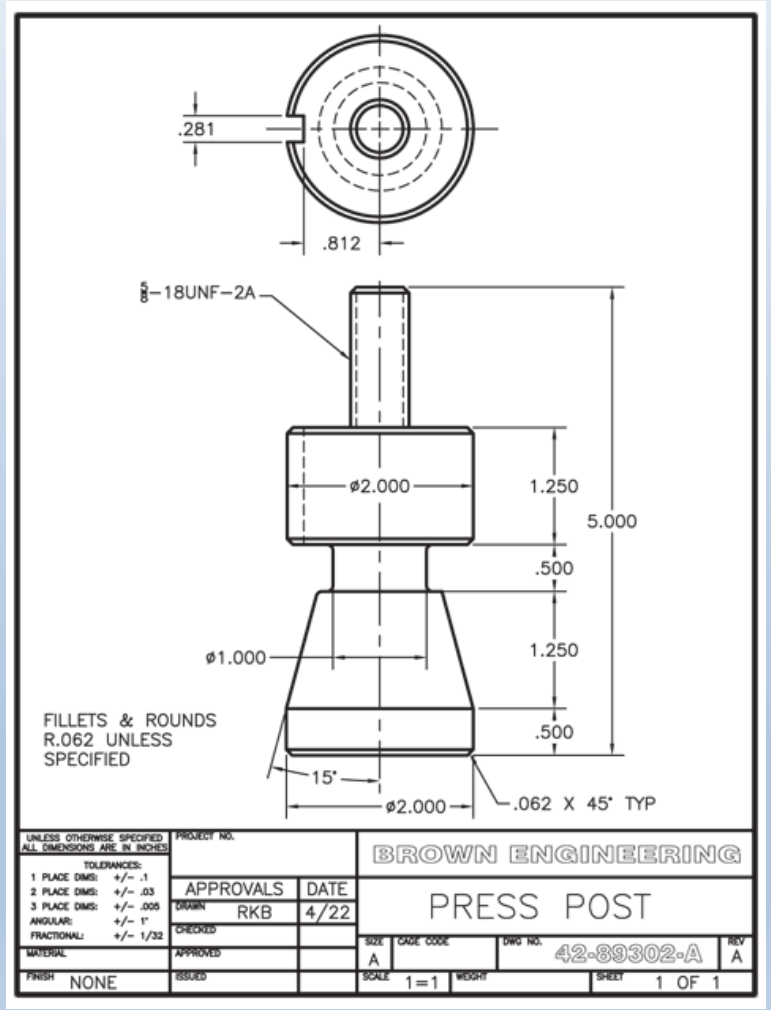
Welcome to Blue Print Reading
presented by
Barrow Advanced Manufacturing

Detail Drawings

- Includes:
  - Name of the part
  - Shape description
  - Size description
  - Notes
  - Materials
  - Special requirements



ASSEMBLY OVERVIVEW

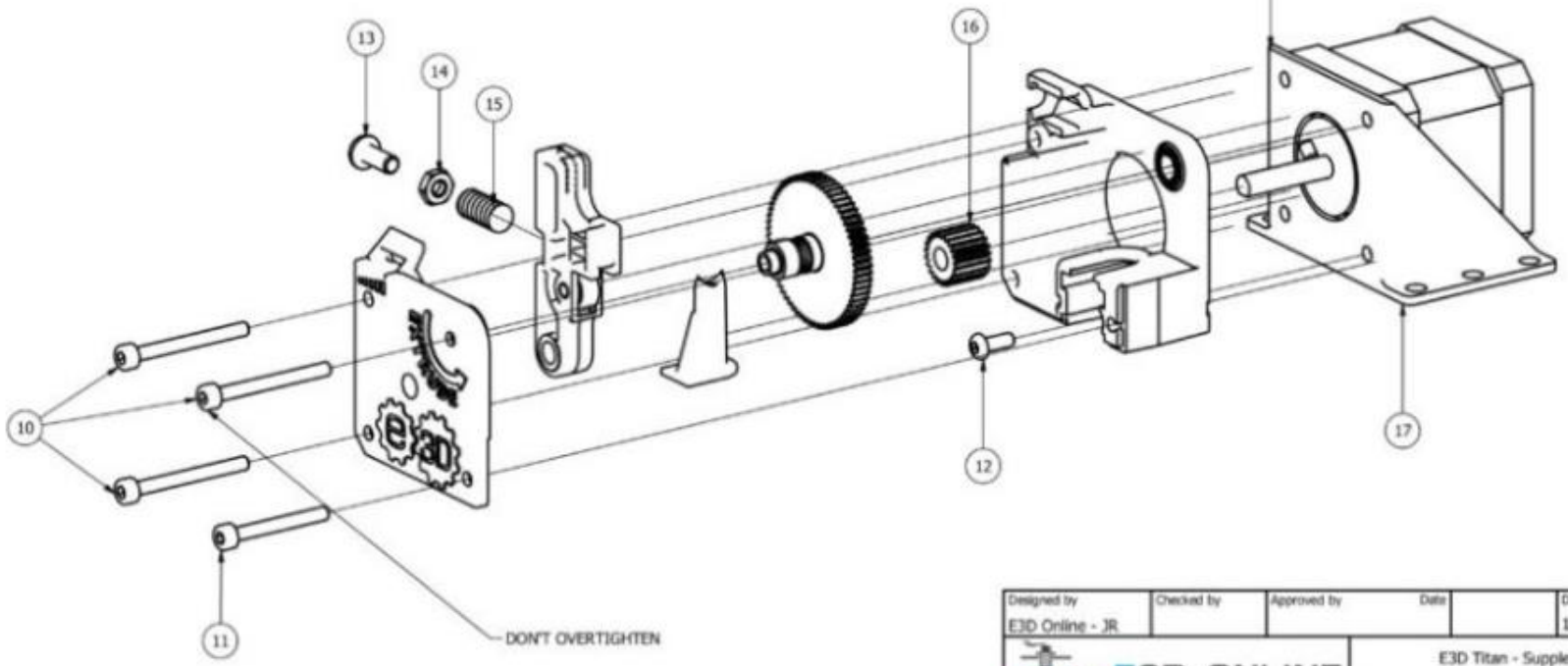
PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
10	3	M3 x 30	M3 x 30 Low Head Socket Cap Screw
11	1	M3 x 25	M3 x 25 Low Head Socket Cap Screw
12	1	M3 x 8	M3 x 8 Dome Head Socket Cap Screw
13	1	M4 x 10	M4 x 10 Dome Head Socket Cap Screw
14	1	M4 Hex Nut	M4 Hex Nut
15	1	EX_SPRING	Extruder Idler Spring
16	1	EX_PINION	Extruder Pinion Gear (Steel)
17	1	EX_BRACKET	Extruder Bracket - Printed Example

NOTE: THESE DRAWINGS ARE FOR REFERENCE ONLY.
REFER TO http://wiki.e3d-online.com/wiki/Titan_Assembly FOR ASSEMBLY INFORMATION

NOTE: A SPACER IS ALWAYS REQUIRED

1. THICKNESS: 2 MIN - 4.5 MAX
2. MAX ASSUMES MOTOR SHAFT LENTH 22.2
3. SUPPLIED FIXINGS FOR THICKNESS OF 2

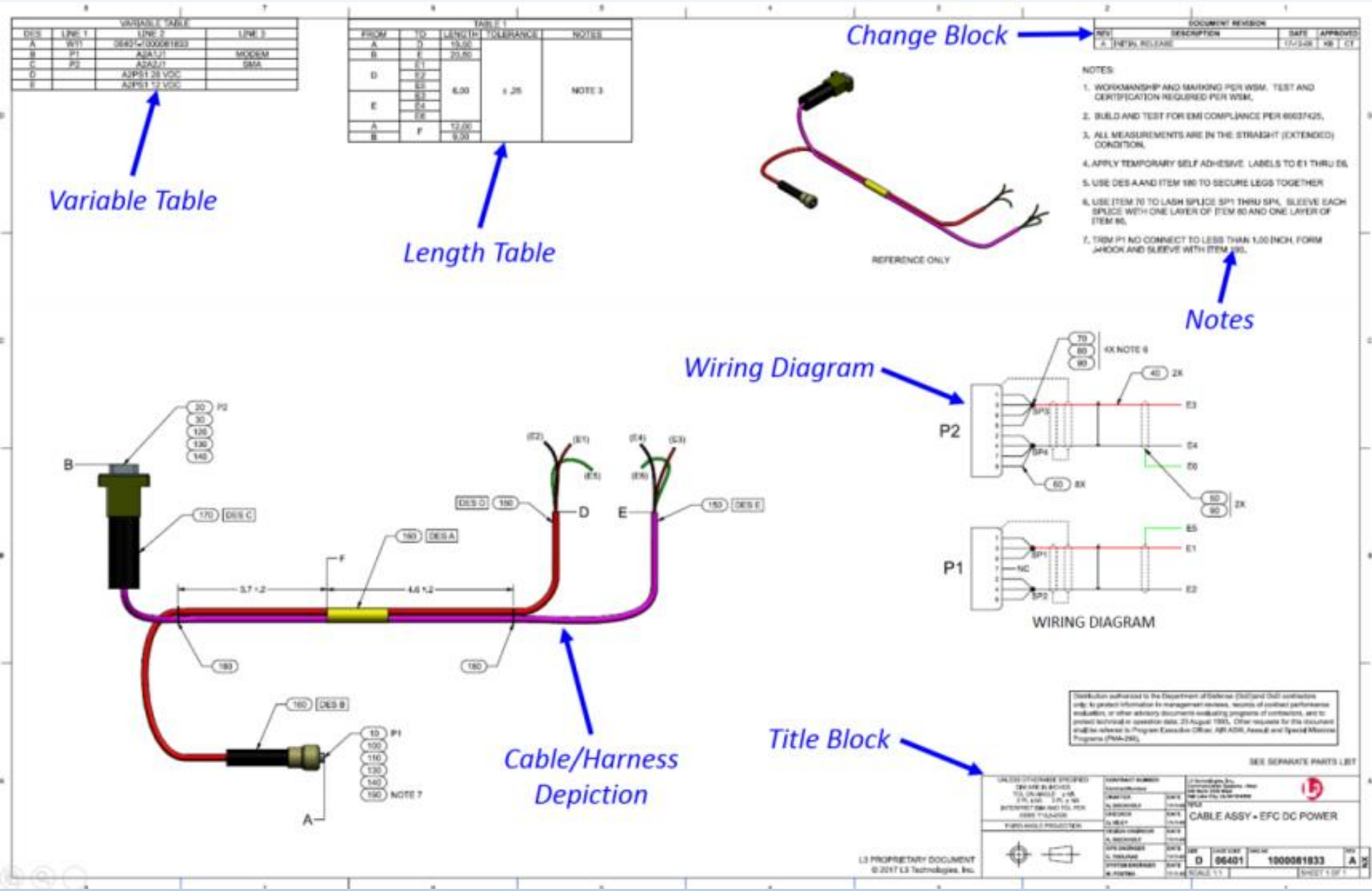


Designed by	Checked by	Approved by	Date		Date
E3D Online - JR					16/02/2016

E3D-ONLINE
your toolkit for everything 3D printing

E3D Titan - Supplementary Drawings

ASM_EX_2 | Edition | Sheet 7 / 12


Change Block
Variable Table
Length Table
Notes
Wiring Diagram
Cable/Harness Depiction
Title Block
WIRING DIAGRAM
REFERENCE ONLY
CABLE ASSY - EFC DC POWER

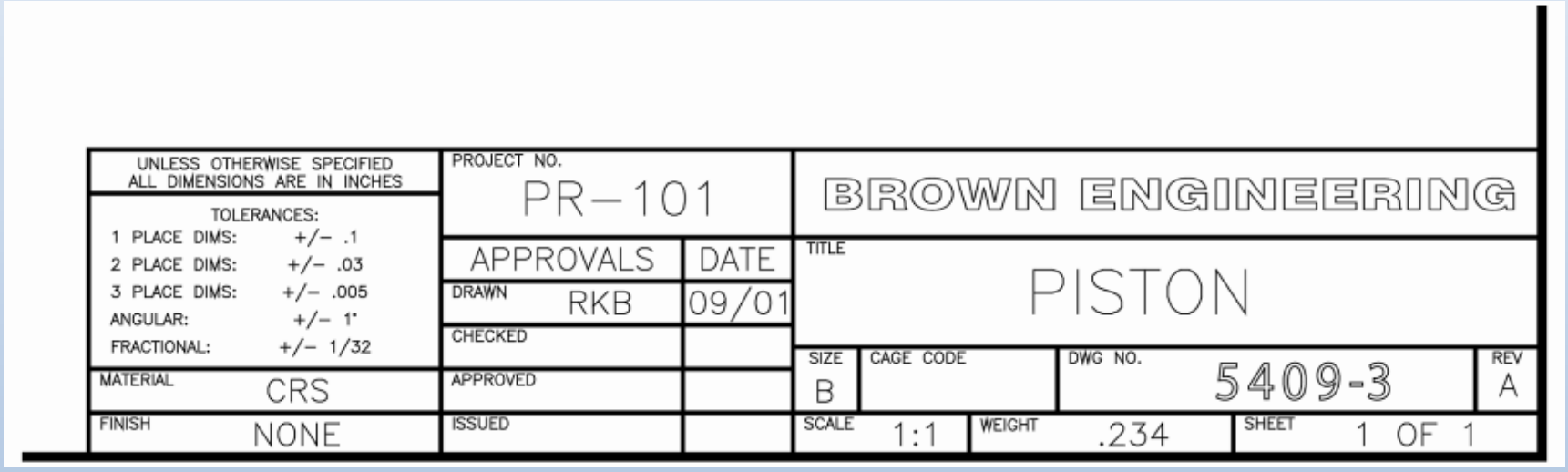
Even though they’re all a little different, every print follows the same basic format as it communicates information to us.

We need to understand the format of a print, then we can find the information, like using an index in a book

Back to what we care about - our own prints and what they tell us

- Prints provide us with the details of:
  - Size
  - Shape
  - Tolerance
  - Materials used
  - Finish
  - Other treatments or processes
  - Other

Basic Title Block Content



Revision History Block

- Revision history block options:
  - Revision letter (status)
  - Date of revision
  - Revision record number (ECO number)
  - Initials for approval, etc.

REVISION HISTORY

REV	DATE	DESCRIPTION	APPRVD
A	02/10	REDRAWN	RKB
B	03/10	ADDED GD&T	DCW
C	11/10	REMOVED HOLE AND KEYWAY	MAR

Parts Lists

- Parts list options:
  - Part ID letter (mark)
  - Quantity
  - Part number
  - Part description

8	1	8400–356	INSTRUCTIONS
7	1	143–5321–150	LABEL, 100–200 SERIES
6	3	304–5300–101	SPRING, GUIDE
5	3	304–5300–100	PIN, GUIDE
4	1	143–5320–410	BUSHING
3	1	143–5320–407	COLLET, SELF–CENTERING
2	1	143–5321–202	HUB, 200 SERIES
1	1	143–5321–201	BASE, 200 SERIES
MARK	QTY	PART NUMBER	DESCRIPTION

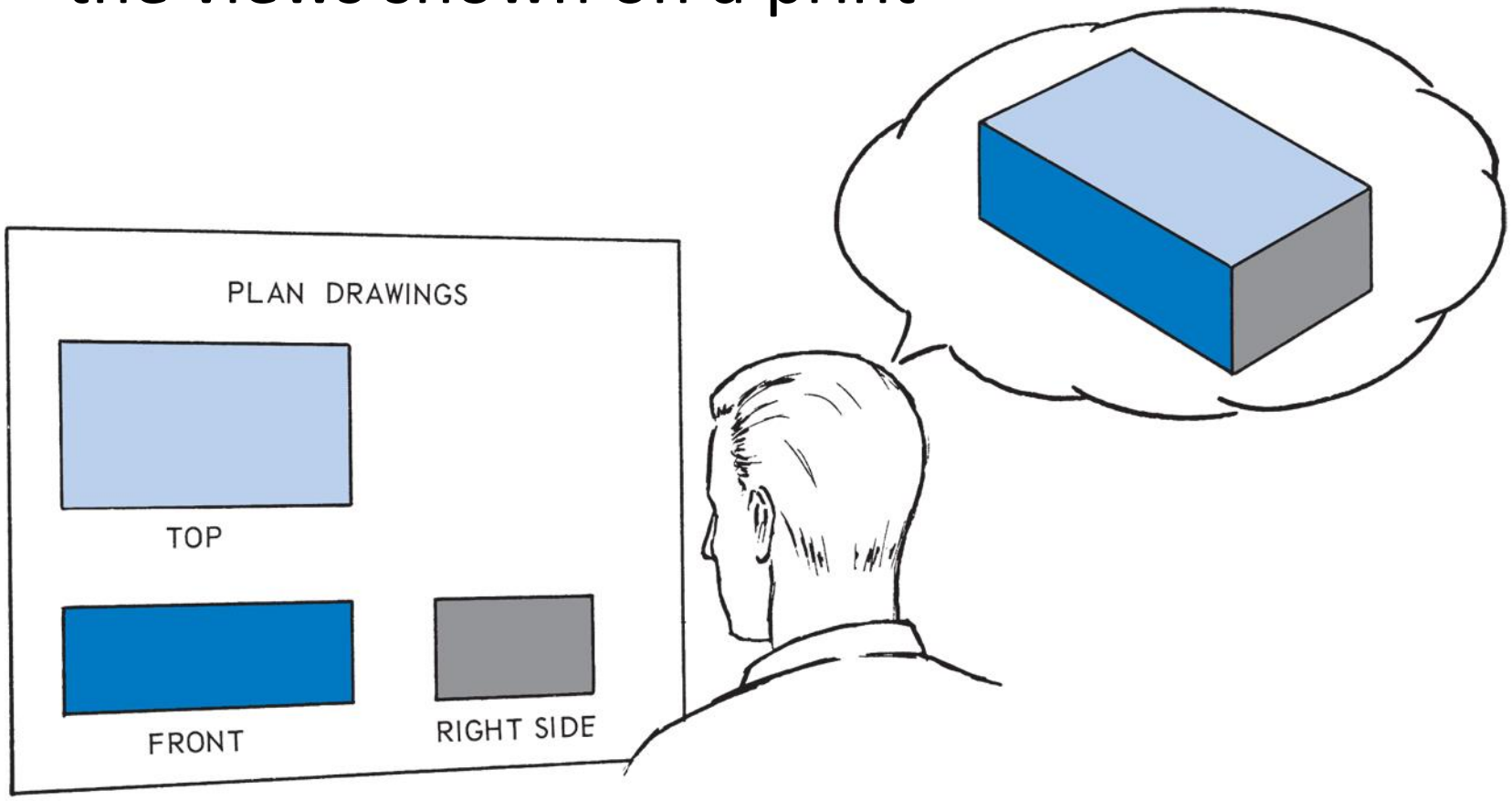
PARTS LIST

Part II

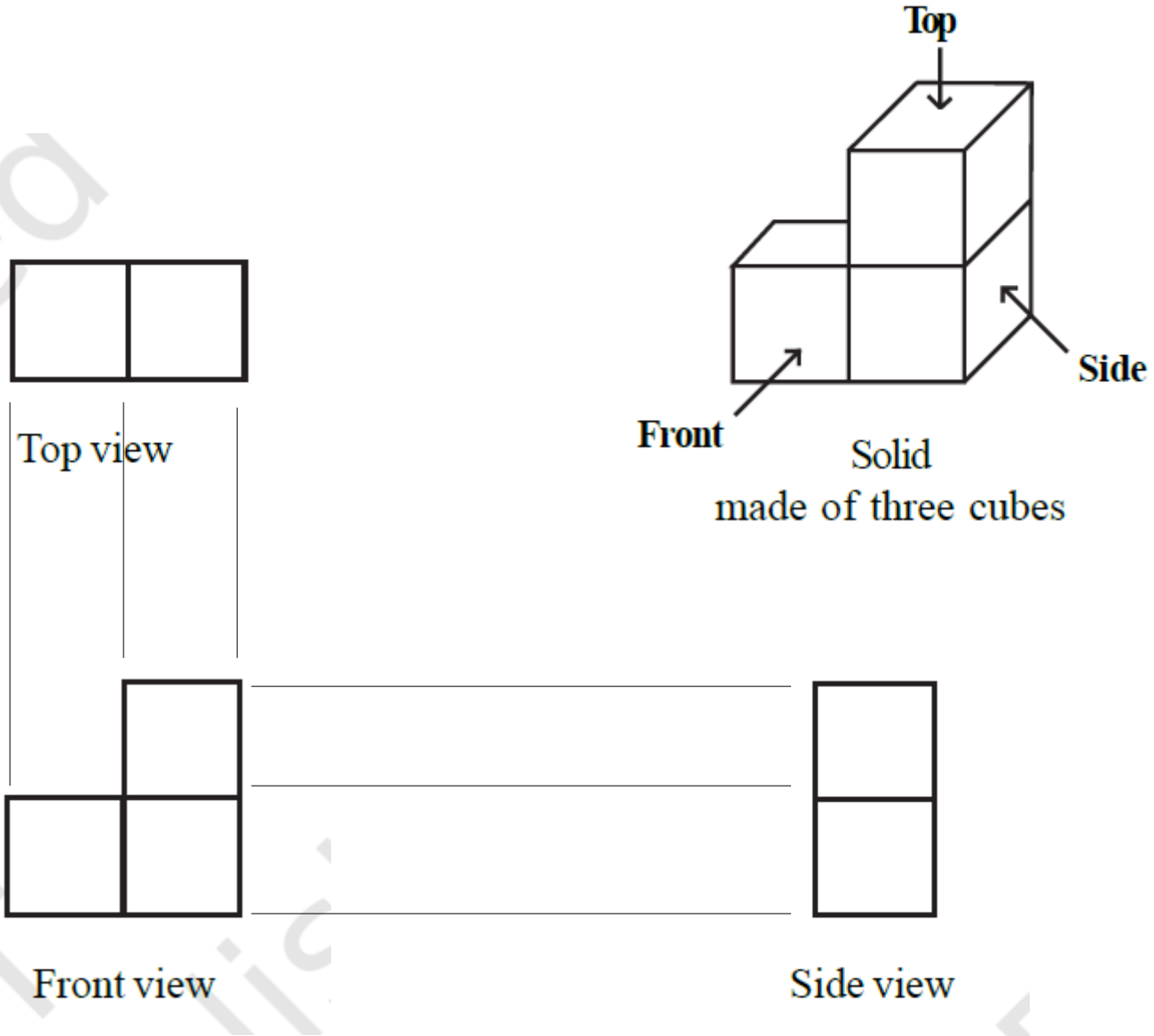
Now that I know where to look, how do I know what I’m looking at?

Print Reading Elements

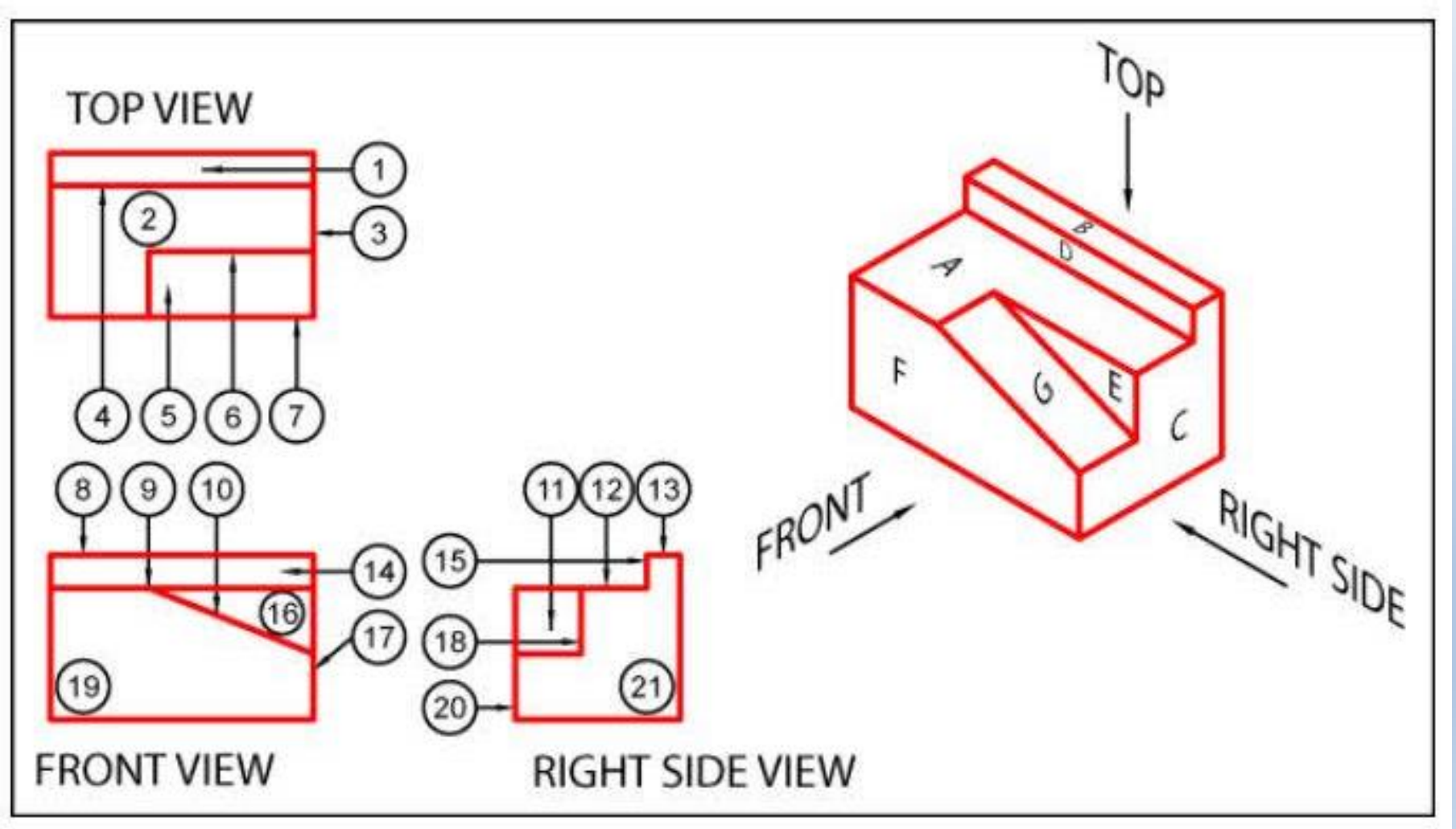
- Visualization is “seeing” the object based on the views shown on a print

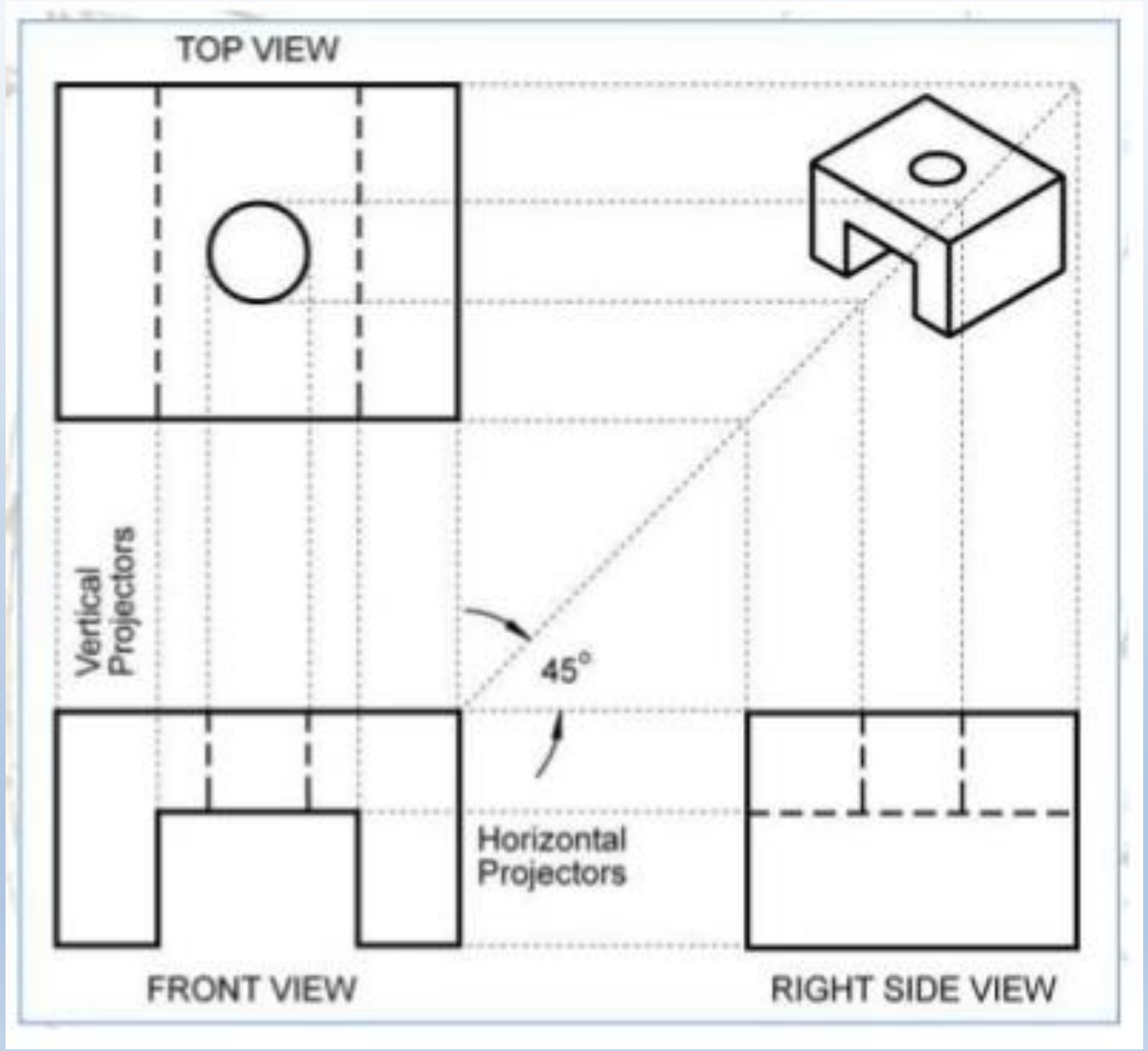


Let’s try again



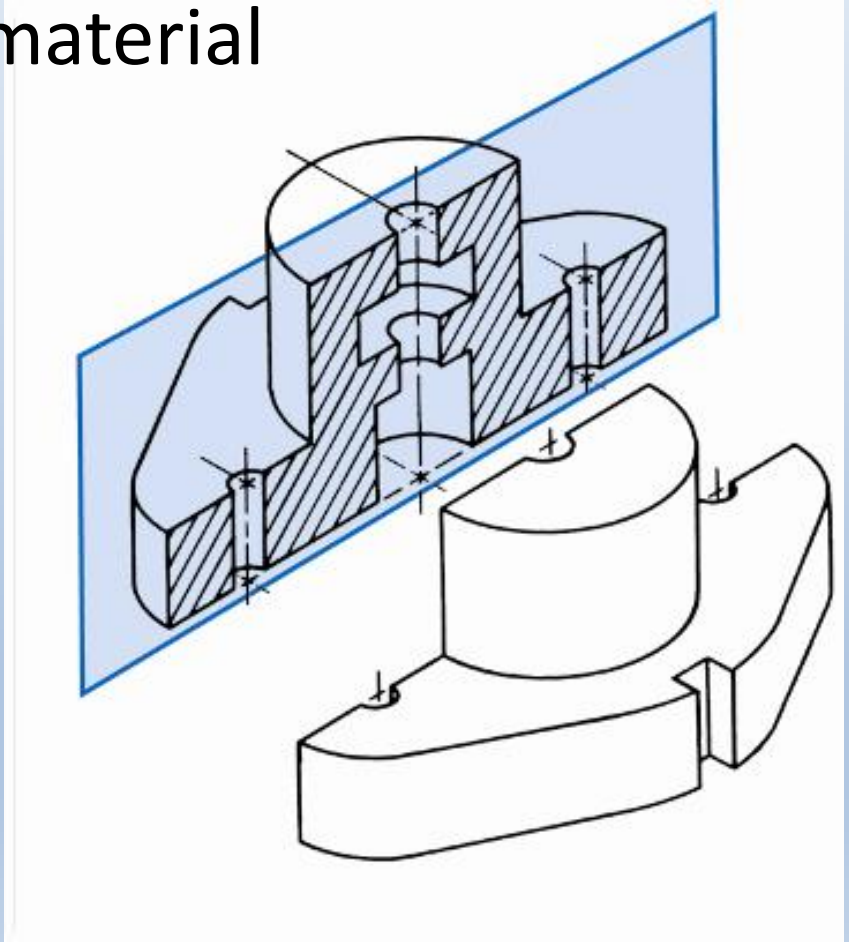
And so on and thus forth




TOP VIEW
Vertical Projectors
45°
Horizontal Projectors
FRONT VIEW
RIGHT SIDE VIEW

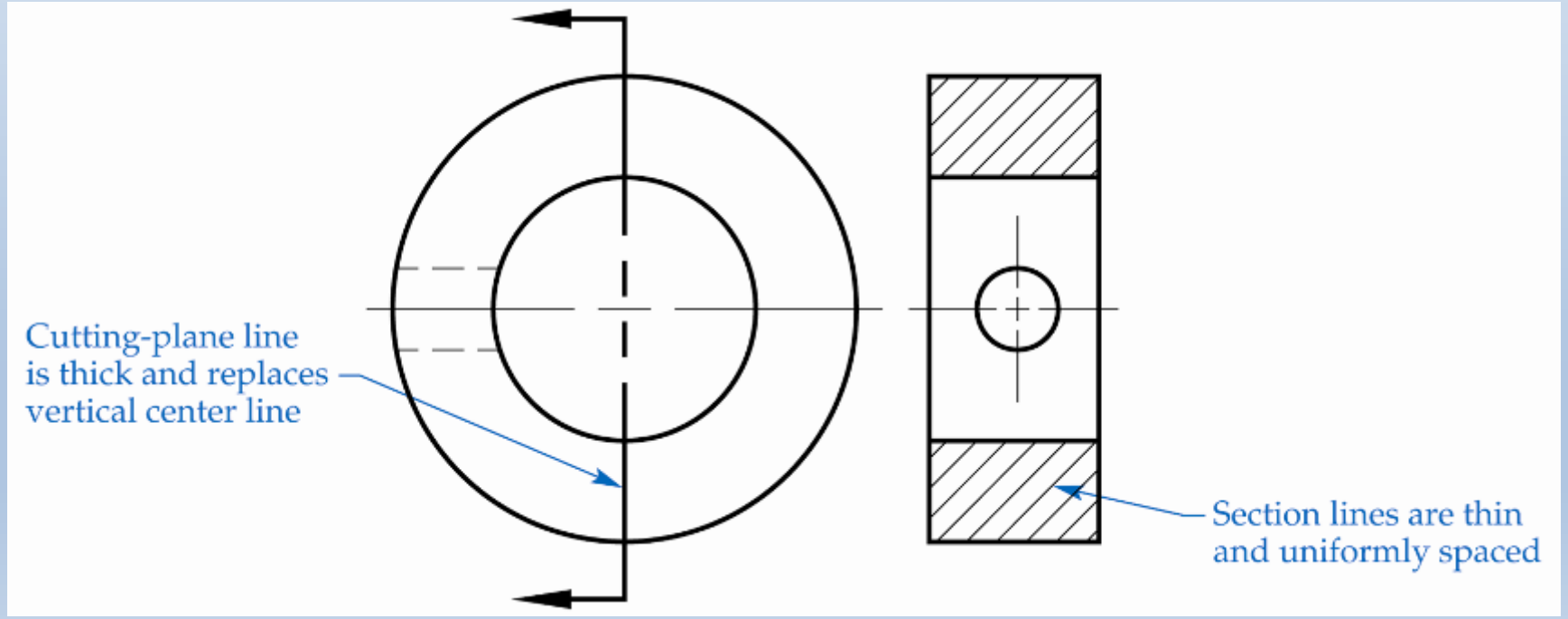
Section Views

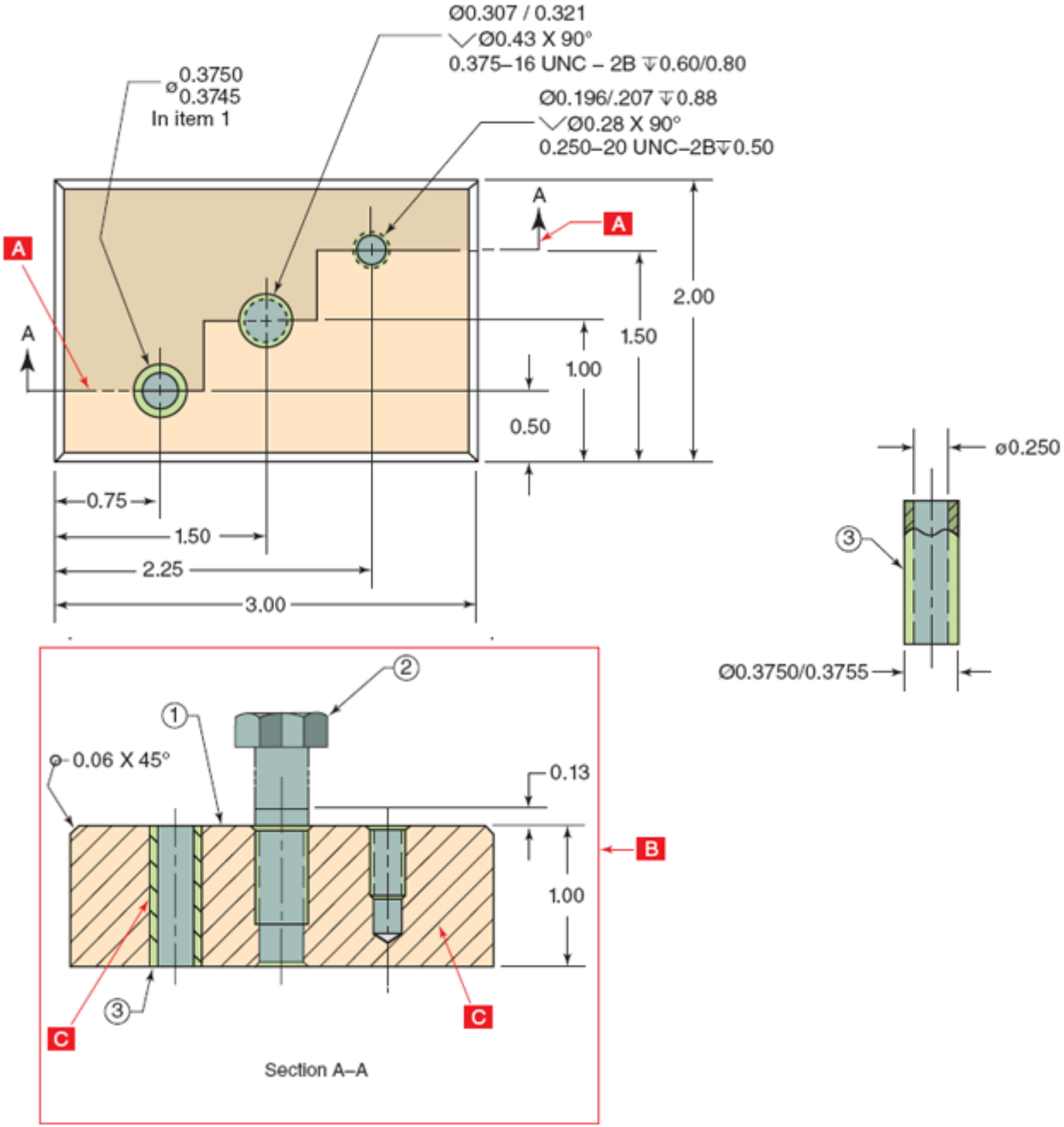
- Created by an imaginary cutting plane slicing through the material



Section View Lines

- Lines used in section views:
  - Section lines
  - Cutting-plane lines




Ø0.307 / 0.321
Ø0.43 X 90°
0.375–16 UNC – 2B ↧0.60/0.80
ø0.3750
ø0.3745
In item 1
Ø0.196/.207 ↧0.88
Ø0.28 X 90°
0.250–20 UNC–2B↧0.50
A
A
A
A
2.00
1.50
1.00
0.50
0.75
1.50
2.25
3.00
ø0.250
3
Ø0.3750/0.3755
2
1
ø 0.06 X 45°
0.13
B
1.00
C
3
C
Section A–A

Part III

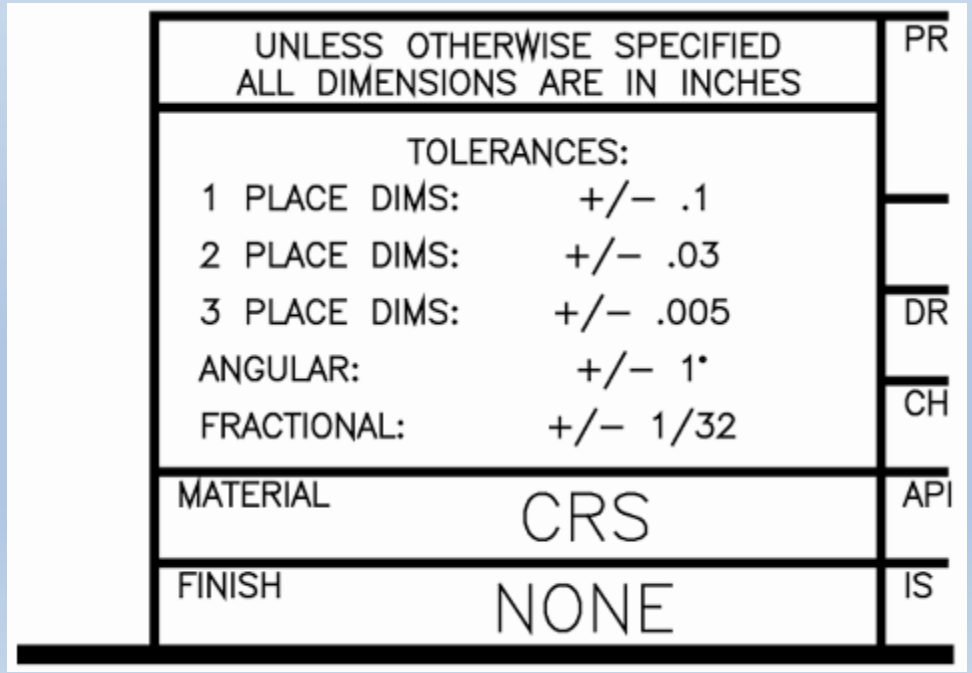
I know what it looks like. How big is it?

-or-

Dimensions and Tolerances

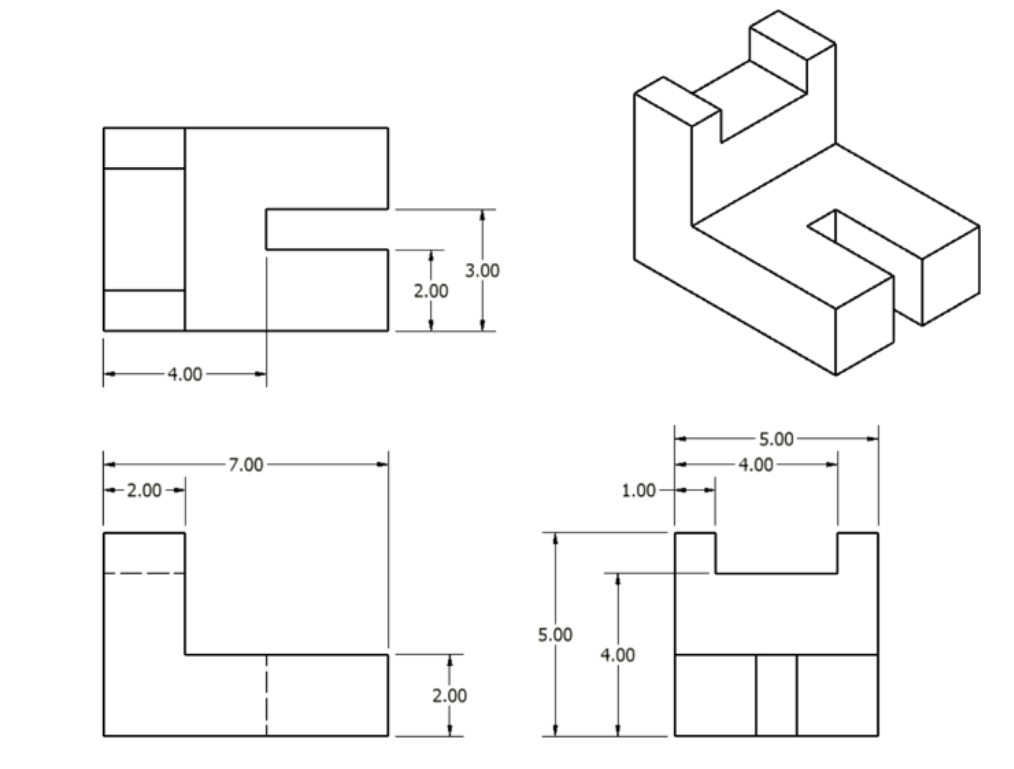
Intermediate Title Block Content

- Tolerances and material information:
  - Material specification
  - Finish area
  - General tolerances

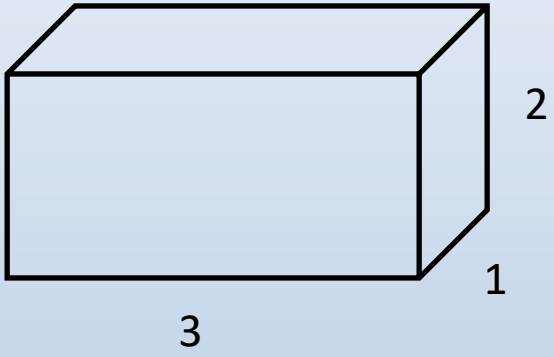


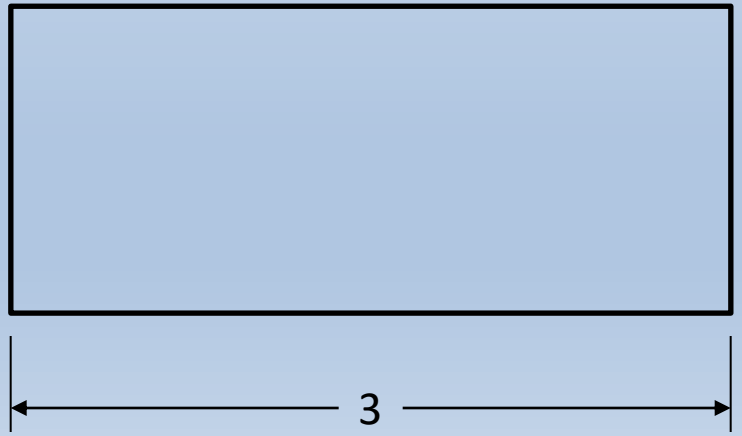
What is the purpose of a detail drawing?

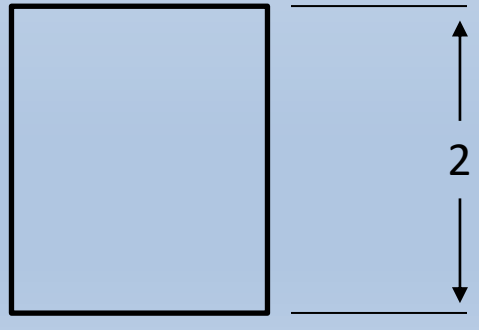
Provides size and shape of an object (conveys information)

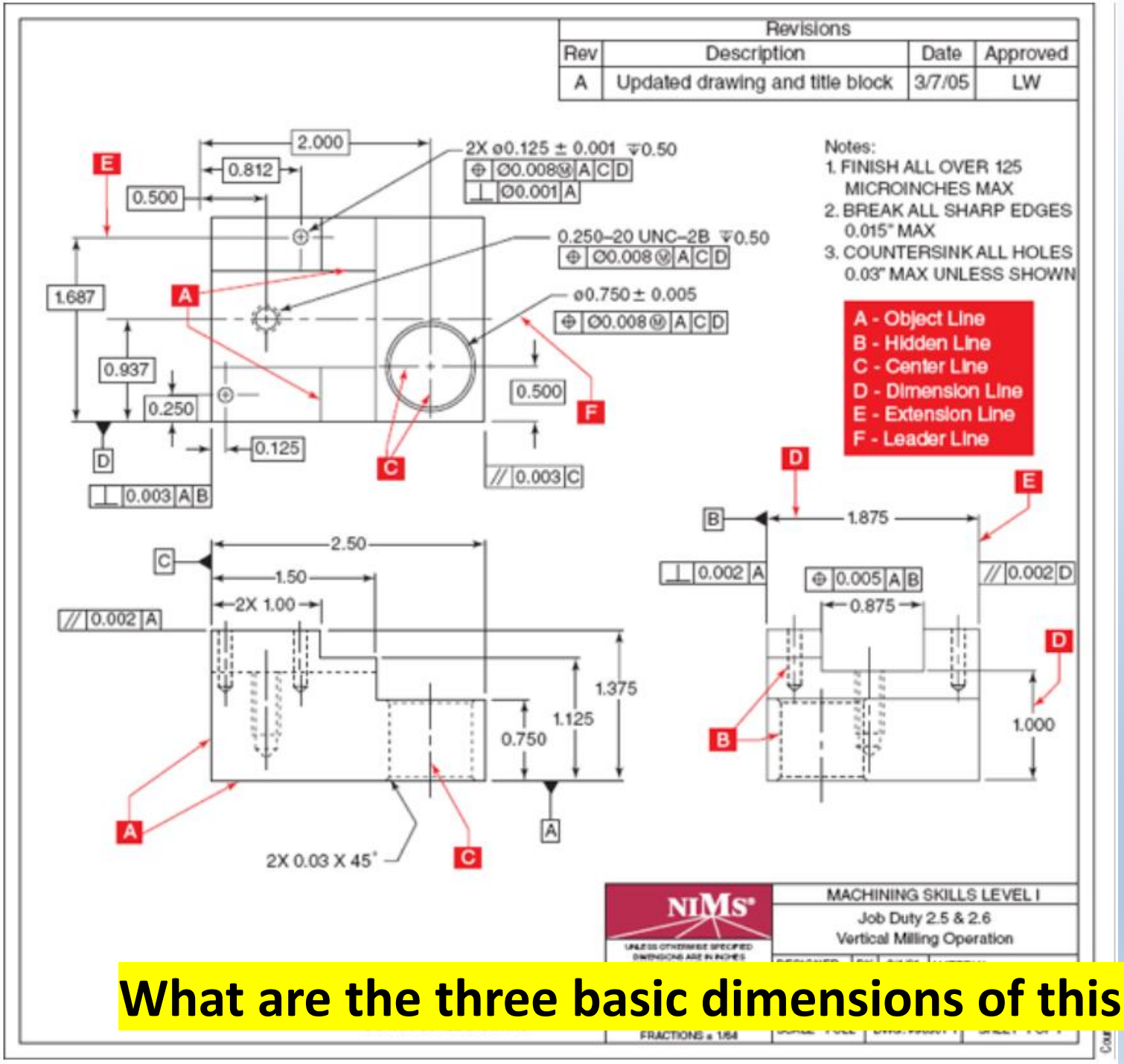



1

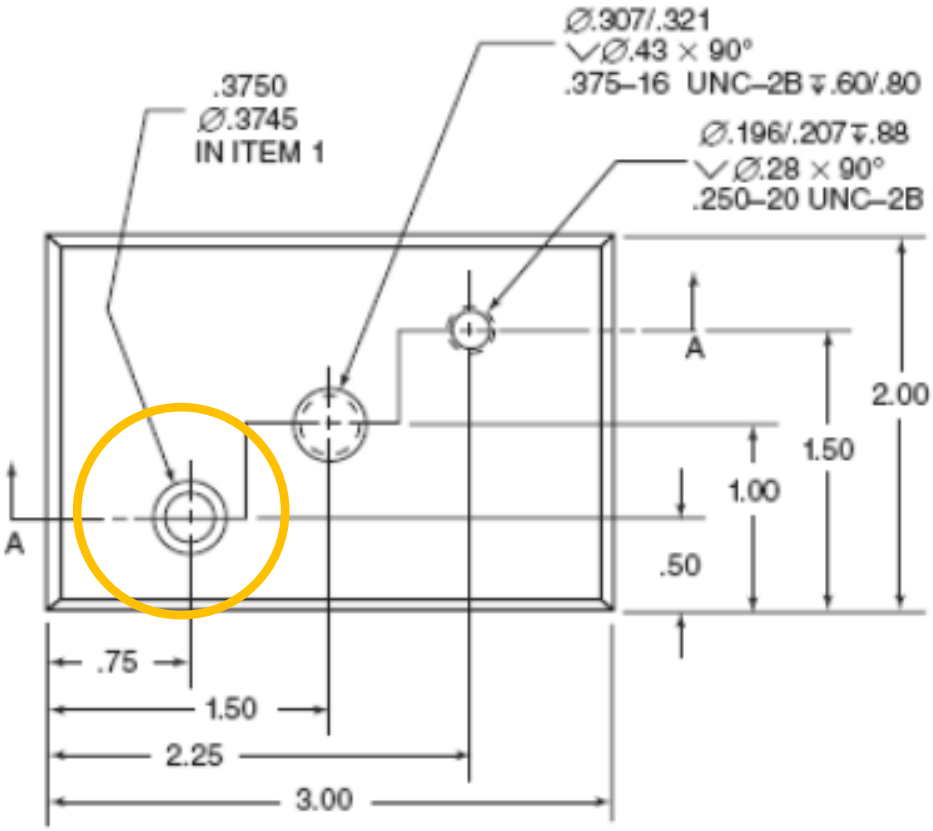

2
1
3


3


2

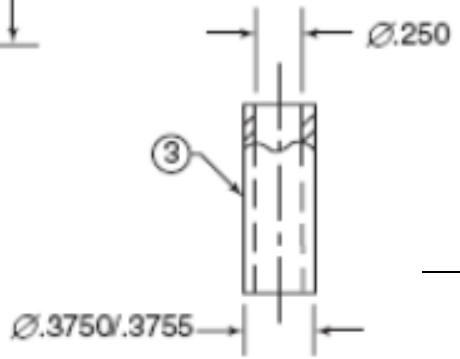


What are the three basic dimensions of this part?

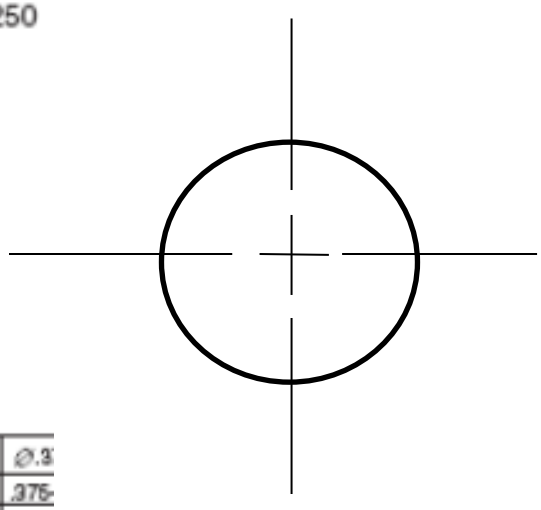


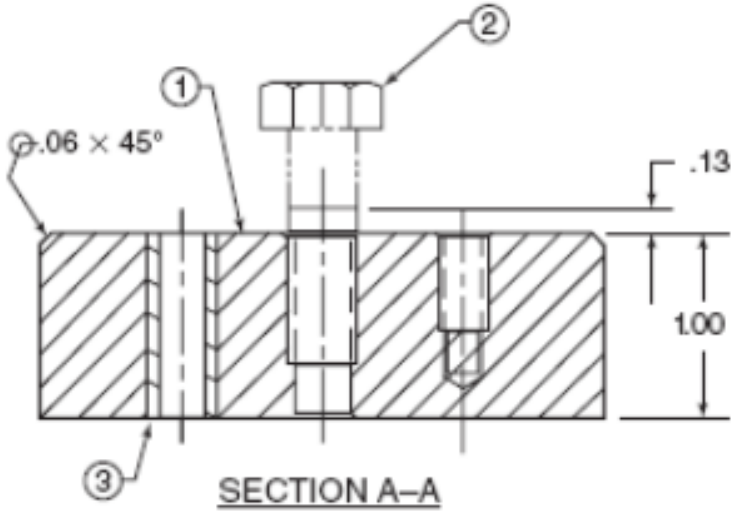
REV	DES
A	UPDATED DRAWING
B	UPDATED .375–16 H

Notes:
1. INSTALL STUD,
2. BLOCK FREE O
3. BROKEN EDGE



.750, .500





ITEM	DESCRIPTION	
3	BUSHING	Ø.3
2	HEX HEAD BOLT	.375-
1	BLOCK	1.00

NIMS®

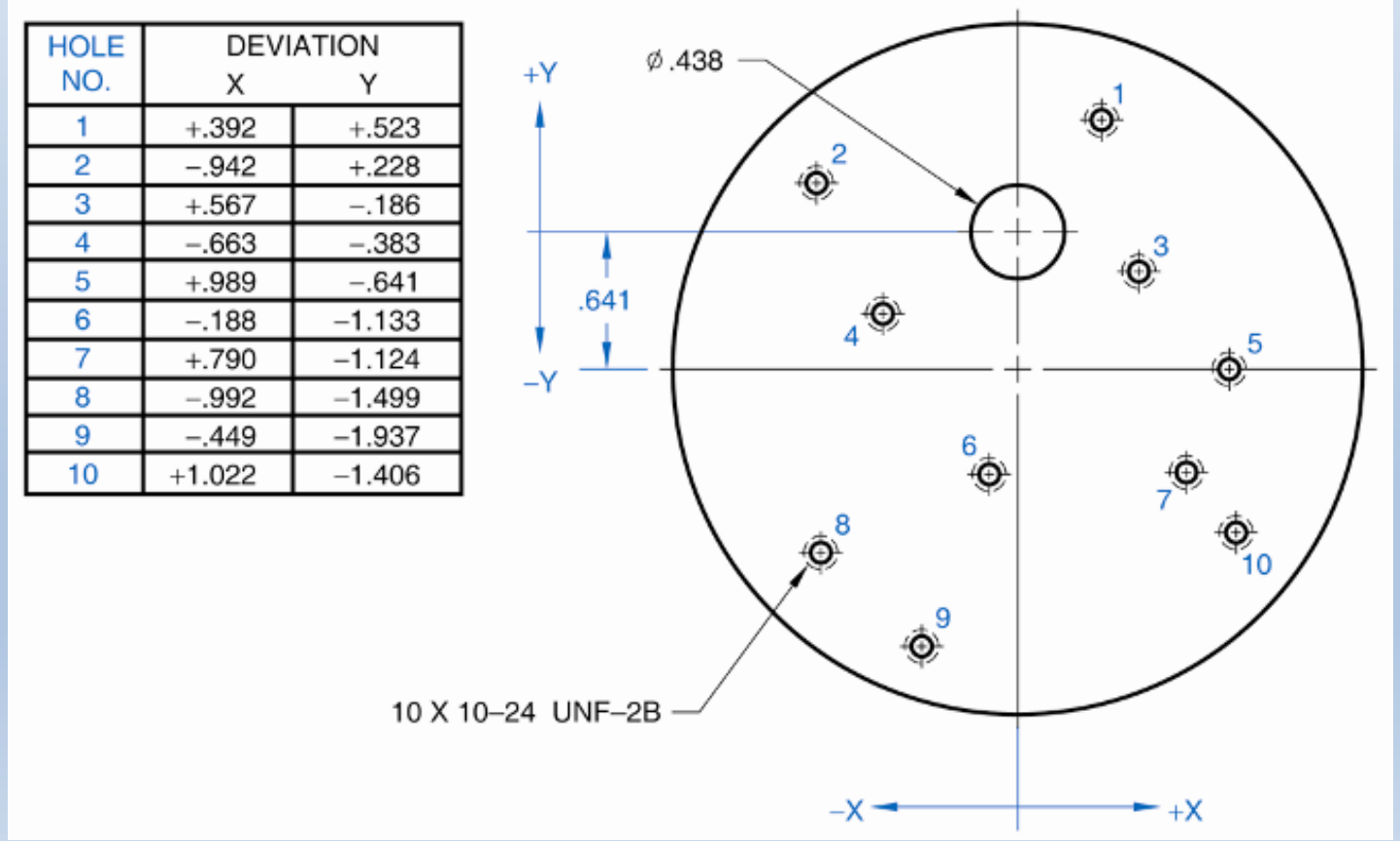
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
INTERPRET DIMENSIONS AND
TOLERANCES PER ASME Y14.5M-19

TOLERANCES

Hole Charts

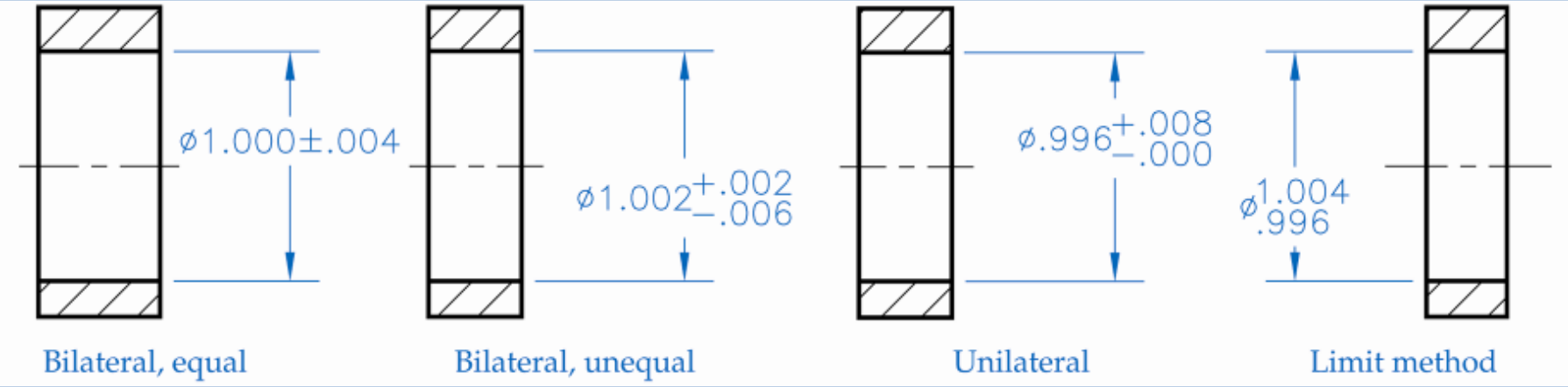
- Often used for a part with a large number of repetitive features

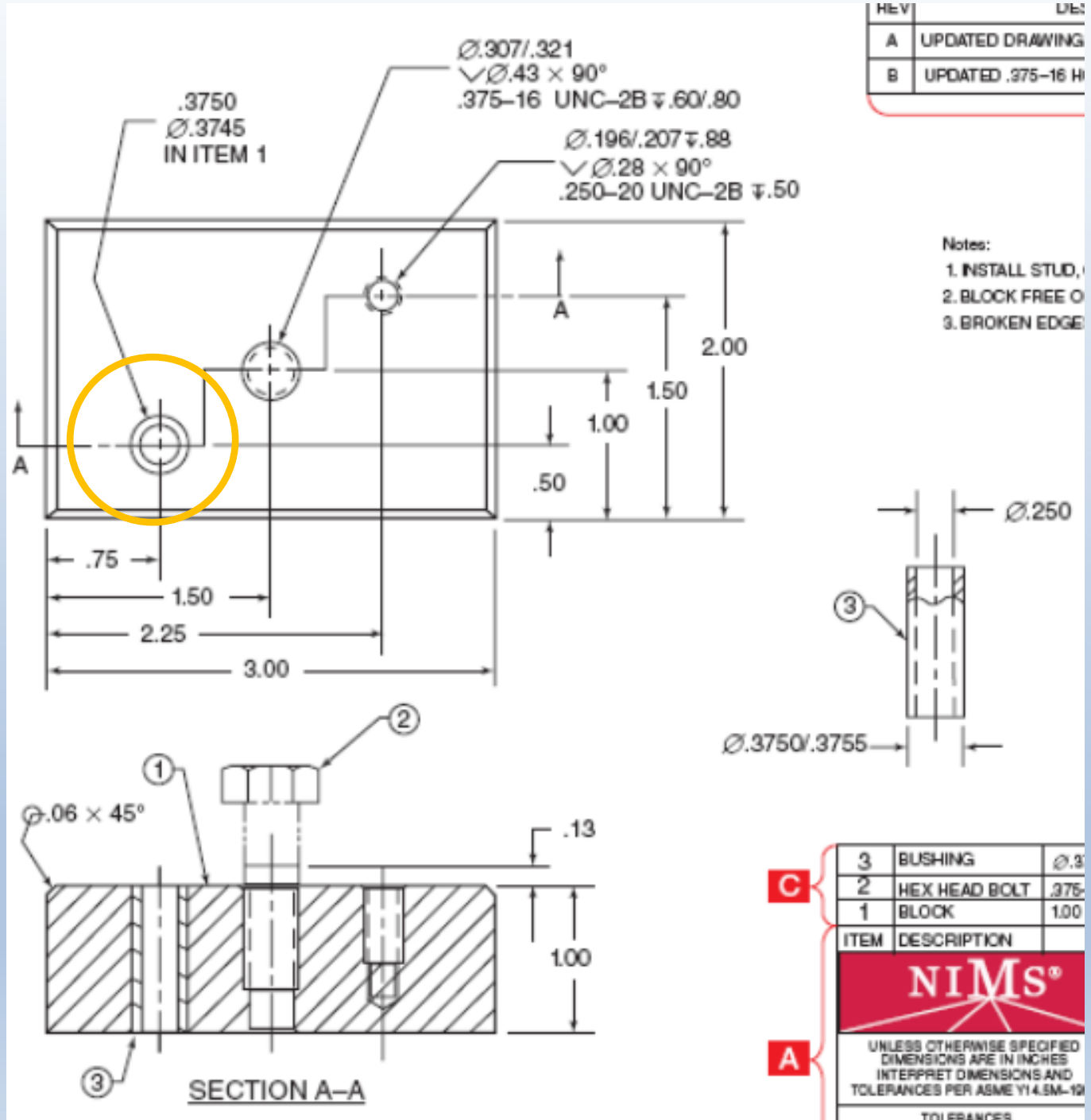
HOLE NO.	DEVIATION X	Y
1	+.392	+.523
2	–.942	+.228
3	+.567	–.186
4	–.663	–.383
5	+.989	–.641
6	–.188	–1.133
7	+.790	–1.124
8	–.992	–1.499
9	–.449	–1.937
10	+1.022	–1.406



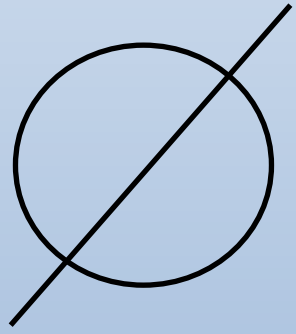
Tolerancing Defined

- Tolerance is the total amount by which a dimension can vary
- In each of these examples, the tolerance is .008″





Diameter between .3745 - .3750



3/8-16 is, by definition UNRC

Set Nominal Screw Size (D) HERE for

NOMINAL SCREW SIZE (D)			
THREADS PER INCH		UNRC	3/8 16
		UNRF	24
TAP DRILL SIZE	UNC	NOMINAL	5/16
		DECIMAL	.313
	UNF	NOMINAL	Q
		DECIMAL	.332

Button Head, Flat Head, Low Head and Socket Head Cap Screws

Screws up to and including 1" size have Class 3A threads. Those larger than 1 inch have Class 2A threads.

Tap drills are for average conditions. For exceedingly soft or hard materials, or short or long lengths of thread engagement, consult ANSI/ASME B1.1.

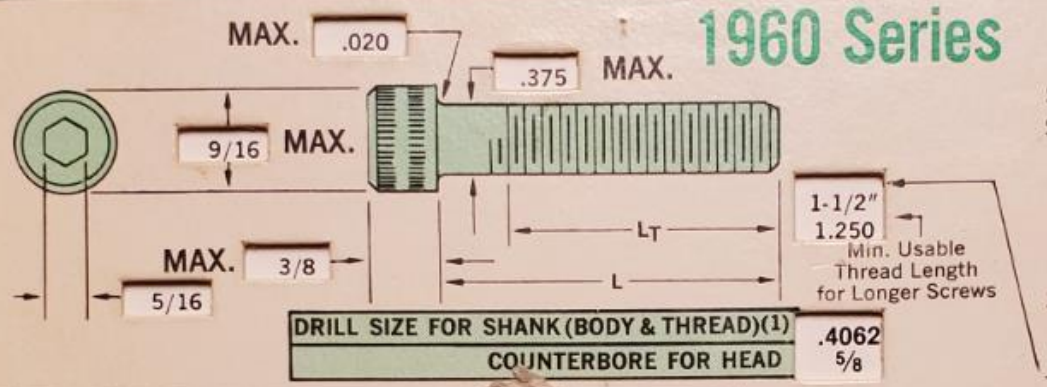
Standard Cap, Flat, Button and Low Head Screws are manufactured from Holo-Krome analysis high grade alloy steels, hardened and tempered to the hardness given below. The Socket Head Cap Screws conform to ASTM A574.

Cap: Hardness—39 - 45 HRC for sizes to 1/2.
37 - 45 HRC for sizes over 1/2.

Flat Heads: Hardness—38 - 45 HRC

Button Heads: Hardness—38 - 45 HRC for sizes to 1/2.
38 - 43 HRC for sizes over 1/2.

Low Heads: Hardness—Same as Button Head Cap.



1960 Series

DRILL SIZE FOR SHANK (BODY & THREAD)(1)		.4062	
COUNTERBORE FOR HEAD		5/8	
AVERAGE TORQUE TO TIGHTEN AVERAGE SCREW TO YIELD	UNRC	995	INCH LBS. (5)
	UNRF	1120	INCH LBS.
AVERAGE TENSION INDUCED IN SCREWS TIGHTENED TO YIELD	UNRC	11,500	POUNDS
	UNRF	13,020	POUNDS (6)
MINIMUM TENSILE STRENGTH	UNRC	13,900	POUNDS
	UNRF	15,800	POUNDS

Values are for standard steel (black finish) screws lubricated with oil clamping hardened steel plates to hardened "nuts" tested at 70° F.

SOCKET HEAD CAP SCREWS

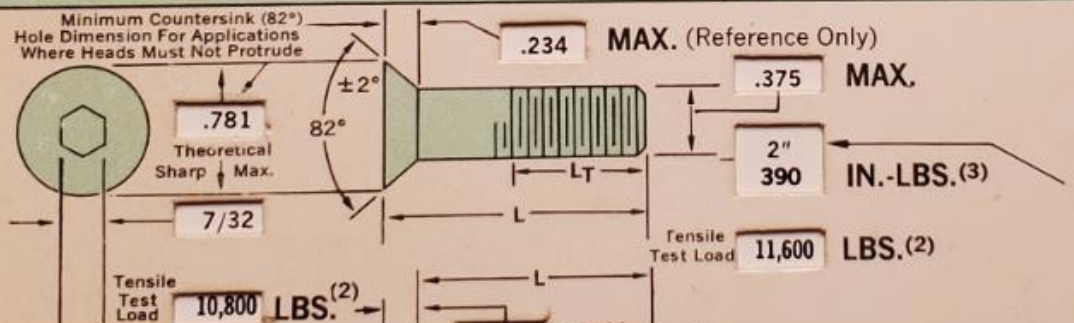
STANDARD LENGTHS (L)

SCREW LENGTHS (L)	INCREMENTS (Sizes to 1" dia.)	INCREMENTS (Sizes over 1" dia.)
1/8" to 1/4"	1/16"	—
1/4" to 1"	1/8"	—
1" to 2"	1/4"	—
2" to 3-1/2"	1/4"	1/2"
3-1/2" to 7"	1/2"	1/2"
7" to 10"	1"	1"
Over 10"	—	2"

THREAD LENGTH (LT). Screws this length and shorter, threading extends to the head.

(a) Diam. #0 to 5/8 inclusive shall have a max. of 2 imperfect threads under the head.

(b) Diam. above 5/8 are threaded as close to head as practicable.



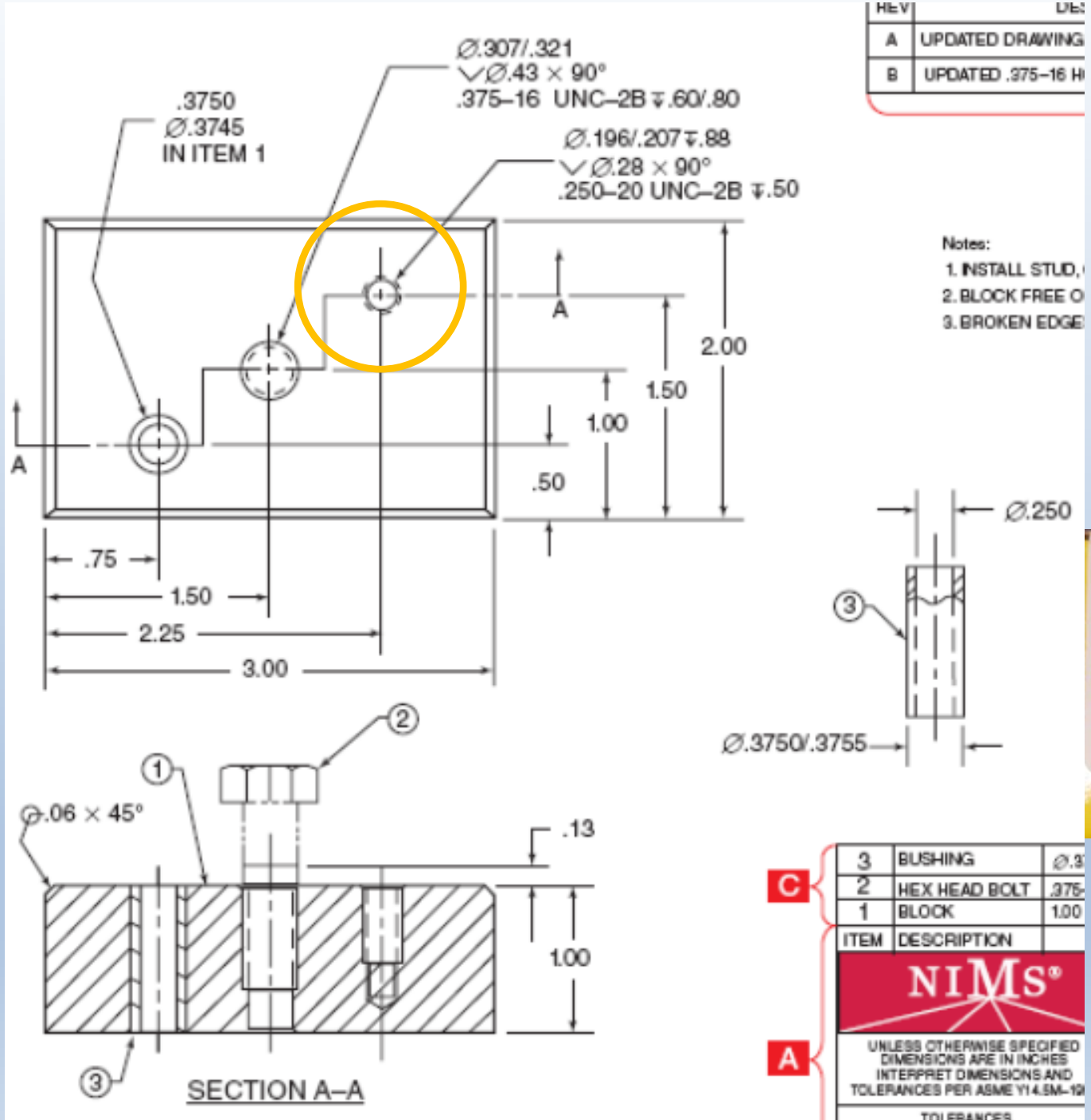
FLAT HEAD SOCKET CAP SCREWS

Standard Lengths (L) are the same as for Socket Head Cap Screws.

THREAD LENGTH (LT). Minimum usable thread length shall equal twice the diameter plus 1/2" (2D + 1/2").

Screws this length and shorter are threaded as close to head as practicable.

BUTTON HEAD SOCKET CAP SCREWS(4)



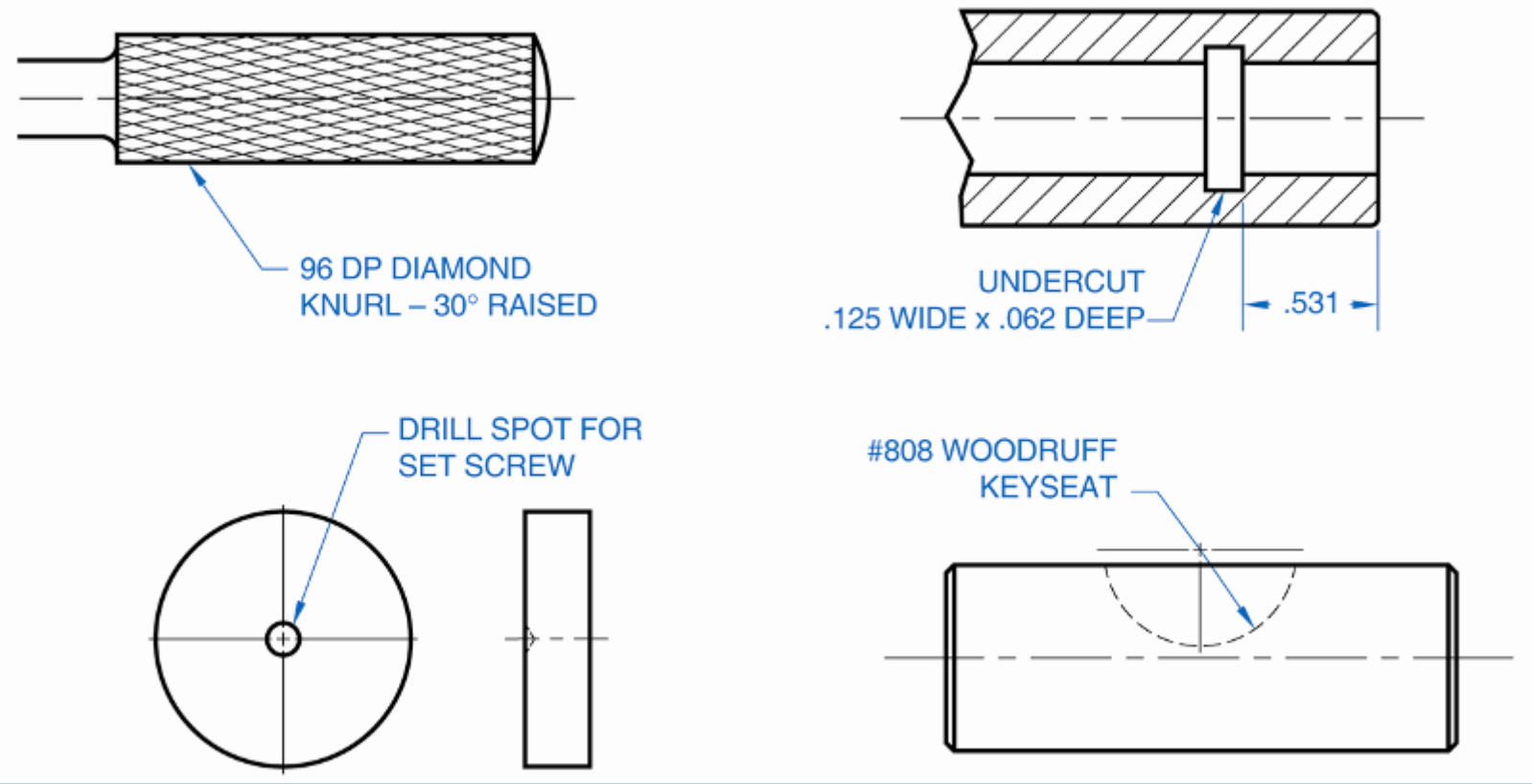
Drill and tap (D&T) for a 1/4-20 bolt

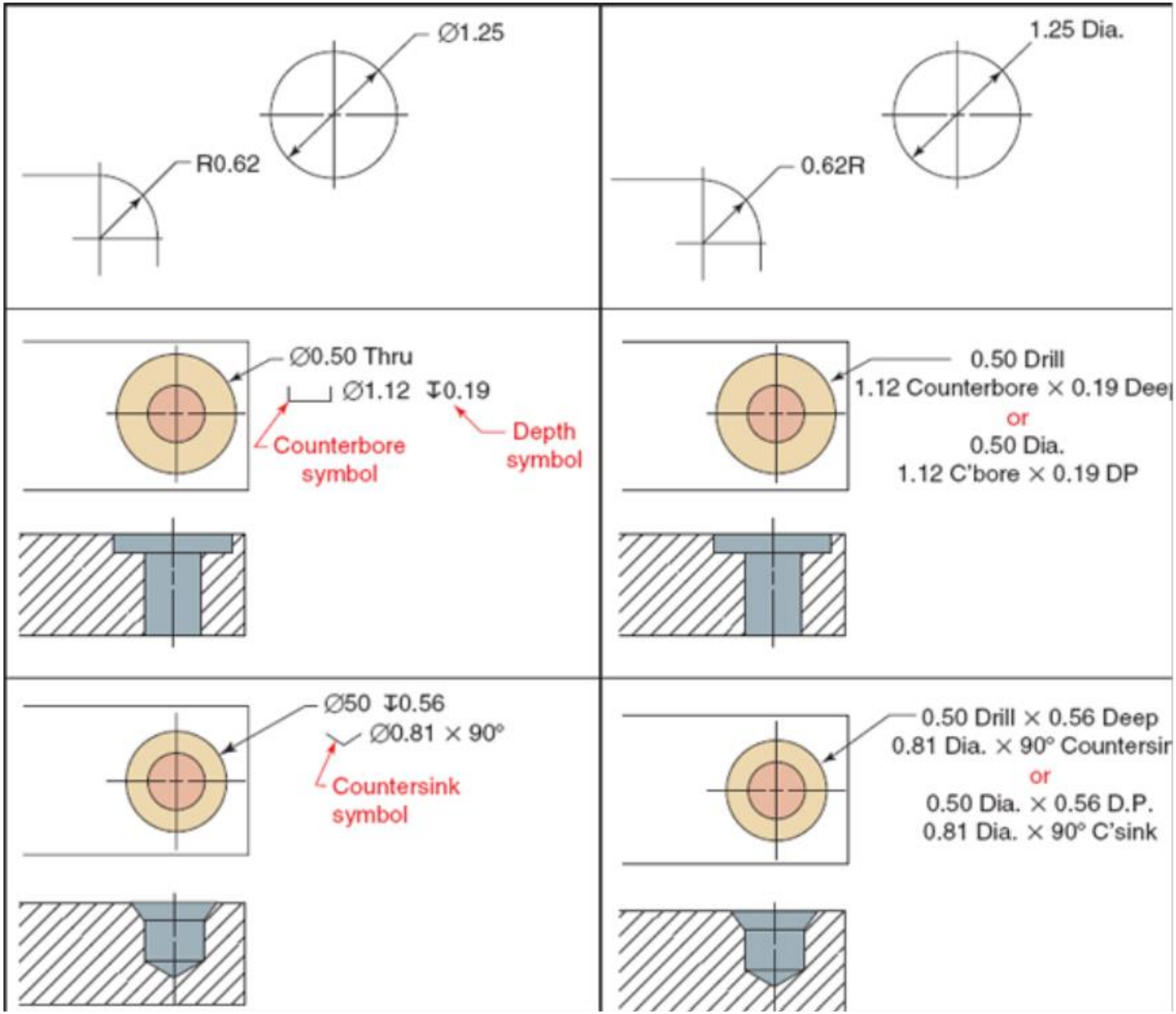
2B is a hole
'A' is a bolt
1,2,3 is a class

.500 deep

Local Notes

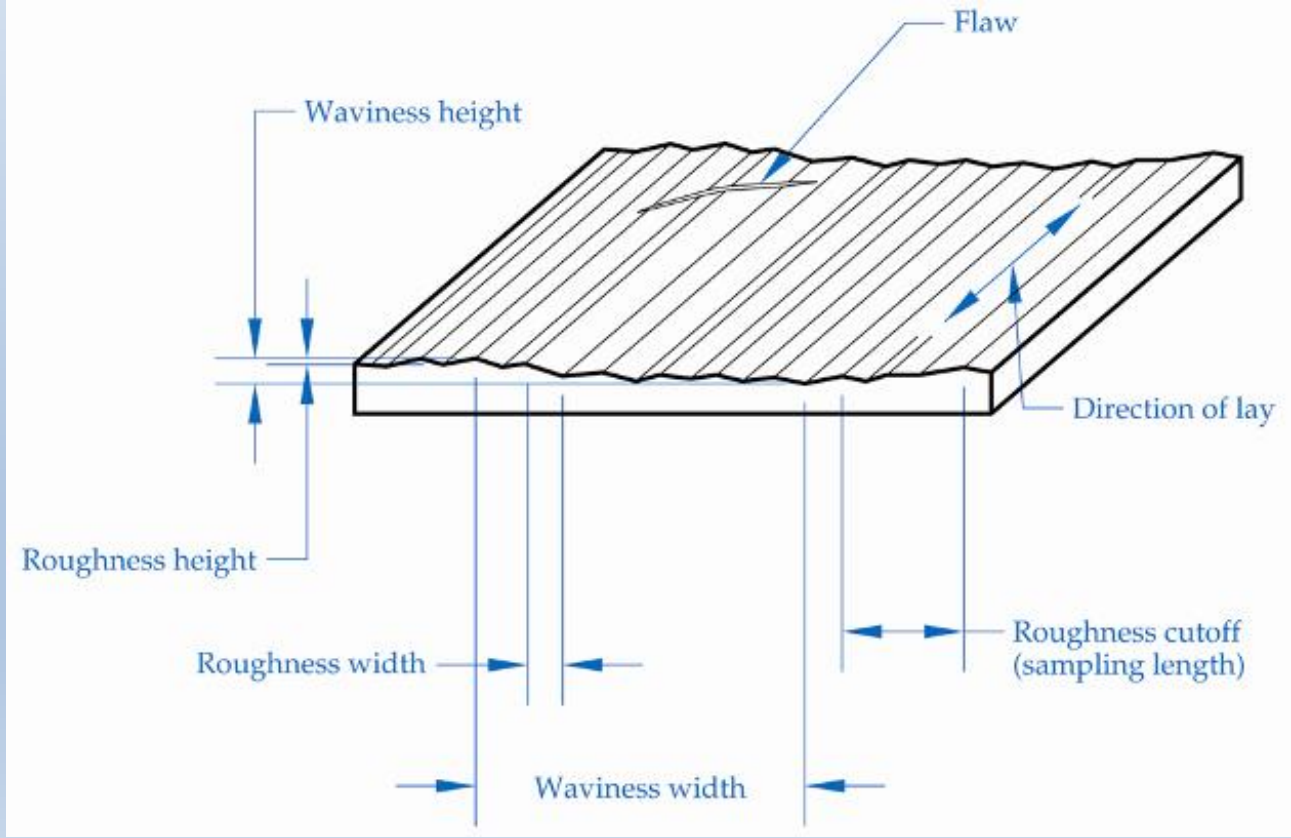
- Local notes are usually applied to a specific feature




Ø1.25
R0.62
1.25 Dia.
0.62R
Ø0.50 Thru
Ø1.12 ↧0.19
Counterbore symbol
Depth symbol
0.50 Drill
1.12 Counterbore × 0.19 Deep
or
0.50 Dia.
1.12 C'bore × 0.19 DP
Ø50 ↧0.56
Ø0.81 × 90°
Countersink symbol
0.50 Drill × 0.56 Deep
0.81 Dia. × 90° Countersink
or
0.50 Dia. × 0.56 D.P.
0.81 Dia. × 90° C'sink

Surface Texture Terms

- Surface texture is the overall roughness, waviness, lay, or flaws of a surface



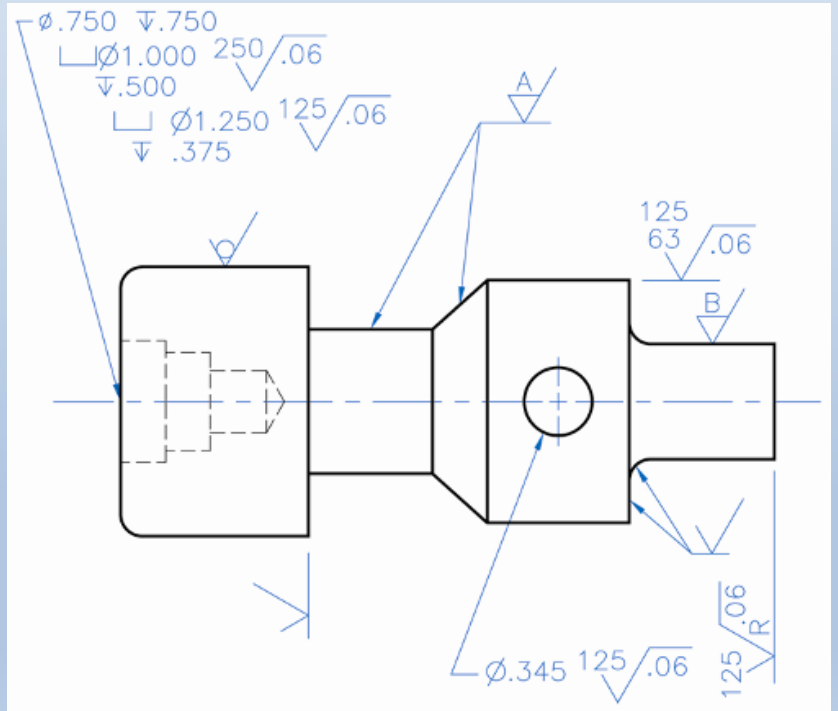
Surface Texture Terms

- Roughness height examples

Roughness Height Rating		Surface Description	Process
Micrometers	Microinches		
25.2	1000	Very rough	Saw and torch cutting, forging, or sand casting.
12.5	500	Rough machining	Heavy cuts and coarse feeds in turning, milling, and boring.
6.3	250	Coarse	Very coarse surface grind, rapid feeds in turning, planning, milling, boring, and filing.
3.2	125	Medium	Machining operations with sharp tools, high speeds, fine feeds, and light cuts.
1.6	63	Good machine finish	Sharp tools, high speeds, extra-fine feeds and cuts.
0.8	32	High-grade machine finish	Extremely fine feeds and cuts on lathe, mill, and shapers required. Easily produced by centerless cylindrical and surface grinding.
0.4	16	High-quality machine finish	Very smooth reaming or fine cylindrical or surface grinding or coarse hone or lapping of surface.
0.2	8	Very-fine machine finish	Fine honing and lapping of surface.
0.05 0.1	2–4	Extremely smooth machine finish	Extra-fine honing and lapping of surface.

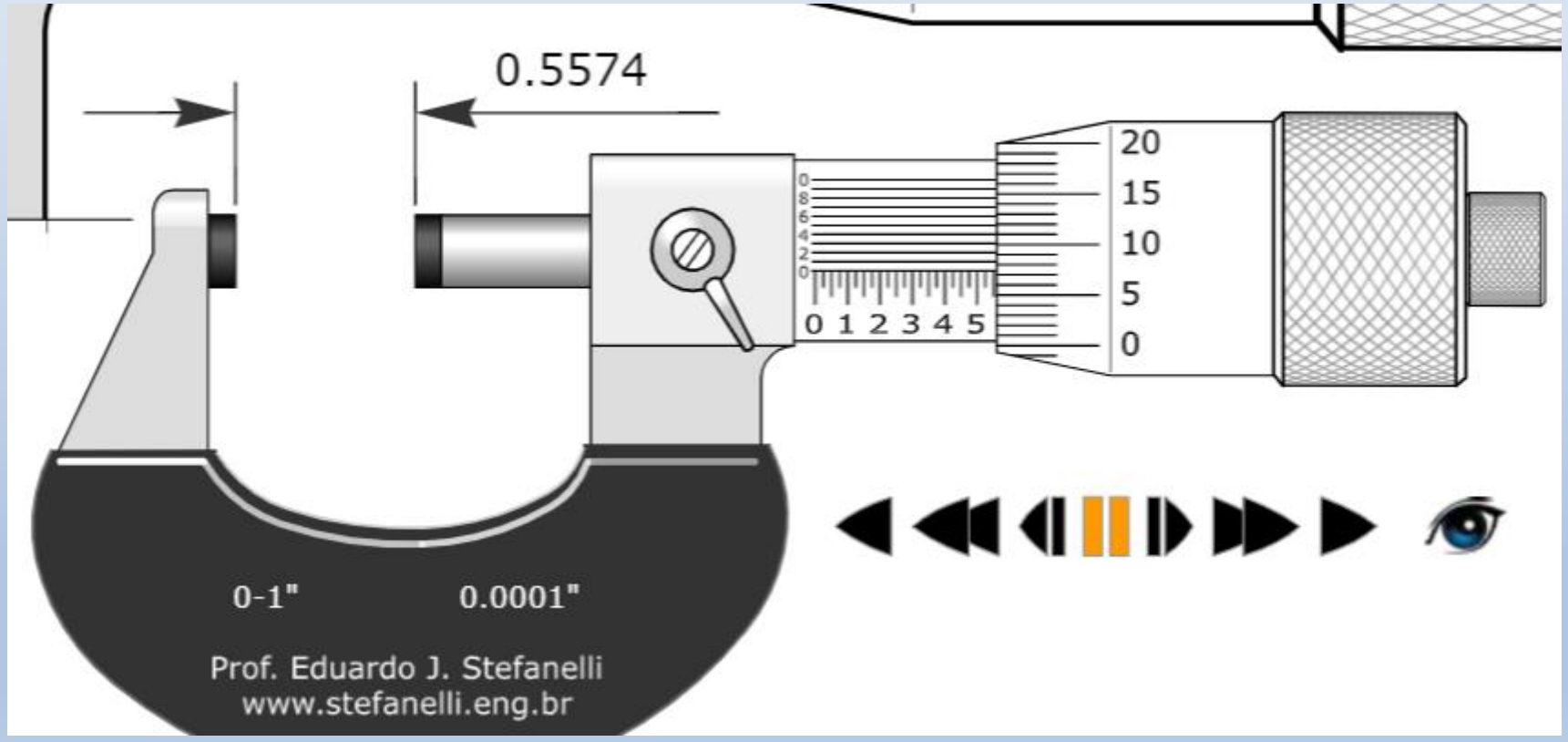
Applying Surface Texture Symbols

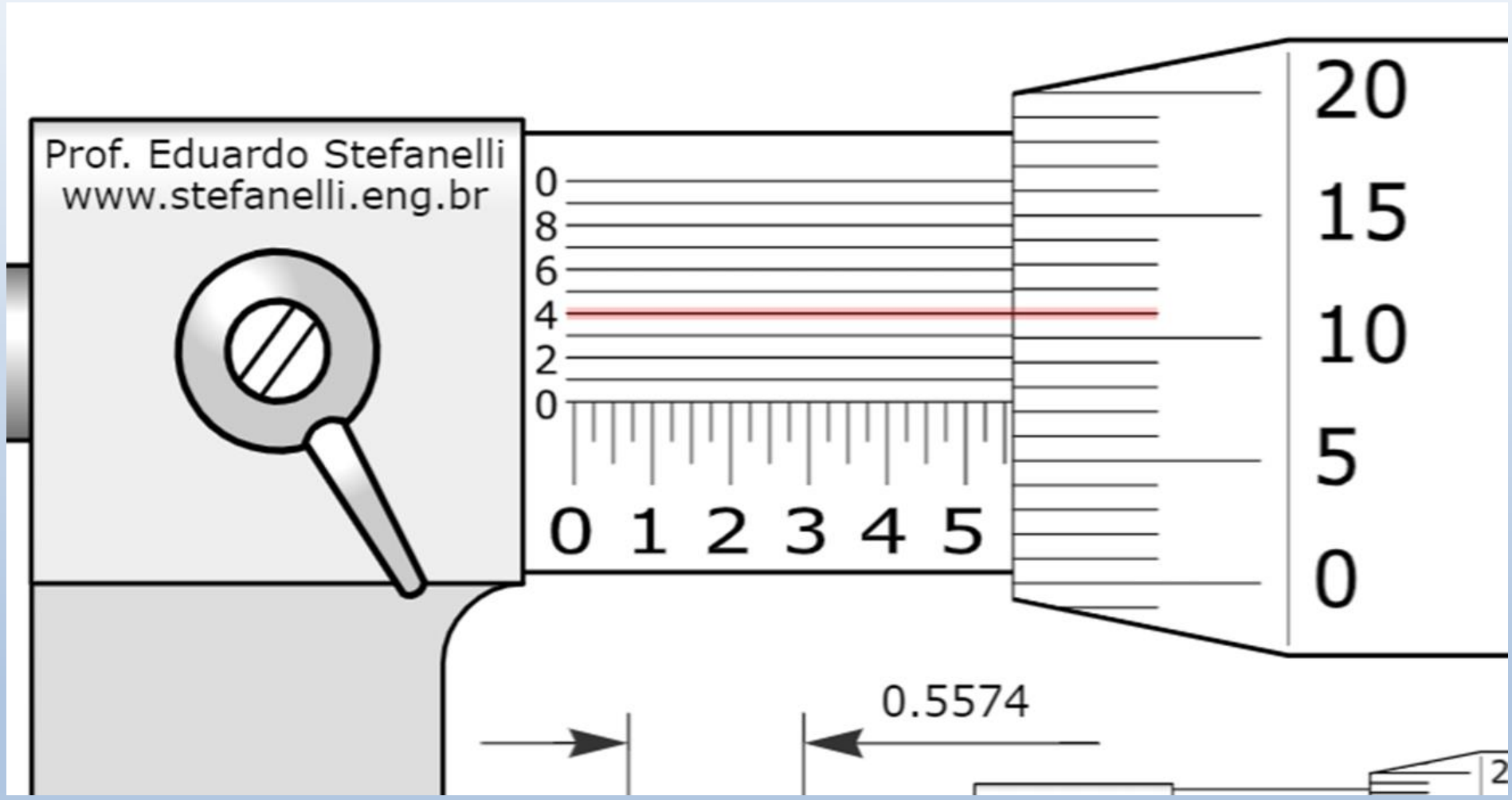
- Surface texture symbols can be attached to:
  - Surface “edge views”
  - Extension lines
  - Leader line shoulders
  - Placed in a note



A parting word on measurements

https://www.stefanelli.eng.br/en/simulator-virtual-micrometer-tenths-thousandth-inch/




Prof. Eduardo Stefanelli
www.stefanelli.eng.br
0
8
6
4
2
0
0 1 2 3 4 5
20
15
10
5
0
0.5574

My pleasure and honor to have worked with you today

Q&A