Difficulty in finding labor

‘It’s hard to find good help these days.’ How many times have you heard that phrase? More times than there are entries on your CV? Skilled tradesmen have grown harder and harder to find, with 52% of contractors saying they are struggling to fill hourly craft positions, according to a September 2020 Associated General Contractors of America survey. When looking specifically at Utility Infrastructure contractors, the rate is 60%. So called ‘Baby Boomers’, who predominantly perform these skilled trade roles, are retiring at an increasing rate, and the western world’s emphasis on college education is not producing enough laborers to replace them.

As the world modernizes and pivots to new utility infrastructure, the demand for skilled laborers will continue to outstrip supply, and contractors will fight over the shrinking pool of candidates. We must take a few steps back and remind ourselves, our employees, and our target candidates who we are, what we are passionate about, and what we can offer each other in terms of personal and corporate achievement and growth.

Time to onboard labor

Infrastructure and construction projects innovate and evolve with the times, and the skills and tools needed from laborers follow suit. It likely goes without saying, but this has become an even larger challenge than finding personnel to hire in the first place. If we do not properly train and equip new additions to our workforce, they grow frustrated and lose motivation to learn and contribute. Engineering and manufacturing teams do the yeoman’s work of preparing designs and components for modularity and remote global deployment, but the work phases of assembly, fastening, and inspection in the field will always remain and require distinct attention to detail.

Depending on the type of structure and geography in which it is installed, this may be welding, bolting, riveting, or some mix thereof. While these joining technologies have existed for decades, their capabilities continue to be expanded and stretched. For welding that may look like robotic automation, high strength steel joints, mixed material joints, or welding in extreme environmental conditions.

Bolting solutions now employ exotic material grades, tightening into the plastic region or with complex multi-stage tightening methods, and post-installation inspection, re-torquing, and marking. Riveting is a very flexible and affordable solution, but there is much interplay between fastener and joint, quality and consistency often varies widely, and vibration and corrosion resistance in long term installations may prove challenging.

These challenges can be learned from and overcome, but we need to support our employees through and motivate and equip them to succeed. At a minimum, these additional hurdles in onboarding and equipping will sap productivity and efficiency, and have the potential to have environmental health and safety impacts. We need to prepare our organizations and departments to properly invest in training and tooling advancements to shift some of these burdens and uncertainties off workers and onto the fasteners and tooling

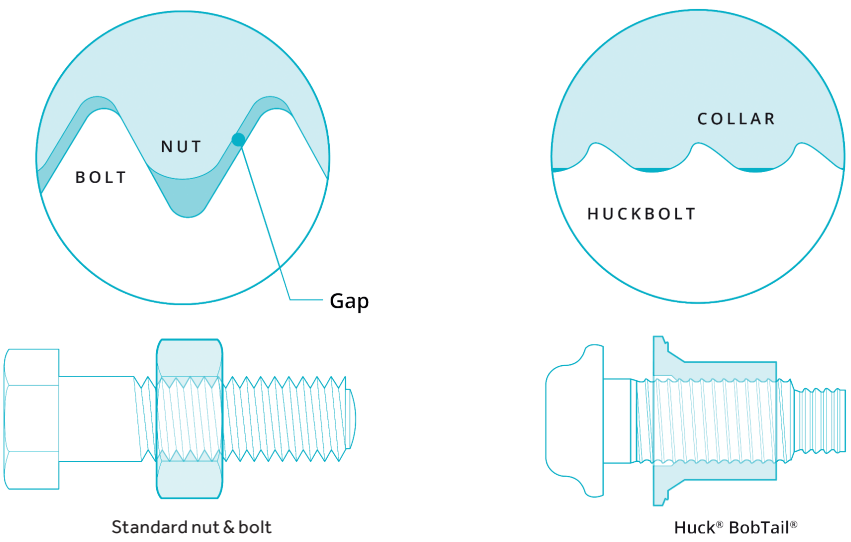
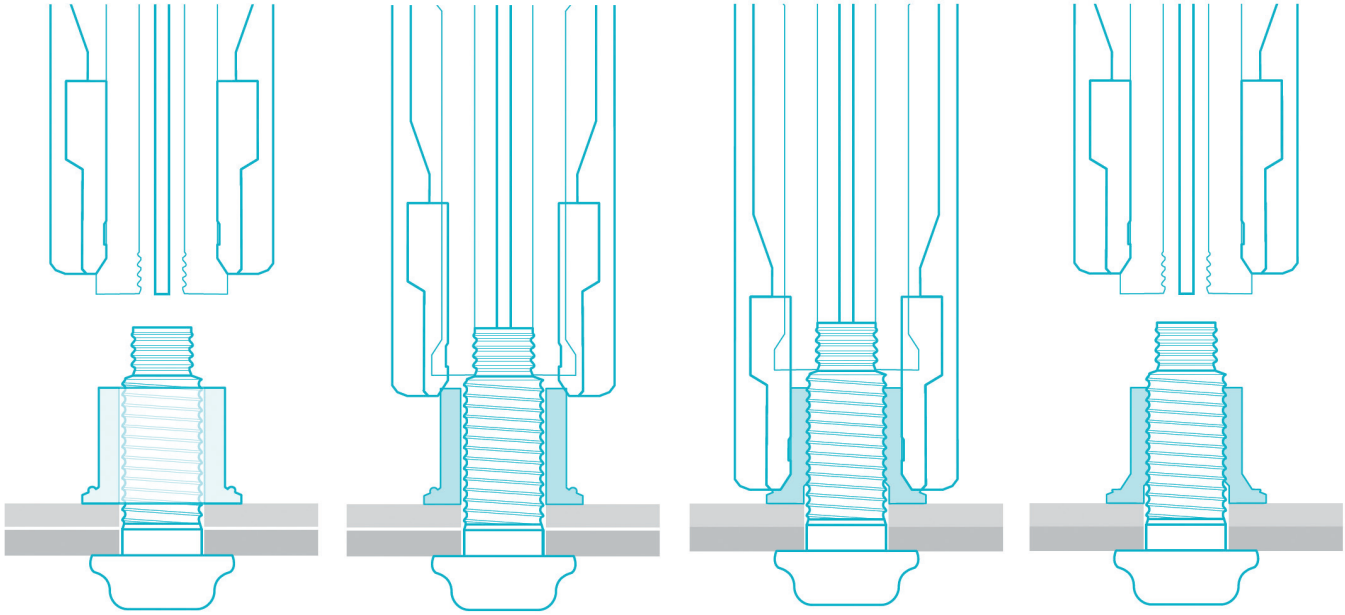


Figure 1: Nut and Bolt vs HuckBolt Engagement

Figure 2: HuckBolt Installation Process



Step 1: Insert pin into the prepared hole, spin the collar onto the pin.

Step 2: The installation tool is applied to annular pull grooves. When the tool is activated, a puller in the nose assembly draws the pin into the tool, causing the swaging anvil to press on the collar, drawing up any sheet gap.

Step 3: At a predetermined force, the anvil begins to swage the collar into the pin's lock grooves. Continued swaging elongates the collar and pin, developing precise clamp.

Step 4: When swaging of the collar into the pin lock grooves is complete, the tool ejects the fastener and releases the puller to complete the sequence.

themselves; we can enable them to work harder and smarter and multiply their efforts with the right equipment and preparation.

There is a simpler way

At Howmet Fastening Systems, we offer products and solutions to meet these challenges. We live and breathe heavy structural assembly. Over the past 60 years we have helped countless customers in a wide range of industries and applications deploy our HuckBolt® lockbolt fasteners to assemble their structures faster, more consistently, and with less operator training or potential for error.

Lockbolts are a two-piece joining technology roughly analogous to nuts and bolts, but with engineered and optimized geometry and function. A key distinction is how the two components engage with one another; nuts and bolts are manufactured with mating helical threads, while lockbolts are a threaded pin and a smooth bore, slip fit collar that is 'swaged' or deformed onto the pin upon installation. The clearances required between nuts and bolts for assembly are their Achilles heel; they act as a secret pathway for transverse vibrations to use to loosen and potentially destroy your joint. Conversely, the swaging action of a lockbolt ensures full engagement on both the loaded and unloaded flanks of the groove form, so there is nowhere for vibrations to cut in (See Figure 1).

The swaging process of a lockbolt may sound intimidating or confusing because it introduces a new term into your vocabulary, but in reality, it is simple and could revolutionize your structural and assembly planning. Nuts and bolts are installed with torque; an installer holds the bolt head fixed on one side of the joint while applying torque to the nut on the opposite side of the joint. The triangular shape of bolt threads converts the applied rotational forces into desired axial clamping forces. However, as this is an indirect conversion of force, many variables can, and regularly do, come into play. Lockbolt swaging generates desired clamp directly; a single tool on one side of the joint pulls on the tail of the bolt while pushing back on the collar, removing any sheet gap and generating low level clamp. Then, the specially toleranced 'swage anvil' on the tool begins to slide over and around the collar in a press fit, deforming the collar onto the bolt while stretching the bolt and generating extremely consistent joint clamp. The tool then retracts off the collar and pin and installation is complete, with no torque or angle measurement required to ensure joint integrity.

Installation and inspection

Linear-pull swage installation is far superior to traditional torque installation because the torque to clamp conversion and its inherent variables has been eliminated. Clamp in a traditionally bolted joint may vary by as much as 30% due to these variables, while clamp in a lock bolted joint will vary by 5% or less. The first major variable in traditional bolt clamp is the torque input method; how accurately and precisely is the operator able to apply torque? Simple hand wrenches and socket wrenches and subjective 'feel' for applied torque provide unreliable input, nut drivers are faster but not necessarily more accurate, and nut runners and torque wrenches can be as accurate as ±4% under controlled conditions.

The simple linear swage action of a lockbolt is precision controlled by hydraulic, pneudraulic, or electrical control, and is thus highly repeatable. So far, we have only considered only torque input variation; the conversion to clamp must still take place, and the next major variable must be considered: coefficient of friction. The highly simplified equation for torque to clamp conversion is clamp = torque / (coefficient of friction x bolt diameter), and the coefficient of friction can vary from 0.04-0.3 or more based on bolt and nut materials and surface finishes, joint materials and surface finishes, thread quality, thread lubricant or lack thereof, and environmental conditions i.e temperature, humidity, debris.

Therefore, even if you are able to control your torque input to ±4% or better with torque-angle-yield (TAY) approaches, coefficient of friction will play an important and detrimental role in the realized joint clamp. HuckBolts do not need to take coefficient of friction into account, as the installation tooling develops and controls the joint clamp load. The highly engineered,

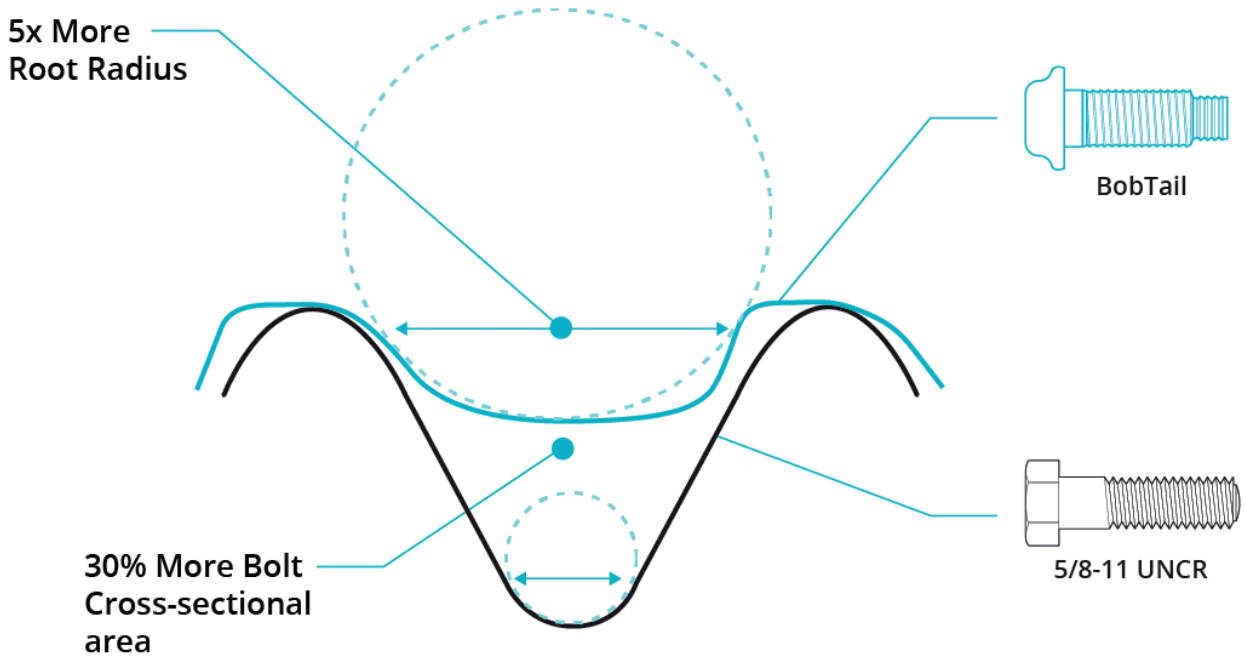


Figure 3: HuckBolt geometry optimization

simple to operate tooling removes all guess work and variables out of the installation process, so onboarding and training time is drastically reduced. Therefore, HuckBolts can be utilized in more material, grade, diameter, and coating combinations than standard nuts and bolts, but with far higher effectiveness and reliability. They can be specified on structural assembly drawings based on their published mechanical values, and the Engineer of Record can sleep well at night knowing that the field contractor's installation method and site's environmental variables will not chip away at his or her designed safety factors.

Once bolts are installed, the job is only half done. They must then be inspected and marked before final project sign-off or product shipment. With traditional nuts and bolts, this is likely done by re-checking with a calibrated torque wrench or inspecting bolt stretch directly with ultrasonics or calibrated calipers, if the bolts are properly manufactured with such inspection in mind. With HuckBolts, the swaged collar can be inspected visually and/or dimensionally for guaranteed mechanical performance. Most collars are manufactured with witness dots on their flange that are contacted and

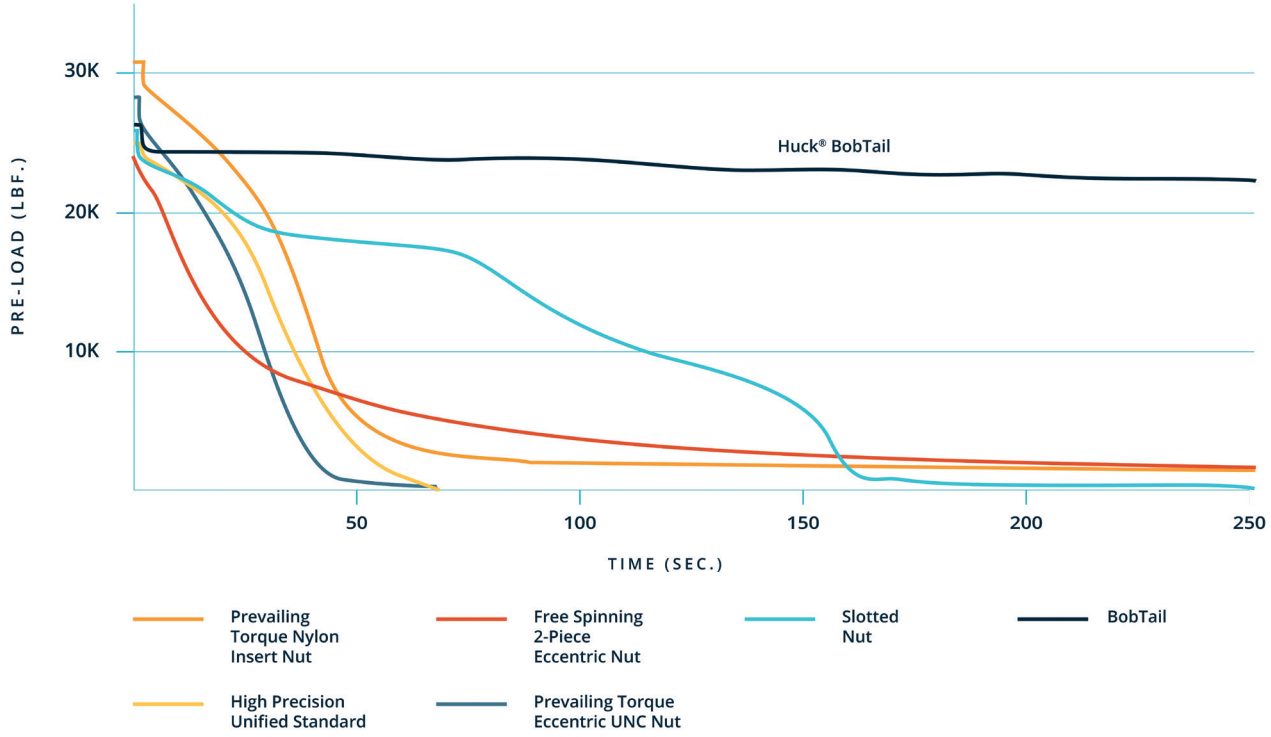


Figure 4: HuckBolt vibration loosening resistance

Figure 5: With and without 1000 Hour Corrosion Protection

deformed by the installation tooling.

This makes for a strong yes/no indicator to the inspector that an installation has been fully performed. Secondly, collar coatings that exhibit high contrast between pre-installed and post-installed conditions are available; and thirdly, caliper dimensions or inspection ring gauges can be provided for quick single step verification that a collar has been installed and joint integrity is achieved. Once inspected, you can be confident in joint performance and do not need to re-inspect or re-torque.

Long term reliability

Solar Energy collection, conversion, and distribution takes place in some of the harshest, most remote regions and terrains in the world. These projects can span tens of thousands of acres, and send energy thousands of miles away. The last thing a project owner wants to do is worry about the long-term viability of their investment. With PV panels now carrying 25-year warranties, one needs assurance that supporting structures will last at the very least that long. At Howmet Fastening Systems, we engineer decades of installed life into every one of our fasteners, and want to give you the confidence to integrate that into your project plans.

The first way that Huckbolts are engineered for high performance and long life is geometry optimization and integrity. Our patented and proprietary bolt threads and lock grooves have been refined through decades of research and development and customer collaboration. We have taken a clean sheet design approach to root radius optimization, cross sectional area maximization, and manufacturing with strict manufacturing and processing controls. This allows structural engineers and planners to get every last ounce of strength out of each joint, and not waste a lot of installed mass on fasteners. In some cases, this can even amount to smaller diameter fasteners, or fewer fasteners in multi-bolt patterns.

This geometry optimization in conjunction with full thread engagement from the collar swaging process greatly increases joint fatigue life and vibration resistance. The improved geometry has smoother radii and more continuous curve transitions, so the stress concentration factor for bolt bending and tensile considerations is greatly reduced. Each and every thread root is designed and manufactured to take more abuse and heavy load cycling than today's optimized bolt thread forms.

The second major way that we manufacture our fasteners for the long haul is through coating development and selection for specific end use. For aluminum alloys we have developed a wide range of custom-tailored passivation and anodization processes including color coding for application matching or part identification. For stainless alloys we can compound corrosion resistance with passivation, sealants, and topcoats. The lion's share of our structural fastener offering is of carbon or alloy steel composition, and we have a plethora of coatings to match.

Smaller diameter and lower strength fasteners are well matched by black oxide, zinc or zinc nickel electroplate finishes with or without passivation and topcoats, while larger diameter and higher strength fasteners are typically protected by zinc flake dip spin coatings and topcoats. These advanced finishes can survive over 1000 hours in ASTM B117 salt spray testing before exhibiting any sign of red rust. Figure 5 shows an example of a HuckBolt collar with and without 'HuckGuard,' one of our high-performance coatings, after 1000 hours in an ASTM B117 test chamber.

Solar fields often exhibit many of the criteria driving high corrosion; temperature cycling, humidity cycling, UV exposure and abrasive debris. We can select fastener finishes to combat these effects and coordinate real world testing to correlate lab performance to real world longevity in your application.

Fastening solutions

Whether your problem is fastening system complexity, training of personnel, installed consistency, vibration loosening, or corrosion attack, we have engineers and designers trained and equipped to provide a labor and cost efficient solution. We have HuckBolts and blind fasteners deployed in tracking and fixed solar energy generation projects all over the world, from PV panel mounting and grounding to structural steel assembly to rectifier and combiner box subassembly to cable tray assembly and mounting. We know your sites need to be assembled and commissioned quickly and accurately, and our engineered fasteners and tools have a long track record of helping global customers do just that, even amidst today's challenges of remote site locations, workforce turnover, and evolving joint materials and complexities. Look us up at hfsindustrial.com, tell us about you challenges, and let us trade your stresses and challenges for solutions and peace of mind.

www.hfsindustrial.com/us/

Contact:

Europe : hfsindustrial.com |
+44 (0) 1952-290011 |
Sales.Telford@howmet.com

Americas: hfsindustrial.com/us |
+1 800-388-4825 |
SalesWaco@howmet.com

Australia: hfsindustrial.com/au |
+61 3 8545 3333 |
HFSMel.Sales@howmet.com