STANLEY®
Engineered Fastening

Spiralock®

Your threaded fastening solution

AS/EN/JISQ9100 - Revision C
and ISO 9001:2008 Registered

STANLEY®
Engineered Fastening

Presentation to Dropped Objects Prevention Scheme (DROPS) Forum

Dropped Objects Pr

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Business Development Manager
17 September 2015

STANLEY®
Engineered Fastening

ONE COMPANY. POWERFUL BRANDS.

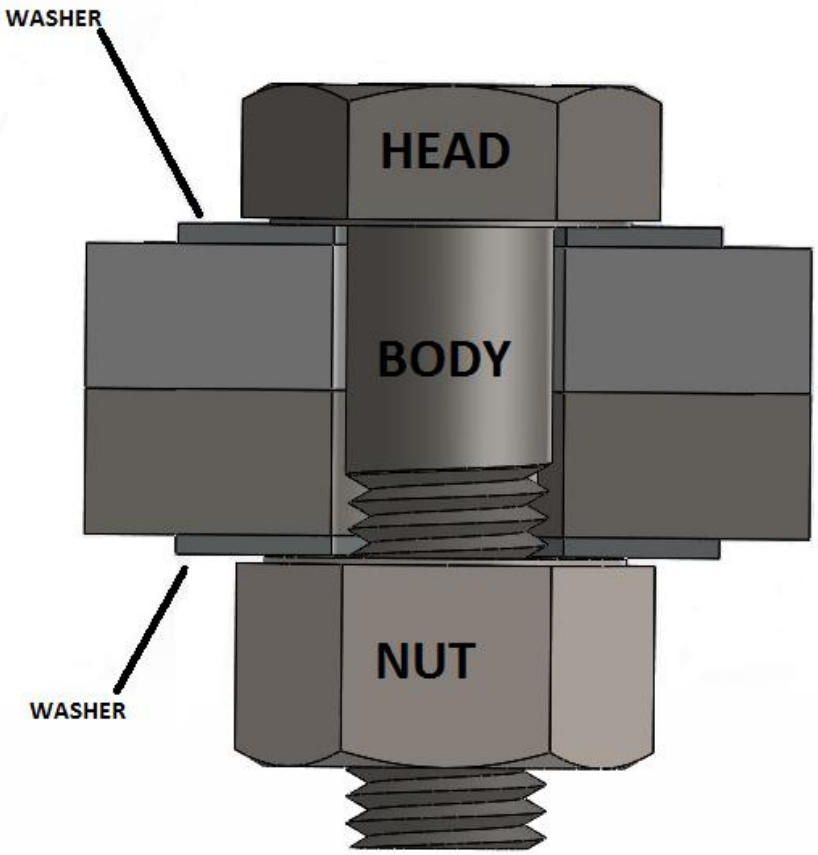
HeliCoil® POP® Avdel® TUCKER® iForm®

Dodge® VIEW TECHNOLOGIES Spiralock® CRIBMASTER Assembly Technologies

WARREN® NPR® GRIPCO® MASTERFIX®

Bolted Joints

- What could be more simple – insert bolt, screw on the nut and all will be OK – right?
- In majority of cases - wrong!



Consequences of Fastener Failure

- Plenty of examples of costly joint failures on the internet e.g.

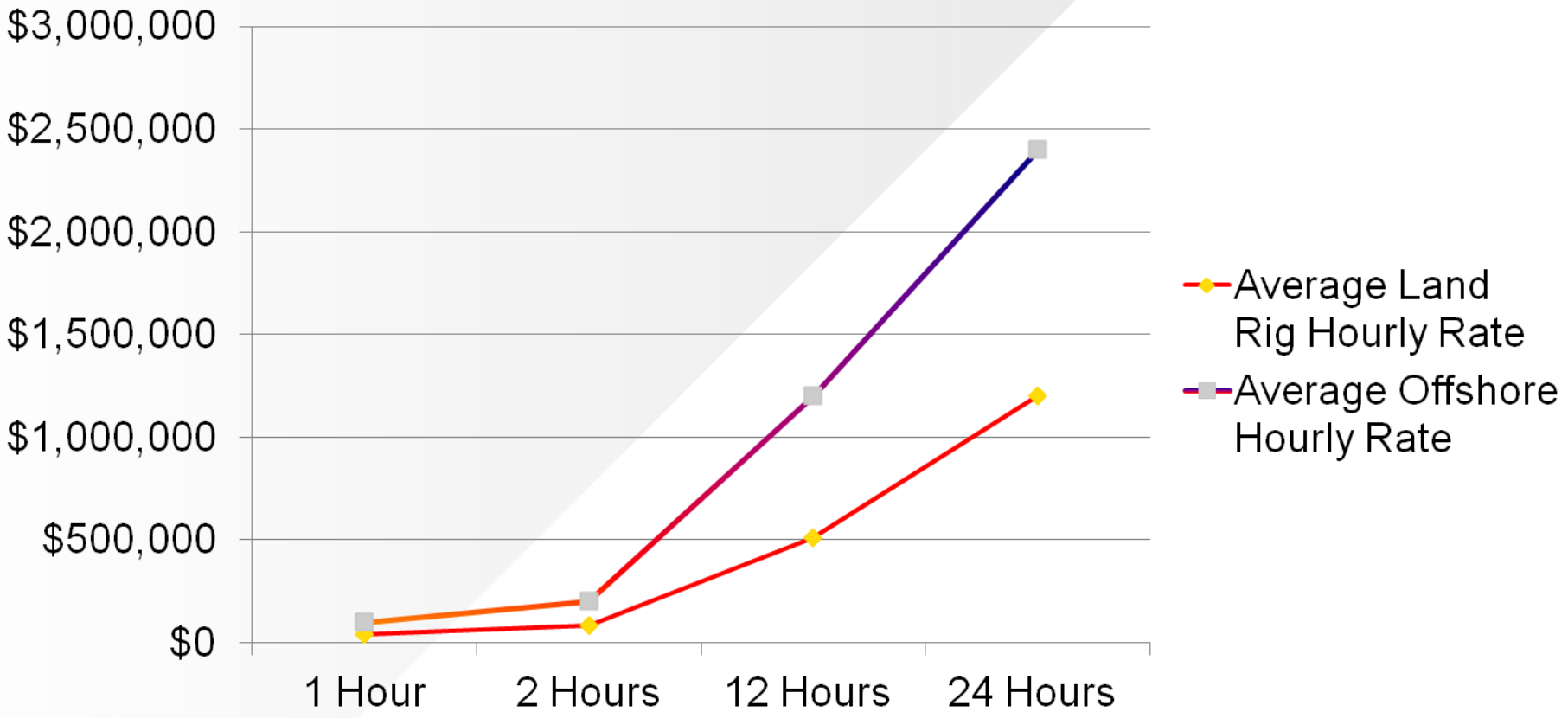
  Loose nut causes $62.4 million in fire damage –

  (Aerospace application)

- Not only financial cost – most serious consequence can be loss of life!

Topside Downtime = Major Lost Money!!

Drilling Rig failure or repair cost based on an Inoperable Rig



(www.offshore-mag.com 2015)

Cost Implications

Repair & Replacement Costs of some current locking options.

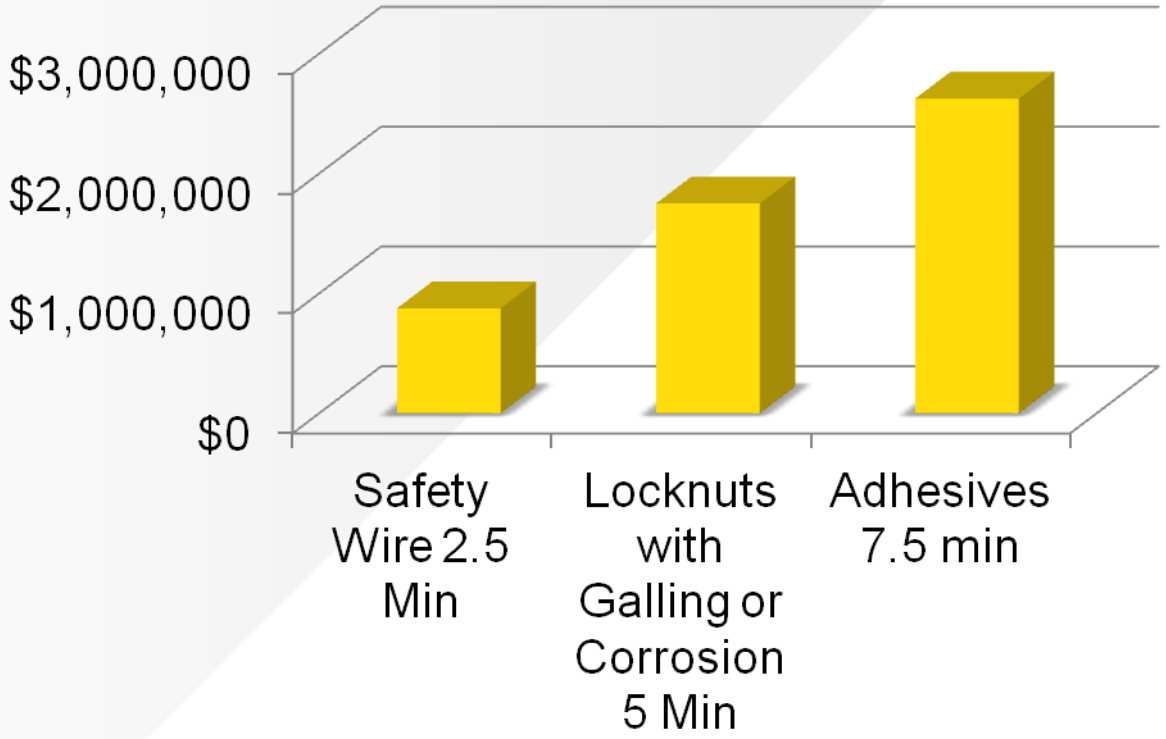


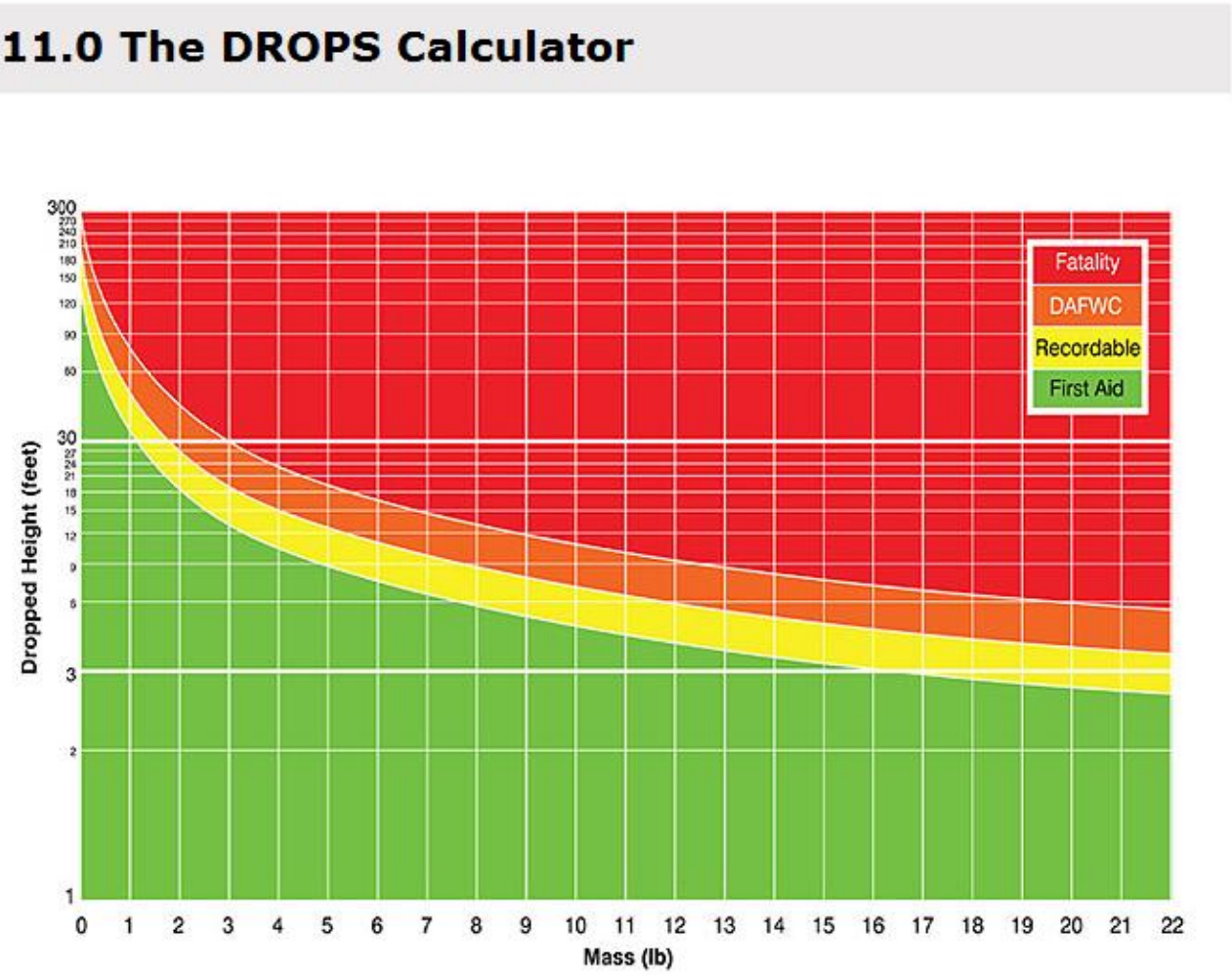
Chart Based on 500 Replaced Nuts annually and cost associated with an inoperable drilling rig

Locking Failures Have Deadly Implications!

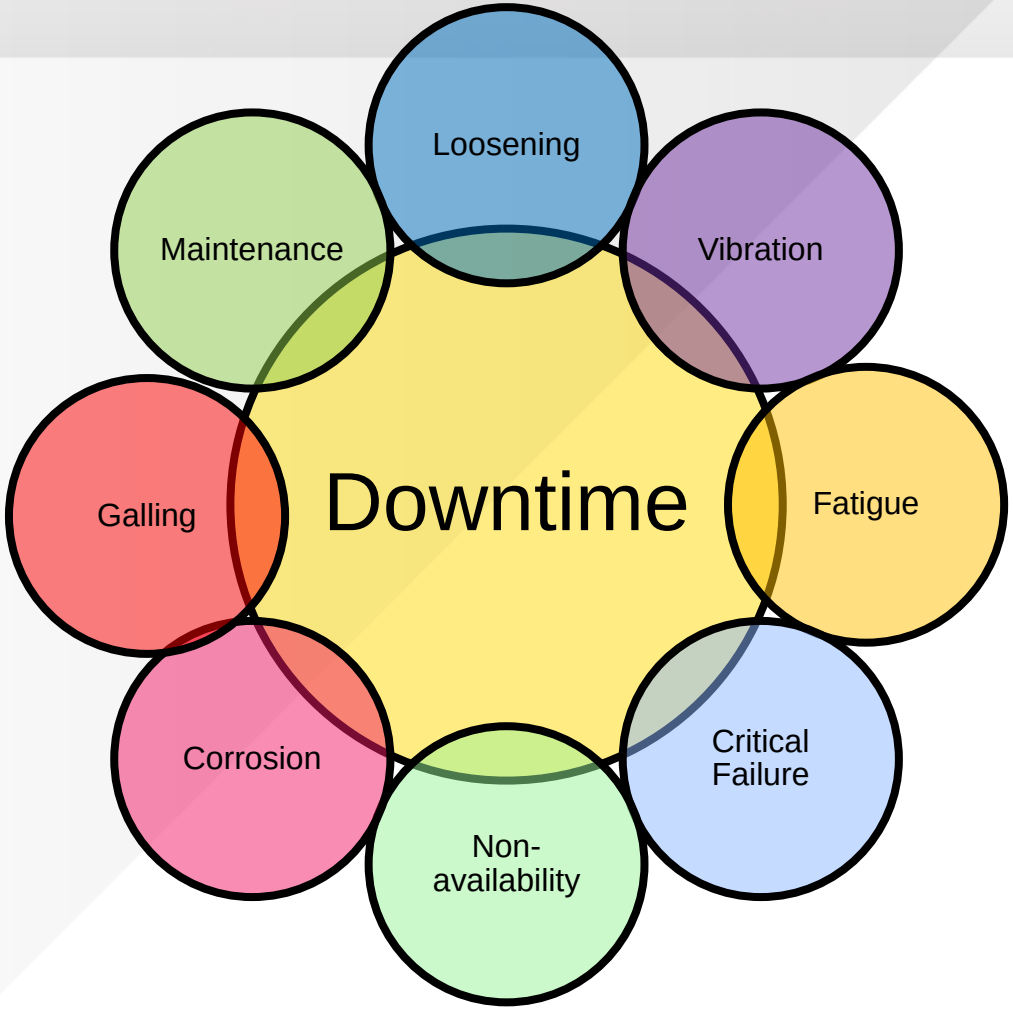
Shell found that 50% of incidents in wells were related to dropped objects (Drillingcontractor.org, 2010)

Red = Dead!

Typical Dropped Objects



Sleepless Nights



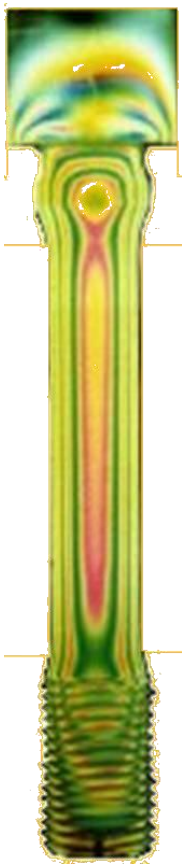
Not only vibration loosening to consider

Each of the above factors will affect fastener selection

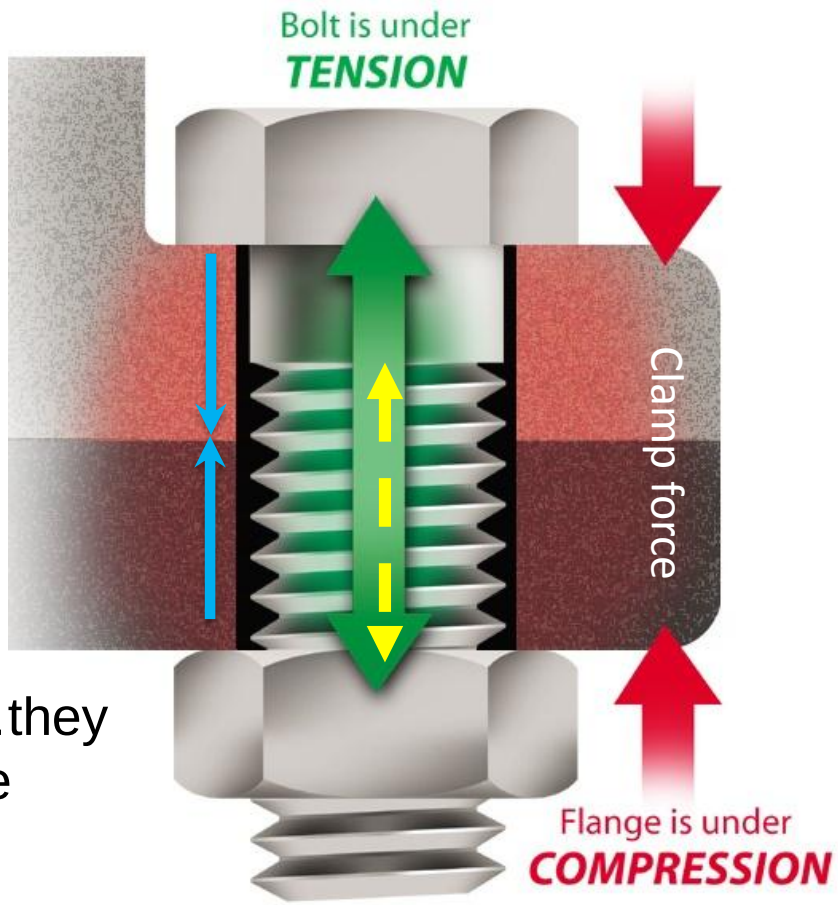
Some Fastener and Thread Selection Criteria

- Long Term Reliability
- Vibration Resistance
- Available space
- Temperature
- Torque/Clamp Requirements
- Resistance to Galling
- Joint Assembly
- Number of re-uses
- Non fastener applications
- Corrosion
- Price

Fundamentals of a Threaded Assembly



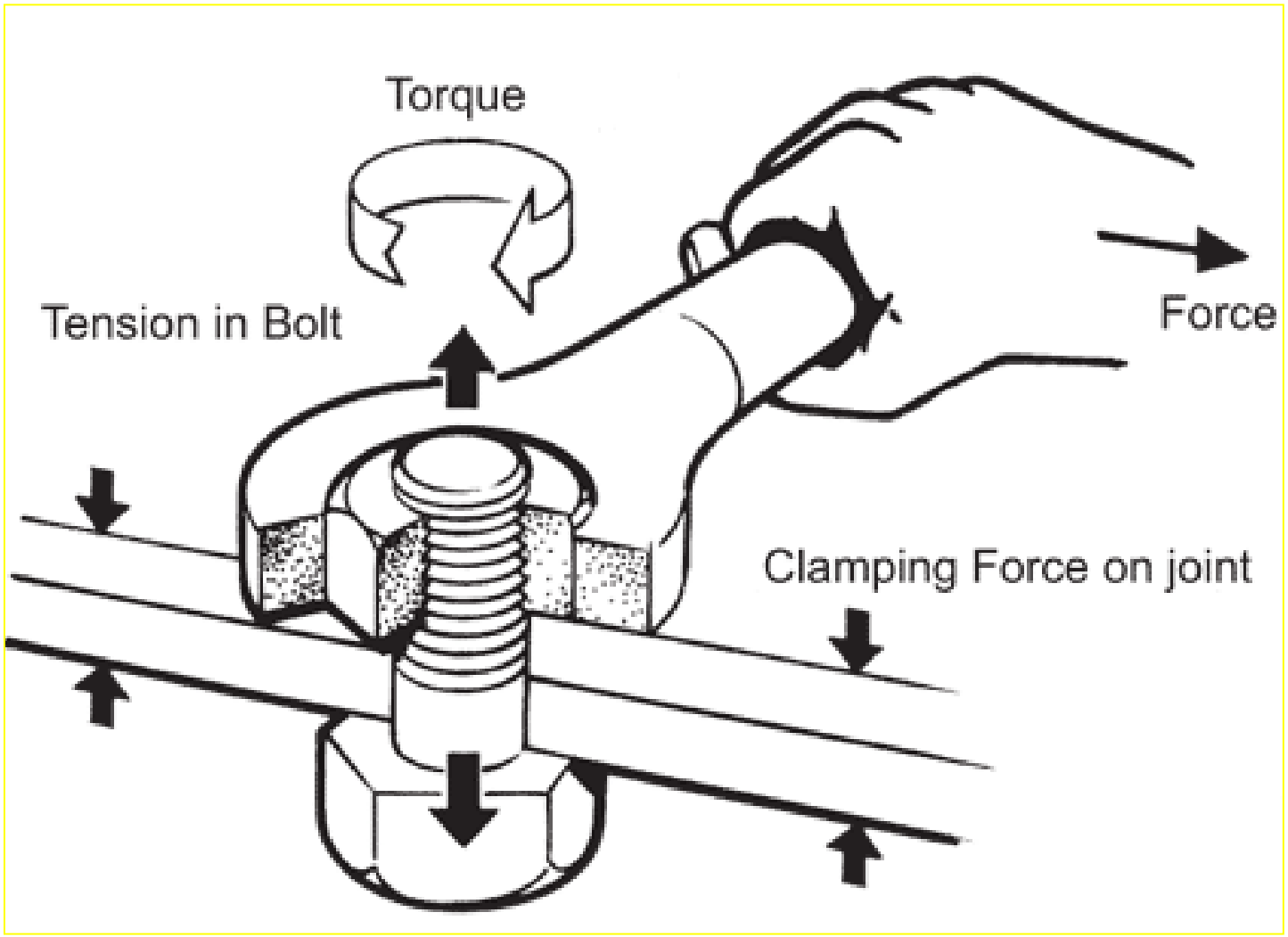
- Preload is stored energy
- Preload should be present in all threaded assemblies
- Loss of preload constitutes a joint failure



Bolts act like heavy coil springs…they must be s t r e t c h e d to be effective!

(Preload is the "initial" load on the bolt from tightening without any external factors being applied).

Tightening Torque



Tightening Torque continued

- The relationship between applied torque and the tension created is described by the relationship:
- $T = K \times D \times F$
- where T = torque,
- K = nut factor, sometimes called the friction factor,
- D = bolt diameter, and
- F = bolt tension caused during tightening.

- Often referred to as the short-form equation.
- Typical Units –Nm (Newton metre)

Typical Variables

- **Lubrication**

  Lubricating an assembly will reduce the amount of torque required to achieve a given clamp load due to the effect on the K factor.

  For example, if the K factor for a dry assembly is 0.2, then for a lubricated joint it might be 0.15. In this instance that would reduce the required torque for a given clamp load by 25%.

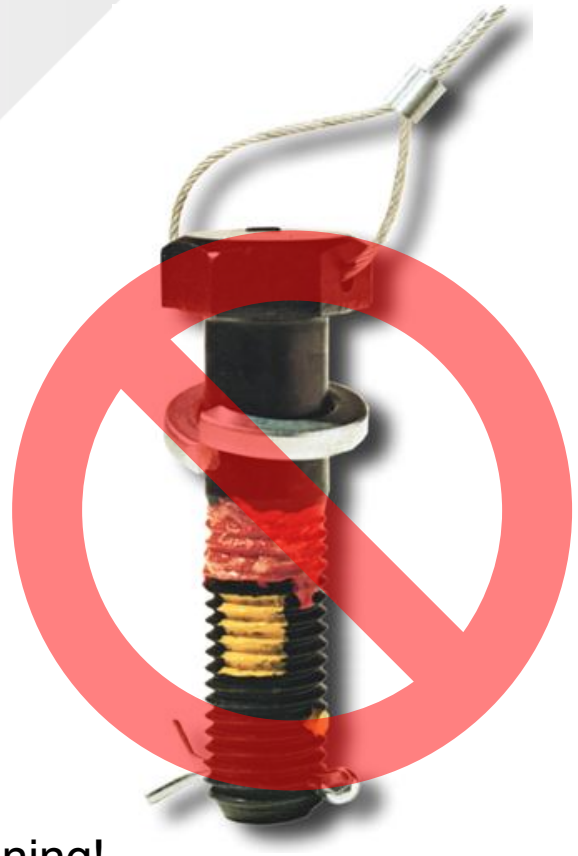
- **Tightening Method**

  There are several ways that the torque can be applied - from a basic spanner to more sophisticated torque wrenches incorporating sensors – and the chosen method can affect repeatability of performance.

Effect of Vibration – risk of loosening

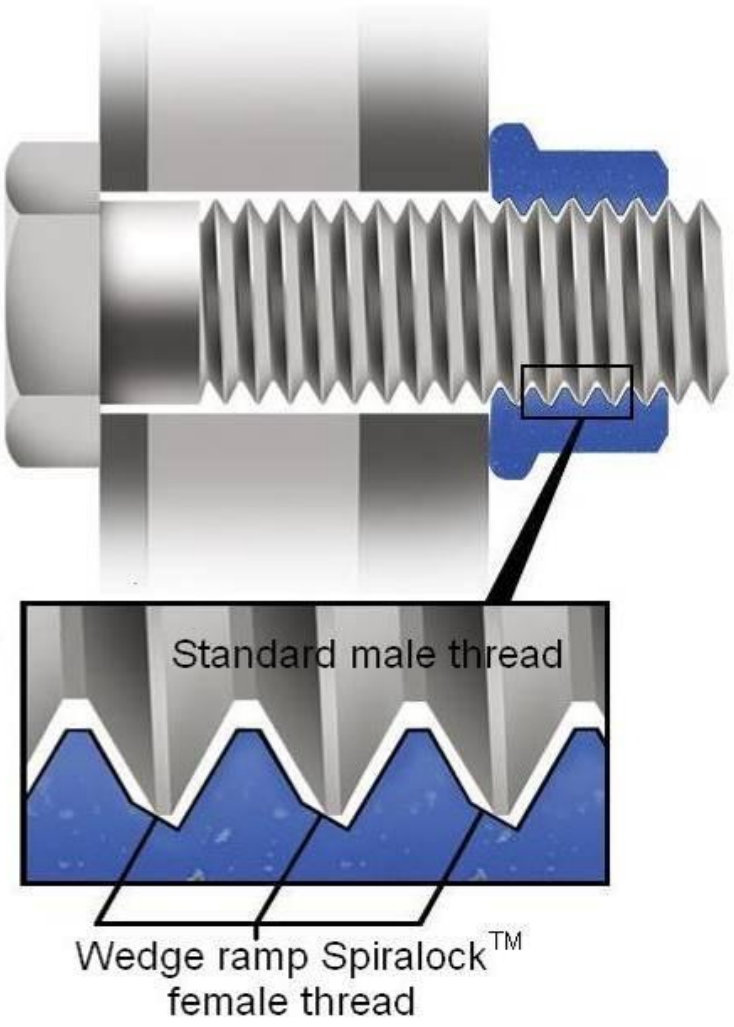
Some Threaded Joint Locking Methods

- Adhesive
- Patch bolt
- Lock washers
- Disk lock - wedge type
- Serrations
- Jam nuts
- Lockwire
- Cotter pin
- Tab lock
- Prevailing torque
  - All metal
  - Nylon ring
  - Interference fit



- None of these “fixes” address the root cause of loosening!
- Spiralock modifies basic joint behavior instead of relying on thread friction

Spiralock® Technology



What is Spiralock?

A self-locking female thread form with a 30° wedge ramp at the root of the thread

The wedge ramp allows the bolt to spin freely until clamp load is applied. At that point, the crests of the standard male thread are drawn tightly against the wedge ramp, creating a continuous spiral line of contact along the entire length of the thread engagement.

Common 60° Thread Limitation: Surface Roughness

60° Thread

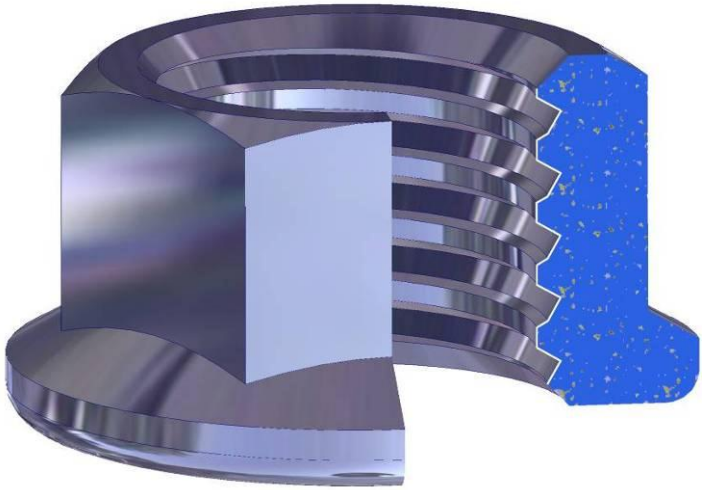
Spiralock

High spots on rough surfaces yield and creep, causing loss of clamp load after initial tightening

Reduced contact surface with Spiralock levels out surface finish issues during tightening

Benefits of Spiralock

- Mates with standard male thread
  - Wedge tightens as clamp load builds
- Free spinning
  - Faster to assemble, reduced operator fatigue
- Reusable
  - No deterioration of lock feature
- Self-centering of male fastener
  - Pushed inward from all sides
- Radial load distribution
  - Lowers chance of shear failure
- Improved fatigue life
  - Load carried across all threads
- Resistant to vibration loosening
  - Eliminates radial clearance - no transverse motion



Common 60° Thread Limitation: Plating Buildup

60° Thread

Plating buildup causes mis-loading of flanks and lowers tension component of joint

Spiralock

Male thread engages with Spiralock wedge ramp, avoiding plating buildup in thread root

Common 60° Thread Limitation: Angle Error

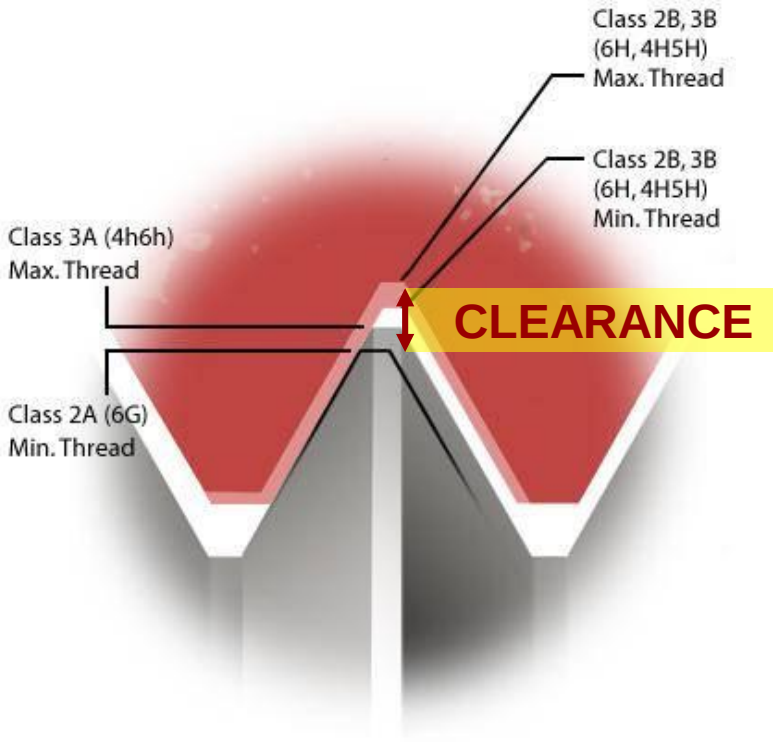
60° Thread

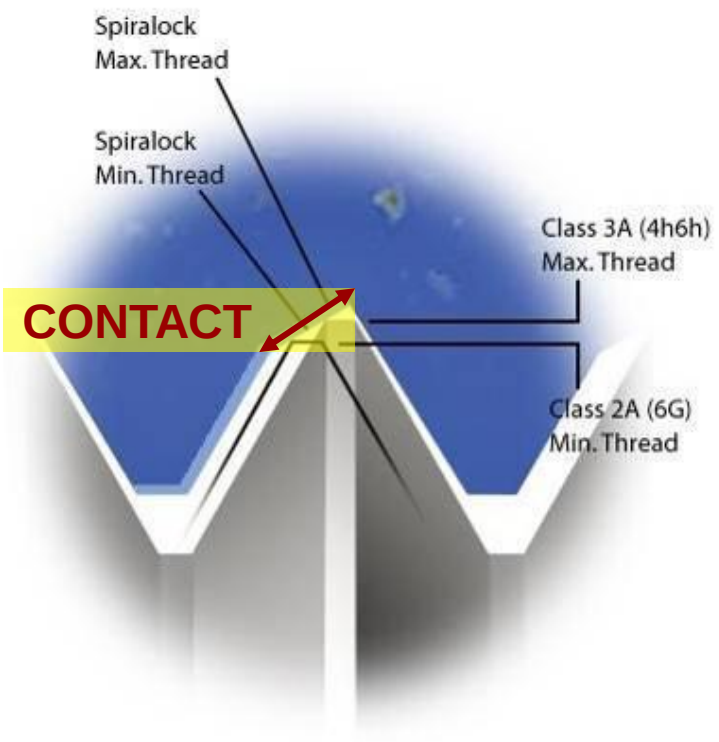
Geometric irregularities can cause non-uniform flank contact and stresses

Spiralock

Line contact with Spiralock eliminates flank angle issue

Thread Tolerances





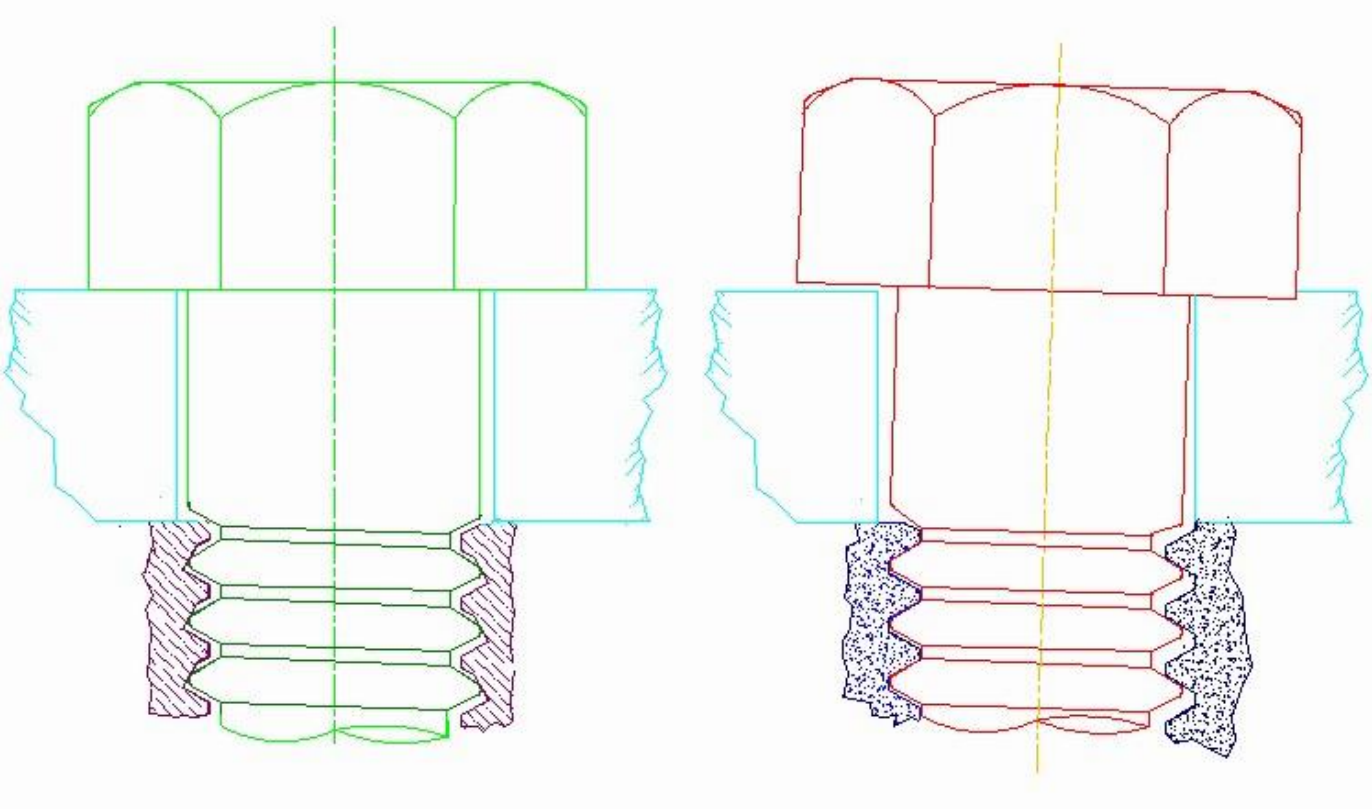
60° Thread

- Significant radial clearance designed in
- Contributes to thread fit variations
- Primary reason vibration loosening can occur

Spiralock

- Male thread crest engagement in helical fashion
- Compatible with 2A & 3A (fractional) and 4g6g or 6g (metric) external threads
- Prevents vibration-induced movement

Self centering

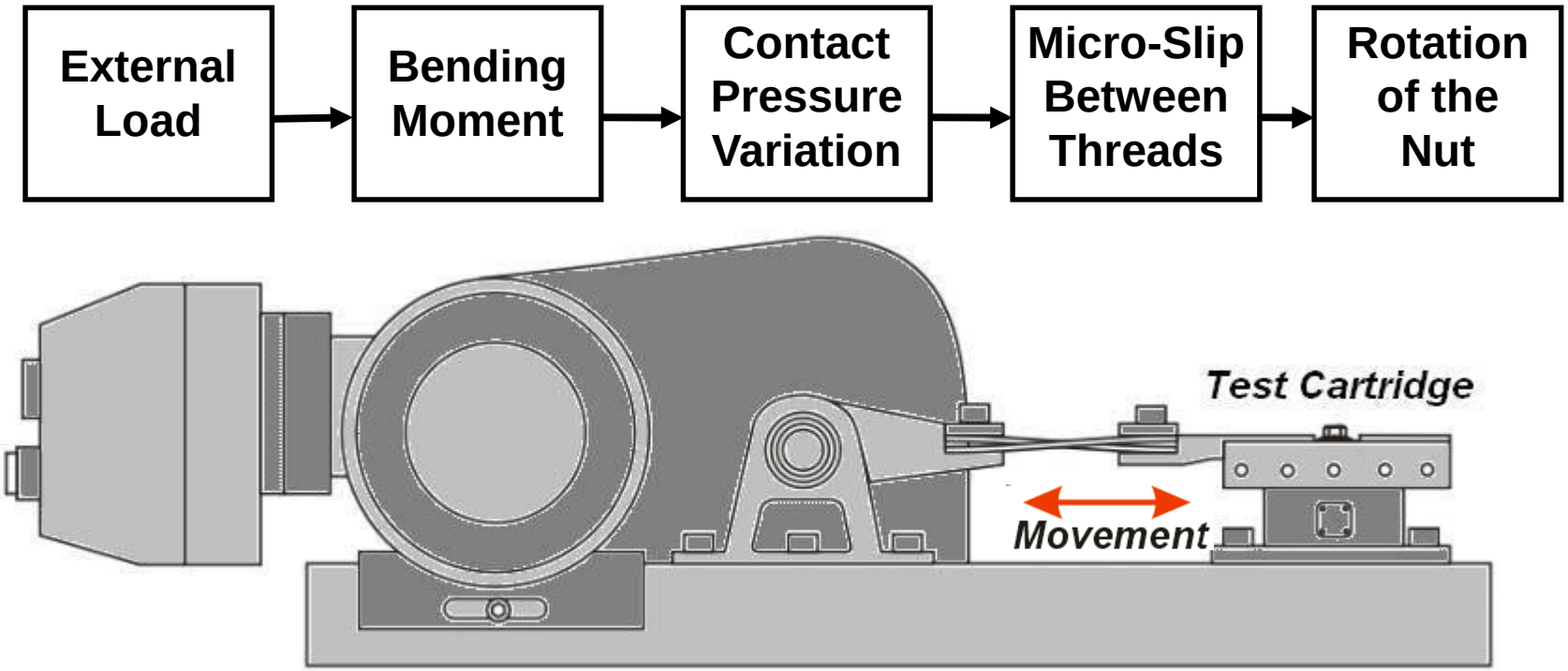


Spiralock Thread

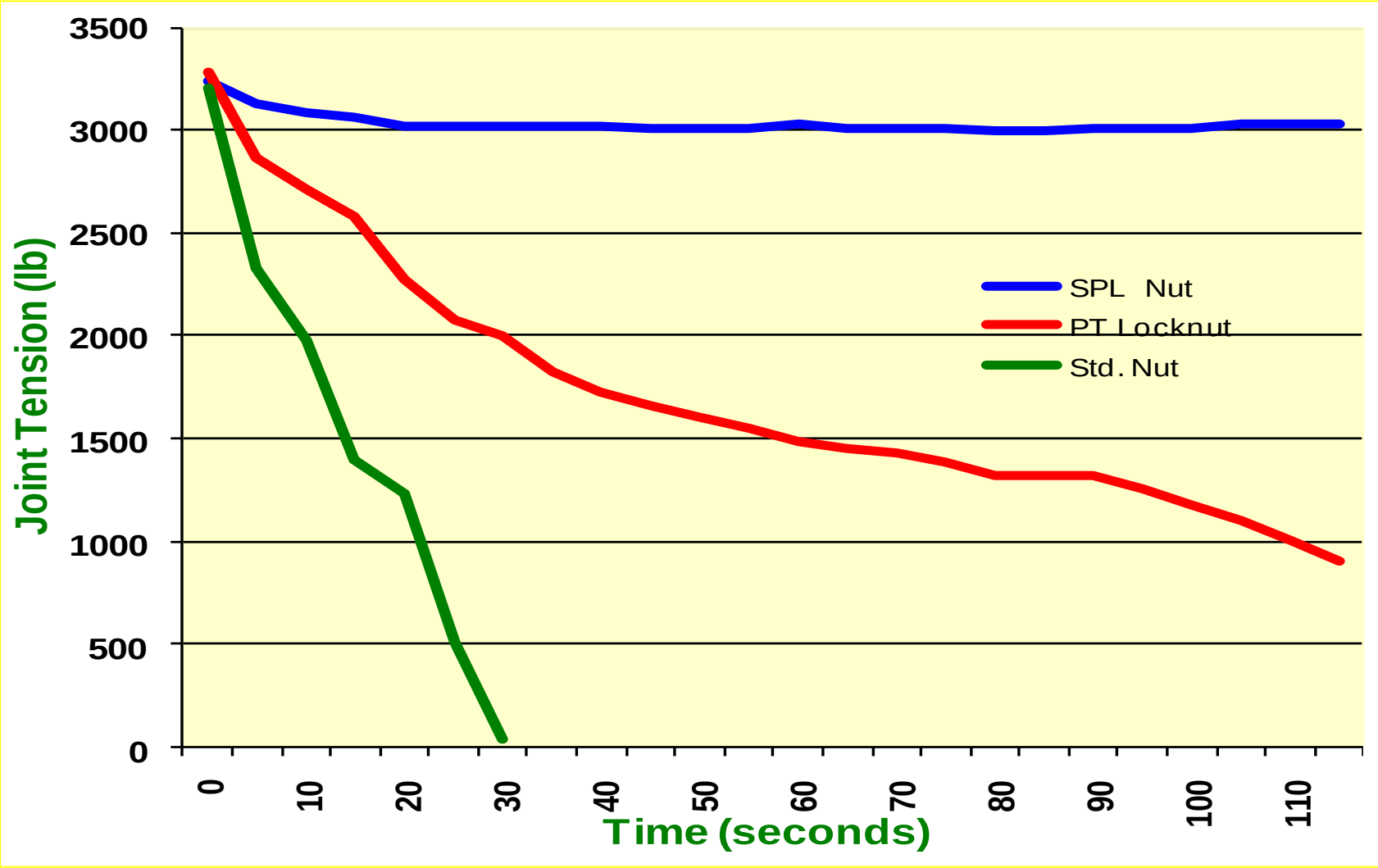
60° Thread

Vibration Loosening

- Junker's Test most widely accepted (DIN 65151) - not adopted by ISO or SAE
- Cam driven transverse movement forces slip plane under bearing surface
- Most severe condition to accelerate self-loosening – perpendicular to bolt stretch
- Treats fastener like it is undersized for application

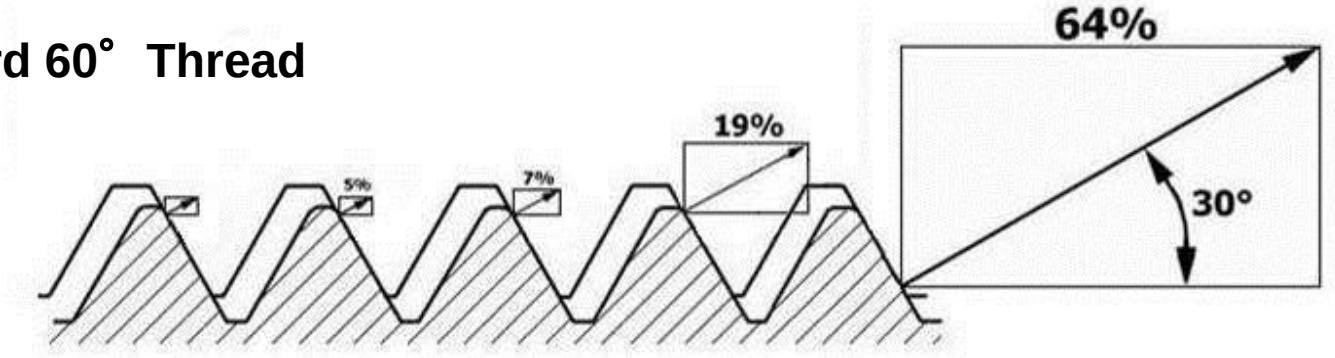


Clamp tension



Thread Stress Distribution – Photoelastic Study

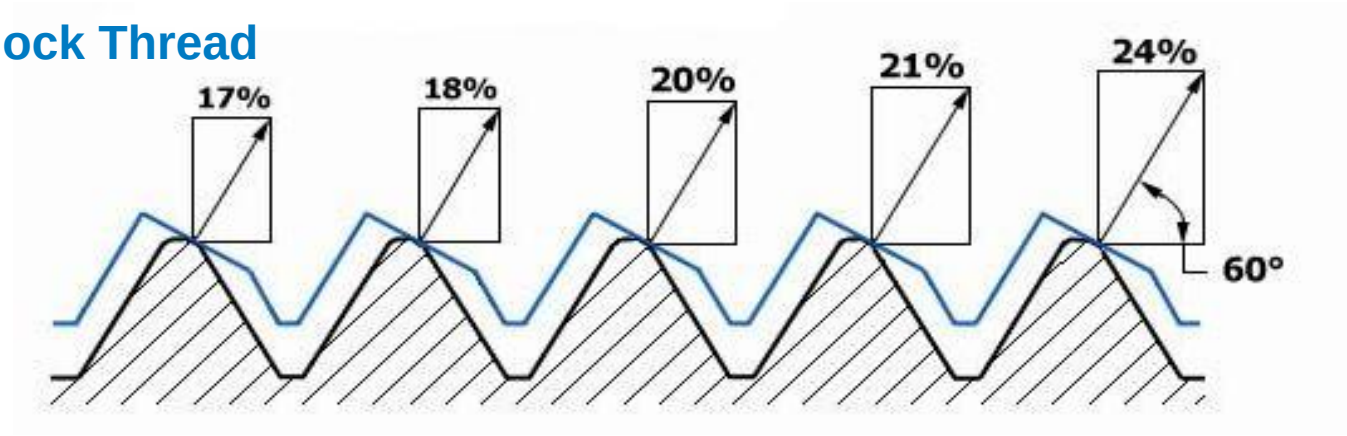
Standard 60° Thread



Stress concentrated on first engaged thread; prone to stripping

Direction of Tension

Spiralock Thread



Radial thread loading distributes stress; improves fatigue life

Source: Kaynar Corporation

Spiralock Fastener Selection

Examples:

- Hex flange nuts
- Self-clinching nuts
- Molded & ultrasonic inserts
- Made-to-order fasteners

Identifying Spiralock

- “SPL” marking
- Can be coated or coloured with dye to suit requirements – greens, reds, blues etc..
- Gauging

Threading Holes with Spiralock Tools

Tapping – Cut and Forming

Multi-Purpose

T-10 Straight Flute

Cold Forming

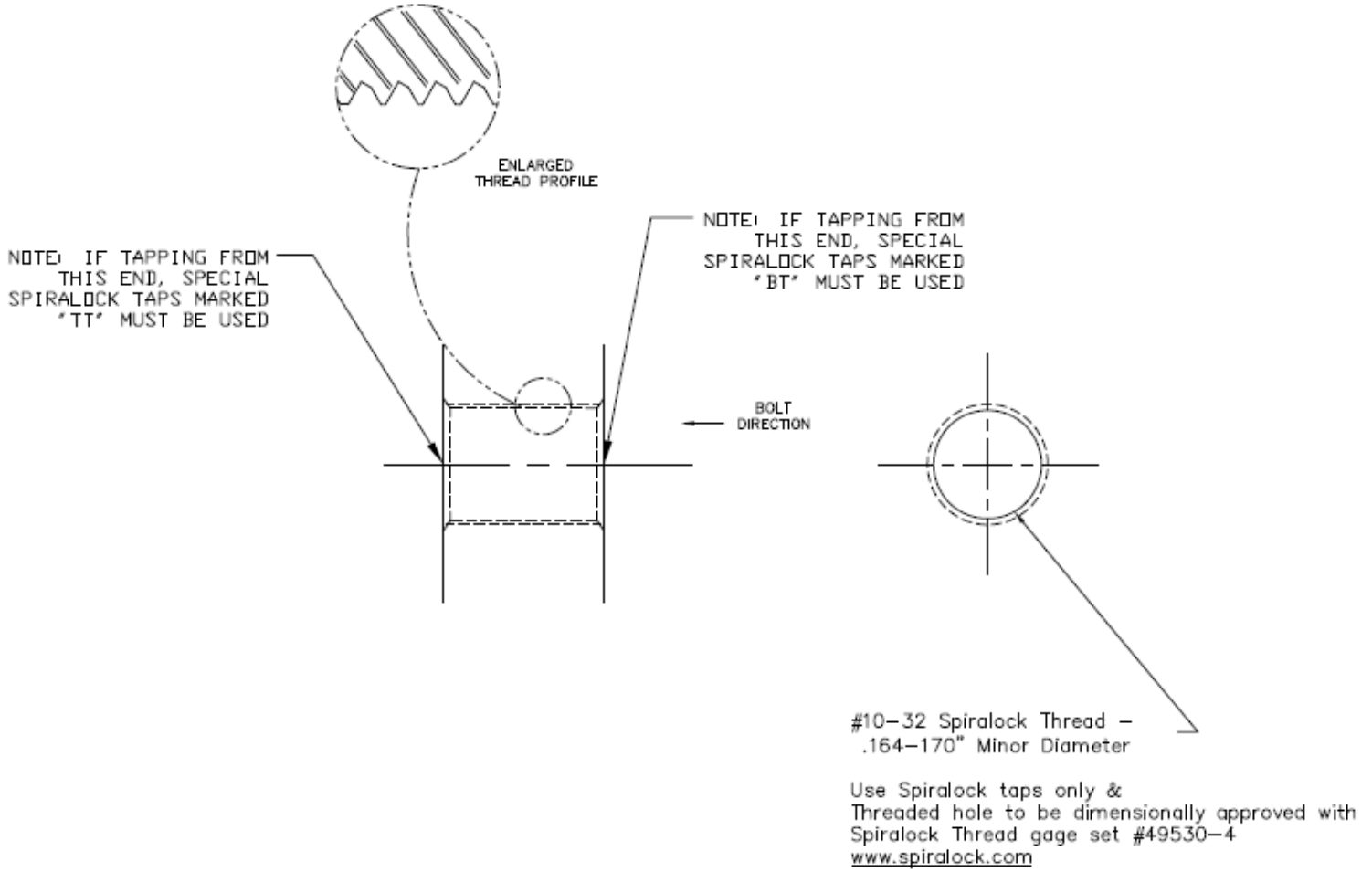
High Performance

Thread Turning

Thread Milling

The purchaser of Spiralock® tools shall have the right to use Spiralock® tools to thread blind and through holes in all elements other than "Fasteners", which are defined to mean discrete male and female threaded elements, the primary purpose of which is to engage or accept a complimentary threaded element. If your application requires a Spiralock ® Fastener, Spiralock Corporation offers a full line of Spiralock fasteners to meet your needs.

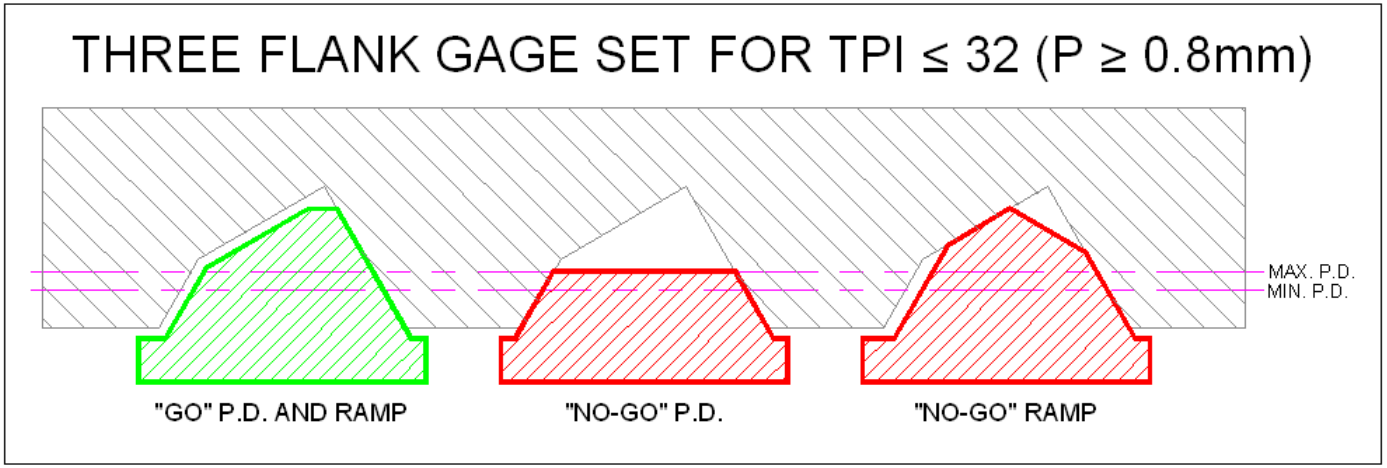
How to specify Spiralock® on drawings

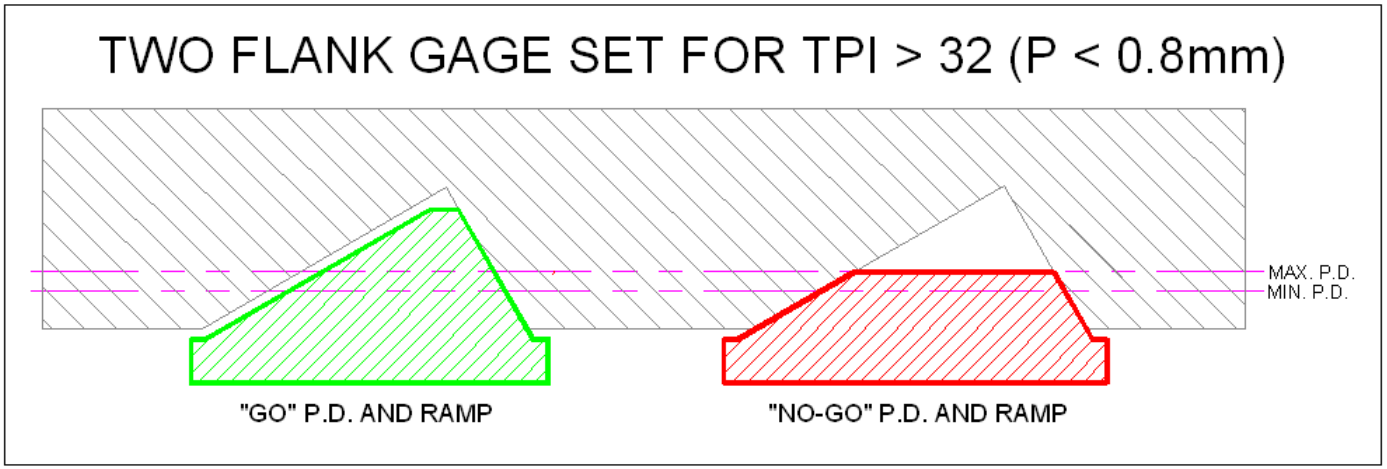


Checking Threads with Spiralock Gages

- Three Part Gauging System
- Checks Pitch Diameter & Thread Geometry
- Certified per MIL-STD-45662A & ANSI / NSCL Z540-1-1994

Spiralock Gauging System





Typical Industries where Spiralock is used

- Oil and Gas
- Aerospace
- Automotive
- Medical
- Power Generation
- Farm and Construction
- Electronics
- Truck
- Shipbuilding

THANK YOU.

STANLEY®

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