Bolting Basics

HYTORC

January 10, 2018

HYTORC

Invented the First Hydraulic Wrench in 1968.

HYTORC Corporate Headquarters

John K. Junkers International Distribution Center

HYTORC's Mission

- **Industrial Bolting**
- **Safety, Quality and Schedule**
- **Innovative solutions**
- **World class customer service**

Customer Service

Outstanding Customer Service provides HYTORC a unique advantage.

Customer Service Policy

- FREE Safety Training on Product Delivery
- FREE Semi-Annual User Safety Training
- FREE Annual Safety Seminar on Appointment
- FREE Loaner Tools in case of Failure
- FREE Torque/Tension Consultation Seminar
- FREE Half Day, First Use Supervision
- FREE Annual Product Inspection on Request
- FREE Product Demonstrations
- FREE 12 Month No-Questions-Asked Warranty
- FREE 5 Year Tool Housing Warranty
- FREE Upgrades During the Lifetime of the Tool to Enhance Safety, Durability, and Function

SAFETY
CONVENIENCE
PEACE OF MIND

Training is a key part of our customer service!

HYTORC Bolting Institute - Who we are…

Our instructors have extensive experience and qualifications.

Chris Krantz

Kerwyn Bornell

John Lay

Randy Reagan

Tom Wick

- Extensive Industrial Bolting Experience
- OSHA Authorized Outreach Trainers
- ASME Authorized Training Instructors
- Qualified Bolting Specialists
- Mechanical Engineers
- Bolting & Safety Subject Matter Experts
- HYTORC Employees

HYTORC® BOLTING INSTITUTE

HYTORC Bolting Institute (HBI)

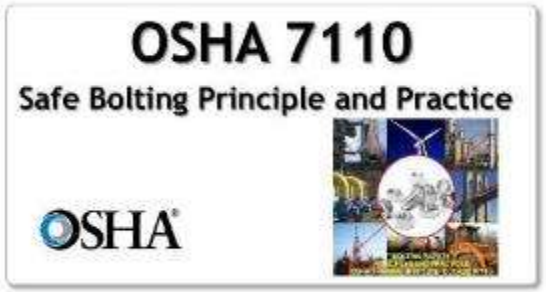
HYTORC believes that Training is the Key to Safe Bolting!

HYTORC

2 hours
Free!

2-to-4 hours
Free!

OSHA



8-hours
$150

ASME

20-hours
Online
+ Hands-On
Evaluation
$1,000

16-hours
Classroom
$1,450

Training
Card or
HYTORC
Certificate

OSHA
Certificate

ASME
Certificate

Bolting Basics

Principles of Bolting

and Pressure Joint Closure

HYTORC

January 10, 2018

BOSS Training Series

Basic Operation and Safety School

Applications

Most all bolting applications fall into one of three categories.

Pressure Vessels and Piping

Machinery

Structural

Soft Joints → **Hard Joints**

Field Maintenance

Often → **Never**

Pressurized Applications

The goal of pressurized joints is to operate leak-free under all conditions, yet allow for easy disassembly and re-assembly.

Characteristics

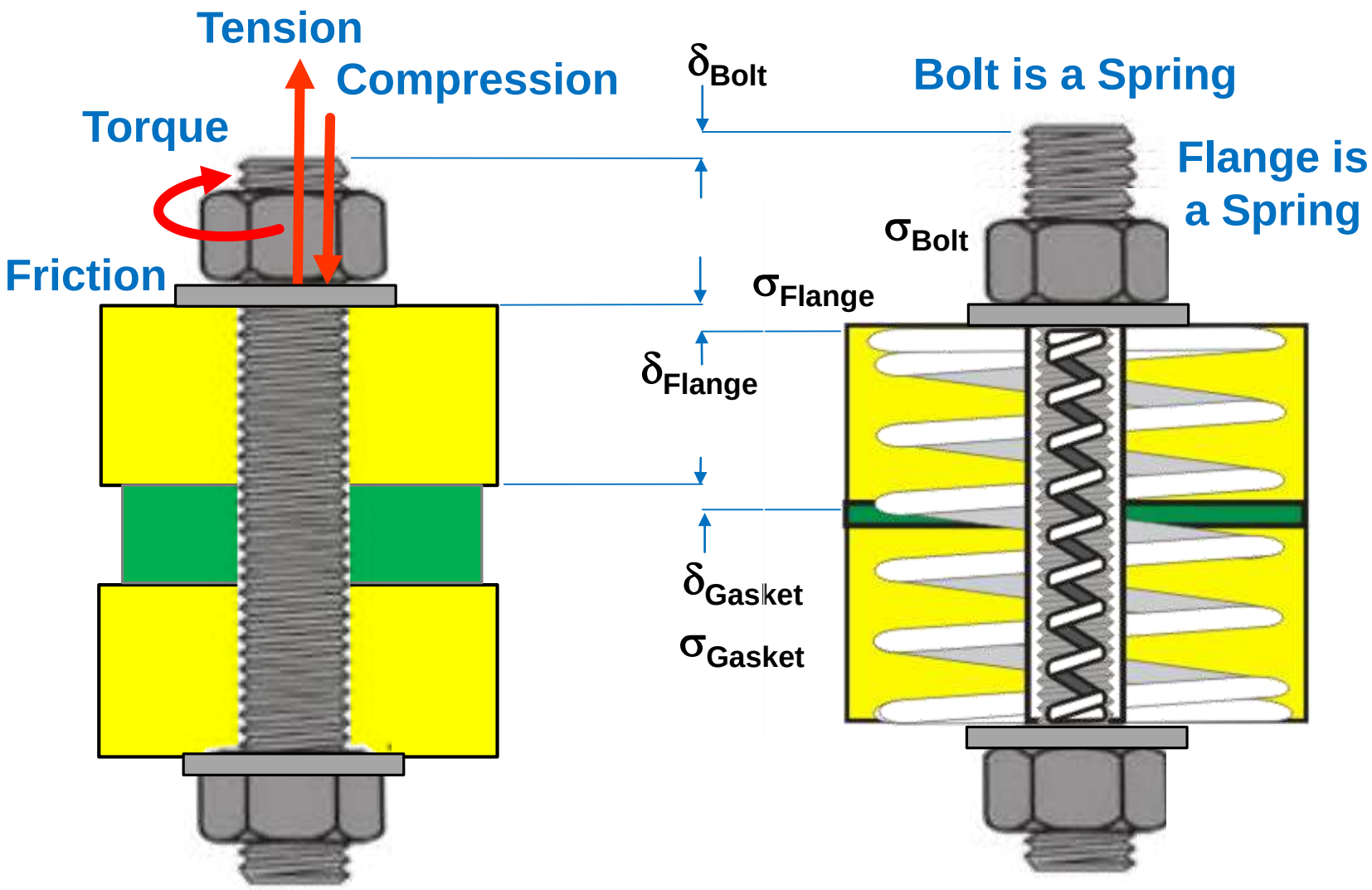
- Flanges with interdependent bolts
- Gasket required to achieve a seal
- Generally standard configurations and sizes
- Wide variety of media; gases, liquids, flammables, corrosives
- High/low and varying temperatures and pressures

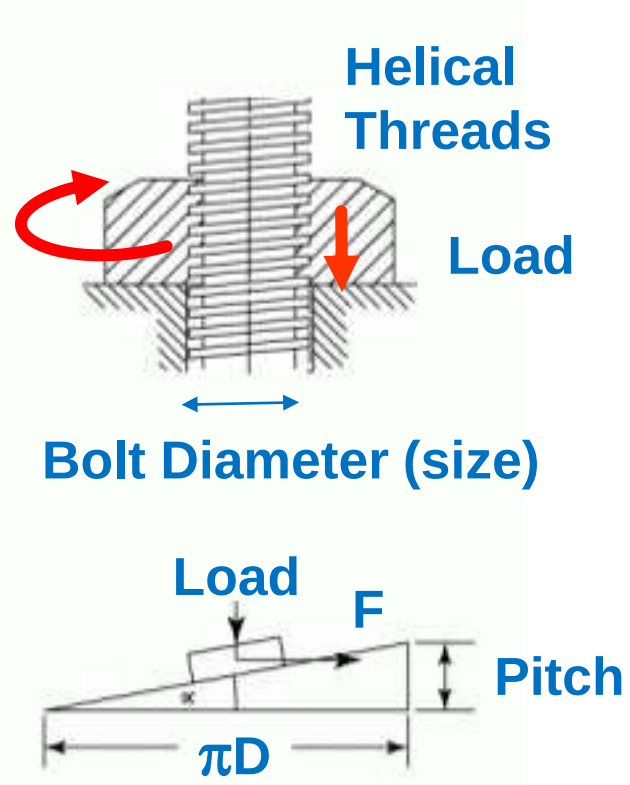
Predominant in:

- **Oil & Gas Production**
- **Oil, Gas and Chemical**
- **Refining**
- **Nuclear, Steam & Hydro**
- **Power Generation**
- **Boilers**
- **Heat Exchangers**
- **Steam Systems**
- **Pipelines**
- **Pumps**
- **Fluid Systems**

Bolt Mechanics

The bolted joint flange assembly is a complex mechanical device with high forces & stress, requires careful selection of bolting parameters and assembly methods.





The bolt & nut threads act as an inclined plane or wedge providing high mechanical advantage

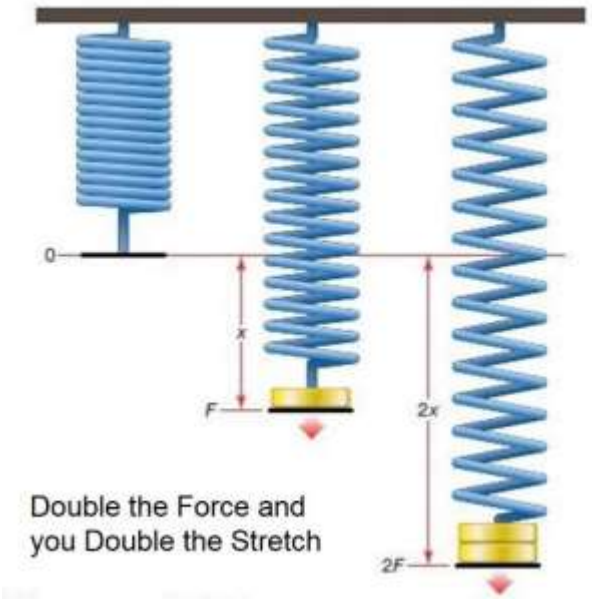
Elasticity

“The force needed to stretch or compress a spring by some distance is proportional to that distance”

Hooke’s Law

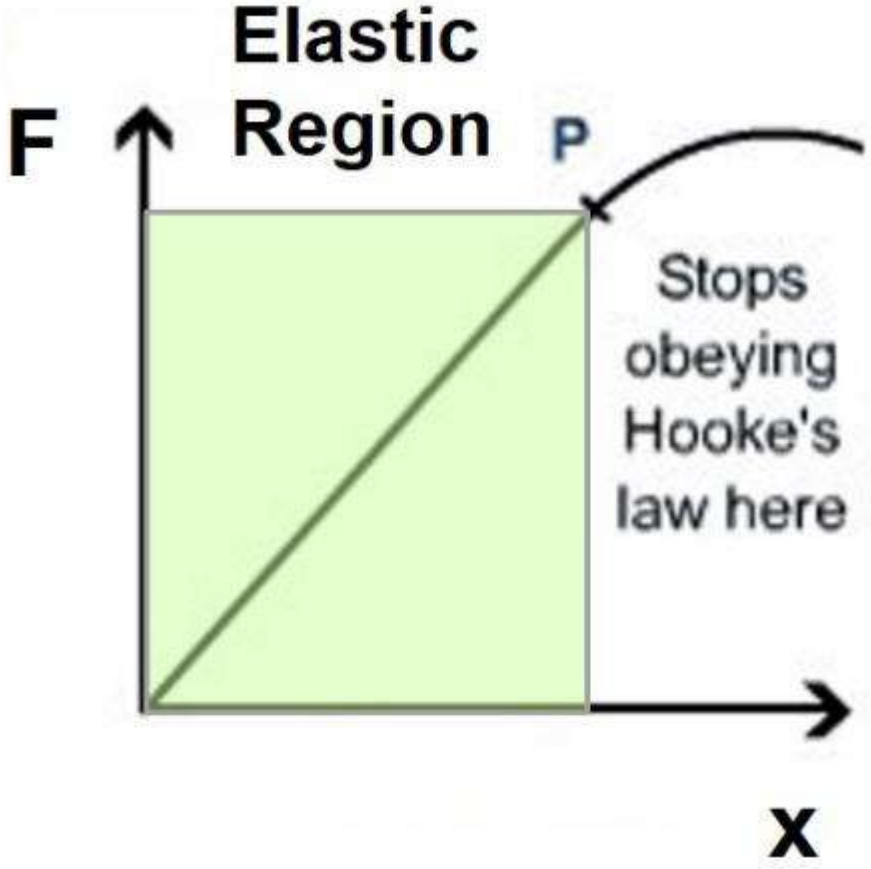
The stretch is linearly proportional to the force

$$F = k\ x$$



Who Said That?

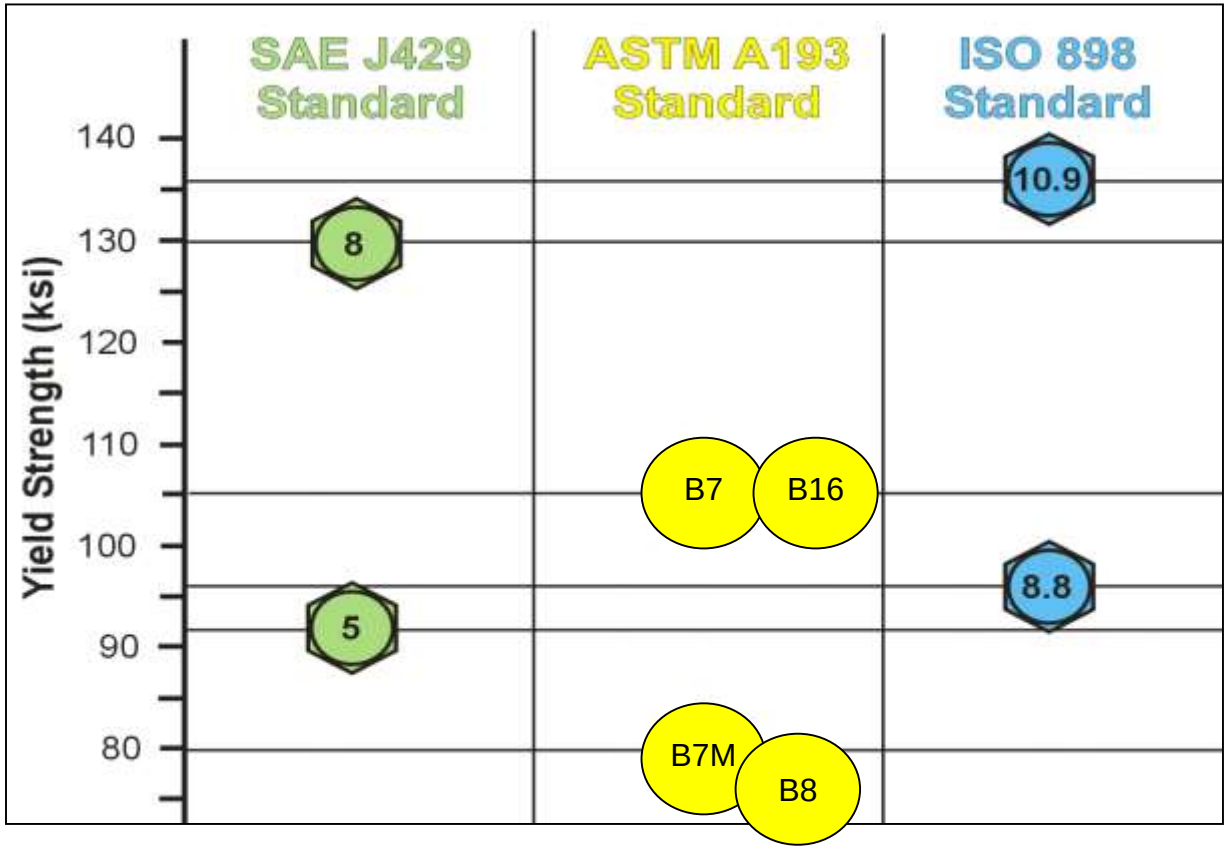
Robert Hook (1653-1705)



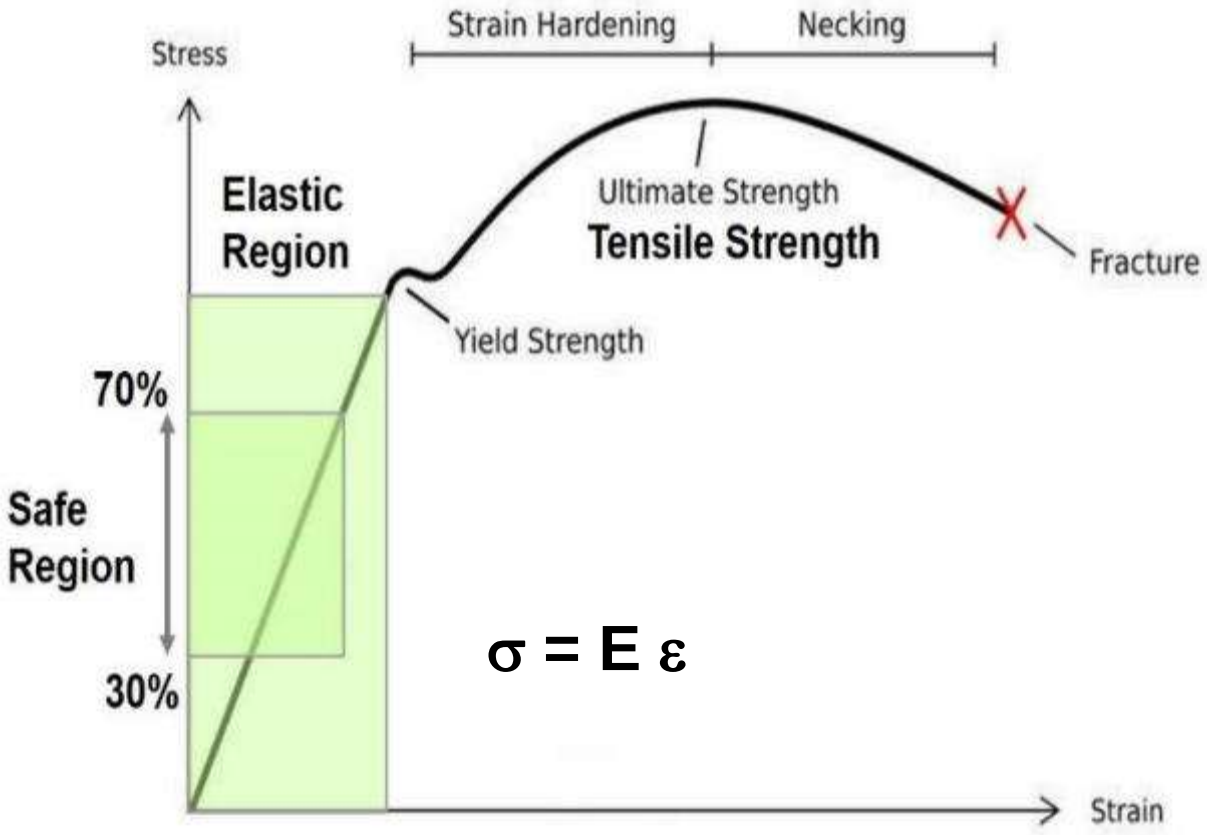
Bolt Strength

Bolt material grades have been standardized making bolt selection easier, still requires consideration of material strength to achieve reliable and safe assembly.

Grade of Standard Bolts



Typical Stress-Strain Curve



Bolt Yield

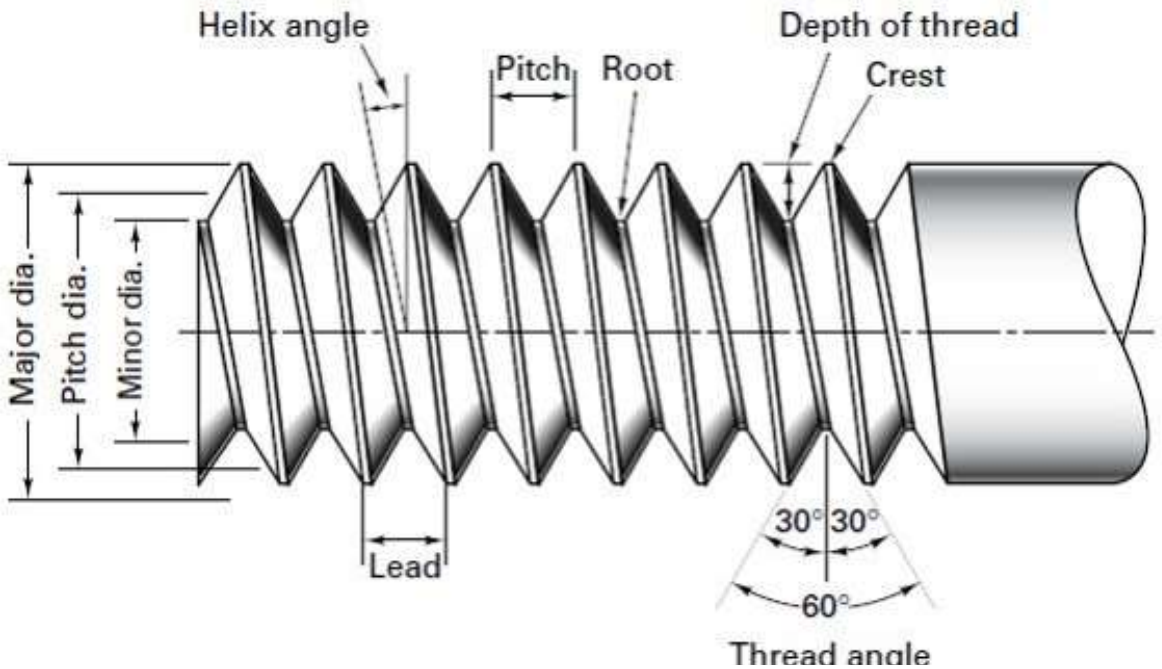
Generally bolts are assembled an operated well below the material yield point, usually a safe target stress is specified as a % of yield stress.

Not yielded

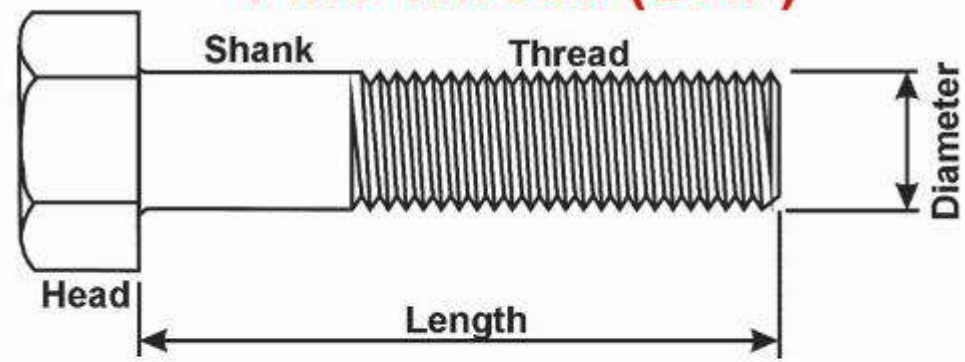
Yielded

Comparison

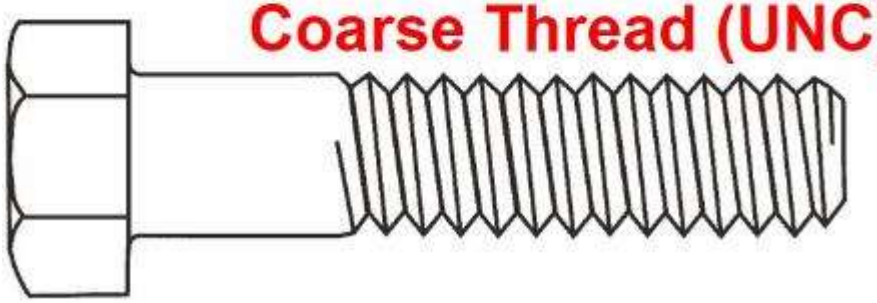
Fastener Terminology



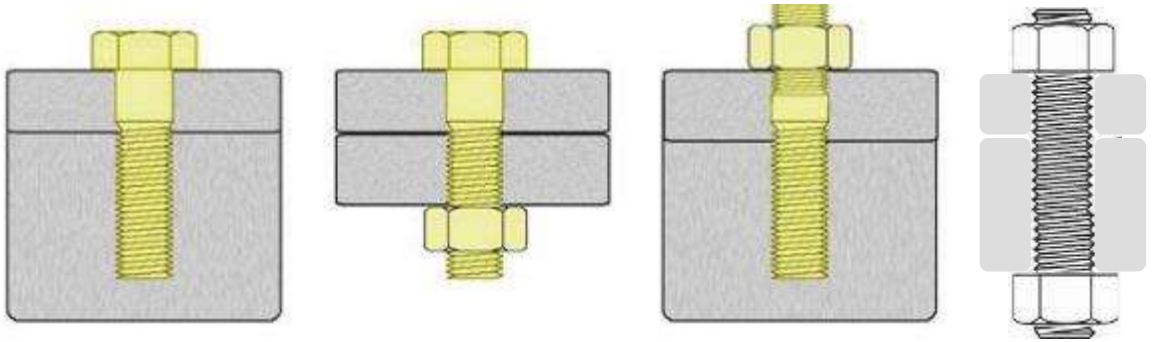
Fine Thread (UNF)



Coarse Thread (UNC)



Screw **Bolt** **Stud** **Headless Bolt**



The basic size of a thread is given by its diameter and pitch.
Inch example: 1-1/4”- 7 UNC
Metric example: M24 x 3

Pitch for inch (UN or Unified National) is “threads-per-inch” (tpi)
Pitch for metric (ISO) threads is “mm from crest to crest”

Bolt Failure

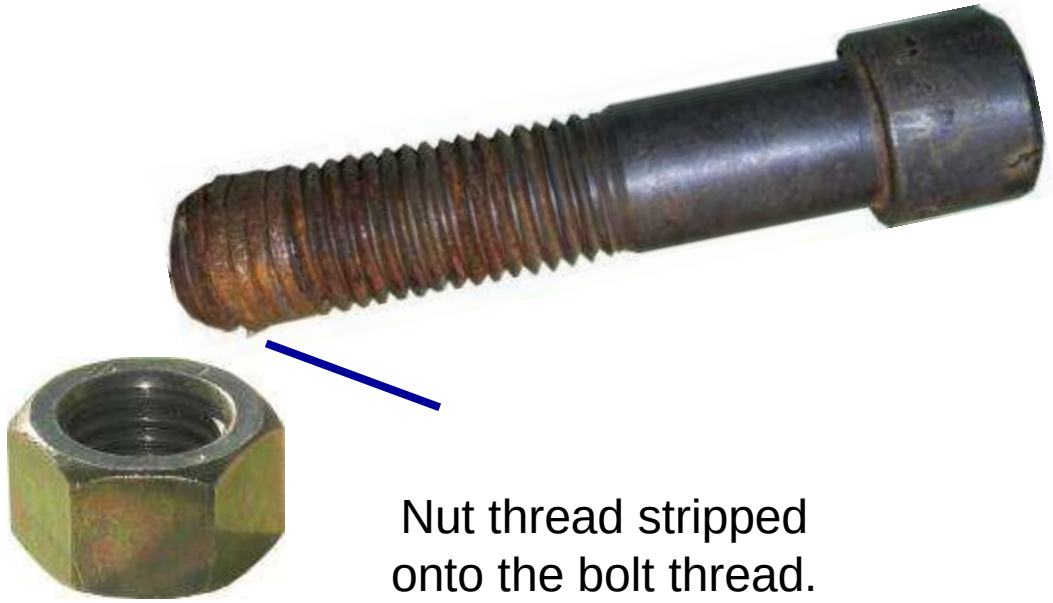
Bolts and nuts have different failure mechanisms.

Bolts Fail Under Tension

- Fail by sudden fracture
- Apparent during tightening

Nuts Fail Under Compression

- Fail by thread stripping
- May not show up until later



Nut thread stripped
onto the bolt thread.

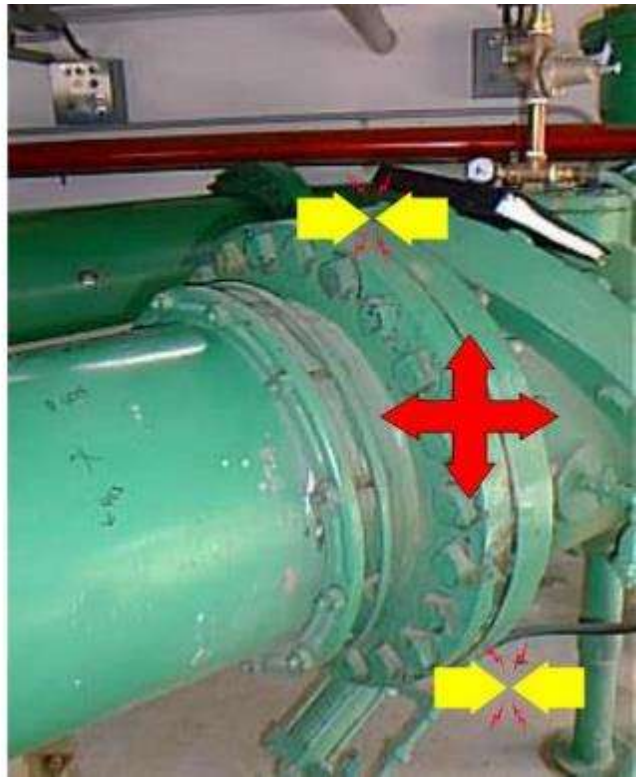
Load is the Goal

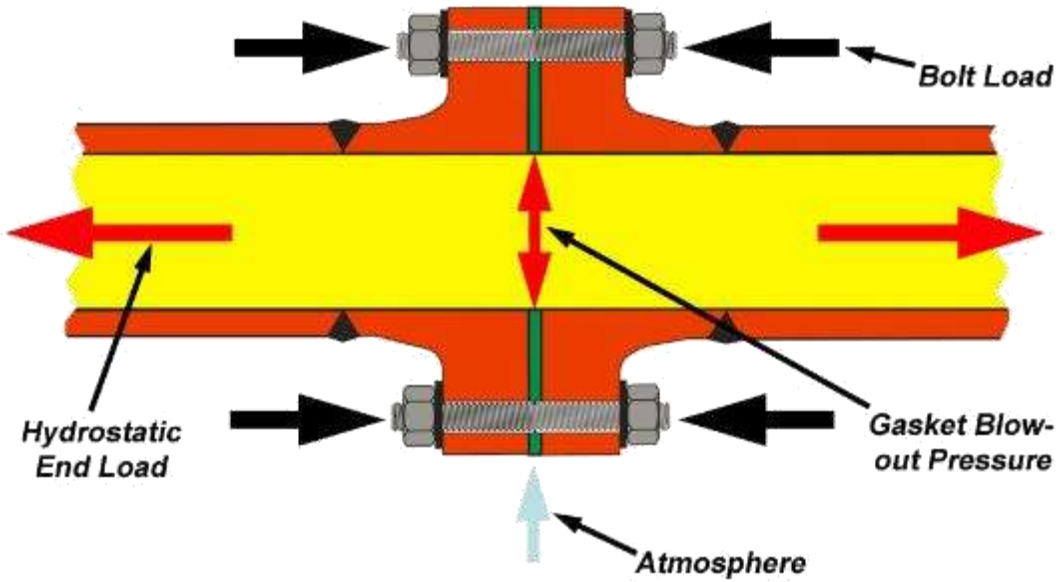
Pre-Load is applied to the joint prior to applying system pressure.

“Pre-Load” or “Clamping Force”

The Total Pre-Load (Bolt Load) is the force clamping the joint together

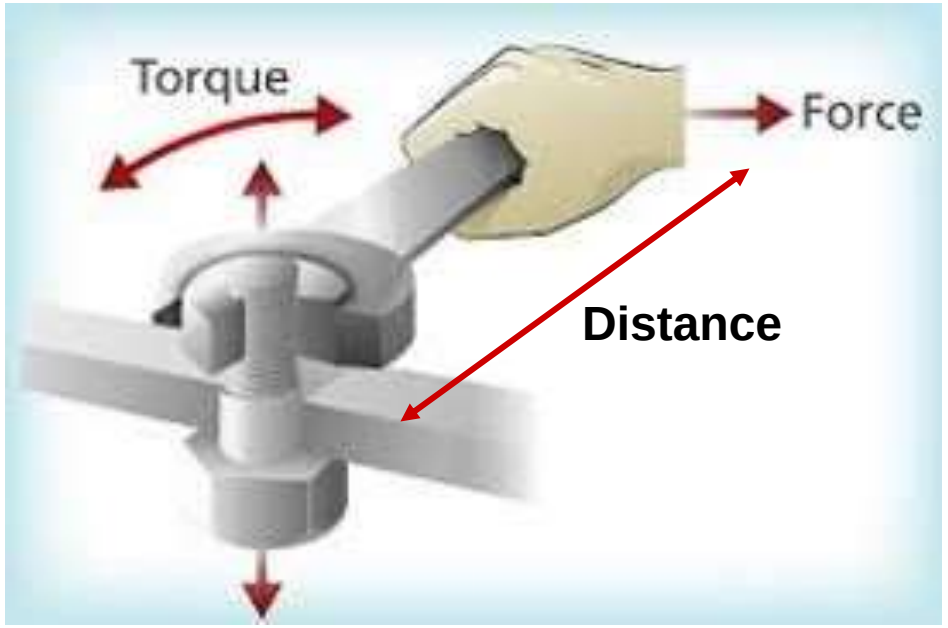
Pre-load must be greater than the pressures trying to push the joint apart





Tightening with Torque

Torque = Force x Distance
e.g. ft-lb or N-m

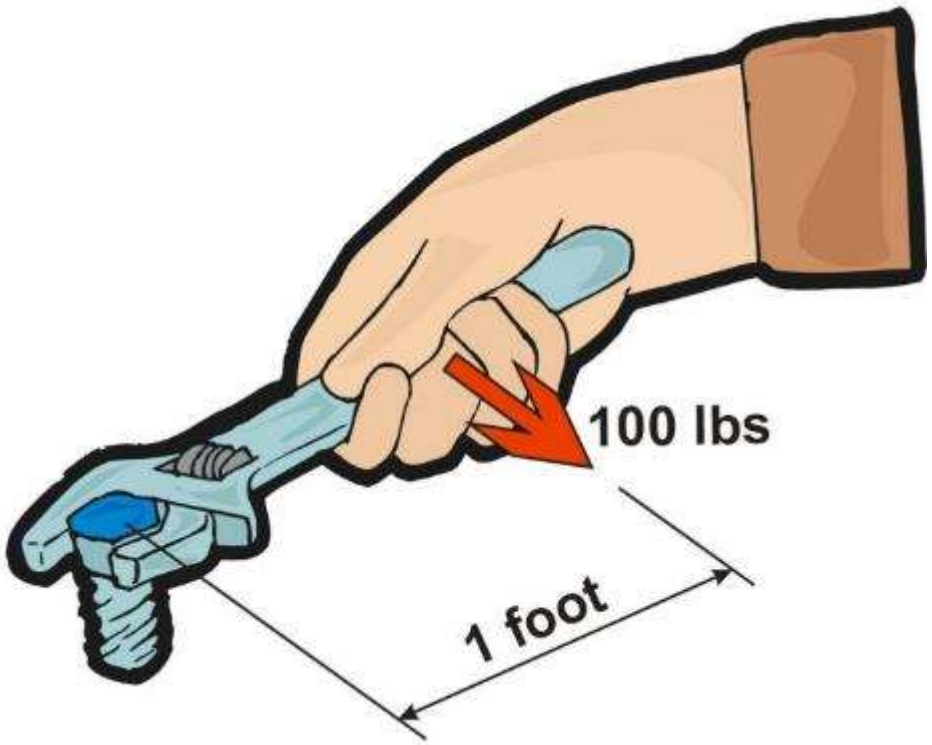


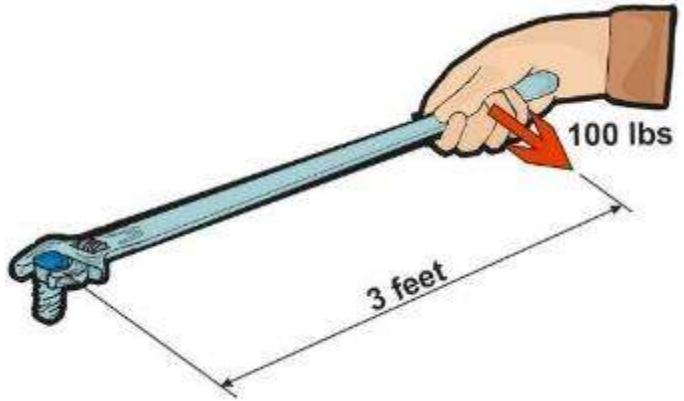
Very High Force in the Screw

As the nut or screw turns, the threads create a Mechanical Advantage and generates a very high force in the screw

Increasing Torque

Increase torque by increasing the lever arm or increasing the applied force.





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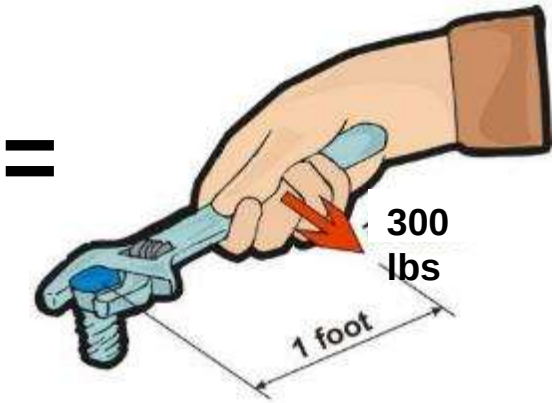


3 ft. x 100 lbs. = 300 ft/lbs **1 ft. x 300 lbs. = 300 ft/lbs**

If you want more torque, get a longer lever or more force.

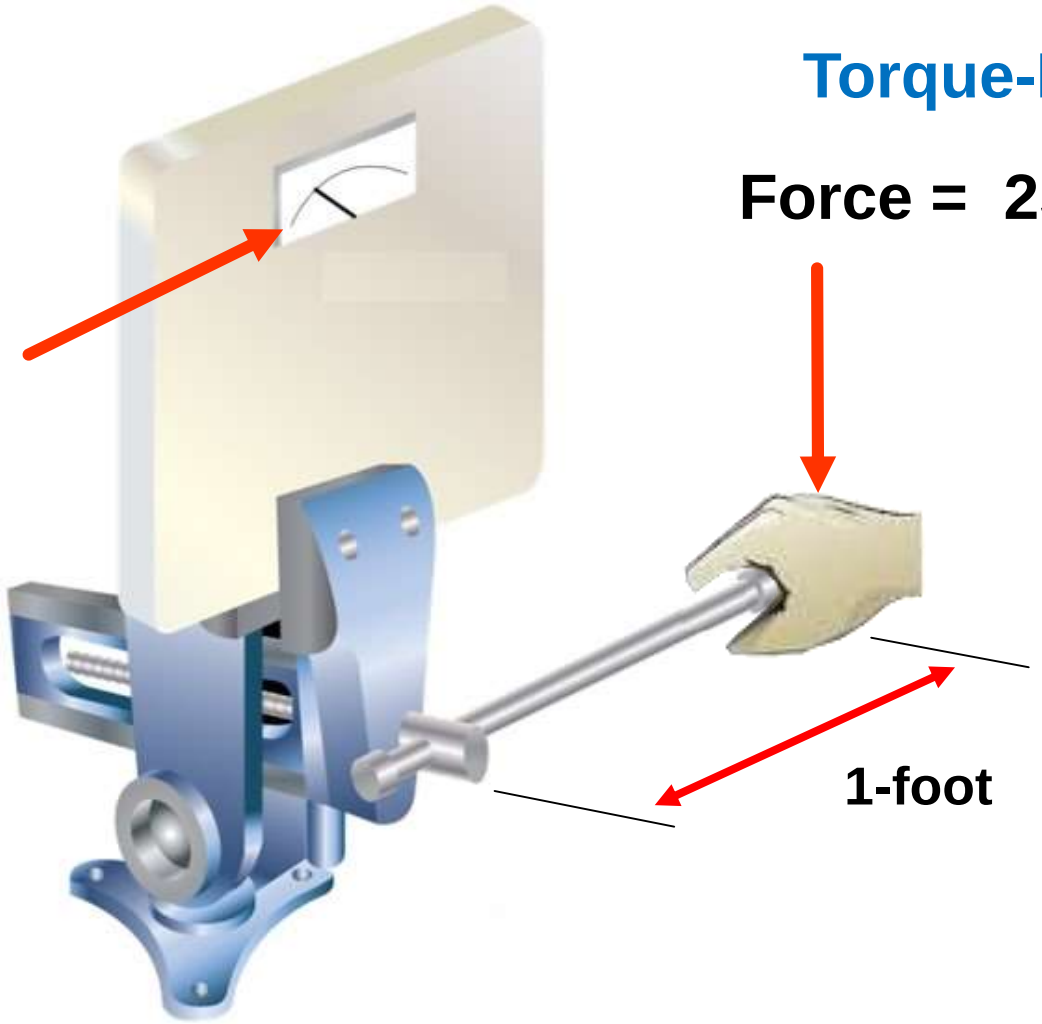
Tightening with Torque

Torque is widely used as a method to tighten bolted flange joints, because torque is easy to apply and to measure.

Torque-Load Relationship

Force = 25lb

What is the Load (Force) on the scale?



What is the Torque?

Torque = Force x Distance

Torque = 25lbs x 1 ft
= 25 ft-lbs.

Tightening with Torque

Torque can be applied with a many different technologies, each having advantages and limitations.

Ft-lbs.

100,000

10,000

1,000

100

Finger/ Hand Tight < 20

Snug Tight 25-100

Clicker Wrench 25-500

Breaker Bar 500 – 1,000

Electronic 25 - 3,000

Pneumatic 50 - 8,000

Hydraulic 200-130,000

Manual

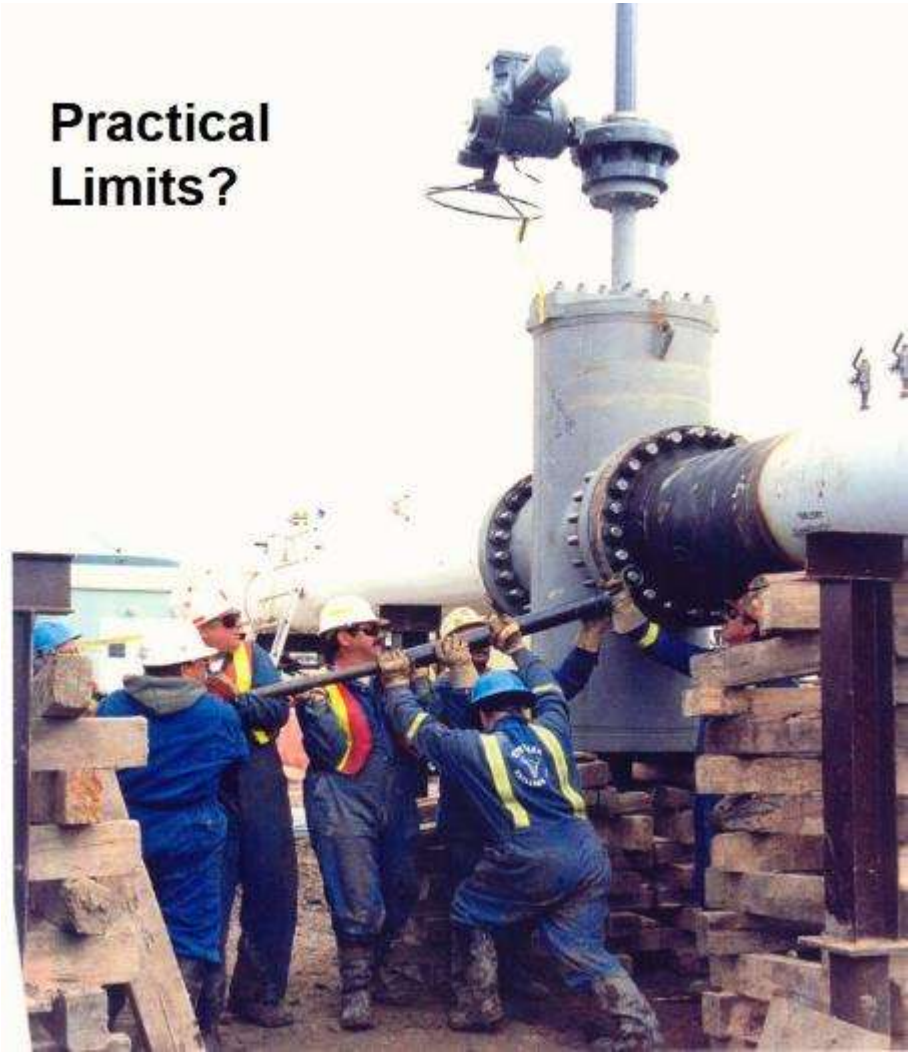
Power Torque Technology

Human Limitations

“Give me a lever long enough and a fulcrum on which to place it and I shall move the world.”

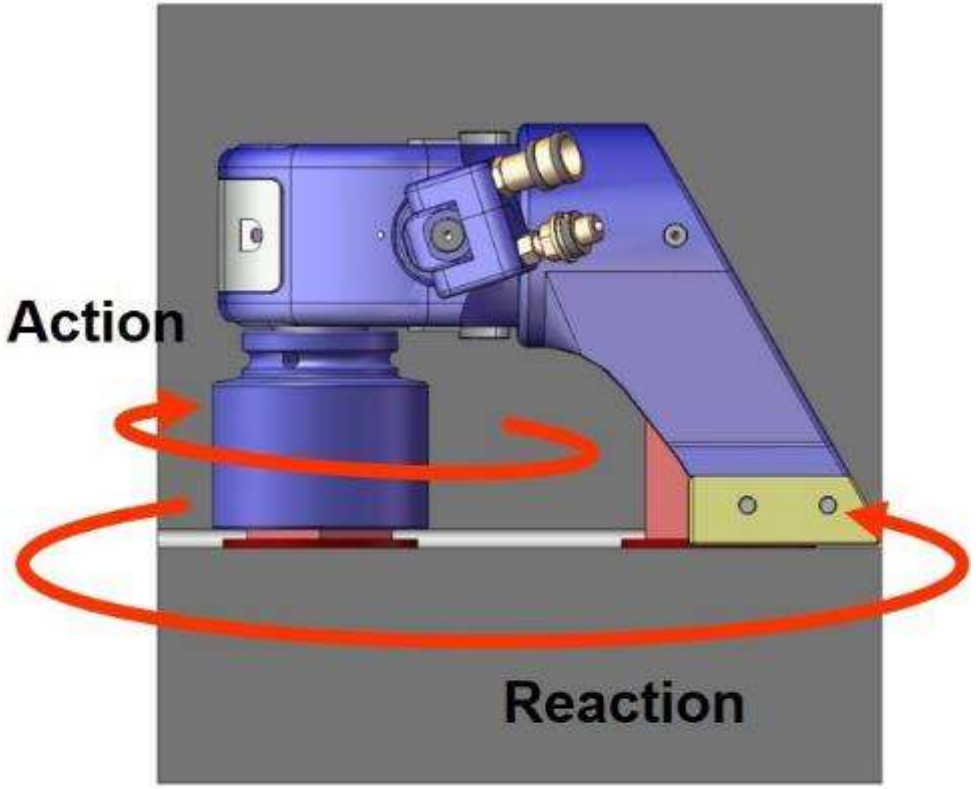
Who Said That?

Archimedes, AD 340



Conventional Torque Reaction Forces

Using conventional torque tightening methods and tools, the application of torque by the driver generates an equal and opposite torque on the tool – must be braced typically with reaction arm.

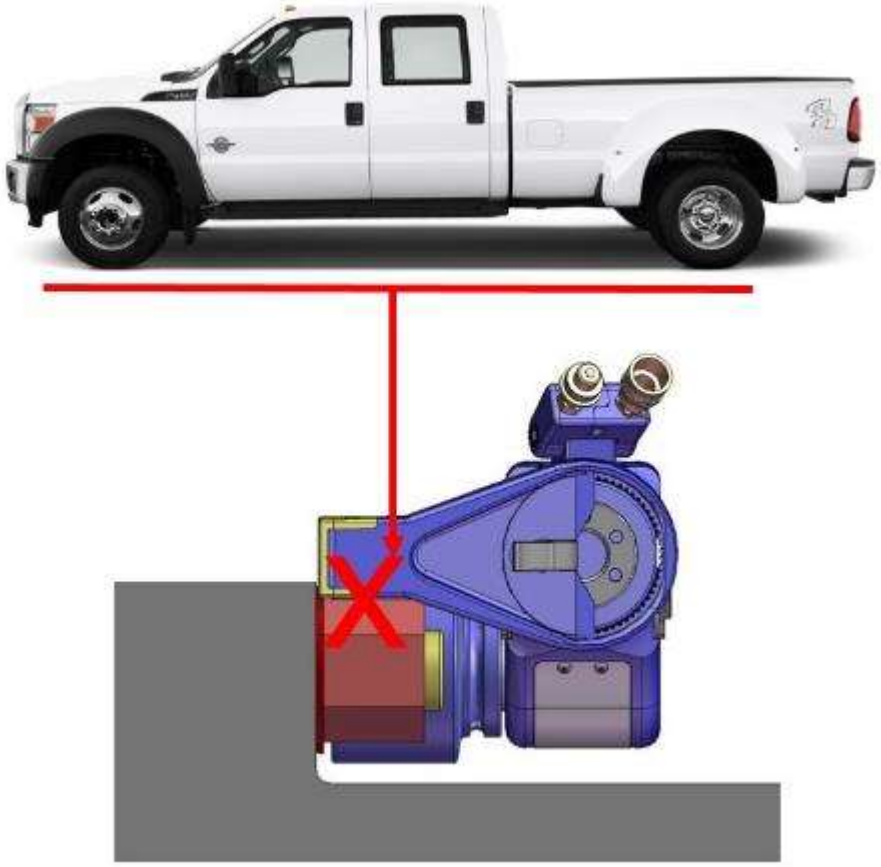


Action – Reaction

For every Tool Torque action driving a nut in one direction there is an equal opposition Torque called “Reaction” driving the tool body in the opposite direction.

Equivalent to a Truck

Looking at this from a different angle, this reaction force is just like parking the entire weight of your truck at a single point



Coordination Issues

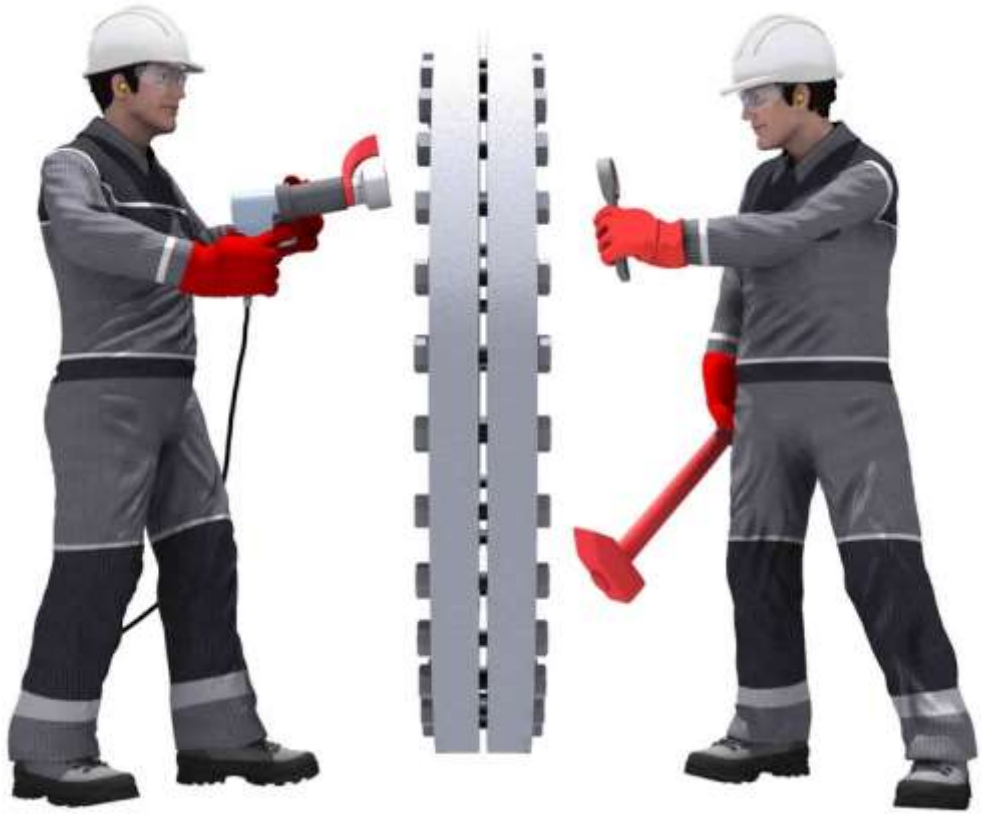
Applying torque using conventional reaction arms and backup wrenches requires coordinating activities to manage reaction forces in both the front and back of the flange.

Must have the correct reaction arm for each application

The exact correct reaction arm or fixture is required for each application and must be available and used at all times. If the correct reaction arm is not available, the job must be stopped to find or order the correct fixture causing delays to schedule. In the absence of the correct fixture, the technician may be tempted to use an incorrect fixture just to get the job done on schedule. Using incorrect fixtures can lead to major equipment damage and significant safety issues.

Active Side
Side where nut is torqued

Passive Side
Side where back nut is held stationary



May require extra manpower to secure the back nut

Tightening bolts with conventional torque techniques involving reaction arms usually involves at least two technicians especially on large flanges. The technician on the active side operates the torque tool while the technician on the passive side secures the back wrench.

Must have the correct backup wrench for each application

A backup wrench must be applied on the back nut in order to keep the back nut from turning under torque. This is an extra extra tool and requires extra planning and coordination to make sure the correct tool is available for the job when it is needed..

Backup wrench may be difficult to release

At the completion of the torque tightening process the backup wrench may often be locked in place against the reaction surface. If this occurs, a tool such as a sledge hammer is needed to pry it loose. This causes potential for collateral damage to equipment and a potential safety hazard.

Conventional Torque Reaction Tools

Using conventional torque tightening methods, the torque tool must be braced typically with reaction arm and the back nut must be braced with a backup wrench.

Reaction Arms and Backup Wrenches Come in a Wide Variety of Sizes and Shapes

Is there a better way?

Given the high concentration of reaction forces involved with conventional torque bolt tightening - and the associated safety hazards and potential damage to equipment…

is there a better way?

Reaction Forces

The reaction arm forces on the front and back wrench forces on the rear create very hazardous pinch points.

Reaction arm pinch hazard

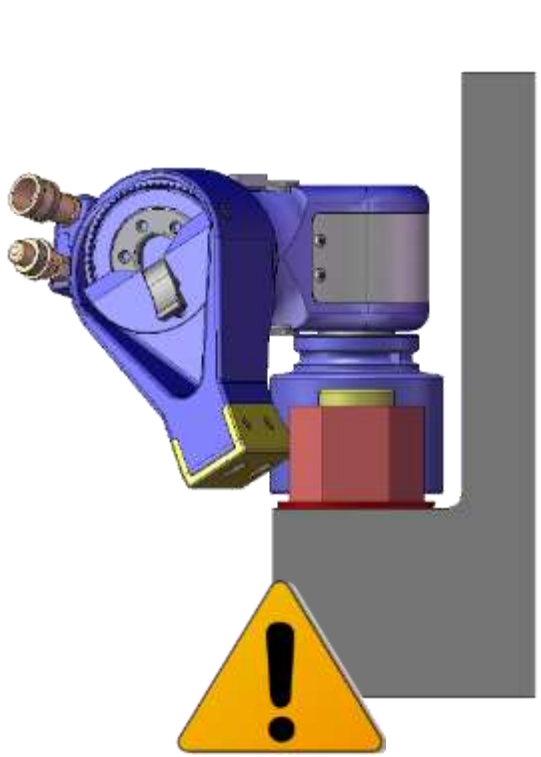
A pinch point is created on the active front side between the he torque wrench reaction arm and the reaction surface. This pinch point is an area where technicians may get their hand caught during normal operations. This can be avoided but only with safety training and constant vigilance.

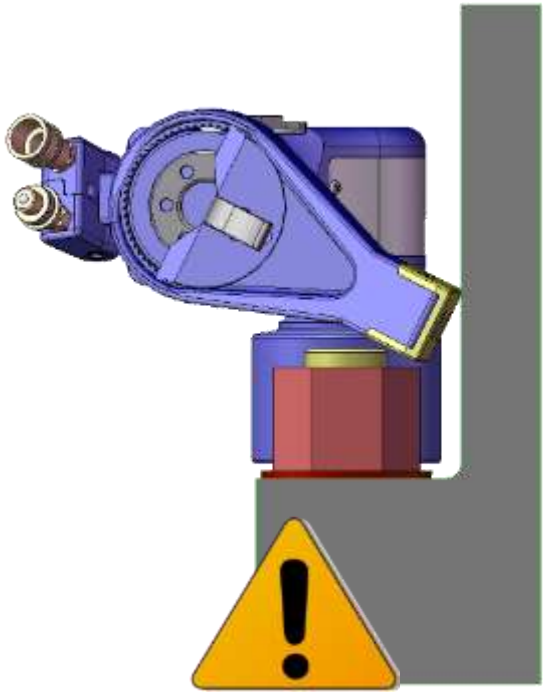
Backup wrench pinch hazard

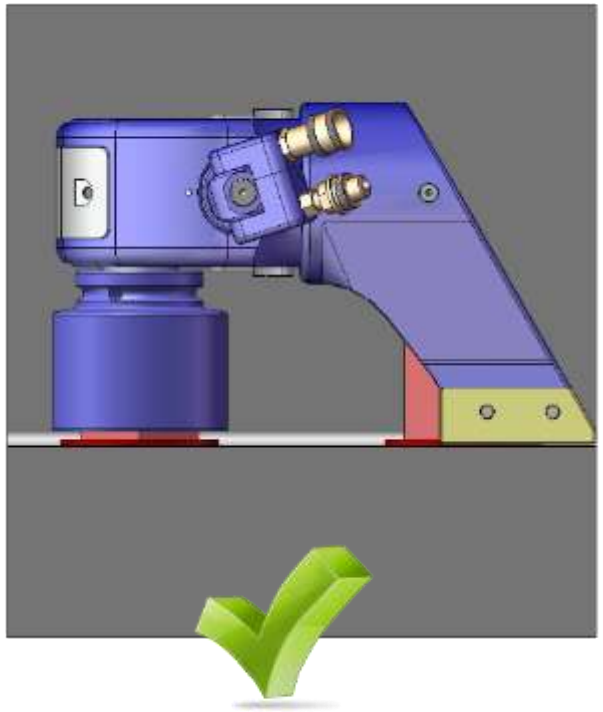
A second pinch point is created on the passive rear side of the flange where the backup wrench is braced against a firm surface. This is a potential area where technicians can get their hands caught. This can be avoided but only with safety training and constant vigilance.

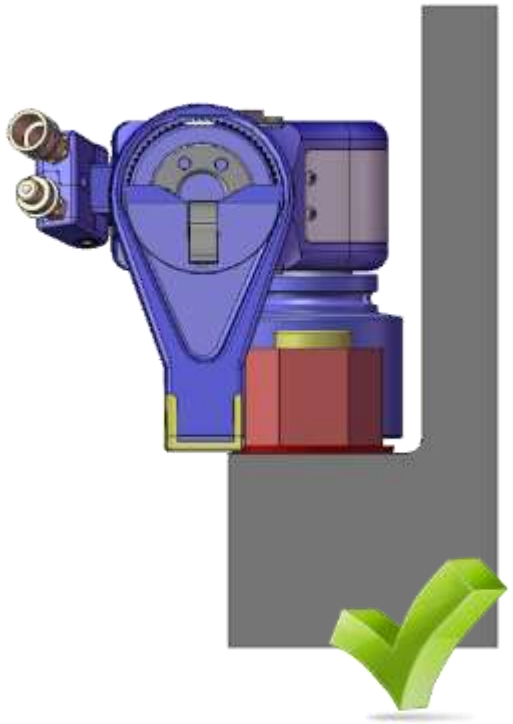
Reaction Forces

Select Reaction Points Carefully









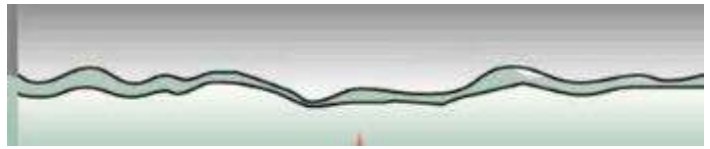
Not Recommended

Recommended

Friction

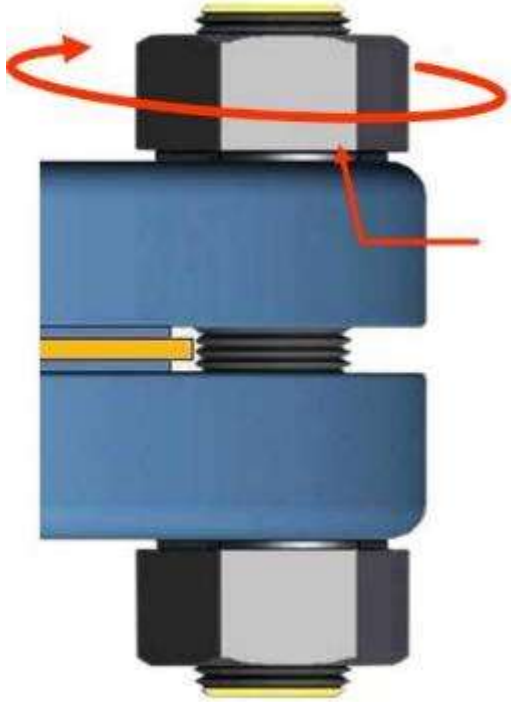
Only 10% of input torque energy is converted into bolt stretch.

Friction

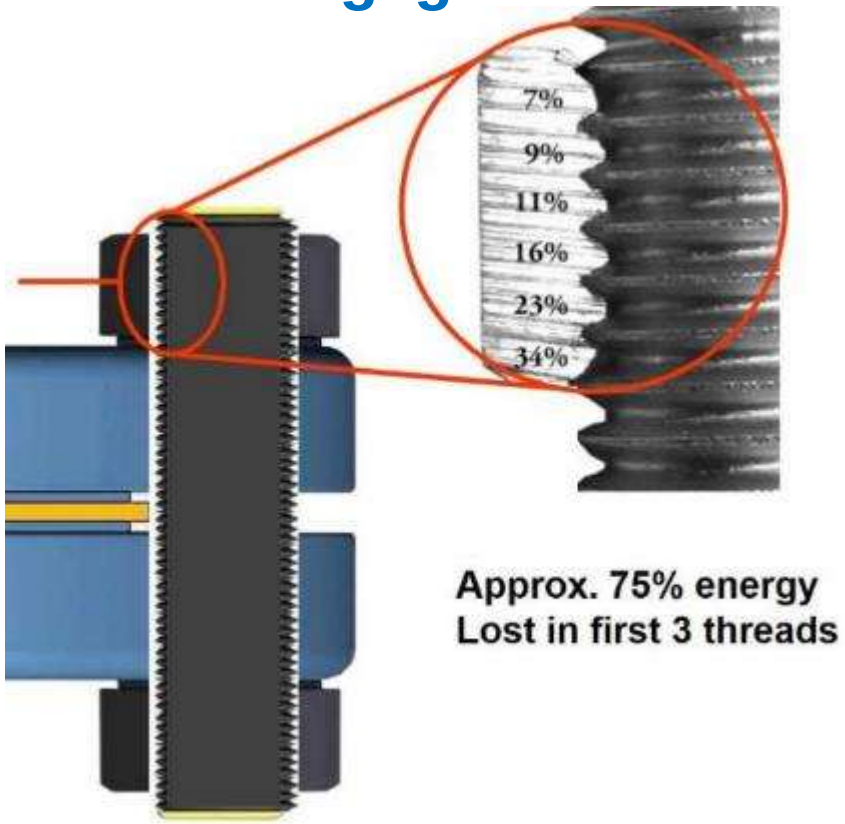


- Friction arises from the surface imperfections as nuts move against flanges and bolts.
- Friction converts kinetic energy into thermal energy – it converts the work to heat.

50% Lost On Nut Face



40% Lost In Thread Engagement



Lubrication

Lubrication is applied to working surfaces.

Threads

Nut Face

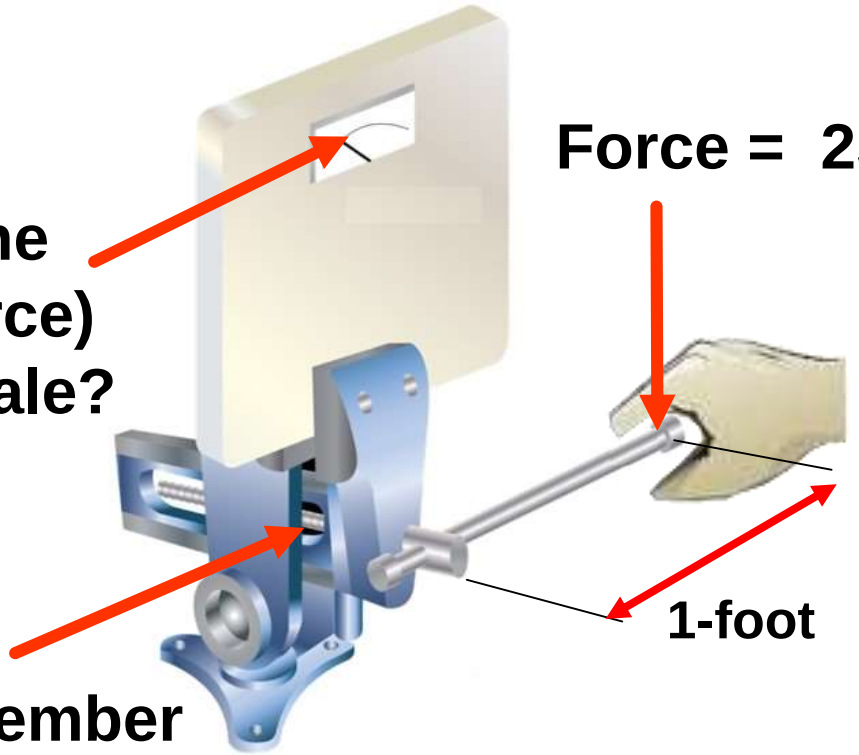
Common Lubricants

Lubrication give a consistent torque-tension relationship and allows the nut and bolt to be re-used.

Friction

To understand the load on the scale we can use a device called a load cell.

What is the Load (Force) on the scale?



Also remember there is a screw and friction at work

Torque = 25lbs x 1 ft
= 25 ft-lbs.

Friction

Applying the same torque, lubrication increases load 2X to 3X, versus dry joint assembly.

Skidmore

$$T = \frac{K \times D \times F}{12}$$

$$\mathbf{K = \frac{T \times 12}{D \times F}}$$

T = Torque = 25 ft-lbs.

D = Bolt diameter = 0.375

Measure F = Force, bolt load

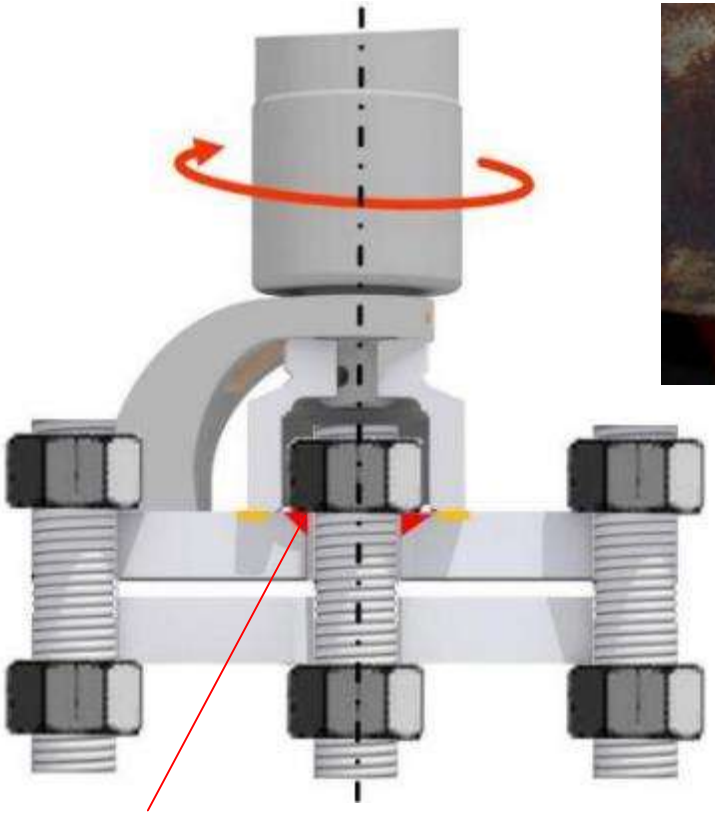
Calculate K = Torque Friction Coefficient

	Dry	Lubricated
F	2,800 lbs.	6,600 lbs.
K	0.286	0.121

Washers!

Without a Washer, metal on metal contact of the nut rotating against the flange causes excess friction and wear

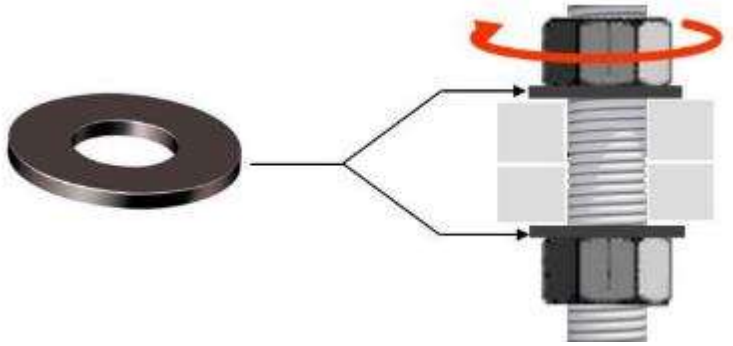
Excess Friction & Wear



High Friction! Nut bearing against the flange

.

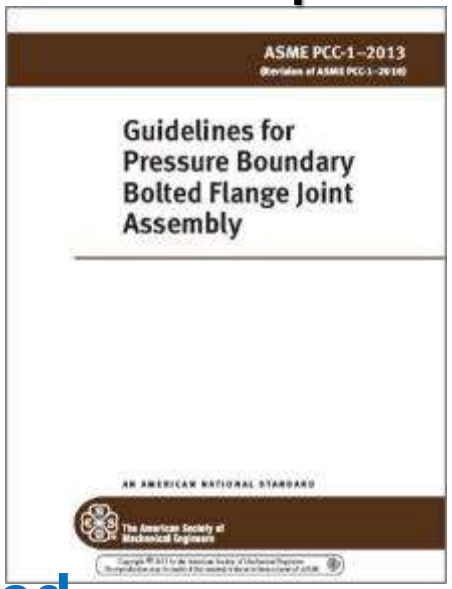
Washer Benefits



1. Flat surface provides square nut rotation.
2. Polished smooth to reduce surface friction.
3. Thin profile fits existing bolts, yet thick enough to protect flange surface.
4. Through-hardened for strength and stiffness to spread load evenly.
5. Stationary, no-rotation.

ASME Recommends Washers

ASME PCC-1 update released in 2013 now recommends washers

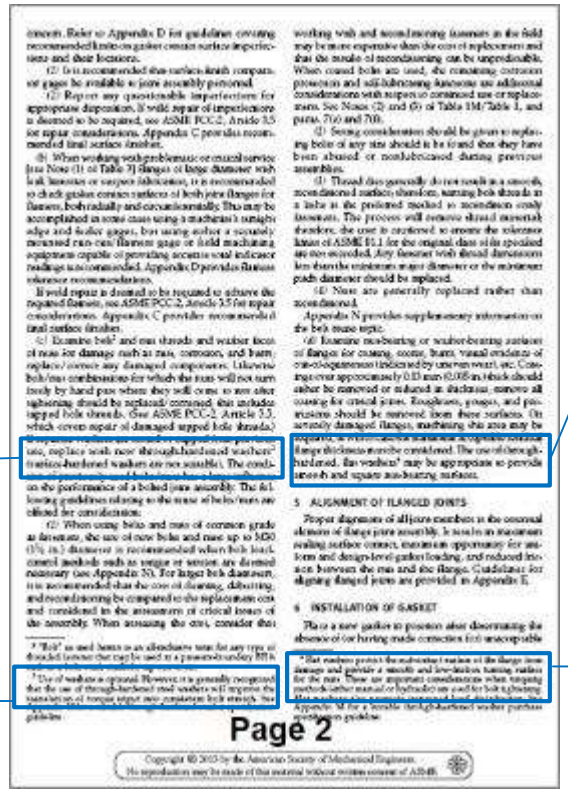


Through-hardened

Replace washers with new through-hardened washers (surface-hardened washers are not suitable).

It is generally recognized that the use of through-hardened steel washers will improve the translation of torque input into consistent bolt stretch.

Improve bolt-load consistency



Flat and smooth nut bearing surface

The use of through hardened, flat washers may be appropriate to provide smooth and square nut-bearing surfaces.

Protect flange from damage

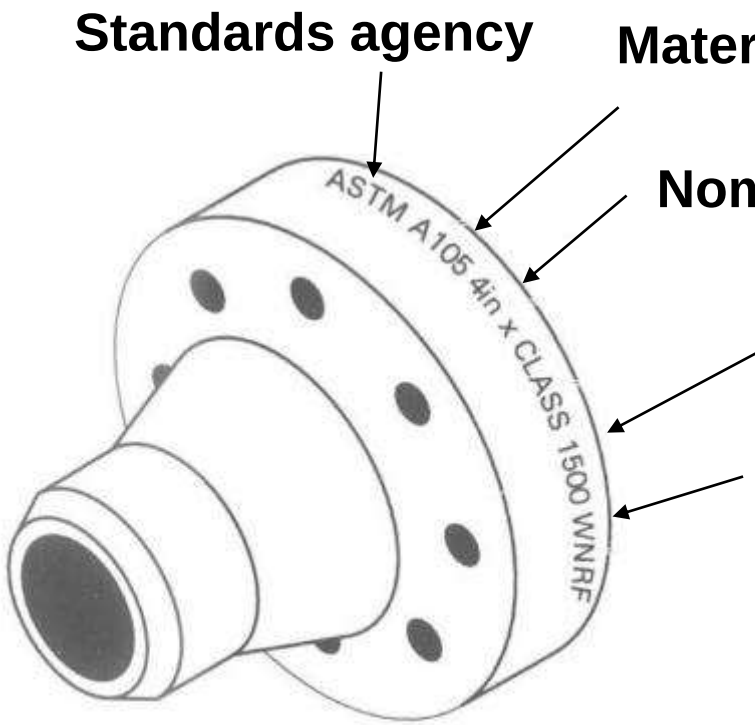
Flat washers protect the nut-contact surface of the flange from damage and provide a smooth and low-friction turning surface for the nuts. These are important considerations when torqueing methods are used for bolt tightening. Flat washers also promote improved load distribution.

Promote load distribution

Flange Standards

Industry standard flanges have significantly improved bolted flange joint reliability.

Flange Markings



Flange Standards

ASME/ANSI
B16.5 covers NPS ½" to 24"
Pressure Classes: 150, 300, 400, 600, 900, 1500 and 2500

B16.47 covers NPSs from 26" to 60
Pressure classes 75, 150, 300, 400, 600, 900

API Pressure Classes: 2000, 3000, 5000

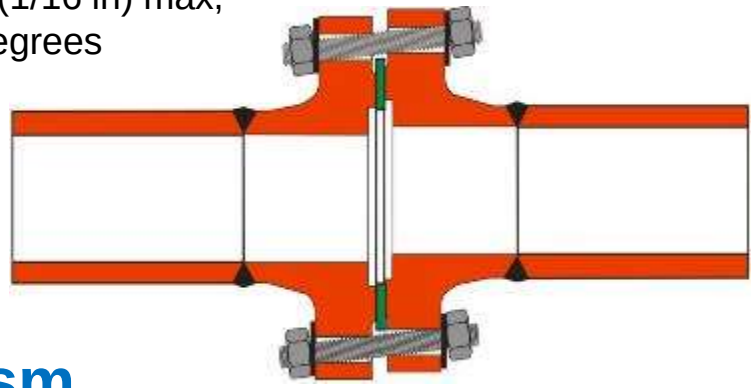
Flange Types

Flange Alignment

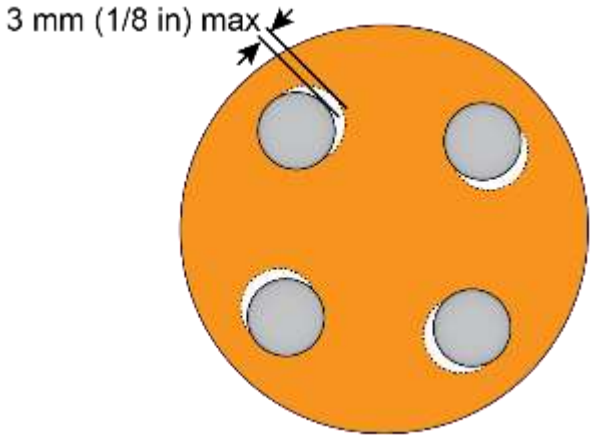
Extreme care must still be given to flange alignment to achieve reliable leak-free assembly.

Center Line High/Low

Offset < 1.5mm (1/16 in) max,
four points 90 degrees



Rotational or Two-hole



3 mm (1/8 in.) maximum gap,
Observe fasters pass through
flange at a 90-deg angle

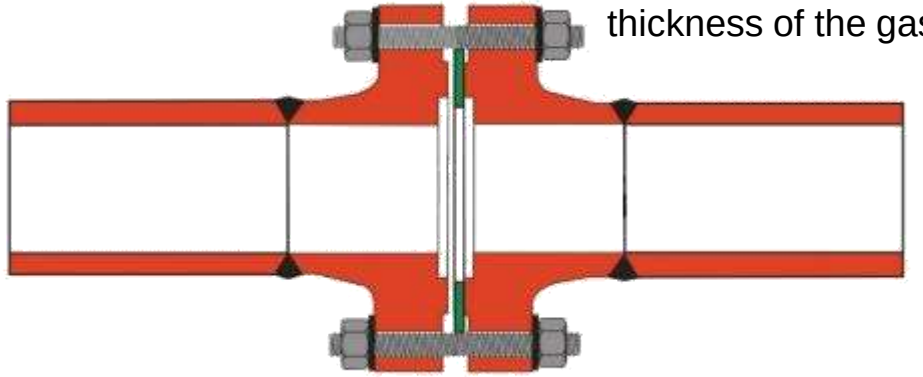
Parallelism

Maximum 0.8 mm(1/32 in) difference between the widest and narrowest achieved using a force no greater than 10% of the maximum torque or bolt load for any bolt

THESE DEFECTS CANNOT BE CORRECTED BY BOLTING ALONE!

Excessive Gap

Greater than twice the thickness of the gasket

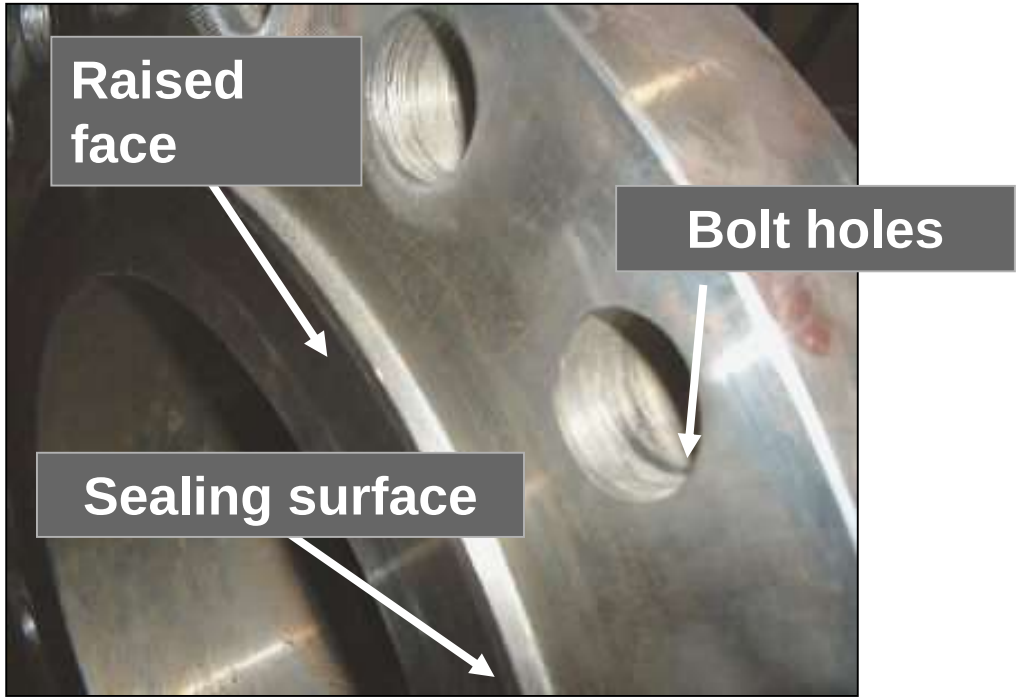


When aligning flanges, no single bolt should be tightened above 20% of maximum bolt load.

Critical Surfaces

Before assembly is started, clean and examine flange and fastener contact surfaces and ensure they are prepared per industry guidelines.

Sealing Surface



- The sealing surface has concentric grooves to grip the gasket.
- Damage here can result in leaks that cannot be fixed by tightening alone.

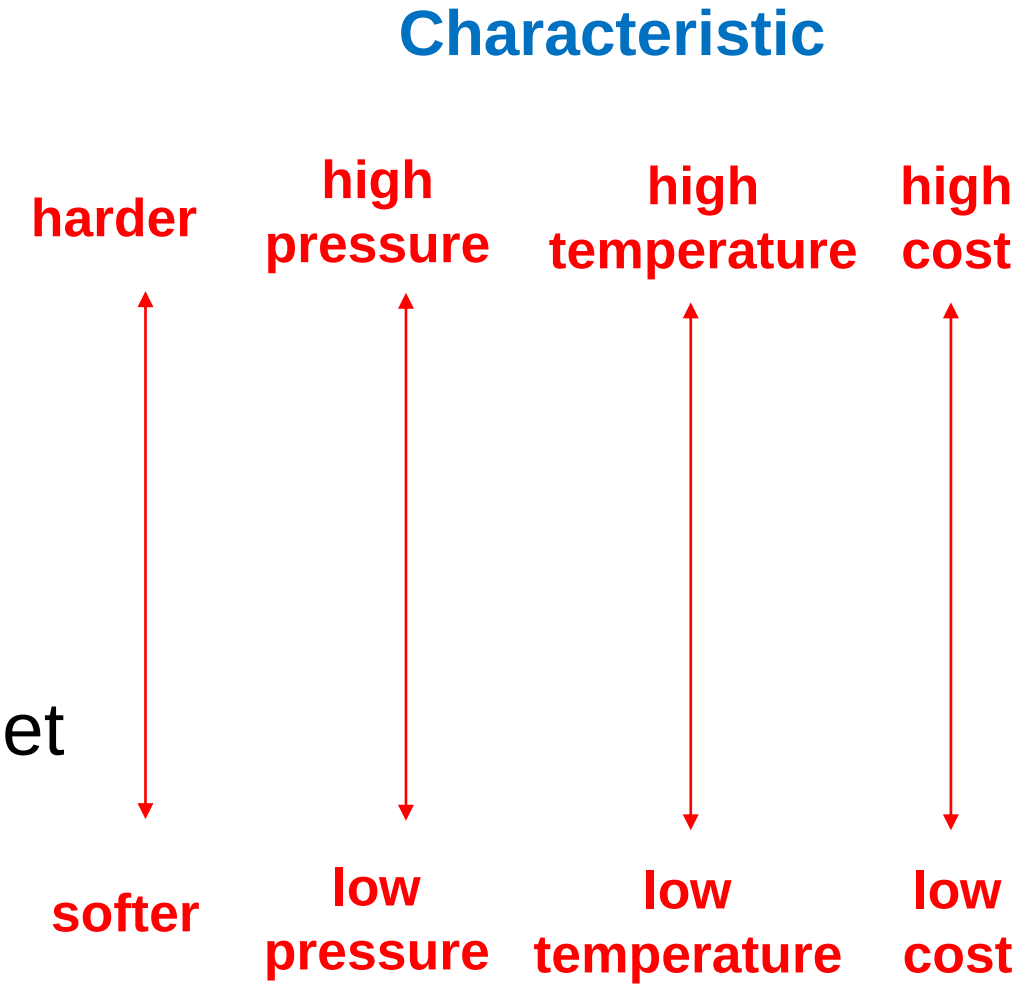
Nut Surface

- Damage to the spot face can change the friction from nut to nut.
- Use hardened washers.

Gasket Materials

A gasket is any deformable material used to create a static seal and maintain the seal under various operating conditions.

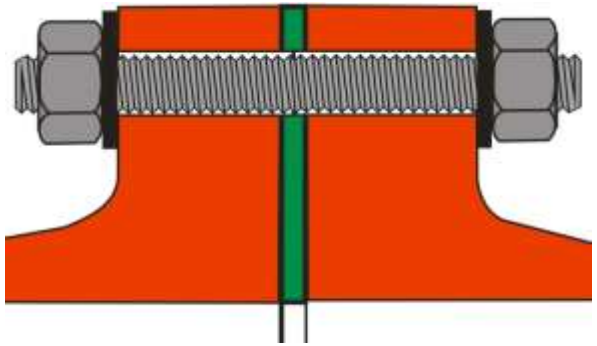
1. Metallic Gaskets
2. Spiral-Wound Gaskets
3. PTFE Sheet & Molded Gaskets
4. Compressed Non-Asbestos Fiber Sheet
5. Premium Grade Rubber Sheet

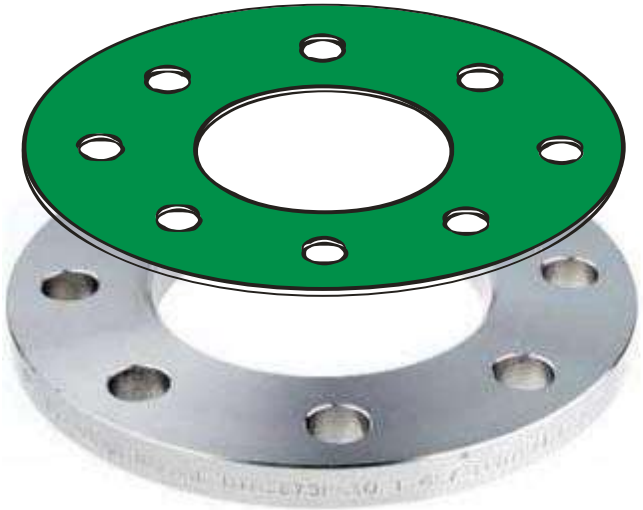


Gasket Configurations

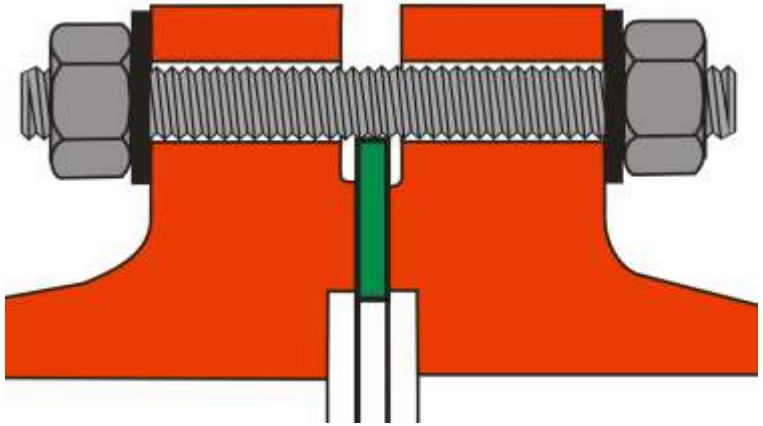
There are three common types of flange face arrangements in pressurized systems.

Full Face

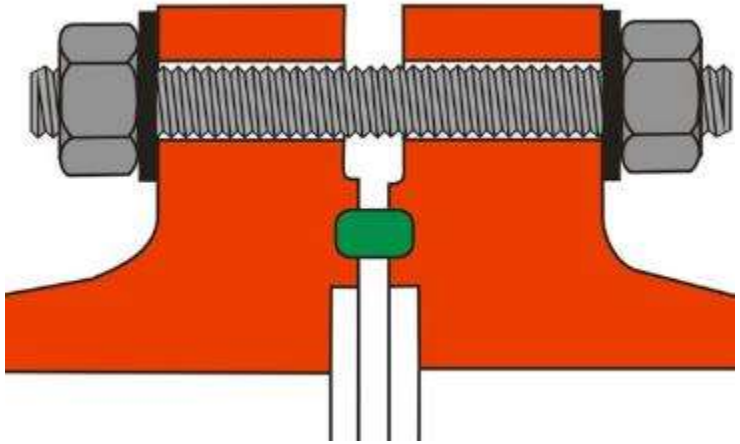


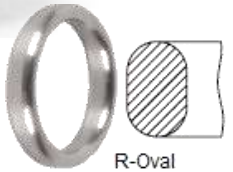


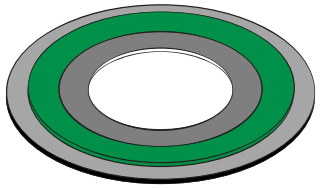
Raised Face



Ring Joint



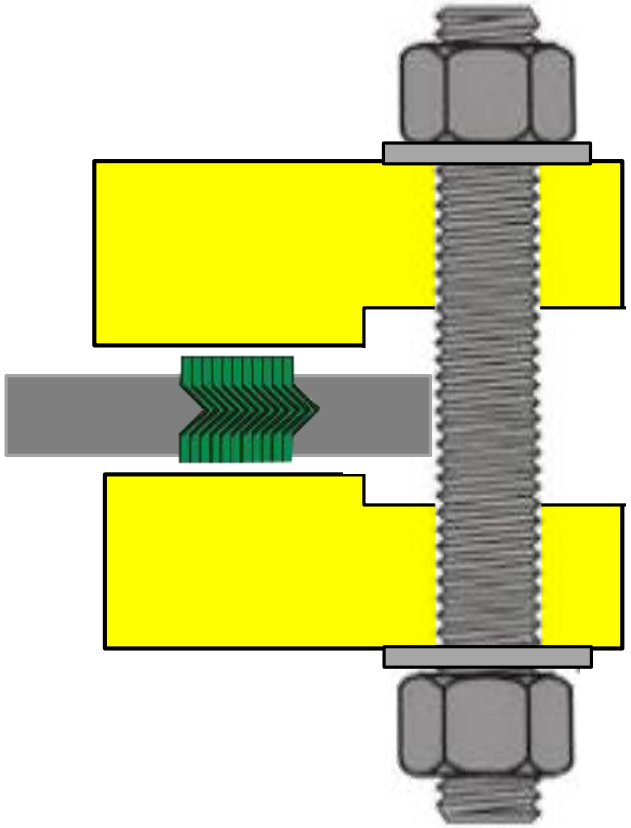




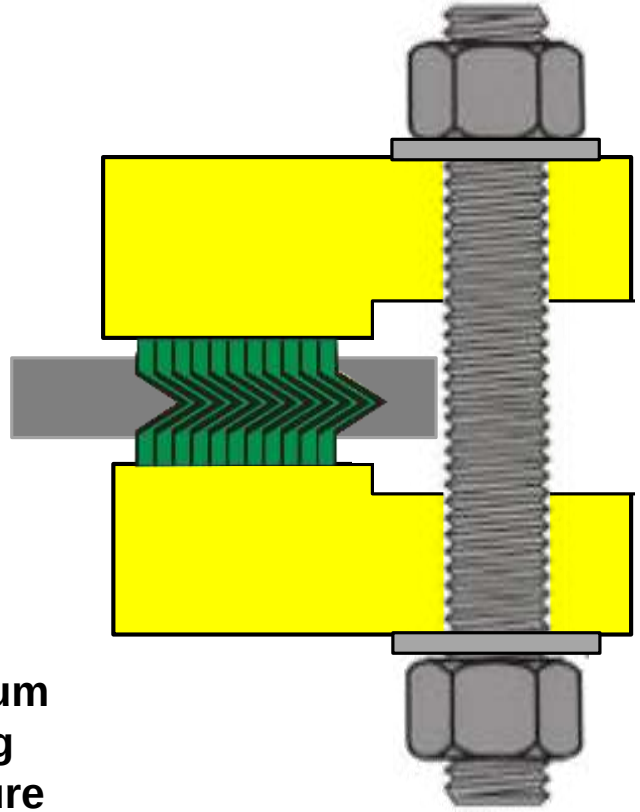
Sealing

With spiral wound gaskets, the filler makes the seal as it flows into the flange surface - gasket pressure is the controlling factor in specifying Torque and Load.

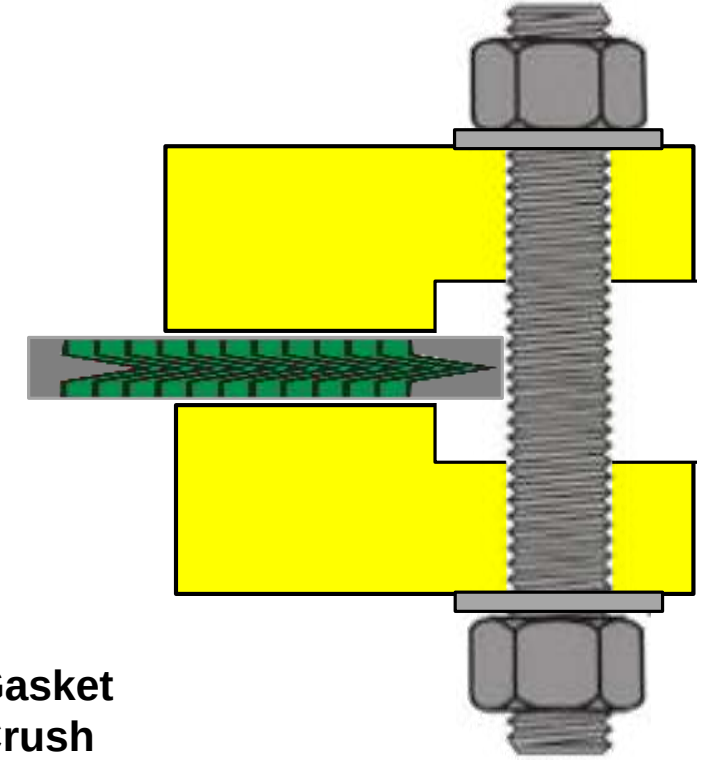
Under Tightened



Properly Tightened



Over Tightened



Minimum Sealing Pressure

Gasket Crush Pressure

Increasing Pressure

Underload Leakage | **Leak Free Joint** | **Overload Leakage**

Gasket Failure

Low Bolt Load

Excessive Bolt Load

Oxidation

*2

Not Centered

Flange Face Surface Damage

Reused

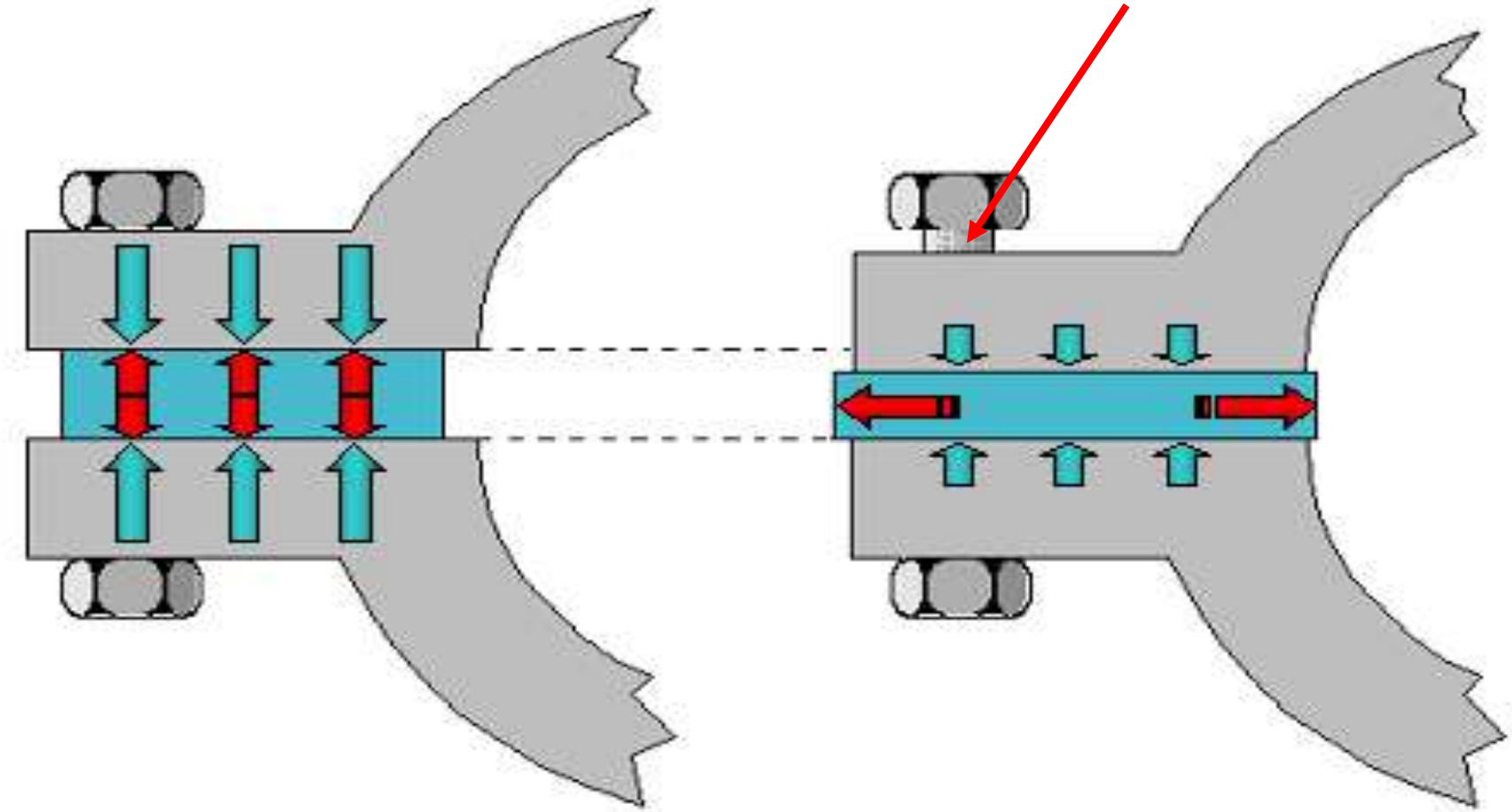
*2

Creep

Flexible gaskets may migrate over time, reducing bolt load.

Initial Installation

Load Loss Over Time



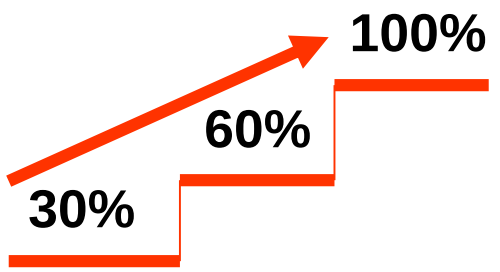
Joint Closure

In most bolted connections… what you do to one bolt affects the others; a cross-pattern bolt tightening sequence and multi-pass process counter the elastic interactions.

Tightening Interdependent Bolts

1. Tighten following a sequence or pattern that distributes load evenly, such as a cross or “star” bolting pattern

2. Tighten in multiple steps to gradually increase load

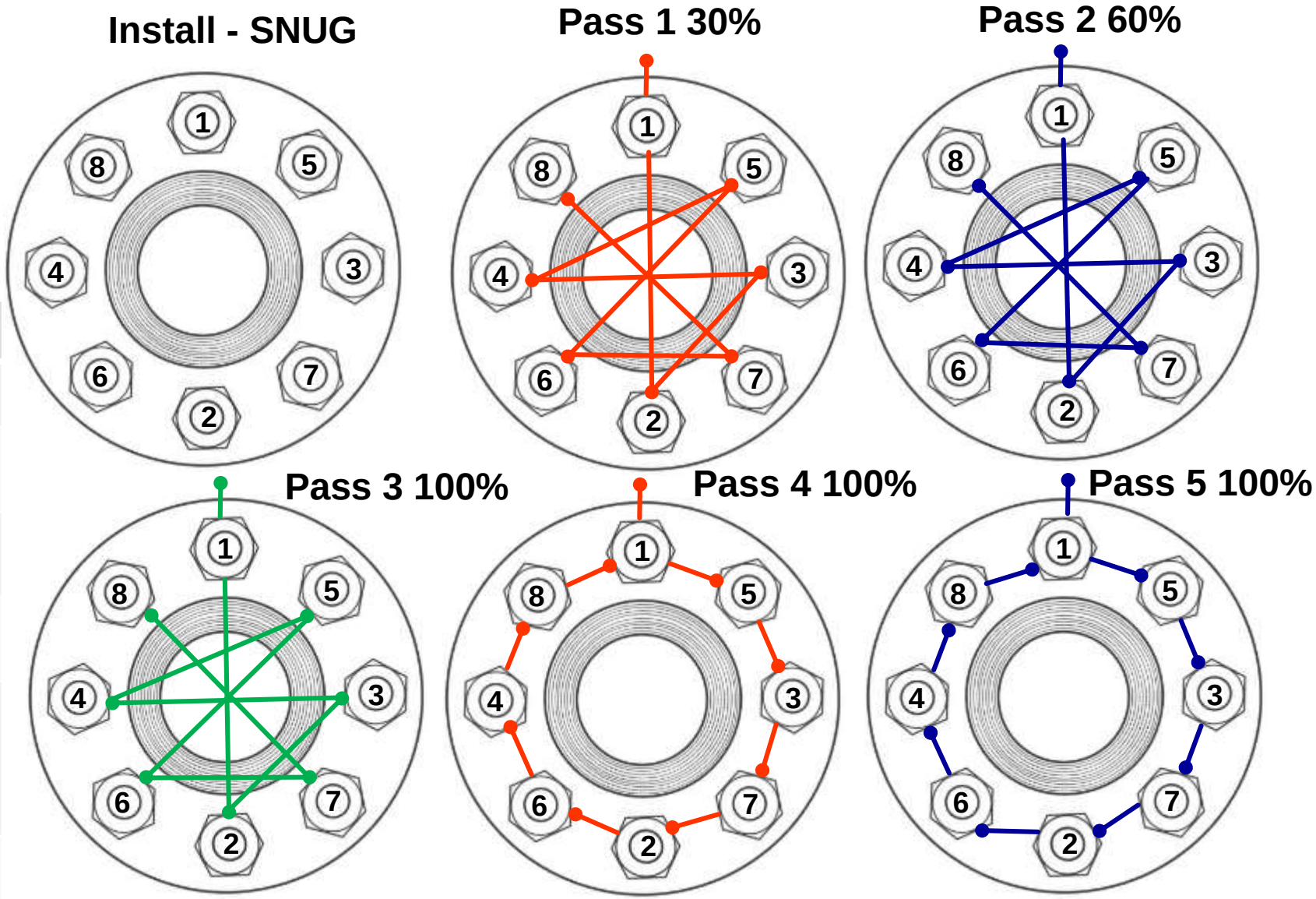


Joint Closure

Single tool bolting plan according to ASME PCC-1, modified legacy method.

- Number the bolts according to alternative legacy sequence
- Apply the torque in steps

Step	Loading
Install	Hand tighten to 10-ft-lb
Pass 1	Tighten to 30% of target torque, check
Pass 2	Tighten to 60% of target torque, check
Pass 3	Tighten to 100% of target torque, check
Pass 4	Continue tightening at 100% target on a circular clockwise pattern until no further movement
Pass 5	Wait a minimum of 4 hr (or after test) and repeat round 4.

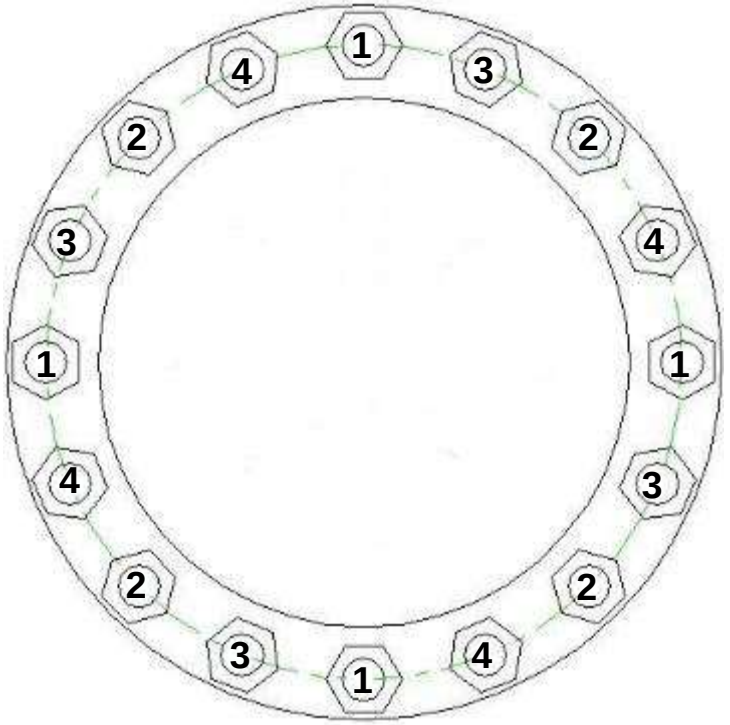


Joint Closure

Bolting Plan with Multiple Tools (4 tools)

- Fewer passes
- Fewer bolts on first pass
- Parallel closure
- Uniform torque
- Cuts average time by 3/4

Number bolts in groups of 4

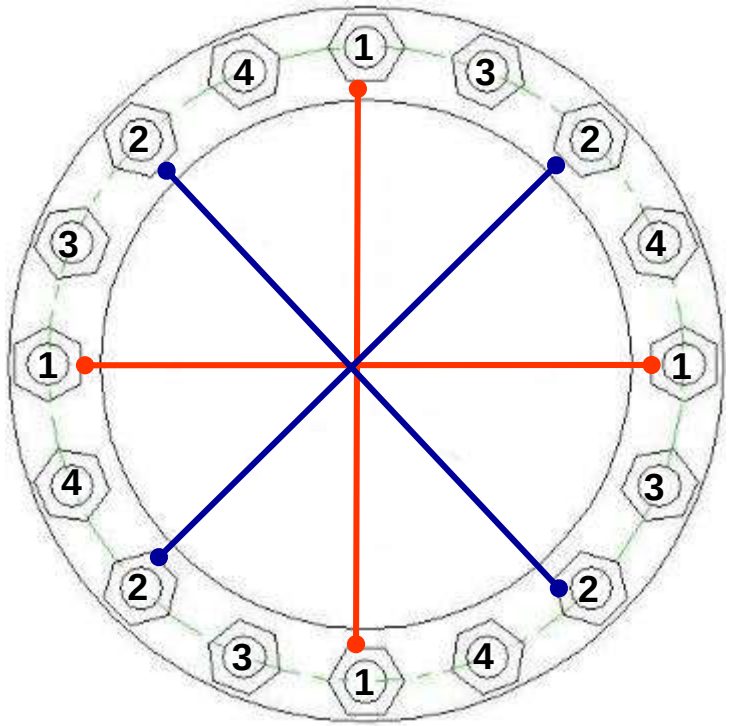


Install Bolts
Hand Tighten
to 10 ft-lb

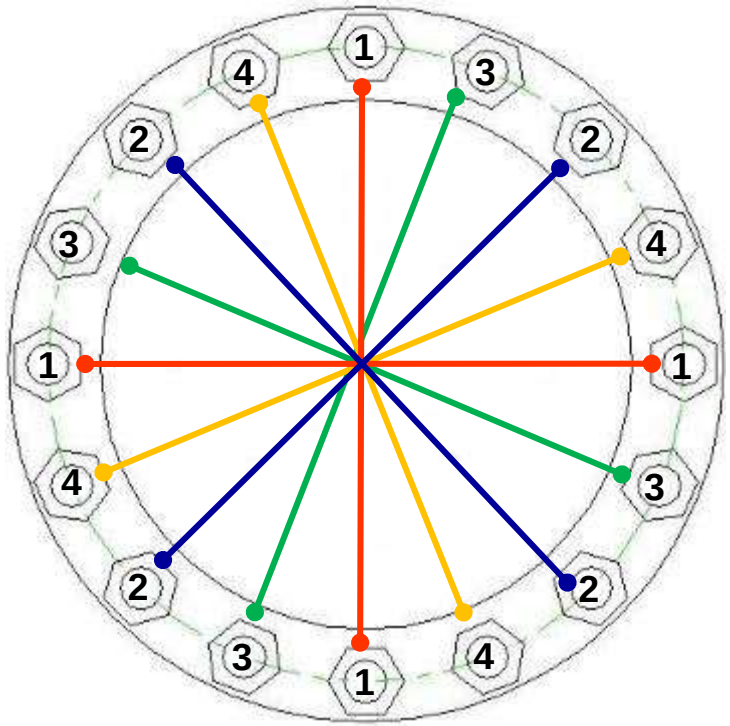
Joint Closure

Bolting Plan with Multiple Tools (4 tools)

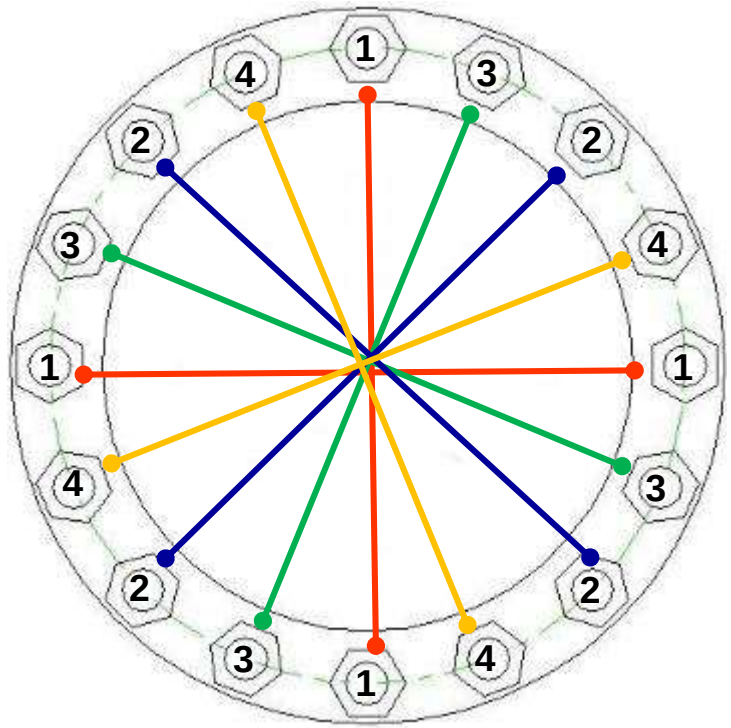
Pass 1 – 4 Tools
Tighten Group 1 and Group 2
at 50% Target Torque



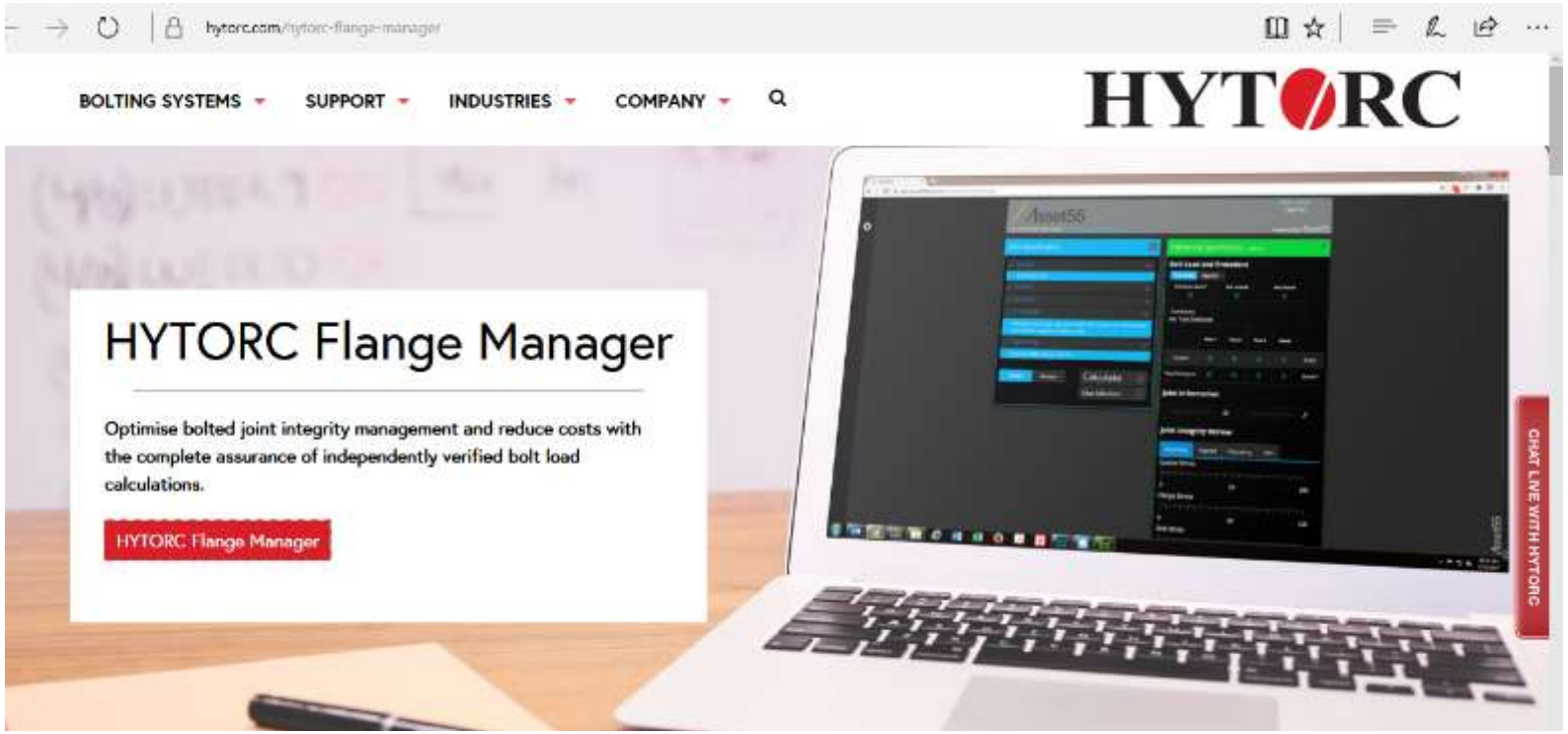
Pass 2 – 4 Tools
Tighten Group 3 and 4 100%
Tighten Group 1 and 2 100%



Pass 3 – 4 Tools
Check all at100% going
Clockwise until no movement



Flange Manager



Joint Manager

Calculation Engine

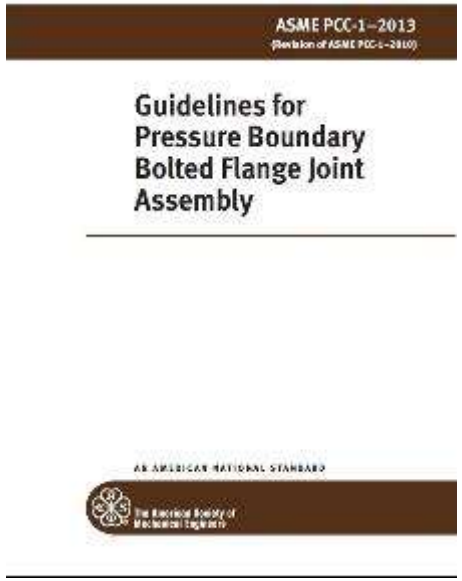
Work Pack Manager

Calculation Manager

Dashboard

Standard: ASME PCC-1-2013

Guidelines Outline Best Practices for Assembly



Sections

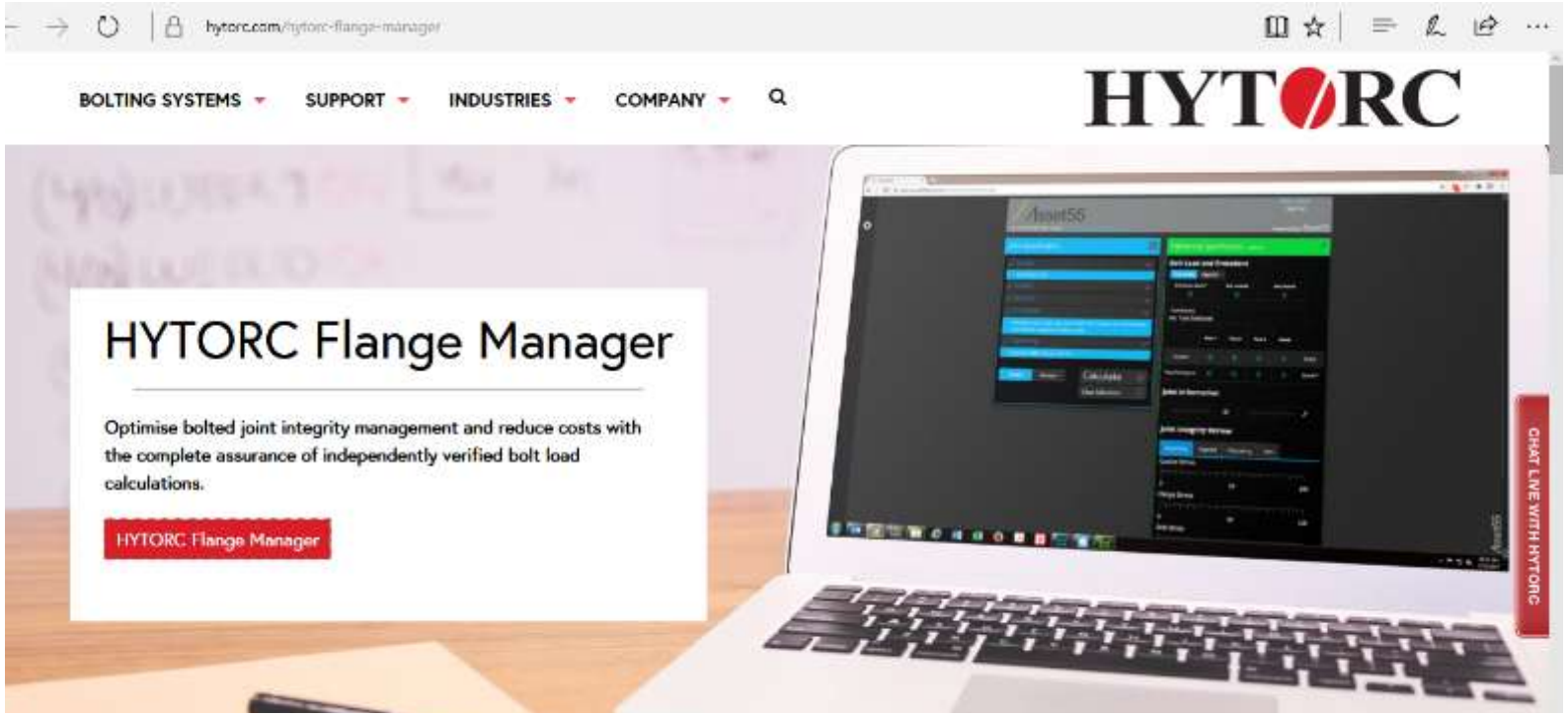
1. Scope
2. Introduction
3. Training and Qualification of Personnel
4. Cleaning and Examination of Flange and Fastener Contact Surfaces
5. Alignment of Flanged Joints
6. Installation of Gasket
7. Lubrication of “Working” Surfaces
8. Installation of Bolts
9. Numbering of Bolts
10. Tightening of Bolts
11. Tightening Sequence
12. Target Torque Détermination
13. Joint Pressure and Tightness Testing
14. Records
15. Joint Disassembly
16. References

Appendices

A. Training and Qualification of Bolted Joint Assembly Personnel
B. Description of Common Terms
C. Recommended Gasket Contact Surface Finish for Various Gasket Types
D. Guidelines for Allowable Gasket Contact Surface Flatness and Defect Depth
E. Flange Joint Alignment Guidelines
F. Alternatives to Legacy Tightening Sequence/Pattern
G. Use of Contractors Specializing in Bolting Services
H. Bolt Root and Tensile Stress Areas
I. Interaction During Tightening
J. Calculation of Target Torque
K. Nut Factor Calculation of Target Torque
L. ASME B16.5 Flange Bolting Information
M. Usage Guidance and Purchase Specification for Through-Hardened Washers
N. Definitions, Commentary, and Guidelines on the Reuse of Bolts
O. Assembly Bolt Stress Determination
P. Guidance on Troubleshooting Flanged Joint Leakage Incidents

Flange Manager

Powered by ASSET 55



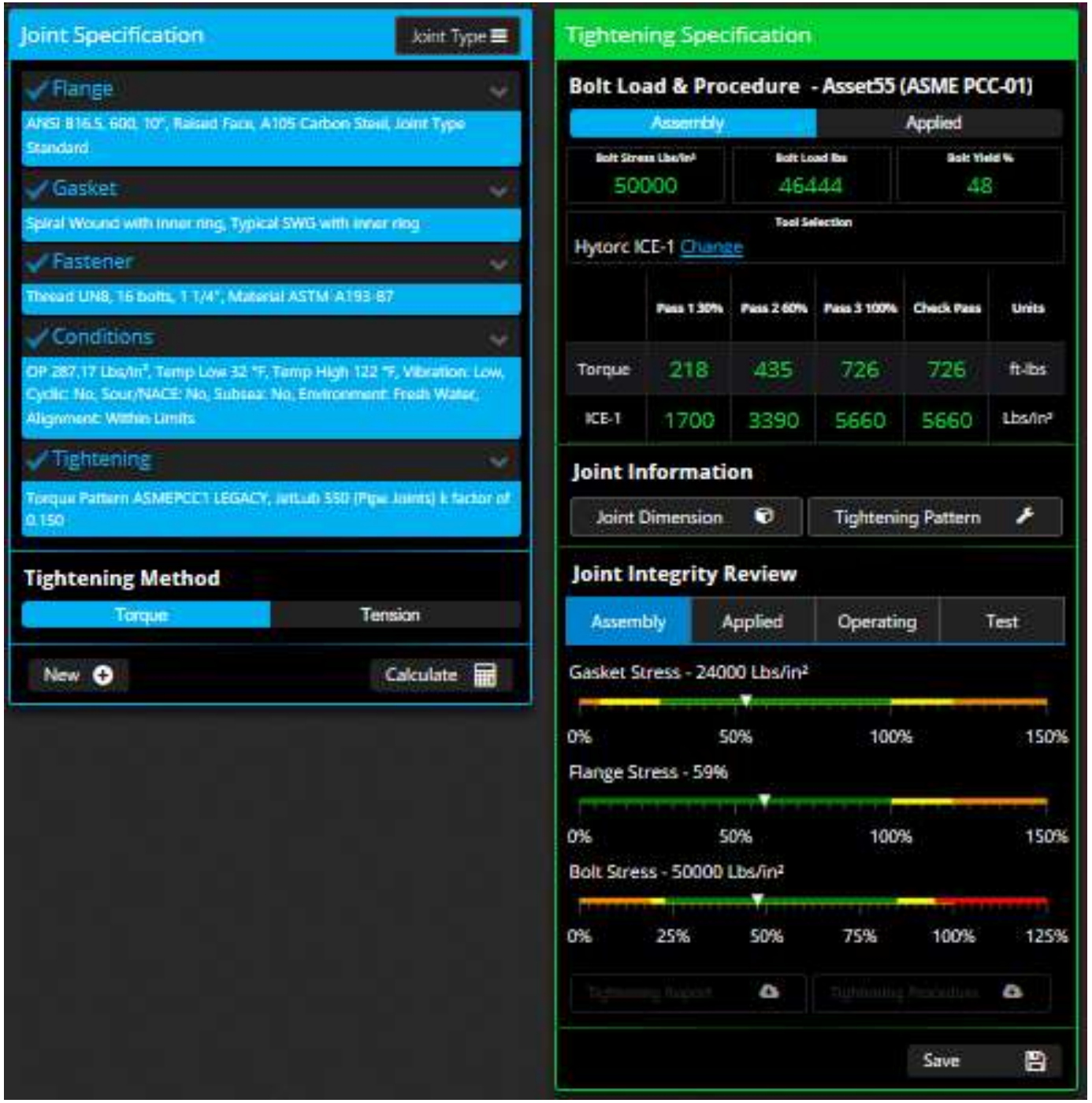
Joint Manager

Calculation Engine

Work Pack Manager

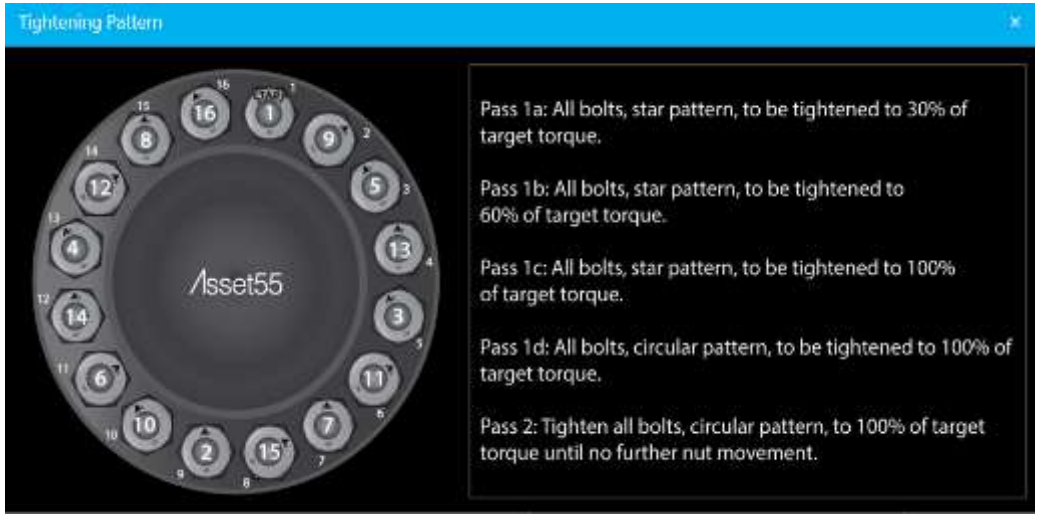
Calculation Manager

Dashboard



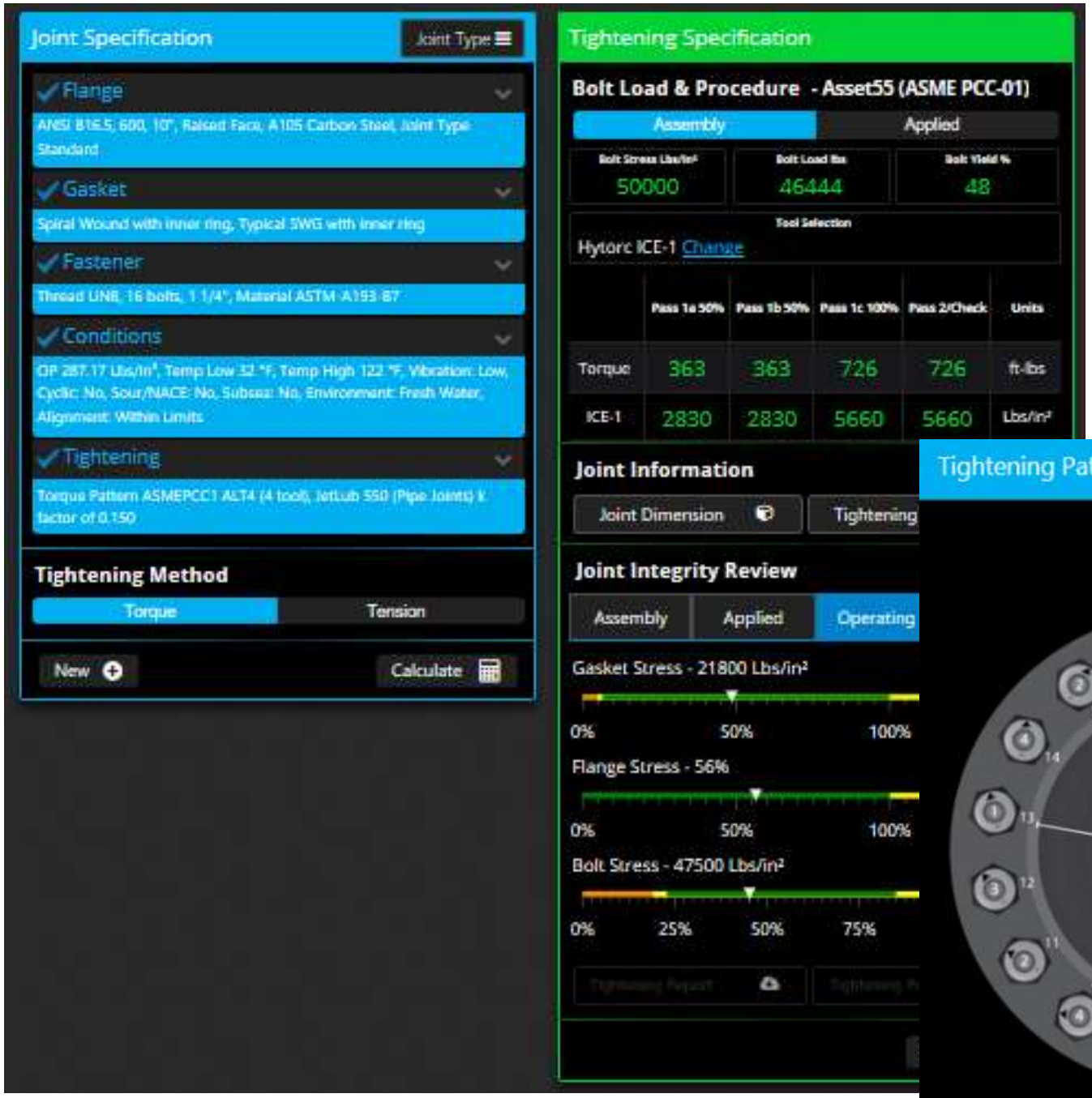
Calculation

Tightening Pattern

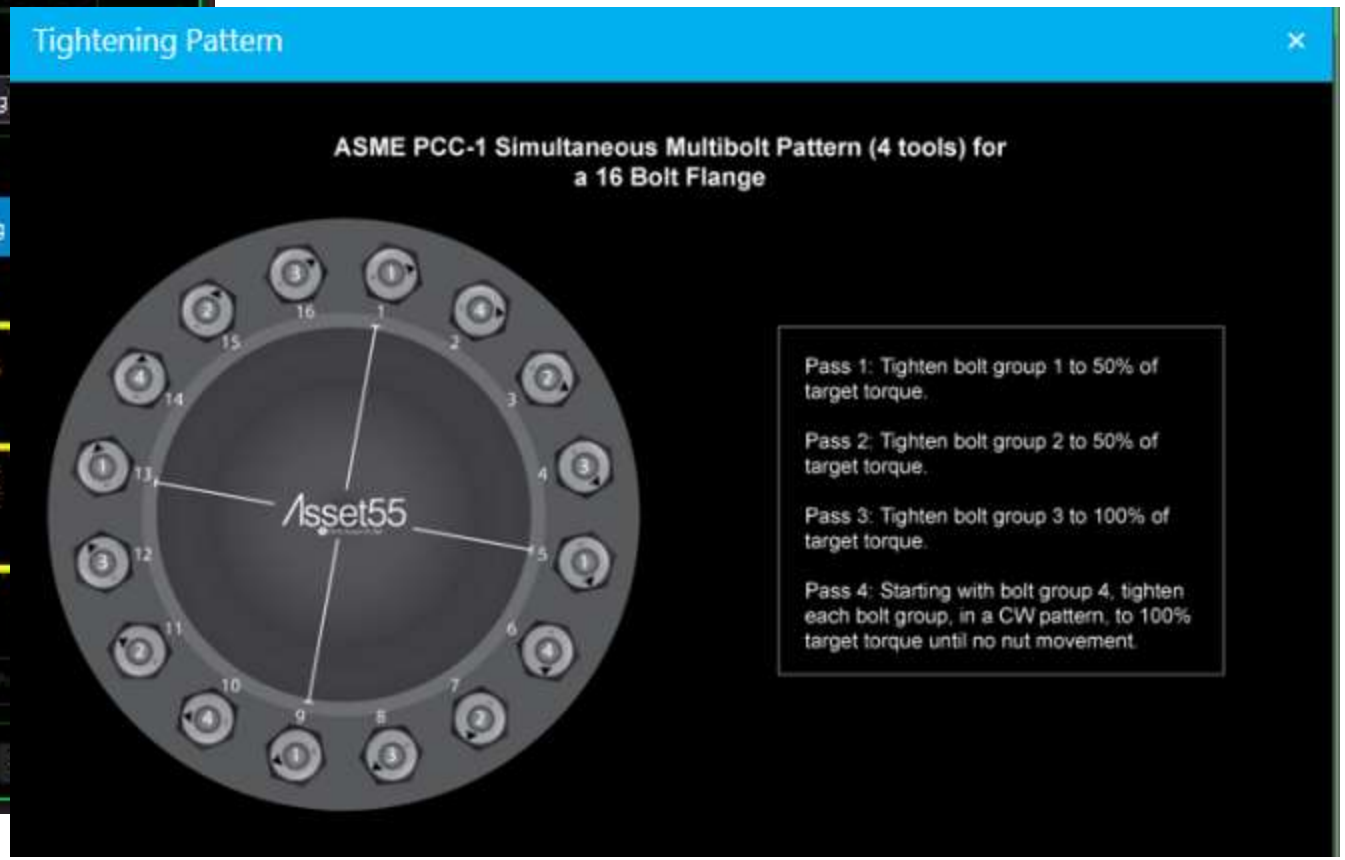


Integrity Review

Data Management, Reports, etc.



Repeat Calculation For 4-Tools



Flange Tightening Report

HYTORC® TIGHTENING PROCEDURE

Company			Site		
Project			Location		
Workpack ID:			Module:		Temp Tag:
Workpack Descri					
MC1 No:			Line No:	kb1234	
MC1 Description:					
System/Unit No:			Tag No:	kbtesting	
Sys/Unit					
Subsystem No:			ISO No:		
Subsys Descripti			P & ID No:		
JOINT SPECIFIC/ ANSI B16.5					
Joint Type	Standard		Category	Raised Face	
Flange	Ratin 150	Size: 4"	Flange Mat	A105 Carbon Steel	
Gasket	Type: Graphite Sheet		Gasket Mat	Typical Graphite Sheet	
Bolt	Dia: 5/8"	No: 8	Bolt Mat.	A320 L7	
Nut	A/F: 26.97 mm		Nut Mat.	A194 Gr 7	
Lubricant	Name Molykote 1000	μ 0.11	Washer.	50mm	
TIGHTENING PROCEDURE					

- Please ensure correct alignment during the assembly process
- Bring flange sealing faces into contact with gasket before 10% of the target torque is achieved
- Measure the flange gap during the tightening process for uniformity

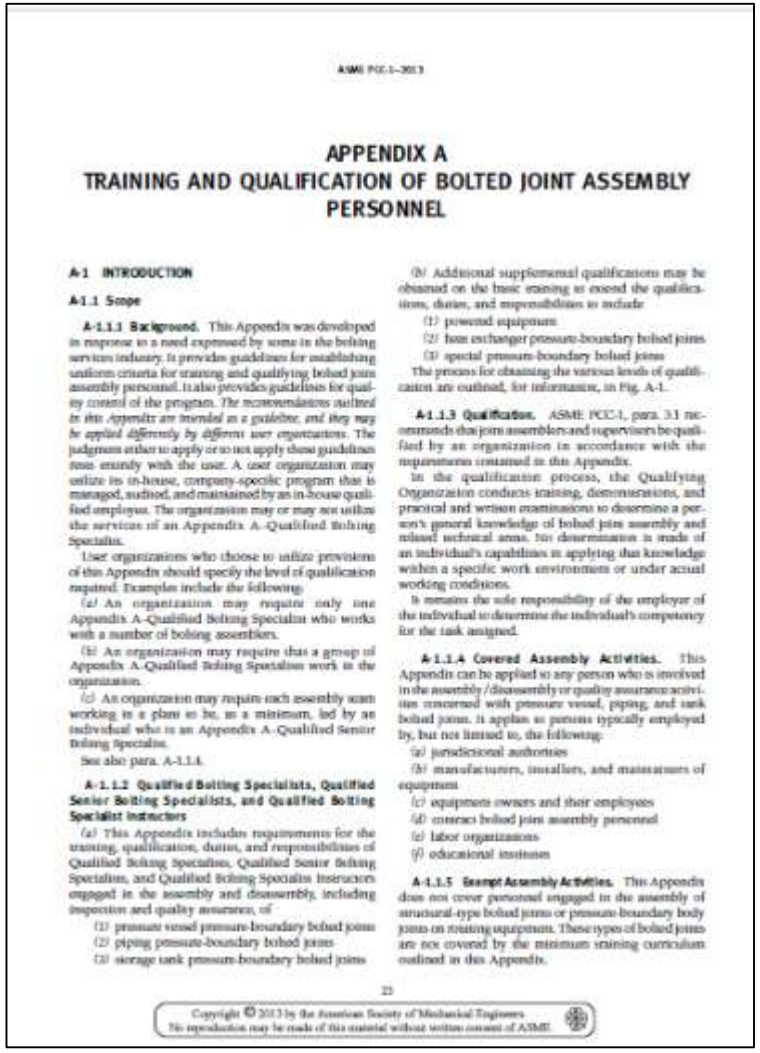
Pass 1: Tighten bolt group 1 to 50% of target torque
Pass 2: Tighten bolt group 2 to 50% of target torque
Pass 3: Starting with bolt group 1, tighten all bolt groups in a clockwise position to 100% of target torque until no nut movement occurs

TORQUE TIGHTENING	Assembly Bolt Stress: 64997 Lbs/i	Pattern: ASME PCC1- Alt 4	
Pump Gauge Serial No:		Serial No:	
Tool Model: Hand Torque Wrench		100% Tool Pressure: 0 Lbs/in²	
Pass 1 30%: 32 ft-lbs	Pass 2 60%: 63 ft-lbs	Pass 3 100%: 106 ft-lbs	Check Pass : 106 ft-lbs
Tool Pressure: 0 Lbs/in	Tool Pressure: 0 Lbs/in	Tool Pressure: 0 Lbs/in	Tool Pressure: 0 Lbs/in
NOTES	Non-Conformity ☐	NC Number:	

Responsible	Assembled by	Tightened by	Inspected by	Company W I T P
Name				
ID No.				
Signature				
Date				

Training: PCC-1-2013 – Appendix A

Guidelines Now Outline Training and Qualification of Bolted Joint Assembly Personnel



ASME PCC-1–2013

APPENDIX A
TRAINING AND QUALIFICATION OF BOLTED JOINT ASSEMBLY PERSONNEL

A-1 INTRODUCTION

A-1.1 Scope

A-1.1.1 Background. This Appendix was developed in response to a need expressed by some in the bolting services industry. It provides guidelines for establishing uniform criteria for training and qualifying bolted joint assembly personnel. It also provides guidelines for quality control of the program. *The recommendations outlined in this Appendix are intended as a guideline, and they may be applied differently by different user organizations.* The judgment either to apply or to not apply these guidelines rests entirely with the user. A user organization may utilize its in-house, company-specific program that is managed, audited, and maintained by an in-house qualified employee. The organization may or may not utilize the services of an Appendix A-Qualified Bolting Specialist.

User organizations who choose to utilize provisions of this Appendix should specify the level of qualification required. Examples include the following:

(a) An organization may require only one Appendix A-Qualified Bolting Specialist who works with a number of bolting assemblers.

(b) An organization may require that a group of Appendix A-Qualified Bolting Specialists work in the organization.

(c) An organization may require each assembly team working in a plant to be, as a minimum, led by an individual who is an Appendix A-Qualified Senior Bolting Specialist.

See also para. A-1.1.4.

A-1.1.2 Qualified Bolting Specialists, Qualified Senior Bolting Specialists, and Qualified Bolting Specialist Instructors

(a) This Appendix includes requirements for the training, qualification, duties, and responsibilities of Qualified Bolting Specialists, Qualified Senior Bolting Specialists, and Qualified Bolting Specialist Instructors engaged in the assembly and disassembly, including inspection and quality assurance, of

(1) pressure vessel pressure-boundary bolted joints
(2) piping pressure-boundary bolted joints
(3) storage tank pressure-boundary bolted joints

(b) Additional supplemental qualifications may be obtained on the basic training to extend the qualifications, duties, and responsibilities to include

(1) powered equipment
(2) heat exchanger pressure-boundary bolted joints
(3) special pressure-boundary bolted joints

The process for obtaining the various levels of qualification are outlined, for information, in Fig. A-1.

A-1.1.3 Qualification. ASME PCC-1, para. 3.1 recommends that joint assemblers and supervisors be qualified by an organization in accordance with the requirements contained in this Appendix.

In the qualification process, the Qualifying Organization conducts training, demonstrations, and practical and written examinations to determine a person's general knowledge of bolted joint assembly and related technical areas. The determination is made of an individual's capabilities in applying that knowledge within a specific work environment or under actual working conditions.

It remains the sole responsibility of the employer of the individual to determine the individual's competency for the task assigned.

A-1.1.4 Covered Assembly Activities. This Appendix can be applied to any person who is involved in the assembly/disassembly or quality assurance activities concerned with pressure vessel, piping, and tank bolted joints. It applies to persons typically employed by, but not limited to, the following:

(a) jurisdictional authorities
(b) manufacturers, installers, and maintainers of equipment
(c) equipment owners and their employees
(d) contract bolted joint assembly personnel
(e) labor organizations
(f) educational institutes

A-1.1.5 Exempt Assembly Activities. This Appendix does not cover personnel engaged in the assembly of structural-type bolted joints or pressure boundary body joints on rotating equipment. These types of bolted joints are not covered by the minimum training curriculum outlined in this Appendix.

23

- Qualified Bolting Specialist (QBS)
- Senior Qualified Bolting Specialist
- Qualified Bolting Specialist Instructor
- Approved Testing Provider
- 12 hours online training & examination
- 8 hours of hands-on evaluation

ASME Qualification Process

There are 3 main steps to obtain ASME Bolting Specialist Qualification

Step 1. Bolting Principles and Procedures Short Courses

Free!

Part 1: Principles of Bolted Joints and ASME PCC-1 (EL601)

$230

Part 2: Flanges, Fasteners and Gaskets (EL602)

$230

3: Putting it Together/ Taking it Apart (EL603)

$230

4: Bolting Safety and Tool Handling (EL604)

Step 2. Bolting Specialist Application Packet and Final Examination

Complete & Submit Application Packet to ASME

Final Exam Complete ASME Exam Online

Step 3: Hands-On Tool Demonstration and Testing

~$500

Schedule and Complete One-day In-person Hands on Tool Demonstration and Testing

Once obtained, the specialist qualification must be renewed every 3 years

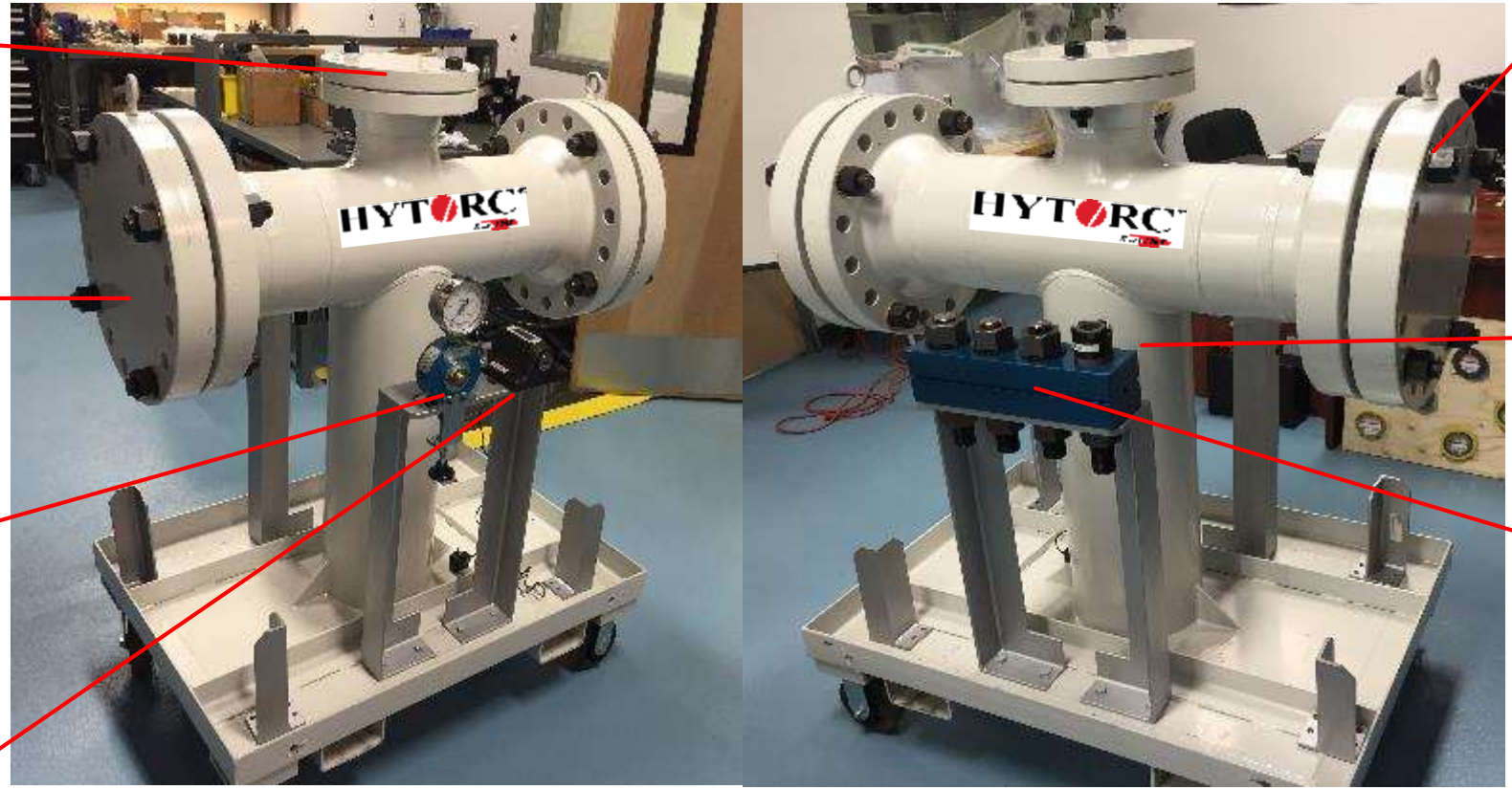
ASME QBS Training Flange

Class 300 Flange Assembled with Manual Torque

Class 600 Flange Assembled with Hydraulic Torque

Skidmore Unit used for Torque-Load Exercises

TrueCheck Unit used for Torque Verification Testing



Class 600 Flange Assembled with Hydraulic Tensioning

Mechanical Tensioning Exercise

Bolting Flange for Pneumatic and Electronic Bolting Exercises

Let’s Bolt!

HYTORC