



## Step Bolts

- *What are they?*
- *How are they designed?*
- *What is their purpose?*
- *What about fall protection?*

To raise awareness of the design, performance and intent of step bolts, a testing paradigm and process was underwritten by NATE and supported by many others in the industry. This test provided accurate data to verify the existing engineering design methodology is in fact valid, and supported enhancements to the climbing facilities section of the ANSI/TIA-222-H Standard.

To address the overriding safety concerns for men and women in the field that routinely work on tower sites which utilize step bolts as part of the climbing facility, the testing was further expanded to include fall arrest loading scenarios applied to both standalone step bolts and to some of the engineered anchorage products currently available on the market. It should be noted that traditional step bolts designed for access and egress purposes in accordance with the ANSI/TIA-222 standards were NOT and are NOT intended to serve as a fall arrest anchorage point, and the testing conducted provided absolute confirmation that step bolts should never be utilized for this purpose.

Prior to the testing it was important that there was a clear scope and application, as well as assurance the information would be used effectively by the industry.

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Authors: **Scott Kisting** (EVP – Proactive Telecommunications Solutions), **JP Jones** (President-Tower & Turbine Technologies, Safety LMS), **Joey Deuer** (President, TUF-TUG Products, Deuer Developments), and James Ruedlinger (VP Engineering – ERI). The members of the PAN Advisory Group who are involved in the writing and researching of each PAN topic include: **John Erichsen** (Principal EET PE, Chairman TIA Committee TR 14), **Scott Kisting** (EVP – Proactive Telecommunications Solutions), **Richard Cullum** (Program Manager – Crown Castle), **Jeremy Buckles** (Safety and Compliance Officer – International, SBA Communications Corporation), **Craig Snyder** (President, Sioux Falls Tower & Communications), and **Stephanie Brewer** (Compliance Coordinator – MUTI-Sabre Industries Telecom Services).

NATE, in its desire to support through education, organized a working group of committee members from TIA TR14 task groups, TIRAP, manufacturers, carriers, and tower owners to be a part of the planning and the testing that occurred. It was critical that all stakeholders' views be represented as the industry is dealing with quality and safety issues.

The testing took place at the University of Dayton Research Institute (UDRI), where they had the means to properly capture the data from the limited/focused tests performed. Their guidance was helpful in performing the tests in a controlled manner to allow for effective collection of data. NATE provided the tower sections for testing.

The initial testing was to determine when step bolts failed. To support this effort, many manufacturers supplied step bolts with no data as to who manufactured the step bolts. The step bolts were initially loaded to determine when they would deform and then yield. Each step bolt was installed in accord with the test requirements established to simulate real world expected installation conditions by a tower climber.

The focus of this document is to discuss properly installed step bolts on the face of a weldment on the tower section. There are the following main components to be considered:

- Step bolt clip
- Welds on the clip to the tower
- Internal nut
- External nut
- Step bolt

Also considered by the test was the diameter of the step bolt, step bolt length, and load application distance as measured from the inside of the step bolt head. Placement of the load for the testing was critical to achieve the proper data and for this purpose custom two-inch spacers were used to ensure the uniform placement of the load.

A tremendous amount of data was captured from the testing, and the high-level understanding of what was achieved through this endeavor is as follows:

1. First – Step bolts properly designed and installed function well for access and egress purposes.
2. Second – Step bolts in and of themselves should never be used as a fall protection anchorage.
3. Third – The proper inspection of the step bolt clip is critical.

This testing was a real validation of the accuracy of the engineering understanding of step bolts' strength limits.

From a TIA standpoint, step bolts were never designed for use as fall protection in and of themselves. They were designed to be implemented as a means of access and egress from a tower with a proper fall protection plan implemented, used by a crew that had been properly trained and was supported by a competent person. The testing confirmed this was correct.

While this testing was being planned, the TIA TR14 Committee was working on an update to the ANSI/TIA-222 Standards from revision G to H. Many of the individuals engaged in this effort supported the TR14 task group in the improvements of the current section of the standard on climbing facilities (Section 12). This included the design, testing and even the placement for step bolts on new structures. Some of the key changes and clarifications for design and manufacture of new climbing facilities utilizing step bolts on telecommunication structures as presented in the ANSI/TIA-222-H standard are as follows:

1. The minimum factored load requirements have been updated and clarified. Step bolts now require a minimum normal concentrated factored load equal to 600 pounds.
2. The critical distance for determining the applied bending moment on the step bolt has been established at 2 inches from the inside face of the step bolt head.
3. The step bolt clip strength requirements have been further clarified.
4. Content for step bolt requirements are found under Section 12.5.1. Please refer to the published revision of the ANSI/TIA-222-H for further information. This section covers items such as:
  - Minimum step bolt diameter or width requirements
  - Minimum clear width distance requirements
  - Minimum step bolt head design requirements
  - Horizontal spread requirements
  - Step bolt material requirements
  - Step bolt clip material requirements
  - Step bolt placement requirements for new latticed structures

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- Step bolt placement requirements for new pole structures

It is important to note that the requirements for special step bolt clips intended for use as fall protection anchorages under the supervision of a competent person are in this section as well.

5. Additional content added for step bolt installation requirements under Section 12.6 from a design perspective. It is imperative that the ANSI/ASSE A10.48 along with other applicable standards be referenced by the competent person responsible for the implementation of the fall protection plan.

The testing data and core principles verified will be presented during NATE UNITE 2018 by John Paul Jones and Joey Deuer. This presentation conveys in depth the importance of identifying the purpose and intent of the step bolts as well as a discussion on the different tests on various step bolt anchors currently available. One of the most important topics being discussed during this presentation is the amount of teamwork from across the industry for this event and the commitment by so many to invest in safety for all involved through education and awareness.

We would be remiss if we did not recognize the manufacturers that attended the testing event, as well as those who provided step bolts and other equipment to be utilized during the testing event. They were incredible in their desire to help support the industry and share knowledge with one another and the rest of the members that were present. There was a myriad of new and existing equipment available for testing and understanding. There were several options that were selected that would allow for use of the step bolt clip for fall protection.

Additional engineered fall protection anchorage products were tested as well in accordance with their design intent. It is important to discuss these as there has been some miscommunication about whether they are suitable for use for fall protection. The first thing that all understood in the working group was that there is no substitute for the role of a competent person in assessing the SOW (Scope of Work), the structure, the issues present, inspection of all PPE (Personal Protective Equipment) to be employed and the means to create a fall protection plan that addresses these concerns.

When installed in accordance with manufacturers' design and installation requirements, all engineered step bolt anchorages tested performed as intended and were a notable example of how the proper equipment

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can provide for a safe working environment if assessed by a competent person as part of an overall fall protection plan.

The following is a list of the participants and contributing companies to the testing event:

- 3M
- Allfasteners USA LLC
- ALL-PRO FASTENERS
- Buckingham Mfg. Co., Inc.
- Craig Firl
- Dawn Smith
- EasTex Tower, LLC
- Ehresmann Engineering, Inc.
- ERI Installations, Inc.
- Guardian Fall Protection
- James Ruedlinger
- Joey Deuer
- JP Jones
- Lee Antenna & Line Service, Inc.
- NATE
- Richard Cullum
- Sabre Towers and Poles
- Safety LMS
- Scott Kisting
- Sheri Deuer
- Stephanie Brewer
- TUF-TUG Products, Deuer Development
- Valmont Industries

In summary, this issue with step bolts is a notable example of what can occur when our industry works together. The NATE testing was essential in establishing that the design intent for step bolts is correct in their application for access and egress, and **STEP BOLTS ARE NEVER TO BE RELIED UPON AS A FALL PROTECTION ANCHORAGE POINT**. Step bolts are specifically designed and intended for access and egress as a part of the climbing facility. Proper inspection due to changed conditions will always require a

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## PLANNING ADVISORY NOTICE (CONTINUED)

competent person and training that ensures that the inspection and equipment is effective based upon the work to be undertaken. Step bolt fall protection engineered anchorages are available from multiple sources

and can be utilized provided they are properly installed and inspected, and the correct PPE is selected. Manufacturers' design requirements and specifications are to be adhered to. Communication is critical as with so much that is undertaken in our industry. ■

