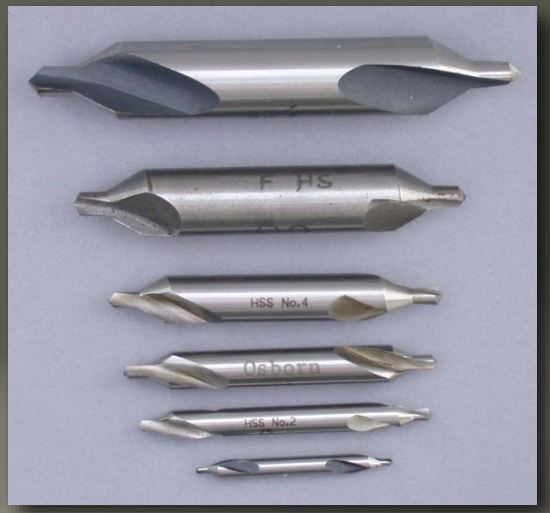
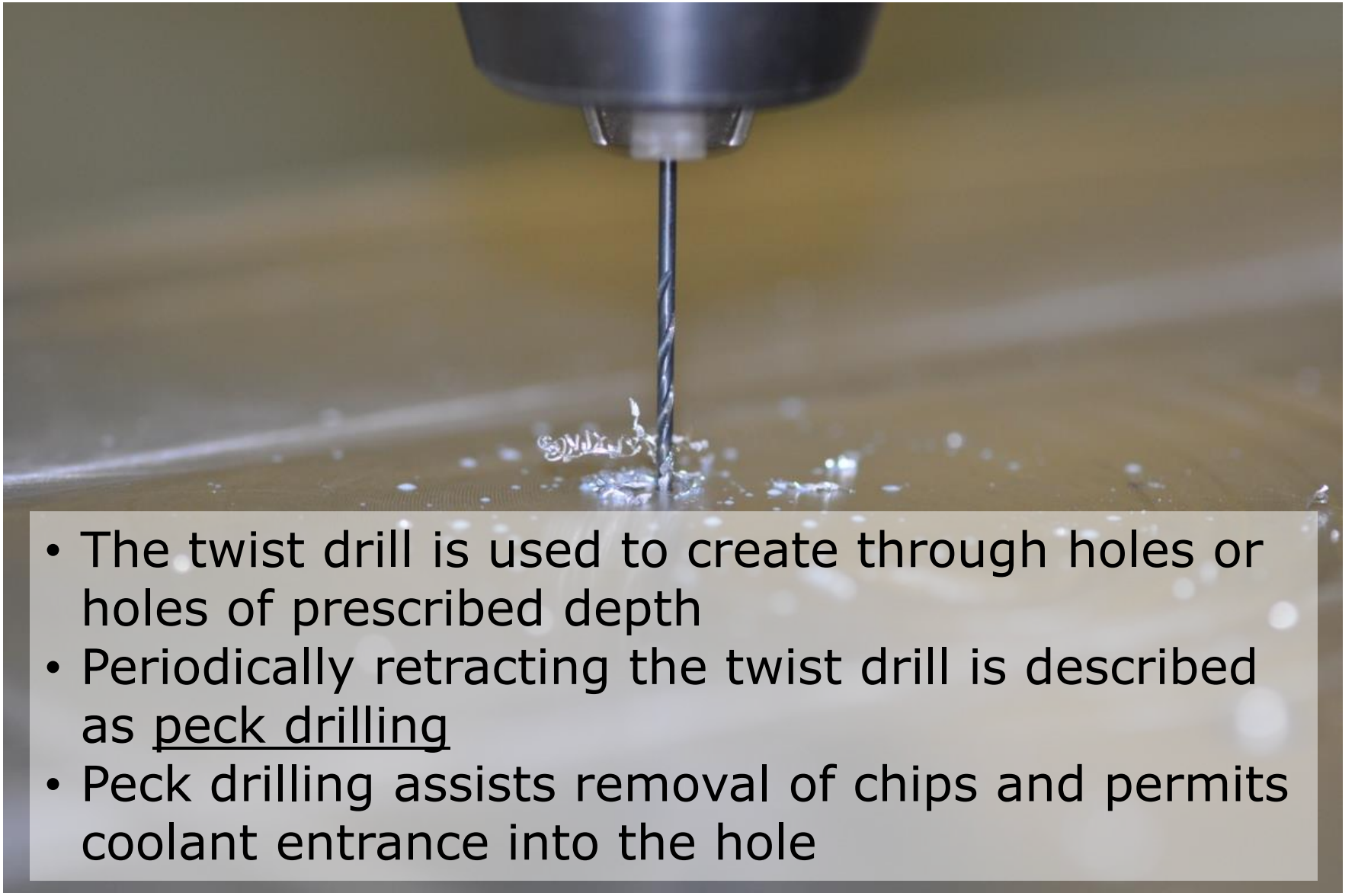
Holemaking

Center Drill



- Twist drills tend to wander on a surface compromising the position of a hole
- Start by center drilling a starting hole
- Center drills have a thicker shank and afford less deflection

Twist Drilling and Peck Drilling



- The twist drill is used to create through holes or holes of prescribed depth
- Periodically retracting the twist drill is described as peck drilling
- Peck drilling assists removal of chips and permits coolant entrance into the hole

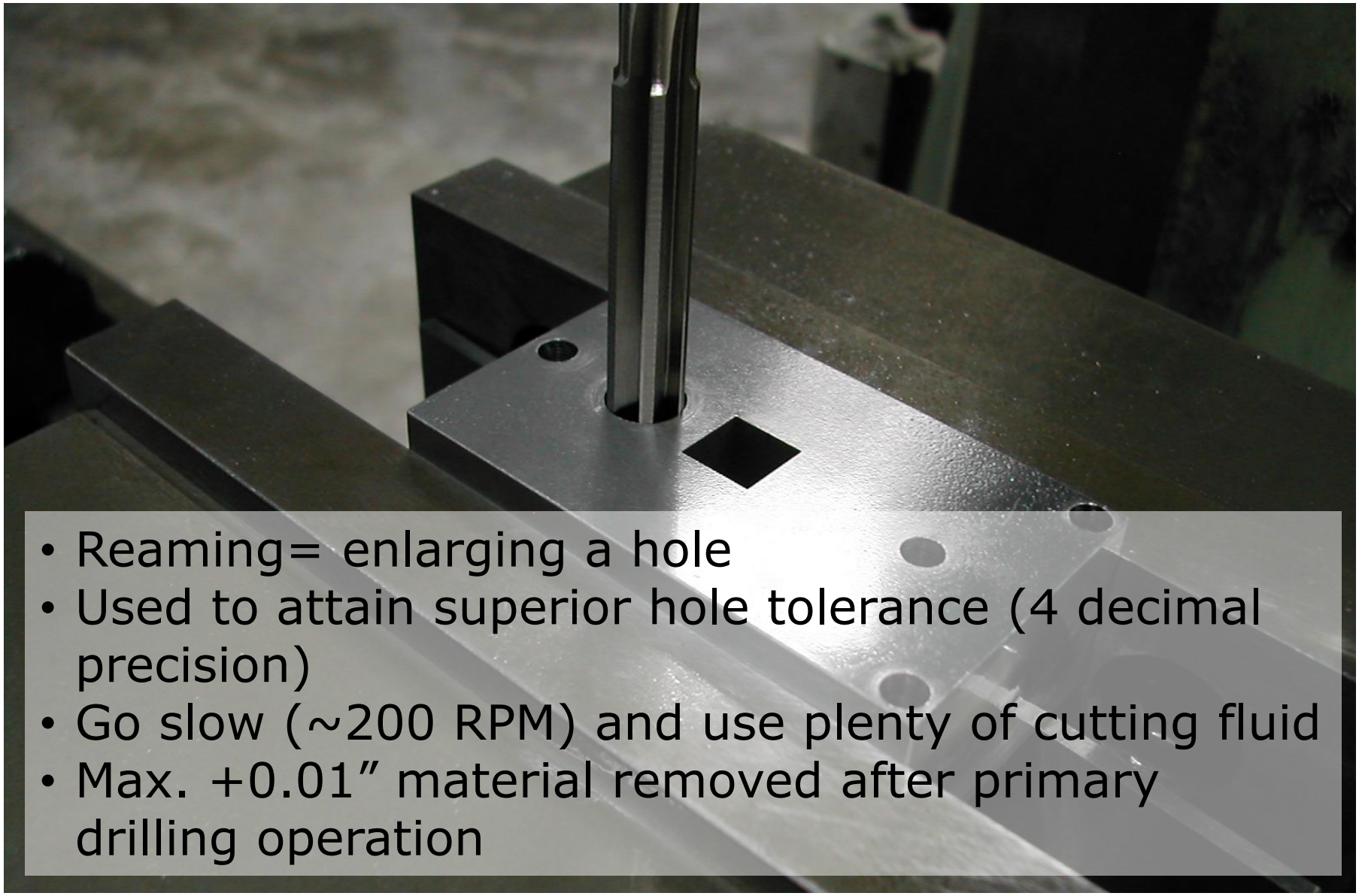
Twist Drill Sizes

- Twist drill sizes are often reported in gauges
- Gauges 80 to 1 run from diameters of 0.0135” to 0.228”, respectively
- Gauges A to Z run from diameters of 0.234” to 0.413”, respectively

Drill Chuck


• Do not expose to side loads as doing so can damage the internal mechanisms

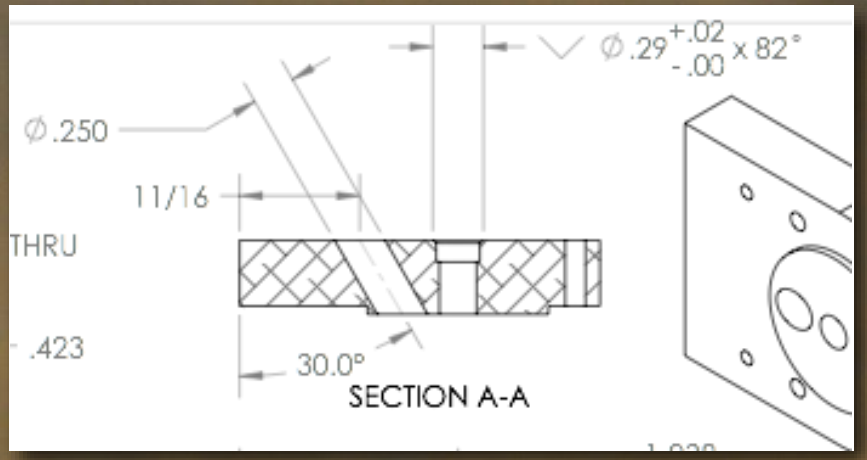
Reaming



- Reaming= enlarging a hole
- Used to attain superior hole tolerance (4 decimal precision)
- Go slow (~200 RPM) and use plenty of cutting fluid
- Max. +0.01” material removed after primary drilling operation

Countersinking

- Used to create a flush interface between a screw and feature face and/or remove burrs
- Typical angles include 60°, 82°, 90°, 110°, and 120°
- Run at low speed



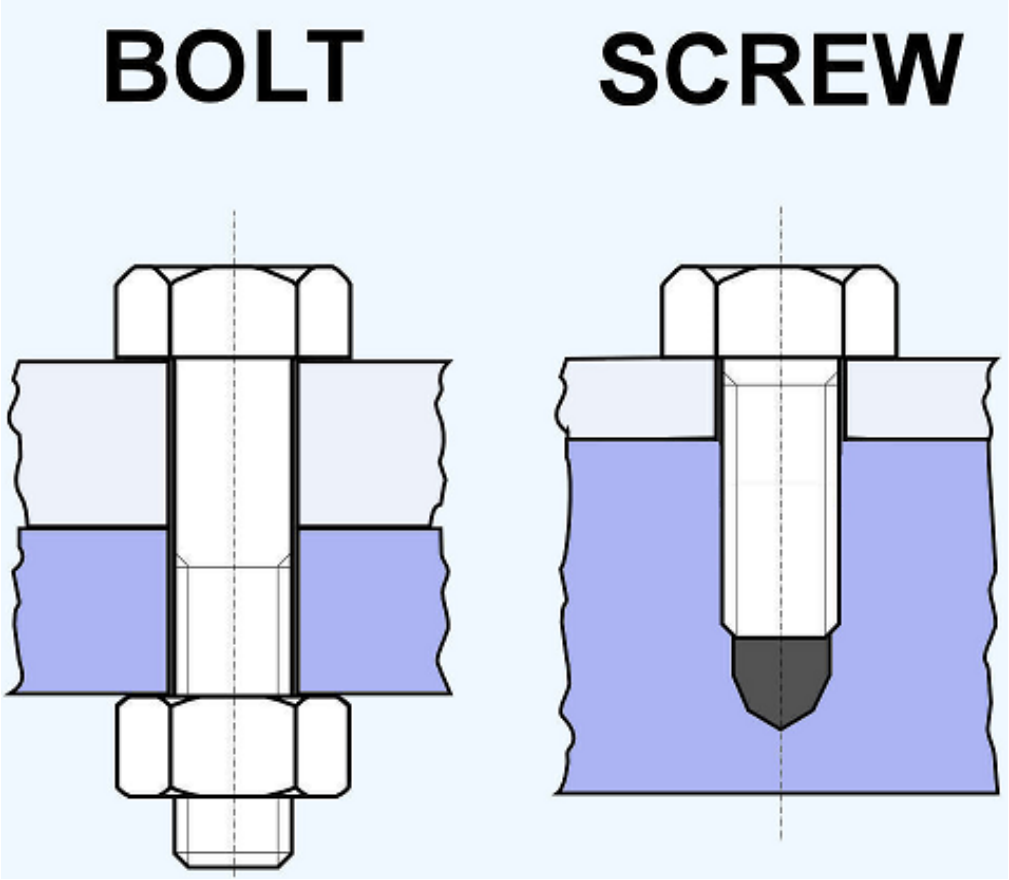
Threads and Thread Cutting

Screws and (Bolts)

Which one is a bolt and which one is a screw?

These are both screws!!!

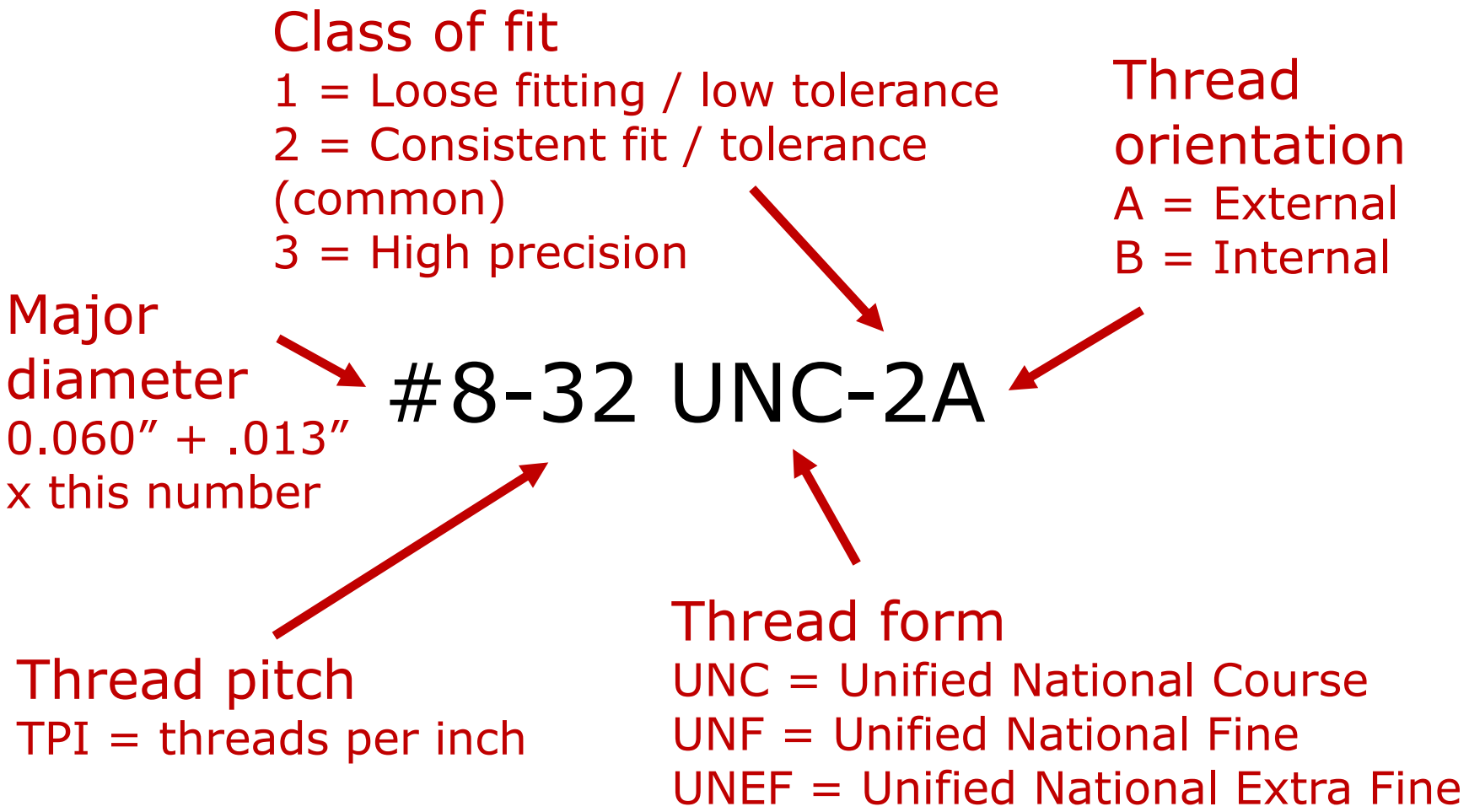
Screws and (Bolts)



A bolt utilizes a nut whereas a screw engages with a feature

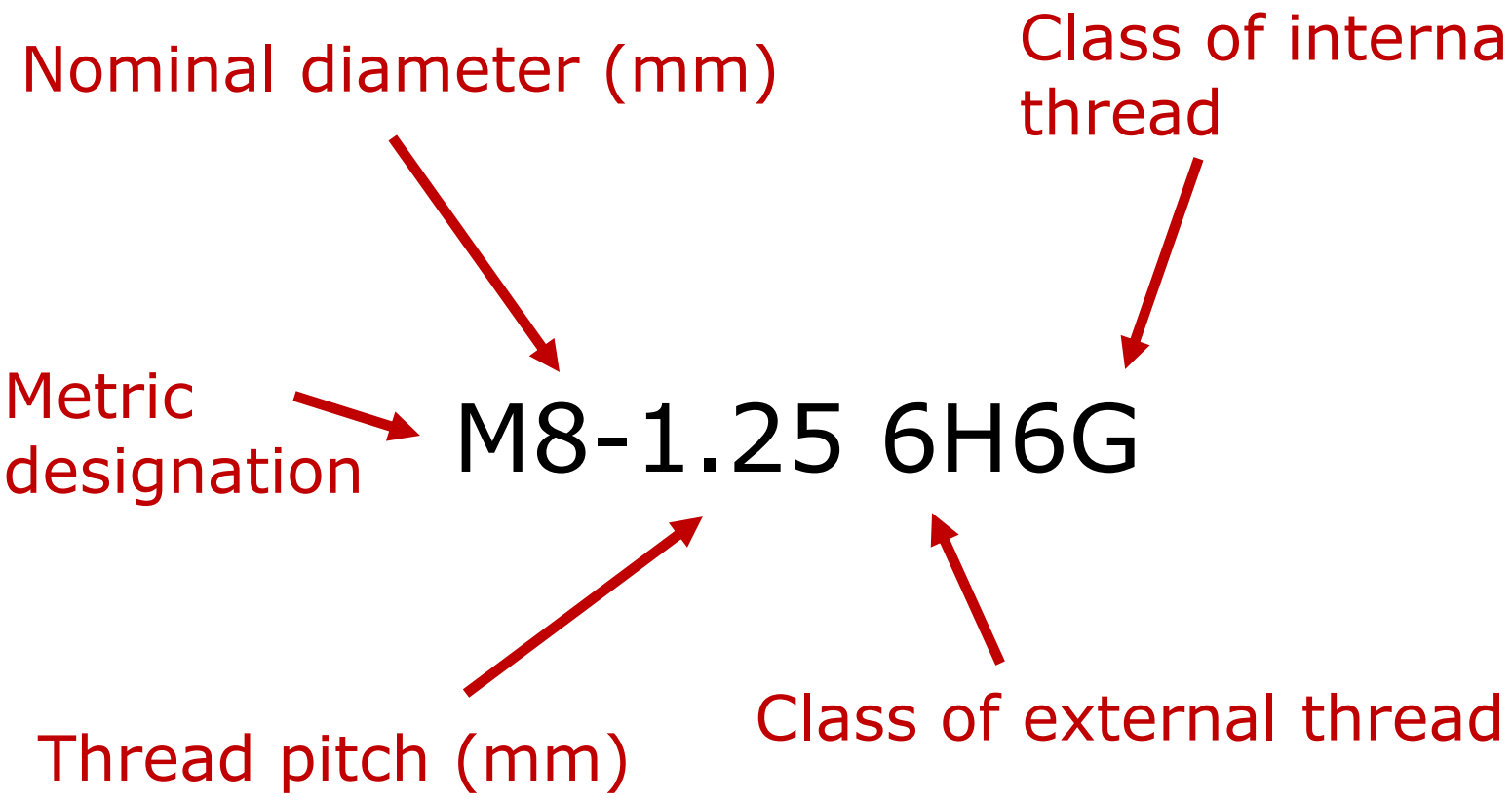
Screw (Hole) Naming Conventions

Thread specifications of the Unified Thread Standard (UTS)

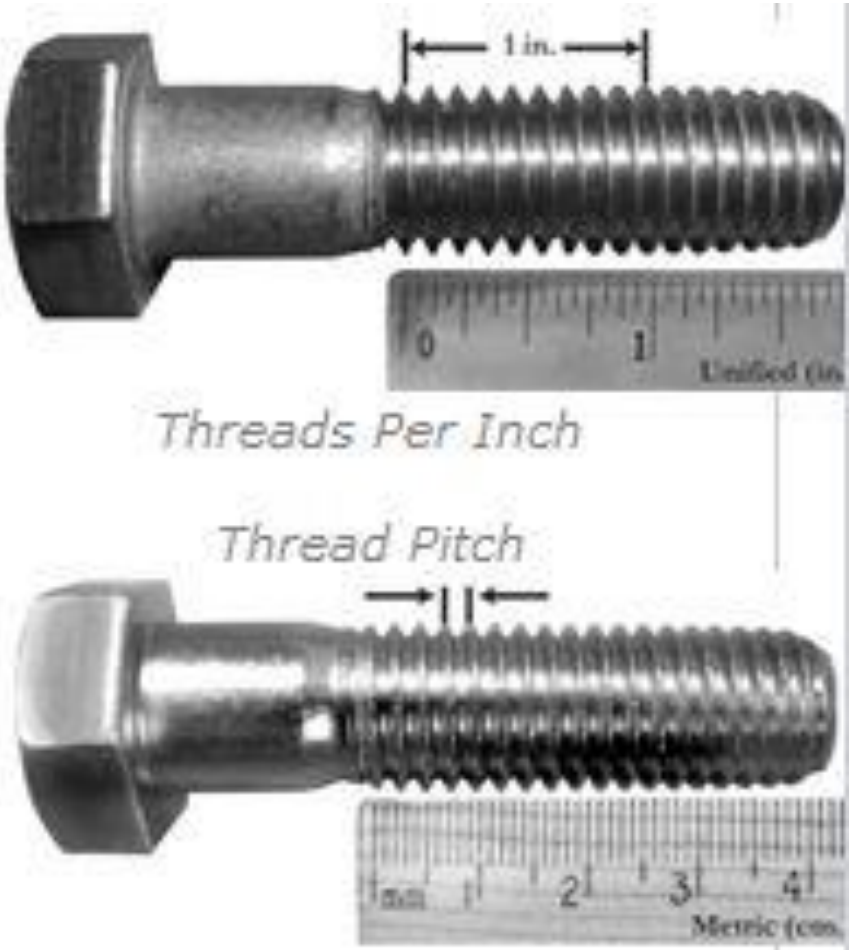


Screw (Hole) Naming Conventions

Metric thread standard



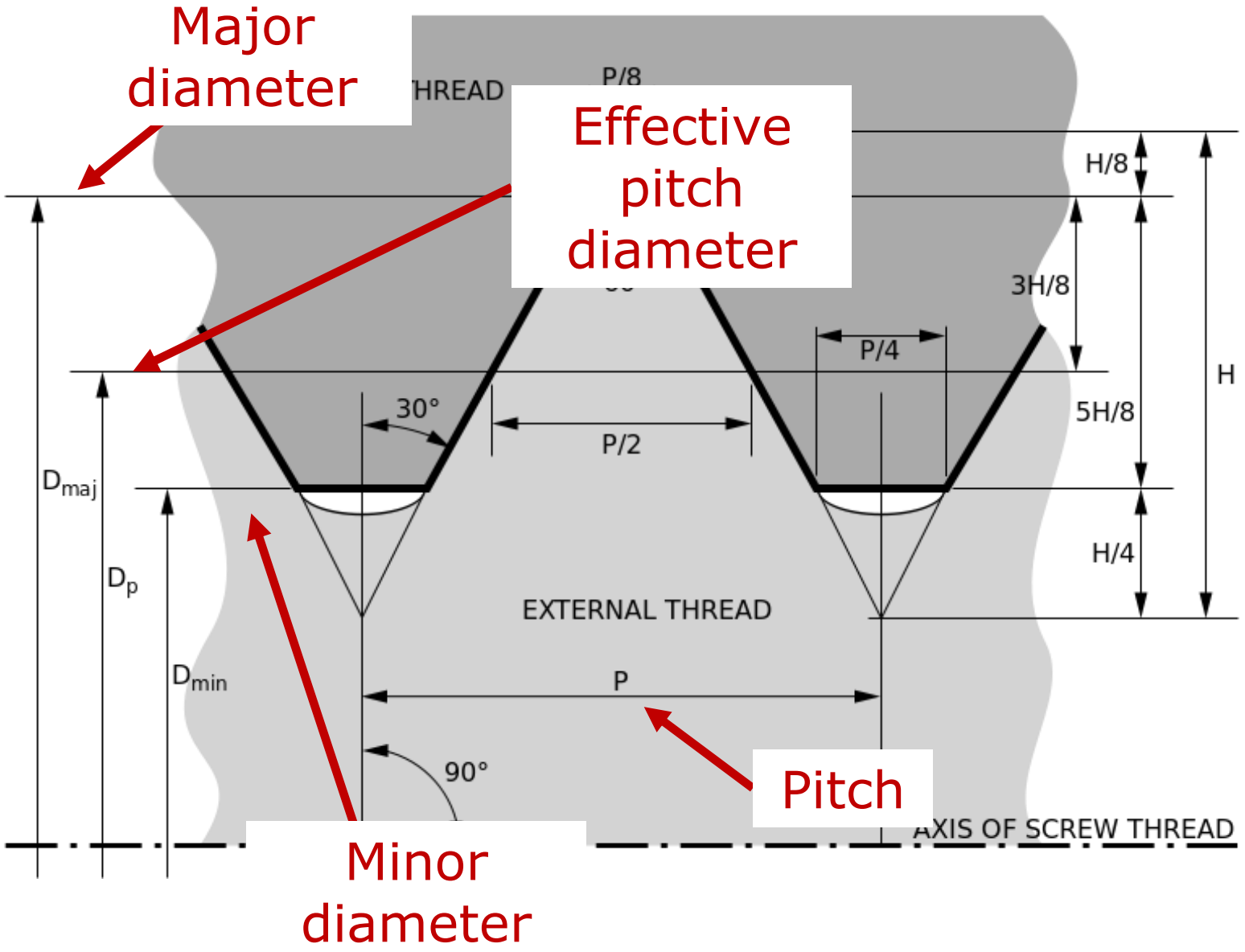
UNC vs. UNF



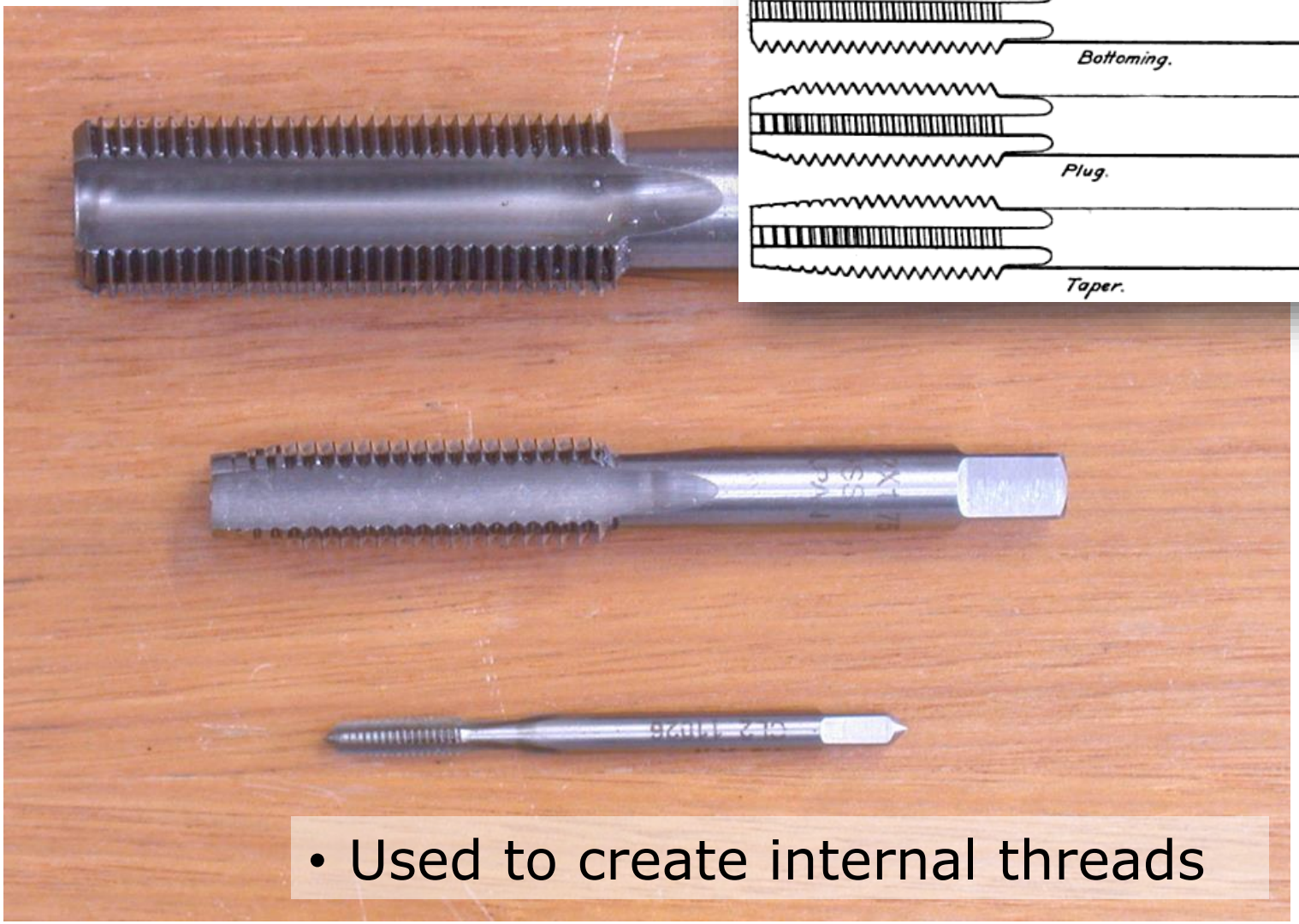
UNC: Most common, fewer threads, easier to insert and remove

UNF: Shallower threads = larger minor diameter and load carrying capability, improved tension adjustment

Screw Profile and Terminology

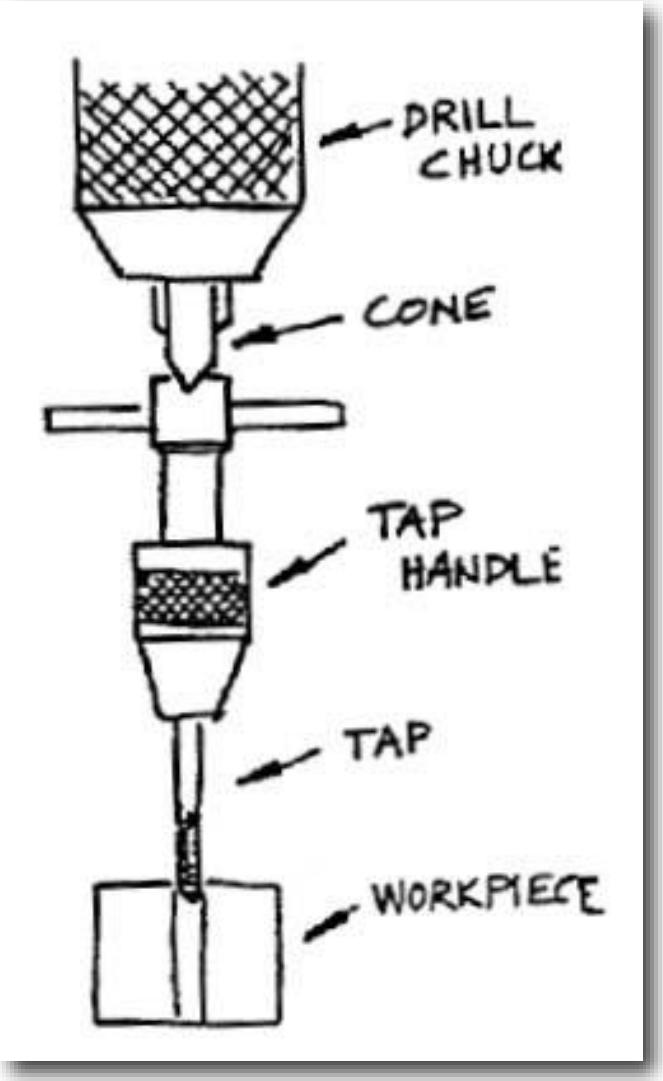


Tap



- Used to create internal threads

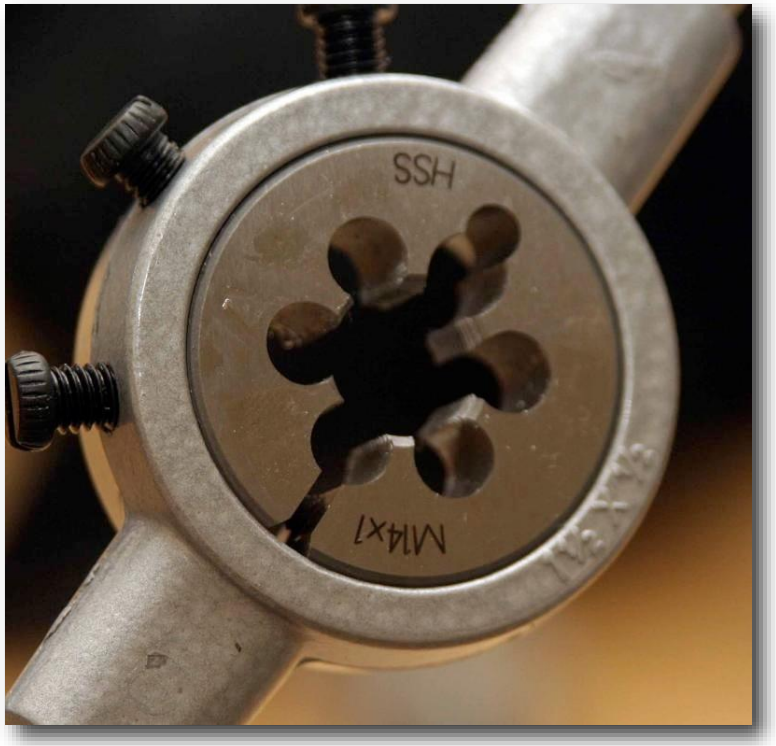
Tap with Tap Guide



- Tap guide ensures parallelity to pilot hole
- Force along tap axis provided by quill and spring-loaded tap guide pin

External Threads

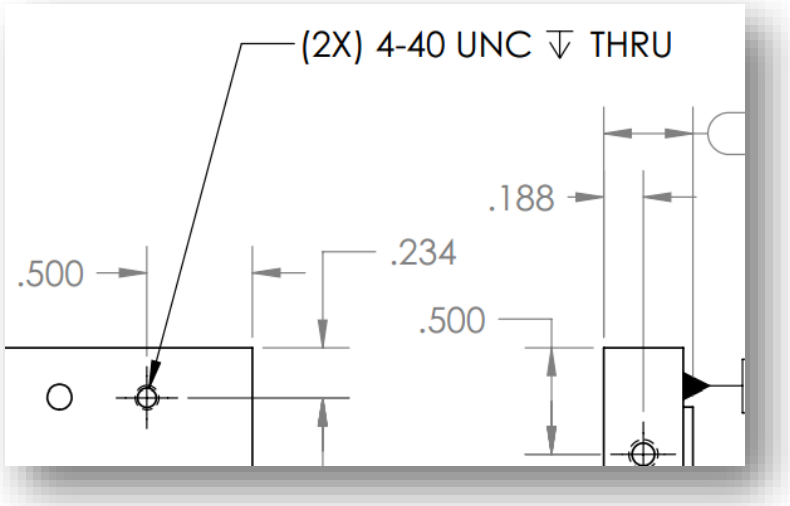
Die



Lathe

Tap Drill Selection

Mounting block

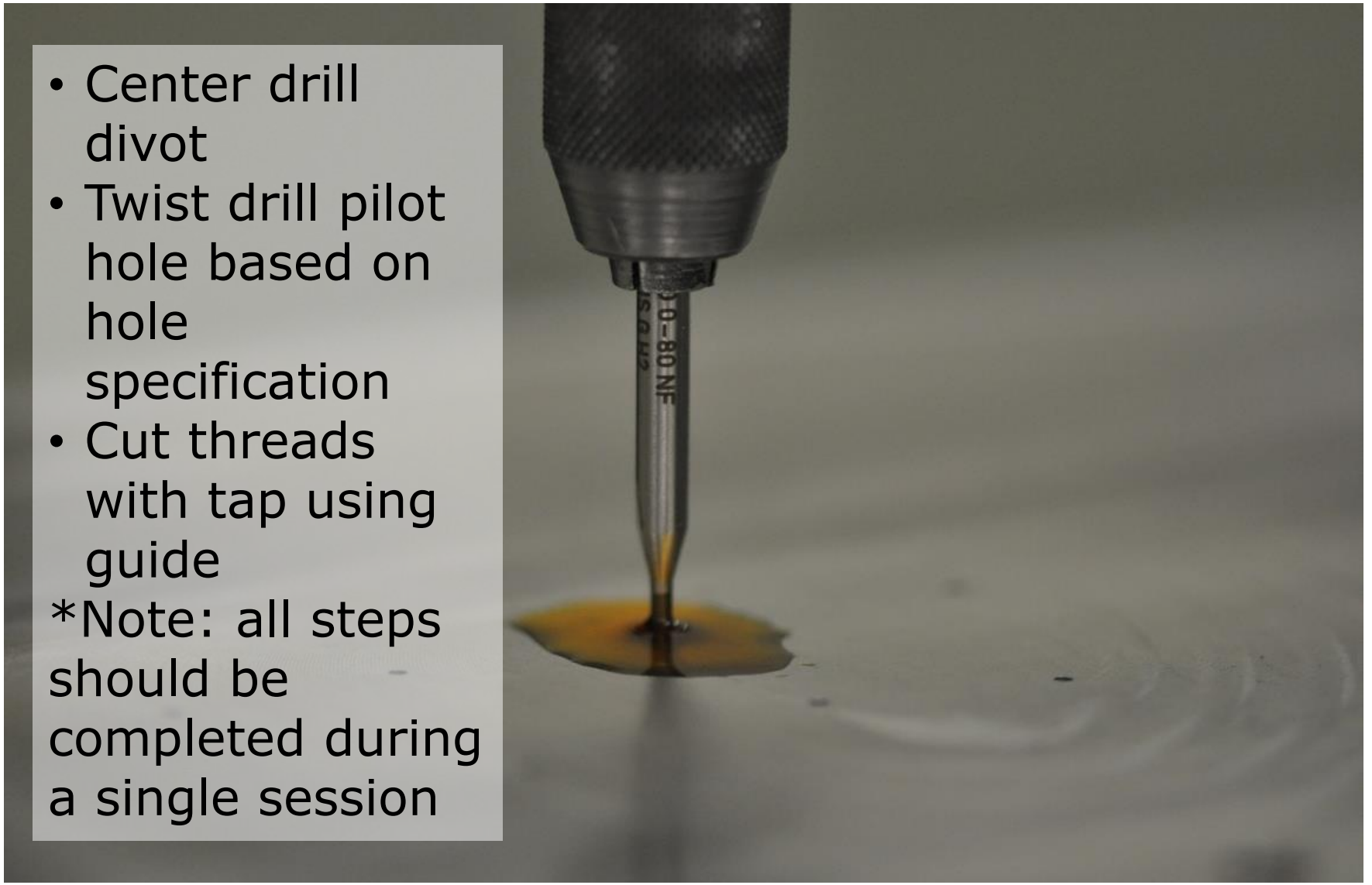


Tap drill chart (MEAM design wiki)

Common Tap and Clearance Drill Sizes

thread size	tap drill	clearance (close)	clearance (free)
0-80 UNF	3/64 (0.047")	52 (0.064")	50 (0.070")
2-56 UNC	50 (0.070")	43 (0.089")	41 (0.096")
4-40 UNC	43 (0.089")	32 (0.116")	30 (0.129")
6-32 UNC	36 (0.107")	27 (0.144")	25 (0.150")
8-32 UNC	29 (0.136")	18 (0.170")	16 (0.177")

Tapping Process



- Center drill divot
- Twist drill pilot hole based on hole specification
- Cut threads with tap using guide

*Note: all steps should be completed during a single session