragraph as shown below.)

Strength increase from cold work of forming is permitted by substituting F_{ya} for F_y, where F_{ya} is the average *yield stress* of the full section. Such increase shall be limited to Chapters D, E, and F (excluding Section F2.4); Sections H1, I4 and I6.2 and; to sections not subject to strength reduction from *local* ~~or *distortional*~~ *buckling* ~~at stress level F_y: specifically, for columns, $P_{n\ell} = P_{ne}$ from Section E3 and $P_{nd} = P_y$ from Section E4, and for beams, $M_{n\ell} = M_{ne}$ from Section F3 and $M_{nd} = M_y$ from Section F4~~. The limits and methods for determining F_{ya} shall be in accordance with (a), (b) and (c).

2. Revise AISI S100-16 Section E2.2 last paragraph as shown below:

E2.2 Doubly- or Singly-Symmetric Sections Subject to Torsional or Flexural-Torsional Buckling

(Revise the last paragraph as shown below.)

For *singly-symmetric* unstiffened angle *sections* ~~for which the *effective area* (A_e)~~ not subject to *local buckling* at *stress* F_y ~~is equal to the *full unreduced cross-sectional area* (A) for *effective width method*, or $P_{n\ell} = P_{ne}$ from Section E3 for *Direct Strength Method*~~, F_{cre} shall be computed using Eq. E2.1-1, where r is the least radius of gyration.

3. Revise AISI S100-16 Section H1.2 second paragraph of the section as shown below:

H1.2 Combined Compressive Axial Load and Bending

(Revise the second paragraph as shown below.)

For singly-symmetric unstiffened angle sections ~~with unreduced *effective area* or $P_{n\ell} = P_{ne}$~~ not subject to *local buckling* at stress F_y, $\overline{M}_y$ is permitted to be taken as the *required flexural strength* [moment due to *factored loads*] only. For other angle sections or singly-symmetric unstiffened angles subject to *local buckling* at stress level F_y ~~for which the *effective area* (A_e) at *stress* F_y is less than the *full unreduced cross-sectional area* (A), or $P_{n\ell} < P_{ne}$~~, $\overline{M}_y$ shall be taken either as the *required flexural strength* [moment due to *factored loads*] or the *required flexural strength* [moment due to *factored loads*] plus $(\overline{P})L/1000$, whichever results in a lower permissible value of $\overline{P}$.

4. Revise Section J7 as shown below:

J7 Connections to Other Materials

In bolted, screw, and power-actuated fastener connections, the available strength [factored resistance] of the connection to other materials shall be determined in accordance with Section J7.1. ~~For power-actuated fasteners embedded in concrete, Section J7.2 is permitted to be used as an alternative.~~

5. Delete entire Section J7.2 as shown below:

~~J7.2 Power-Actuated Fasteners (PAFs) in Concrete~~

~~J7.2.1 Minimum Spacing, Edge and End Distances~~

~~The minimum center-to-center spacing of the *PAFs* and the minimum distance from center of the fastener to any edge of the connected part, regardless of the direction of the force, shall be as provided by Table J7.2.1-1.~~

~~Table J7.2.1-1~~
~~Minimum Required Edge and Spacing Distances in Concrete~~

~~PAF Shank Diameter, d_s, in. (mm)~~	~~Minimum PAF Spacing in. (mm)~~	~~Minimum Edge Distance in. (mm)~~
~~0.106 (2.69) $\le d_s <$ 0.158 (4.01)~~	~~4.00 (102)~~	~~3.20 (81.3)~~
~~0.158 (4.01) $\le d_s <$ 0.197 (5.00)~~	~~5.00 (127)~~	~~3.50 (88.9)~~
~~0.197 (5.00) $\le d_s <$ 0.206 (5.23)~~	~~6.00 (152)~~	~~4.00 (102)~~

~~J7.2.2 Pull-Out Strength in Shear~~

~~For *PAFs*, as depicted in Figure J5-1(a), used to cold-formed steel framing track-to-concrete *connections*, the *nominal pull-out strength* [*resistance*] in shear is permitted to be taken as P_{nos} = 1,450 lbs (6,450 N), and the following *safety factor* and *resistance factors* shall be applied to determine the *available strength* [*factored resistance*] in accordance with Section B3.2.1, B3.2.2, or B3.2.3:~~

~~Ω = 3.25 (*ASD*)~~

~~ϕ = 0.50 (*LRFD*)~~

~~= 0.40 (*LSD*)~~

~~In addition, the following limit conditions shall apply:~~

~~(a) $d_s \ge$ 0.118 in. (3.00 mm),~~

~~(b) Normal weight concrete as defined in ACI 318 for the United States and Mexico and CAN/CSA A23.3 for Canada with minimum specified compressive strength, f'_c, of 2.5 ksi (17.2 MPa),~~

~~(c) $d_e \ge 3$ (h_{ET}),~~

~~(d) $h_{ET} \ge$ 1.0 in. (25.4 mm), and~~

~~(e) Minimum required edge and spacing distances as shown in Table J7.2.1-1.~~

~~where~~

~~d_S = Nominal shank diameter~~

~~d_c = Thickness of supporting concrete~~

~~h_{ET} = Embedment depth of *PAF* in concrete~~

Supplement 1 to AISI S100-16-C:

1. Revise the 10th paragraph of Section A3.3.2 as follows:

A3.3.2 Strength Increase From Cold Work of Forming

(Revise the 10th paragraph as follows.)

Prior to 2016, the requirements for applying the provisions of strength increase from cold work of forming were written for using the *Effective Width Method*. The requirements were revised in 2016 to make the provisions also applicable to the *Direct Strength Method*. The strength increase from cold work of forming is applicable to sections that are not subject to strength reduction from *local* ~~and *distortional*~~ *buckling* ~~at a *stress* level of F_y for compression members or when the extreme compression fiber reaches F_y for flexural members~~. ~~In some cases, when evaluating the *effective width* of the *web* using the *Effective Width Method*, the reduction factor ρ according to *Specification* Section 1.1.2 may be less than unity but the sum of b_1 and b_2 of Figure 1.1.2-1 of the *Specification* may be such that the *web* is fully effective, and cold work of forming may be used. This situation only arises when the *web* width to *flange* width ratio, h_o/b_o, is less than or equal to 4~~. This requires the cross-section to be fully effective when using the *Effective Width Method*, or $\lambda_\ell \le 0.776$ in *Specification* Section E3.2 or F3.2 when using the *Direct Strength Method*.

2. Revise Section J7 as shown below:

J7 Connections to Other Materials

When a *cold-formed steel structural member* is connected to other materials, such as hot-rolled steel, aluminum, concrete, masonry or wood, the *connection* strength should be the smallest of the strength of the fastener, the strength of the fastener attachment to the *cold-formed steel structural member*, or the strength of the fastener attachment to the other material.

In 2016, provisions were added to *Specification* Section J7.2 for power-actuated fasteners (PAFs) connecting cold-formed steel framing track-to-concrete base materials. These provisions were based on an experimental study where cold-formed steel wall tracks were attached to concrete base materials and subjected to monotonic and cyclic/seismic test loads (AISI, 2013h). In 2018, these provisions were removed to avoid unconservative designs of track and other cold-formed steel structural member attachments to concrete and to avoid unintended interpretation of the validity of these provisions in different applications.

3. Delete the entire Section J7.2:

~~J7.2 Power-Actuated Fasteners (PAFs) in Concrete~~

~~In 2016, provisions were added to *Specification* Section J7.2 for *power-actuated fasteners* (*PAFs*) connecting cold-formed steel framing track-to-concrete base materials. These provisions are based on an experimental study where cold-formed steel wall tracks were attached to concrete base materials and subjected to monotonic and cyclic/seismic test *loads*~~

(AISI, 2013h). The experimental data demonstrated that residual monotonic shear strength of *power-actuated fastener connections* after cyclic/seismic loading closely matched the reference monotonic shear strength.

The experimental data further demonstrated that ductile steel failure modes limit the capacity of the *connection* with thinner cold-formed steel track. Where this failure mode is dominant, the use of *Specification* Section J5.3.2 to determine the strength of cold-formed steel track *connection* is appropriate. For thicker track, the *limit state* was pull-out of the fastener in shear. Figure C-J7.2-1 illustrates the *connection* failure of the *power-actuated fastener* pull-out (pry-out) in shear. The nominal value of P_{nos} = 1,450 lbs (6,450 N) is given by *Specification* Section J7.2.2. This nominal value is based on tests with normalweight concrete as specified in ACI 318 for the United States and Mexico and in CAN/CSA A23.3 for Canada with the minimum specified concrete strength of 2.5 ksi (17.2 MPa). The nominal value is considered as a lower bound strength based on the concrete strength used in the test program. Where justified in manufacturers' evaluation reports or test data that the shear strength of *PAF* in lightweight concrete is equivalent to normalweight concrete, this nominal value may be extended to the following applications:

(a) For the United States and Mexico: Sand-lightweight concrete, as specified in ACI 318, with a minimum specified concrete strength of 3.0 ksi (20.7 MPa) and a minimum embedment at 1 in. (25.4 mm); and

(b) For Canada: Structural low-density concrete, as specified in CAN/CSA A23.3, with a minimum specified concrete strength of 20 MPa and a minimum embedment at 25 mm.

Industry installation guidelines recommend that the thickness of the concrete base material, d_c, should be greater than or equal to three times the *PAF* embedment, h_{ET}.

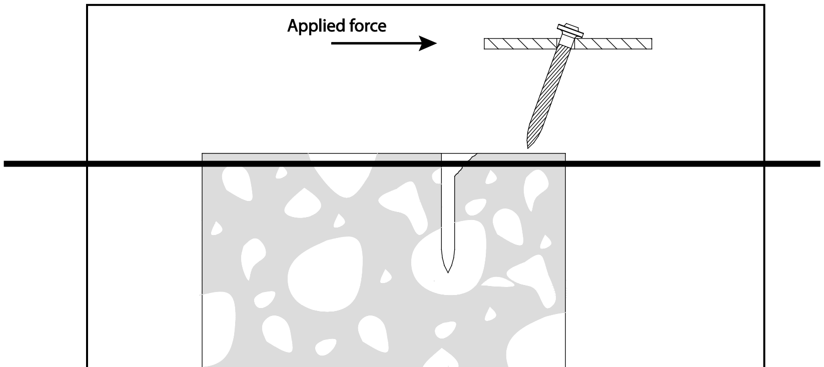

Figure C-J7.2-1 PAF Pull-Out (Pry-Out) in Shear

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