

# THE IMPORTANCE OF API 20E AND API 20F BOLTING STANDARDS

A U.S. Bolt Manufacturing, Inc. White Paper

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API 20E-0001  
API 20F-0001

Throughout the development of the industrialized economy, bolts, screws, studs, nuts and other miscellaneous fasteners, known collectively as Bolting, have largely been deemed commodity items. In the vast majority of commercial applications, a Bolting failure bore limited consequences. Typically, a failed fastener was simply removed and its replacement installed. There were limited implications to Bolting failures, typically a few minutes or maybe hours of downtime while a replacement part was installed so the machinery could resume operating. This scenario was true of most Bolting used in Oil and Gas applications as well. As the O&G Industry has expanded, however, continuously moving into evermore harsh and unforgiving environments, we've seen the consequences of Bolting failure in these applications present infinitely greater risks.

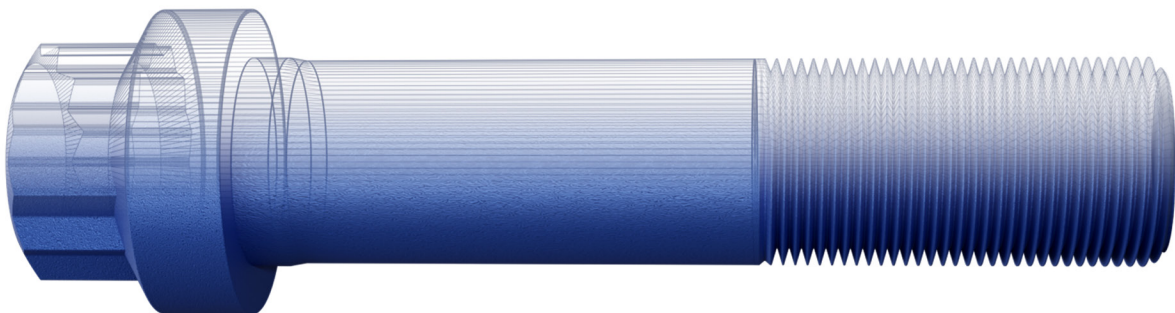
When drilling offshore for oil and gas in water depths in excess of 12,000 feet or producing oil and gas in a land-based fracking development adjacent to a suburban neighborhood, where rig hands can see and hear children playing in their backyards, a catastrophic Bolting failure presents safety hazards of a completely different nature. In either scenario, there is potential for the loss of human life, extreme environmental impact and financial ruin.

After weathering these risks for years, the O&G Industry addressed the challenge of Bolting-related issues head-on. One of the most important components of this Bolting initiative was the creation and publication of API Specification 20E and Specification 20F. The management of bolting in these very critical applications is complex. In addition to the need for bolting to be manufactured to the highest of quality and integrity standards, it is crucial that the design of the bolting is correct. Management of strength levels and applied plating and coating are necessary to reduce the propensity for environmentally induced embrittlement stress failure. If the material strength is too high, the bolting will likely fail catastrophically. Certain coatings are known to cause fastener failure in marine environments. Also important is the control of applied preload as the bolting is installed. Too much preload stress can lead to failure, as can too little stress. Historically, there has been relatively little attention paid to the installation processes. This is rapidly changing.

## History of the Specifications

For the past 100 years, the American Petroleum Institute (API) has published Specifications and Standards for every type of pressure boundary product used in the exploration, drilling, production, refining, transportation and distribution of petroleum products. The manufacturing process control, testing and inspection of pipe, valves, fittings, flanges, gaskets, o-rings and seals have been addressed in API Standards, which regulate production of those products. Product and equipment producers who were evaluated and found to be compliant with those API Specifications could be awarded an API Monogram and licensed to mark their product with the Monogram. In the arena of pressure boundary products, Bolting was the sole component category with no such control.

The Association of Wellhead Equipment Manufacturers (AWHEM) is a trade association providing value-added support to the O&G Service Manufacturing Industry. This organization provides technical support to the Industry by evaluating and certifying component designs and technical support to API, aligning industry standards. In response to multiple O&G Operators and Original Equipment Manufacturers, with each initiating their own enhanced-quality Bolting specifications, AWHEM chose to create an industry document to standardize the specifications. A committee of AWHEM subject matter experts convened to write a high integrity Bolting technical guide. This document was published as AWHEM TR1001 (now obsolete). API Sub Committee 20 on Supply Chain soon became aware of this document and created a committee to use the document as a basis to develop their own specification. In August 2012, API published Specification 20E, Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries. This standard specifies the requirements for the qualification, production and documentation of alloy and carbon steel bolting used in the petroleum and natural gas industries. The companion specification covering corrosion resistant Bolting, API 20F, was published a couple of years later.



## API 20E Services Levels

The API 20E Specification establishes three Bolting Specification Levels (BSL-1, BSL-2 and BSL-3). These BSLs define ascending levels of technical, quality and qualification requirements. Increasing levels of severity reflect increased consequence of Bolting failure. The highest level of criticality, BSL3, is expected to be reserved for those applications in which Bolting failure is not an acceptable option. A common definition for BSL3 application is a "critical application; one through which a bolt failure would result in release of hydrocarbons into the atmosphere." The Specification has no design responsibility and does not identify specific applications that would require BSL; that is the obligation of the designer, user, or API Product Committee, who has a full understanding of the application service demands and consequences of product failure. NOTE: It's important to understand that this Specification is designed to control the manufacturing of purpose-built critical components. It is not expected that post-manufacturing testing and inspection of any commercially produced product would comply with 20E or 20F. Compliance to these specifications cannot be "inspected in;" the product must be manufactured with the specific intent of full compliance.

## Applications

API 20E and 20F compliant Bolting is now mandatory for many products being manufactured to API Specifications. These products include:

1. Valves
2. Surface Trees
3. Subsea Well Heads and Trees
4. Drill Through Equipment
5. Blow Out Preventers
6. Choke & Kill Manifolds
7. Well Head Connectors
8. Drilling Risers
9. Subsea Pipelines
10. Production Risers, Jumpers and Gas Export Equipment
11. High Pressure/High Temperature (HP/HT) Equipment

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