Understanding Threads and Fasteners

- There are three basic applications for screw threads:
  - To hold parts together
  - To provide for adjustment between parts
  - To transmit power
Screw Thread Terms

Typical thread forms include:
- Sharp-V thread (60 degrees)
- American national thread
- Unified thread
- Unified extra fine thread series
- Metric thread
- Square thread
- Acme thread

Screw Thread Forms
Screw Thread Forms

- Typical thread forms (cont.)
  - Standard worm thread
  - Whitworth thread
  - Knuckle thread
  - Buttress thread
Thread Pitch

Right-hand and Left-hand Threads
Single and Multiple Threads

- Single threads are composed of one ridge and the lead is equal to the pitch
- Multiple threads are composed of two or more ridges running side by side
Thread Fits

- ANSI has established 3 classes of fit:
  - Class 1 – when clearance between mating parts is essential
  - Class 2 – high quality for the bulk of interchangeable screw thread work
  - Class 3 – exceptionally high quality recommended only when high cost of precision is warranted

Thread Fits

- Some specialized metric thread applications are specified by:
  - Tolerance grade
  - Tolerance positions
  - Class
  - Length of engagement
There are three methods of representing screw threads on drawings:

- Schematic
- Simplified
- Detailed
Methods for Drawing Thread
Thread Notes

- ASME/ANSI Y 14.6-2001 “Screw Thread Representations” is a standard for representing, specifying, and dimensioning screw threads on drawings.
  - These same notes or symbols are used in correspondence, in records, and in specifications for parts, taps, dies, tools, and gages.
Thread Notes

External Thread Symbols
Internal Thread Symbols

Detailed Representation
Detailed Representation

Use of Phantom Lines
Threads in Assembly

Pipe Thread Representation
Bolts, Studs, and Screws

(a) Bolt  (b) Cap screw  (c) Stud

Types of Screw Heads
Tapped Holes

- The bottom of a drilled hole formed by the point of a twist drill is cone shaped.
- The thread length is the length of full or perfect threads.
  - The tap drill depth does not include the cone point of the drill.
Standard Bolts and Nuts

- Standard bolts and nuts have characteristics determined by:
  - Bolt types
  - Finish
  - Proportions
  - Threads
  - Thread lengths
  - Bolt lengths

Specifications

- In specifying bolts, the following information must be covered in order:
  - Nominal size of bolt body
  - Thread specification or thread note
  - Length of bolt
  - Finish of bolt
  - Style of head
  - Name
Locknutes and Locking Devices

(a) Regular unfinished jam nut (Amer Std)
(b) Regular semi-finished jam nut (Amer Std)
(c)
(d)
(e)
(f)

(g) Finished slotted nut (Amer Std)
(h) Finished castle jam nut (Amer Std)
(i) ESNA stop nut

Standard Cap Screws

(a) Hexagon head
(b) Flat head
(c) Round head
(d) Fillister head
(e) Hex socket
Standard Machine Screws

Standard Wood Screws
Keys

- Keys are used to prevent movement between shafts and wheels, couplings, cranks, and similar machine parts attached to or supported by shafts.
Keys

Machine pins include taper pins, straight pins, dowel pins, clevis pins, and cotter pins.
Springs

- A spring is a mechanical device designed to store energy when deflected and to return the equivalent amount of energy when released.
- Springs are classified as:
  - Helical springs
  - Flat springs

Helical Springs

- Helical springs have three types:
  - Compression springs
  - Extension springs
  - Torsion springs
Helical Springs

(a) Detailed round wire spring
(b) Detailed Square wire spring
(c) Small spring in section
(d) Use of phantom lines
(e) Schematic compression spring
(f) Schematic tension spring

Compression Springs

FL = Free length
t = Dia of wire
D = Controlling dia inside or outside
L1 = Comp length (min)
L2 = Comp length (max)

(a) No. of coils
Plain ends
(b) Square ends
(c) Plain end ground
(d) Squared and ground
Compression Springs Required

Extension Springs

- MATERIAL: 2.00 OIL TEMPERED SPRING STEEL WIRE
- 14.5 COILS RIGHT HAND
- MACHINE LOOP AND HOOK IN LINE
- SPRING MUST EXTEND TO 110 WITHOUT SET
- FINISH: BLACK JAPAN
Extension Springs Required Information

Extension Spring
Torsion Springs

MATERIAL: .059 MUSIC WIRE
6.75 COILS RIGHT HAND NO INITIAL TENSION
TORQUE: 2.50 INCH LB AT 155° DEFLECTION SPRING MUST
DEFLECT 180° WITHOUT PERMANENT SET AND
MUST OPERATE FREELY ON .75 DIAMETER SHAFT
FINISH: CADMIUM OR ZINC PLATE

Torsion Spring Manufacture
Flat Springs

MATERIAL: 1.20 X 14.0 SPRING STEEL
HEAT TREAT: 44-48 C ROCKWELL
FINISH: BLACK OXIDE AND OIL