

ICC-ES Evaluation Report

ESR-3371

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

REPORT HOLDER:

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EVALUATION SUBJECT:

NITROSET SOLID PROPELLANT DRIVEN CEILING CLIP
ASSEMBLIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Residential Code*® (IRC)

Properties evaluated:

Structural

2.0 USES

Nitroset Solid Propellant Driven Ceiling Clip Assemblies are used as alternatives to the cast-in-place anchors described in 2012 IBC Section 1908 (2009 and 2006 IBC Section 1911) for placement in concrete. The ceiling clip assemblies are used as supporting hardware for suspended ceiling systems. The ceiling clip assemblies may be used under the IRC where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The Nitroset ceiling clip assemblies are comprised of a steel bracket (clip) premounted on a power-driven fastener. The head of the fastener is encapsulated in a plastic sleeve which contains a cylindrical charge of nitrocellulose, used in the driving mechanism.

3.1.1 Utility Ceiling Clip Assembly: The Nitroset Utility Ceiling Clip Assembly is comprised of a carbon steel fastener with a steel or plastic top-hat washer, and a carbon steel clip. The fastener is manufactured from steel wire complying with ASTM A510, Grade 1060 or 1062, heat-treated, and mechanically zinc-plated to a minimum thickness of 0.0003 inch (0.008 mm). The clip is a

111-degree angle measuring $\frac{3}{4}$ inch (19 mm) wide. The 1-inch-long (25 mm) leg is fitted to the fastener and the $\frac{3}{4}$ -inch-long (18.2 mm) leg has a 0.31-inch-diameter (8 mm) hole through which the ceiling wire is attached. The clip is produced from steel complying with ASTM A1008 SS Grade 30 having a base metal thickness of 0.071 inch (1.8 mm). See Table 1 for fastener dimensions and additional descriptions, and see Figure 1 for a depiction of the assembly.

3.1.2 Standard Ceiling Clip Assembly: The Nitroset Standard Ceiling Clip Assembly is comprised of a carbon steel fastener and a carbon steel clip. The fasteners are manufactured from steel wire complying with ASTM A510, Grade 1060 or 1062, heat-treated, and mechanically zinc-plated to a minimum thickness of 0.0003 inch (0.008 mm). The clip is a 135-degree angle, with an offset in the fastened leg, and is $\frac{3}{4}$ inch (19 mm) wide. The $\frac{3}{4}$ -inch-long (19 mm) leg is fitted to the fastener and the $\frac{7}{8}$ -inch-long (21.5 mm) leg has a 0.29-inch-diameter (7.4 mm) hole through which the ceiling wire is attached. The clip is produced from steel complying with ASTM A1008 SS Grade 30 having a base metal thickness of 0.071 inch (1.8 mm). See Table 1 for fastener dimensions and additional descriptions, and see Figure 2 for a depiction of the assembly.

3.2 Substrate Materials:

Normal-weight concrete must be stone-aggregate and comply with IBC Chapter 19 or IRC Section R402.2, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 Allowable Loads: The allowable tension, shear and 45-degree-angle loads for the ceiling clip assemblies installed in normal-weight concrete are provided in Table 2. The stress increases and load reductions described in IBC Section 1605.3 are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for gravity loads acting alone. Allowable loads described in this report apply to the connection of the ceiling clip assemblies to the base material only. Design of the connection of the attached material to the clip must comply with the applicable requirements of the IBC.

4.1.2 Seismic Considerations: The ability of the Nitroset ceiling clip assemblies to resist seismic loads has not been evaluated. They may be used to attach nonstructural components listed in Section 13.1.4 of ASCE 7, which are exempt from the requirements of ASCE 7. They may also be used to support acoustical tile or lay-in

panel suspended ceiling systems, distributed systems and distribution systems where the service load on any individual assembly does not exceed 90 lbf (400 N) in accordance with Section 13.4.5 of ASCE 7-10.

4.2 Installation:

Installation procedures must be in accordance with this report and the Nitroset published installation instructions. A copy of these instructions must be available on the jobsite at all times during installation.

Installation requires the use of a tool which activates the solid propellant mounted on the fastener, in accordance with the Nitroset published installation instructions.

Minimum spacing between embedded fasteners must be 4 inches (102 mm), and minimum edge distance must be 4 inches (102 mm). Concrete thickness must be a minimum of three times the embedment depth of the fastener. Fasteners must not be driven until the concrete has reached the specified concrete strength noted in Table 2.

5.0 CONDITIONS OF USE

The Nitroset solid propellant driven ceiling clip assemblies described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The ceiling clip assemblies are manufactured and identified in accordance with this report.
- 5.2 Assembly installation complies with this report and the Nitroset published installation instructions. In the

event of a conflict between this report and the Nitroset published installation instructions, this report governs.

- 5.3 Calculations demonstrating that the actual loads are less than the allowable loads described in Section 4.1.1 must be submitted to the code official for approval. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 Refer to Section 4.1.2 for seismic considerations.
- 5.5 The use of the ceiling clip assemblies is limited to dry, interior locations.
- 5.6 The use of ceiling clip assemblies is limited to installation in uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70) dated June 2014.

7.0 IDENTIFICATION

Fasteners are imprinted with an 'N' on the head as shown in Figure 3. The ceiling clip assembly packaging is labeled with the product designation, fastener description, report holder's name (Nitroset, LLC) and address, and the evaluation report number (ESR-3371).

TABLE 1—NITROSET CEILING CLIP ASSEMBLIES

| PRODUCT DESIGNATION | TYPE | SHANK STYLE | SHANK LENGTH (in.) | SHANK DIAMETER (in.) | HEAD DIAMETER (in.) | CORE HARDNESS (Rockwell C) |
|---------------------|----------|-------------|--------------------|----------------------|---------------------|----------------------------|
| CLU222 | Utility | Smooth | 7/8 | 0.125 | 0.292 | 50-54 |
| CLAS525 | Standard | Step | 1 | 0.145 / 0.130 | 0.292 | 50-54 |
| CLAS532 | | | 1 1/4 | | | |

TABLE 2—ALLOWABLE LOADS FOR NITROSET ASSEMBLIES INSTALLED IN NORMAL-WEIGHT CONCRETE (lbf)^{1,2}

| ASSEMBLY | EMBEDMENT DEPTH (inches) | CONCRETE COMPRESSIVE STRENGTH | | | | | |
|----------|--------------------------|-------------------------------|-------|-----------|-----------|-------|-----------|
| | | 4,000 psi | | | 6,000 psi | | |
| | | Tension | Shear | 45-Degree | Tension | Shear | 45-Degree |
| CLU222 | 3/4 | 120 | 165 | 120 | 115 | 276 | 209 |
| CLAS525 | 13/16 | 158 | 242 | 151 | 163 | 184 | 168 |
| CLAS532 | 1 1/16 | 150 | 147 | 213 | 171 | 146 | 152 |

For SI: 1 inch = 25.4 mm; 1 lbf = 4.4 N; 1 psi = 6895 Pa.

¹Fasteners must not be driven until the concrete has reached the specified compressive strength.

²Concrete thickness at the point of penetration must be a minimum of three times the embedment depth.



FIGURE 1—UTILITY CEILING CLIP ASSEMBLY



FIGURE 2—STANDARD CEILING CLIP ASSEMBLY



FIGURE 3—FASTENER HEAD MARKING