

Benefits of LockBolt Technology in Steel Construction Applications

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Lockbolt technology has emerged as a prominent fastening solution within steel construction. This article explores the technical merits of lockbolts, highlighting their superior performance compared to traditional bolted connections.



1. Eliminating Pre-Load Scatter: Addressing Torque-Controlled Challenges

The most common method is the torque-controlled tightening method. Due to the low effort involved, it is very economical, but it has some significant disadvantages, particularly with regard to the achievable pre-load. This inconsistency arises from two primary sources:

- **Friction Variability:** The coefficient of friction between the threads and the bearing surface of the nut/bolt and washer can exhibit variations due to factors such as lubrication, surface finish, dust, heat, moisture, and other invisible elements. This variability directly impacts the achieved pre-load.
- **Human Error:** The application of torque by human installers can introduce inconsistencies, ultimately affecting the final pre-load.

Lockbolts are not subjected to the twisting force of torsion that a torque wrench applies to a conventional bolt and address this challenge by employing a controlled pre-tensioning process:

- **Pre-tensioning:** The Huck lockbolts are installed using direct tension and swaging. The Huck installation tool grips the pintail of a Lockbolt and then pulls to close the gaps in the materials being joined. Inside the nose assembly, a hardened-steel, conical-shaped anvil is then forced down the collar to progressively squeeze, or swage, the collar material into the grooves, reducing collar diameter and increasing its length. This force stretches the pin to create a consistent clamp. This eliminates the influence of friction and human error on the pre-load.

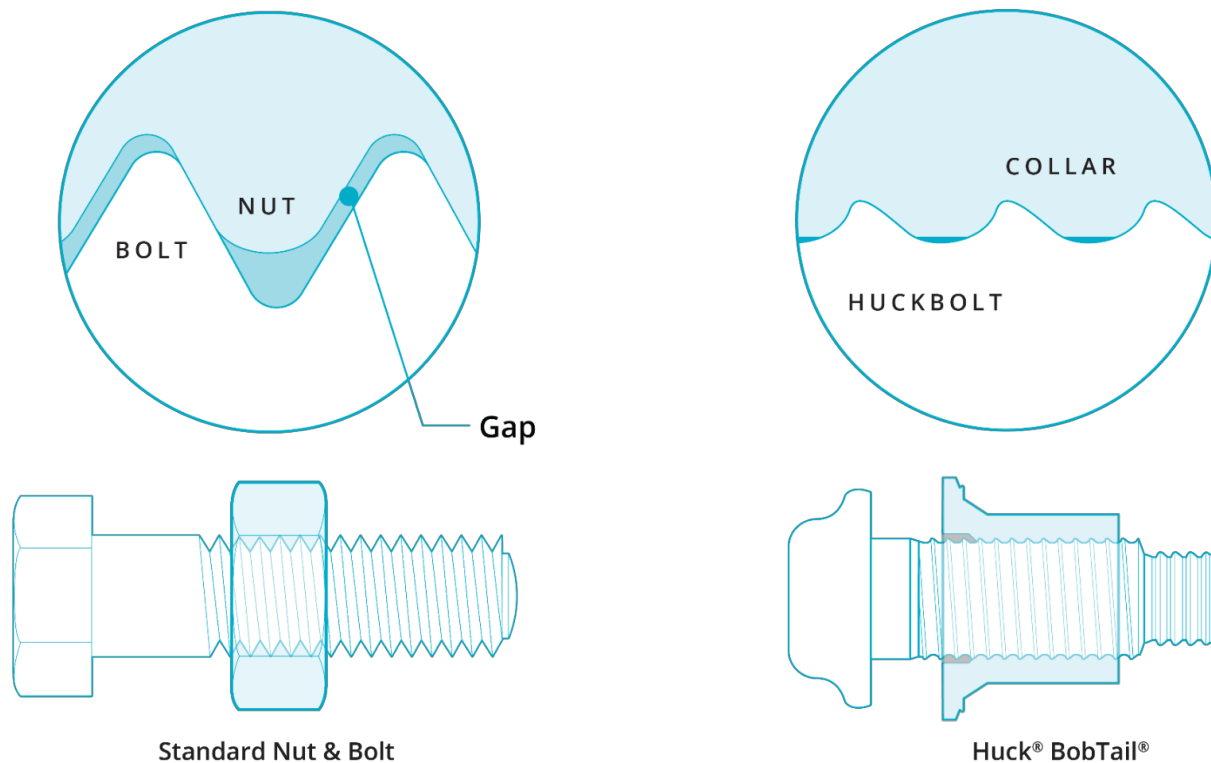
- **Pre-load Verification:** The correct installation process can be checked visually by inspecting the deformed swage bumps on the collar-flange or using ring gauges. If the collar has been deformed correctly, the full pre-load has been introduced into the connection, ensuring consistent performance across all installed lockbolts.

Formal Considerations:

- **Pre-Tensioning Equipment Calibration and Maintenance:** For torque-controlled tightening, the devices used must have an accuracy of $\pm 4\%$ according to EN ISO 6789. The calibration must be carried at least once a year, but also in the event of incidents that occur during use (significant impact, falling, overload, etc.) and affect the tightening device. No such check is required for lockbolts, but regular checks at the beginning and end of a shift and when there is a change of operator are recommended to ensure proper installation.
- **Pin Material Properties:** The chosen steel for the pin needs to exhibit consistent elastic behaviour during pre-tensioning to achieve reliable pre-load values. For preloaded connections, the bolts should have a strength grade of 8.8 or 10.9 acc. to ISO 898-1.

2. Enhanced Vibration Resistance: A Mechanistic Analysis

Lockbolts excel in environments prone to significant vibration, including seismic zones. This superior performance can be attributed to two key aspects of their design and installation:



Formal Considerations:

- **Pin Material Selection:** The pin is typically manufactured from high-strength steel. This ensures the pin can withstand the pre-tensioning force and maintain the lock under dynamic loading scenarios.
- **Collar Design Optimisation:** Thanks to the integrated flange on the collar and the torsion-free tightening process, washers are no longer required on either side of the lockbolt, so that there are fewer parting lines that promote settlement and the associated loss of preload.

3. Installation Efficiency: Streamlining the Construction Process

Lockbolts offer significant advantages in terms of installation speed and ease compared to conventional bolted connections:

- **Simplified Installation Procedure:** The lockbolt installation process involves inserting the pin, assembling the collar, applying tension through Huck-tooling. A lockbolt often installs in under 2-seconds. This straightforward approach requires minimal training compared to torque-controlled methods.
- **Visual Inspection:** In contrast to torque-controlled methods where visual inspection is not possible, lockbolt installations rely on a simple visual inspection to confirm proper swaging by a quick visual inspection of the collar. This eliminates the need for complex measurements, retightening, or additional equipment.

Formal Considerations:

- **Clearance Hole Requirements:** The drilled holes for lockbolts necessitate a slightly larger diameter than the nominal bolt diameter to accommodate pin movement during installation. Specific hole size requirements are defined in the manufacturers specifications and relevant industry standards.
- **Installer Training:** While basic installation is straightforward, proper training ensures installers understand the importance of ensuring a full swage of the collar and potential issues such as damaged pins or collars.

4. Approvals and Certifications: Building Confidence

Lockbolts are a widely accepted fastening solution backed by rigorous testing and certifications:

- **Material Characterisation:** The steel used for lockbolt components undergoes stringent testing to ensure they meet the required mechanical properties for strength, ductility, and fatigue resistance. This is often mandated by approval bodies like DIBt (German Building Authority).
- **Performance Evaluation:** Lockbolts have been subjected to various tests to assess their performance under static and dynamic loads. These tests include tensile testing, shear testing, slip-load and creep testing as well as fatigue testing to evaluate real-world conditions.
- **Quality Management Systems Implementation:** Lockbolt manufacturers typically implement quality management systems to ensure consistent production quality and adherence to relevant standards.

Conclusion:

Lockbolt technology provides a technically superior fastening solution for steel construction applications. Lockbolts address the limitations of torque-controlled tightening methods by eliminating pre-load scatter caused by friction variability and human error.

Their positive locking mechanism and high clamping force provide superior vibration resistance, making them ideal for seismically active zones. Lockbolt installation offers significant advantages in terms of speed and ease due to the straightforward process and visual inspection methods.

Finally, lockbolts benefit from rigorous testing, certifications, and quality management systems, ensuring consistent performance and building confidence in their use.