Mech 220
Engineering Graphics
MECHANICAL DRAWINGS:
DIMENSIONING & TOLERANCING
2/3

Fall 2017-18

Inst.: Abed Alkader Al Saidi

Office: ***IOEC room 411***

Extension: ***3504***

e-mail: ***aa166@aub.edu.lb***

DIMENSIONING A DRAWING:

position dimensioning schemes

Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *position* dimensioning schemes

- **Different dimensioning systems or styles can be used to place or orient dimensions on a drawing based on the:**
  - Dimension tolerance
  - Space needed for dimensioning
  - Size of the drawing

- **Depending on the circumstances several or any of the following systems may be used:**
  - Chain Dimensioning
  - Parallel Dimensioning
  - Datum Dimensioning
  - Ordinate Dimensioning
  - Tabulated Dimensioning

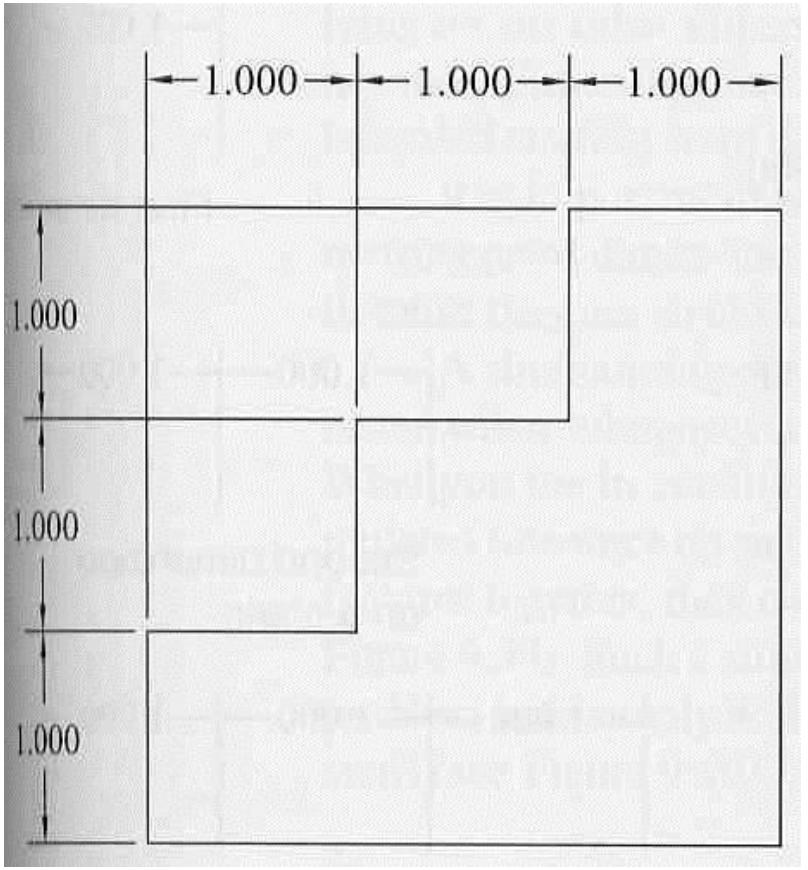
Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (1) chain dimensioning

Chain (point to point) dimensioning

- A string of dimensions placed along a straight line.
- Every features such as a corner or circle center has an extension line referencing it off.
- The dimension values are then placed in the chain or straight line form.

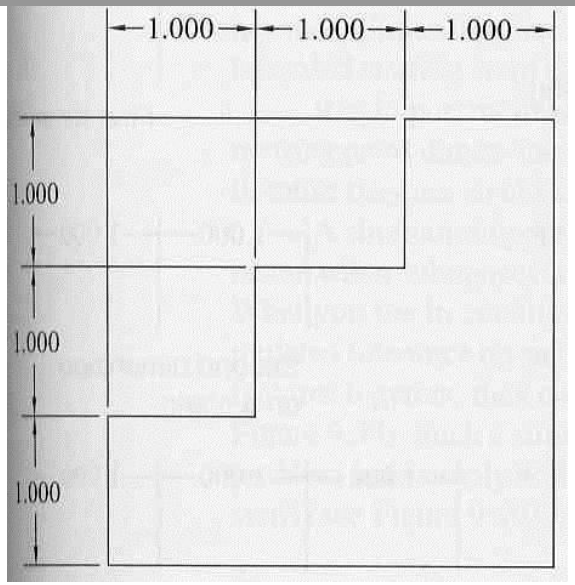


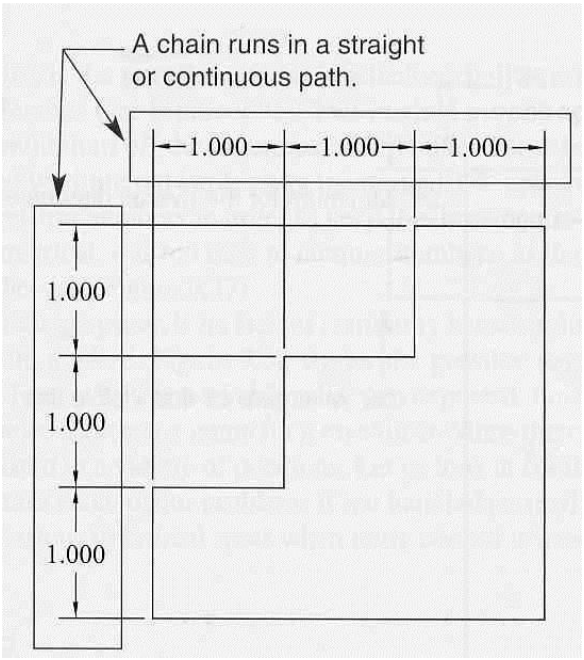
Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (1) chain dimensioning

Chain (point to point) dimensioning





Principal advantages:

1) Simple
2) Saves drawing space

Principal dis-advantages:

1) Appears crowded when small features are used
2) Lousy tolerance stackup

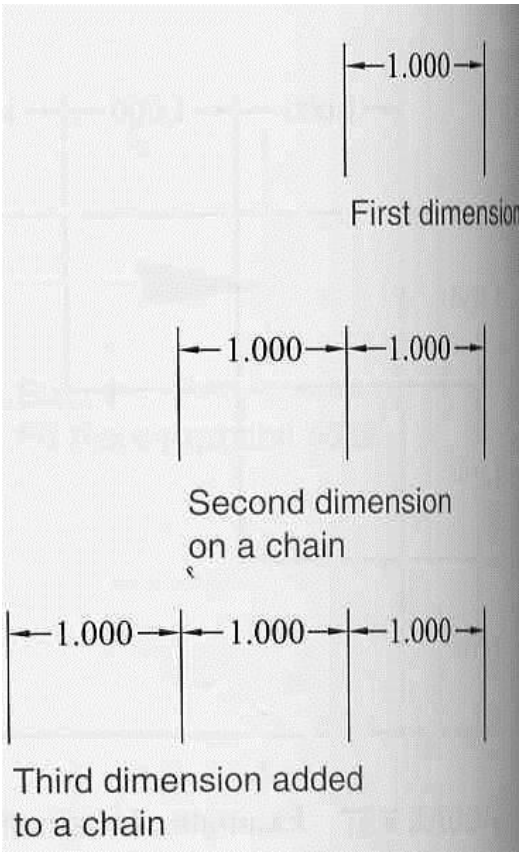
Mech 220: 7th LECTURE

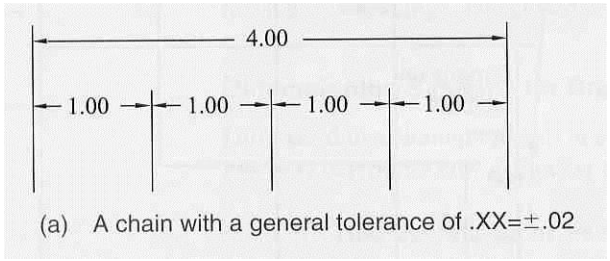
DIMENSIONING

drawing dimensioning schemes- (1) chain dimensioning

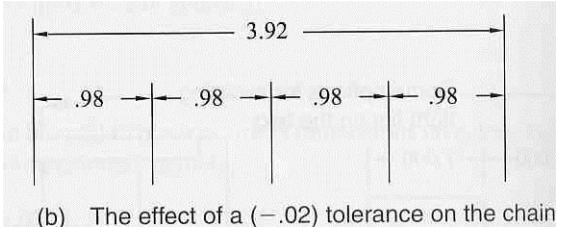
Principal dis-advantages:

Lousy tolerance accumulation (stackup)

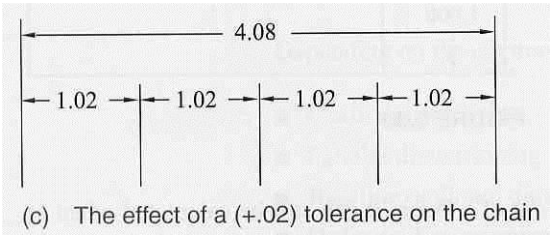




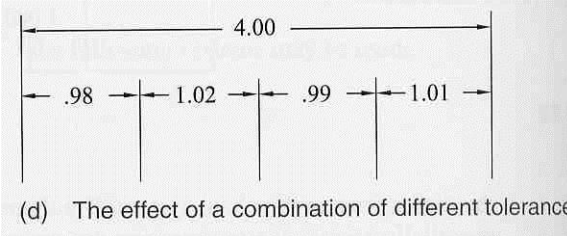
(a) A chain with a general tolerance of .XX=±.02



(b) The effect of a (−.02) tolerance on the chain



(c) The effect of a (+.02) tolerance on the chain



(d) The effect of a combination of different tolerance

Mech 220: 7th LECTURE

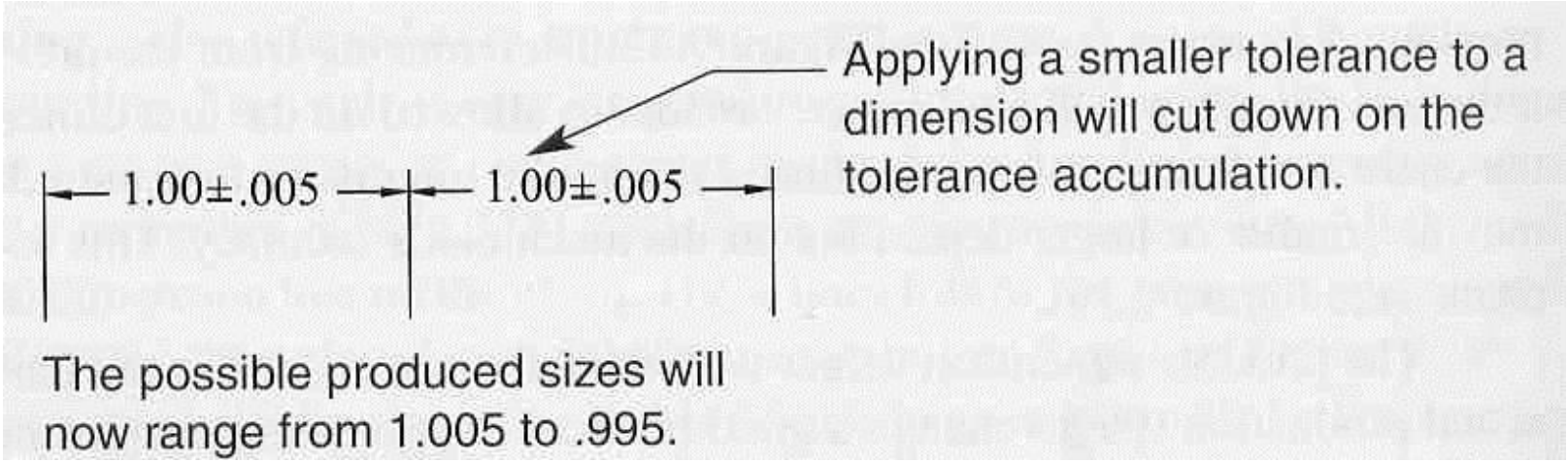
DIMENSIONING

drawing dimensioning schemes- (1) chain dimensioning

Principal dis-advantages:

Lousy tolerance accumulation (stackup)

Possible remedy (yet not a good one):



- **Tolerance decisions are normally made by the design engineer whereas the drafter must place them correctly on the finish drawing according to standards.**

Mech 220: 7th LECTURE

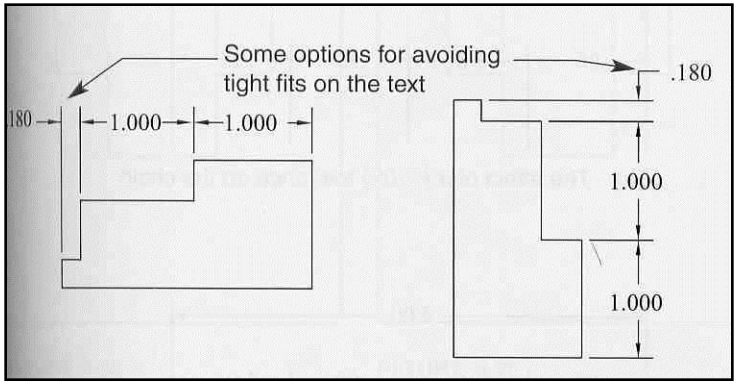
DIMENSIONING

drawing dimensioning schemes- (1) chain dimensioning

Principal dis-advantages: Appears crowded when small features are used.

Possible remedies:

- It is typical to place an overall dimension above a chained dimension



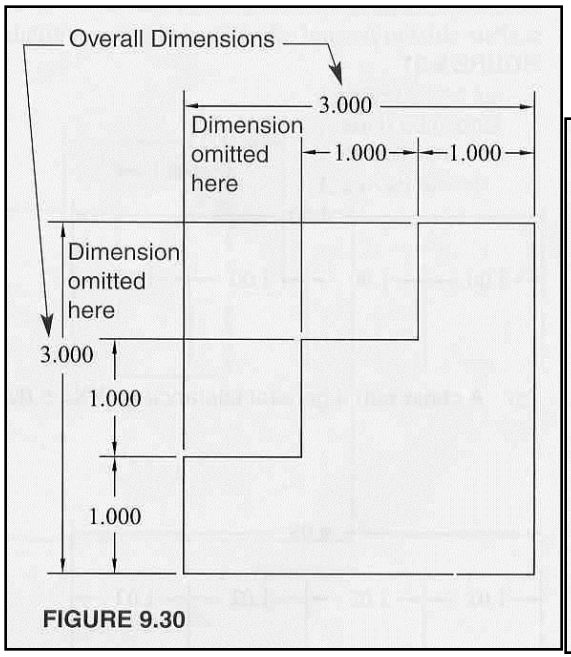
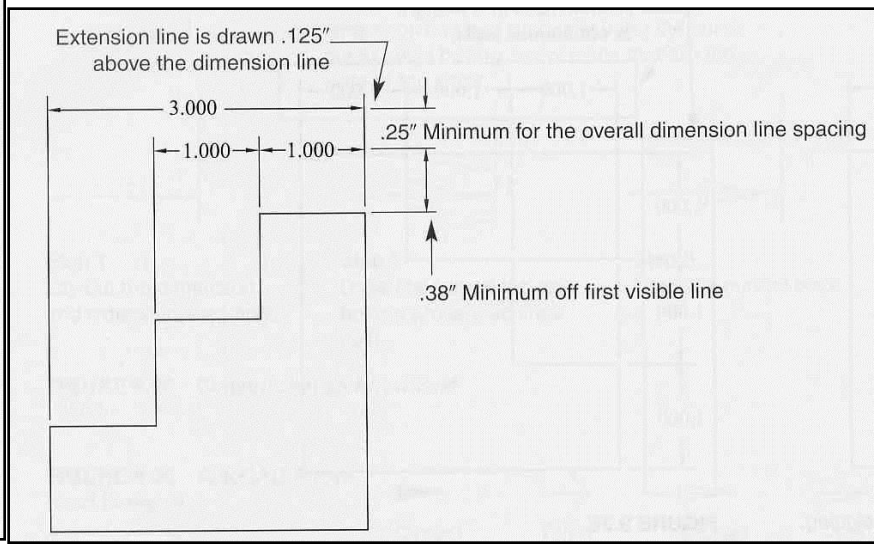


FIGURE 9.30



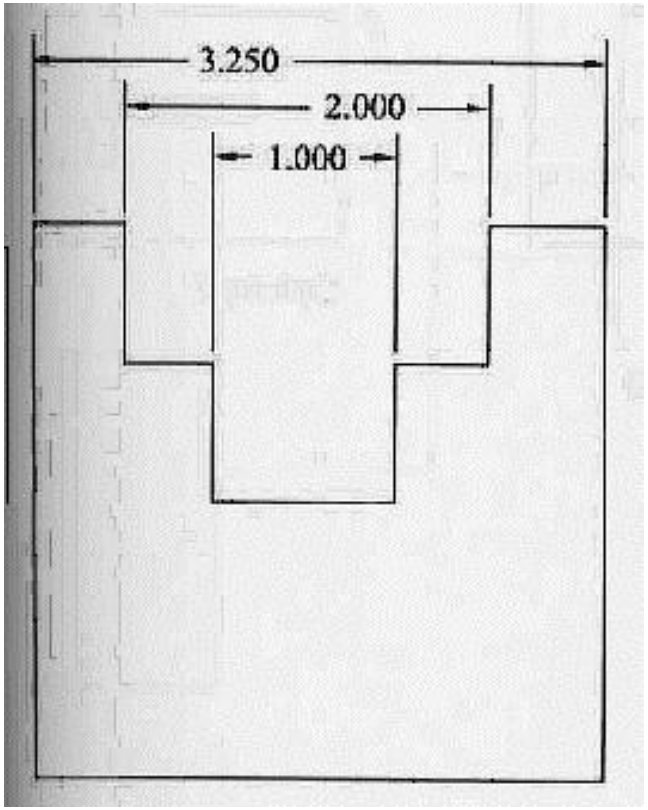
Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (2) parallel dimensioning

parallel dimensioning

- Each dimension stands alone, not relying on any other dimension.
- The inner most dimension is first placed and the other dimensions are staggered starting from the inside and working outward.



Mech 220: 7th LECTURE

DIMENSIONING

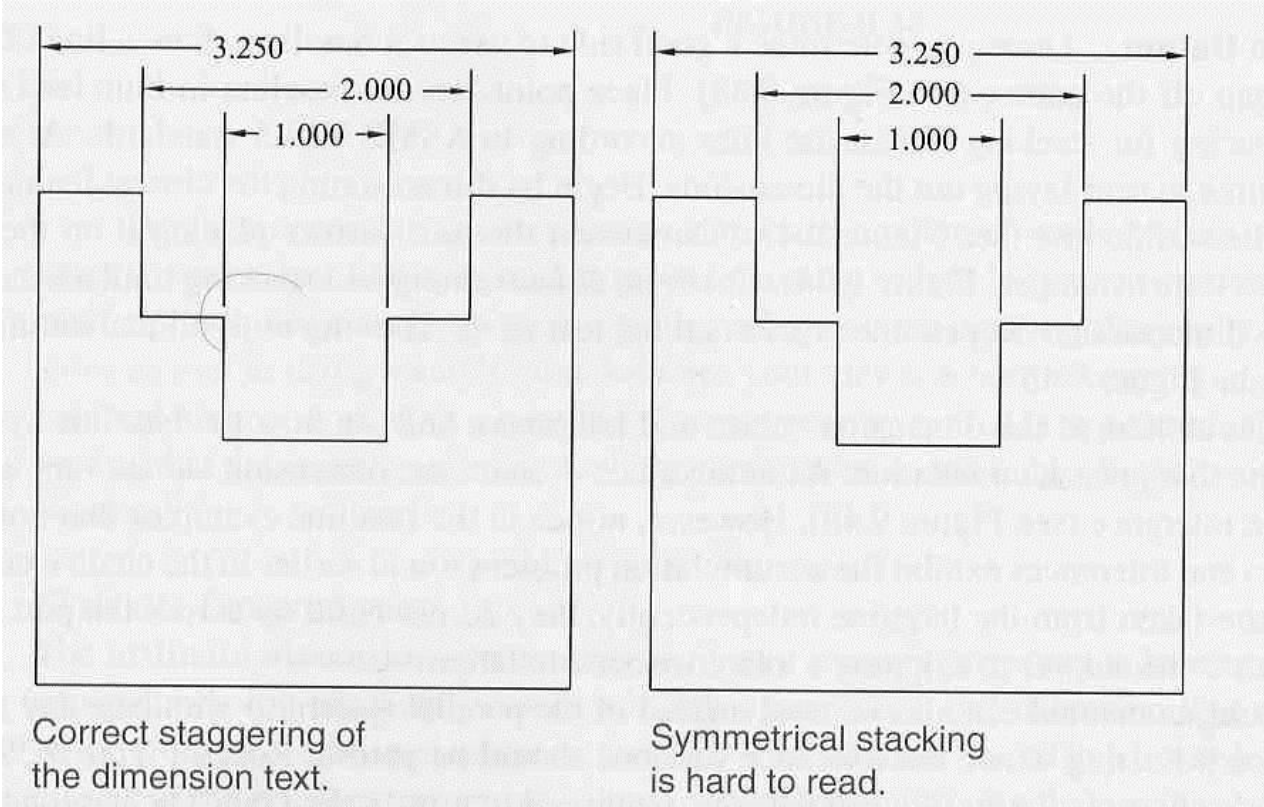
drawing dimensioning schemes- (2) parallel dimensioning

Drafting Tip:

For clarity, Do NOT stack dimensions symmetrically

but rather

USE staggered dimensions



Correct staggering of the dimension text.

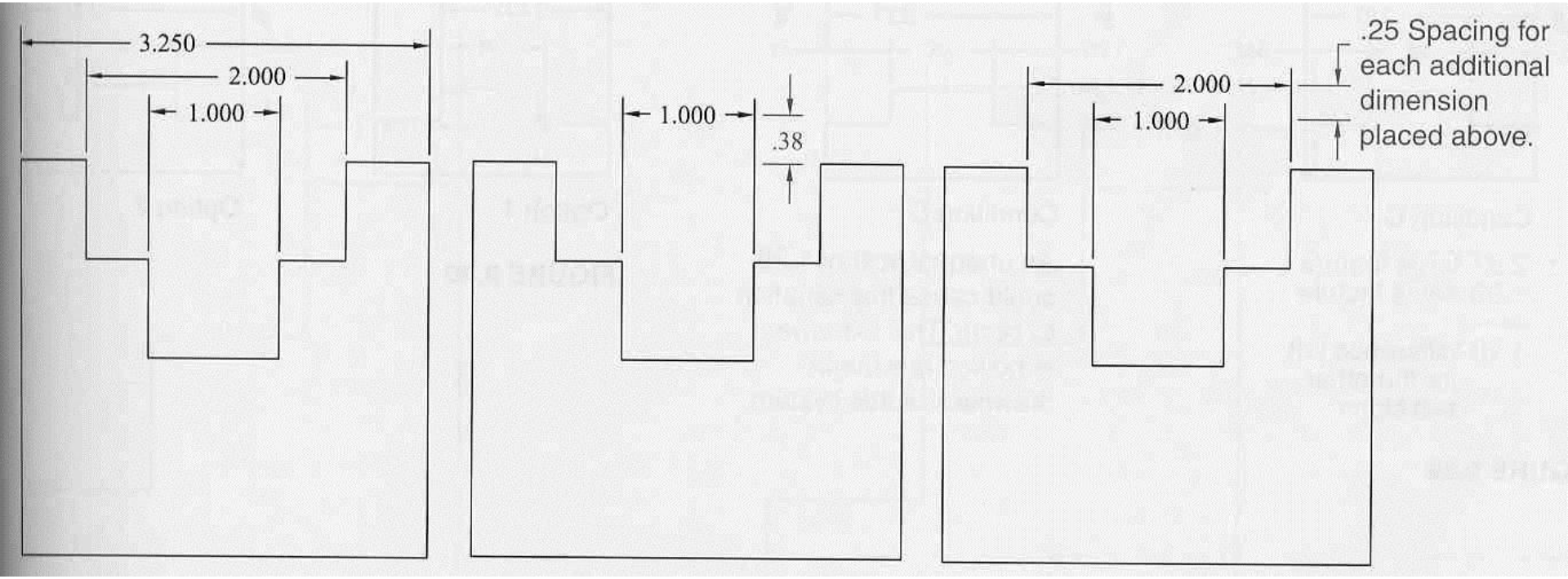
Symmetrical stacking is hard to read.

Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (2) parallel dimensioning

parallel dimensioning



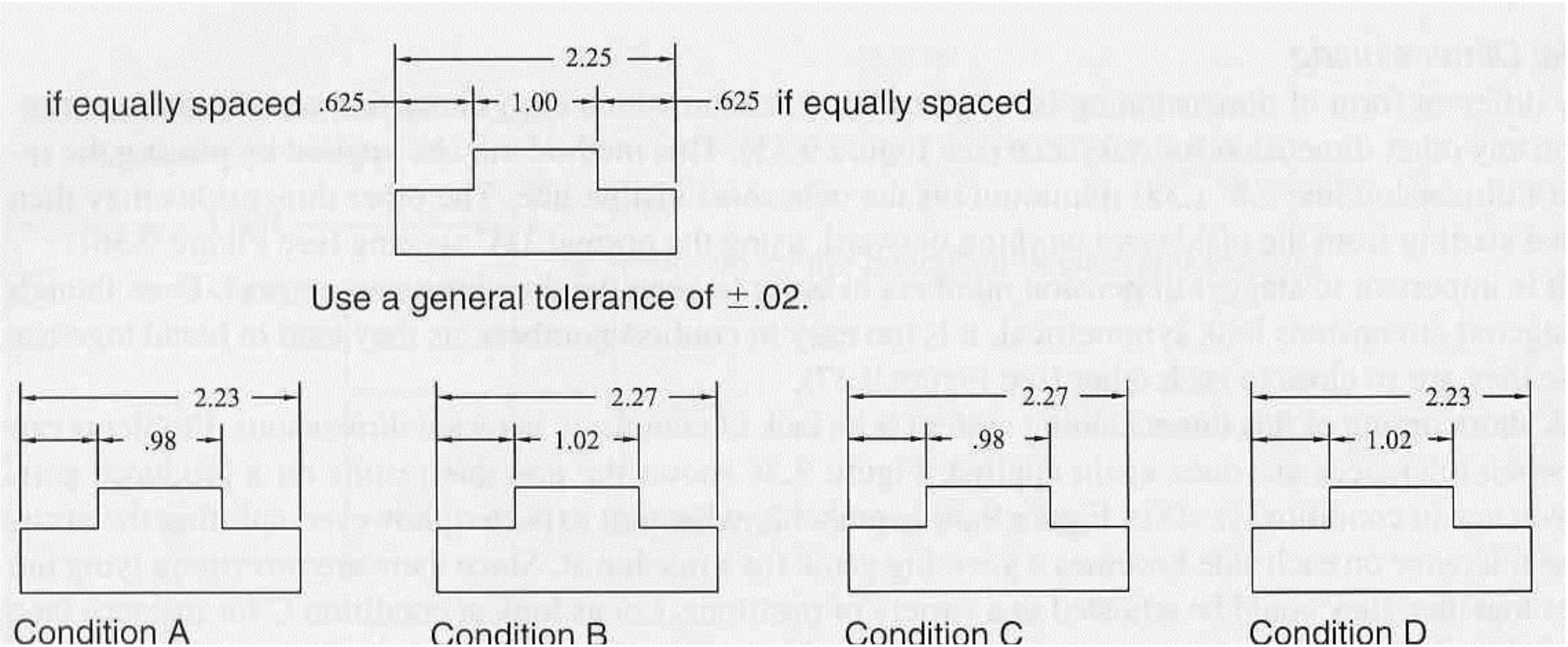
Principal advantage:

Simple since each dimension is independent of other dimensions

Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (2) parallel dimensioning



Principal dis-advantage:

Again, lousy tolerances!

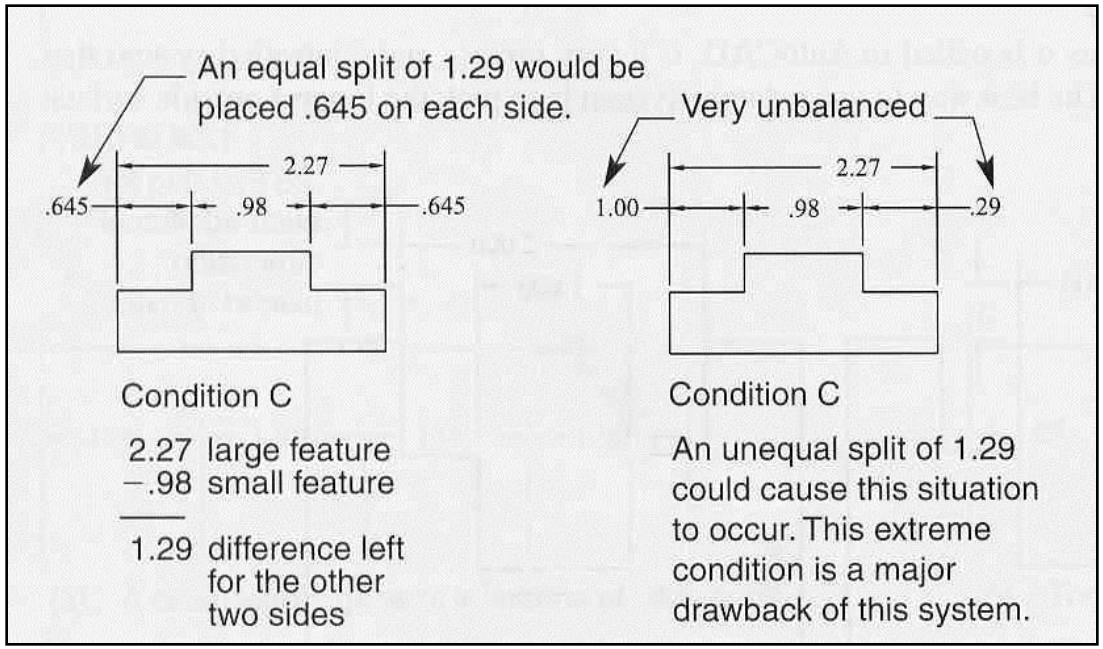
- **Splitting the accuracy tolerance on each side becomes a guessing game for the machinist**

Mech 220: 7th LECTURE

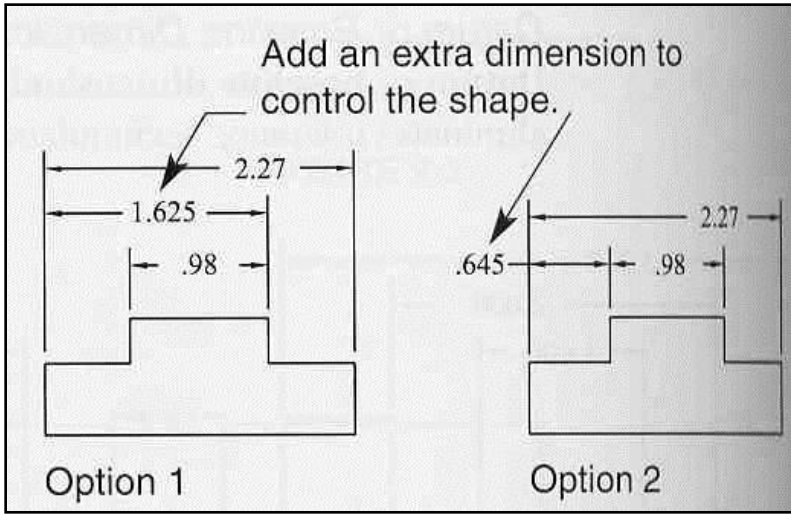
DIMENSIONING

drawing dimensioning schemes- (2) parallel dimensioning

Examine Condition C:



Possible remedy:



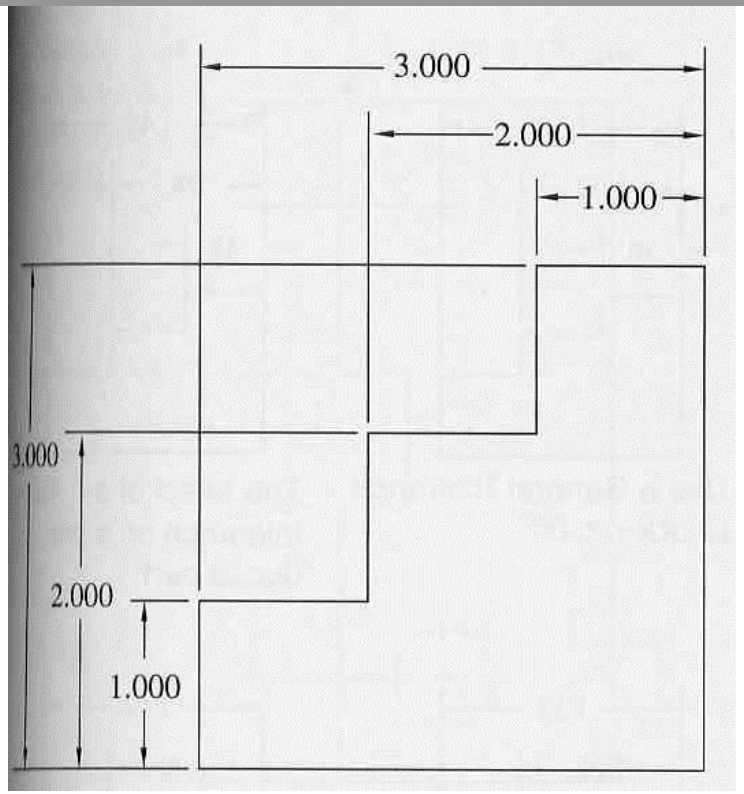
- **Adding more dimensions to critical spots when more control is needed between the dimensions.**

Mech 220: 7th LECTURE

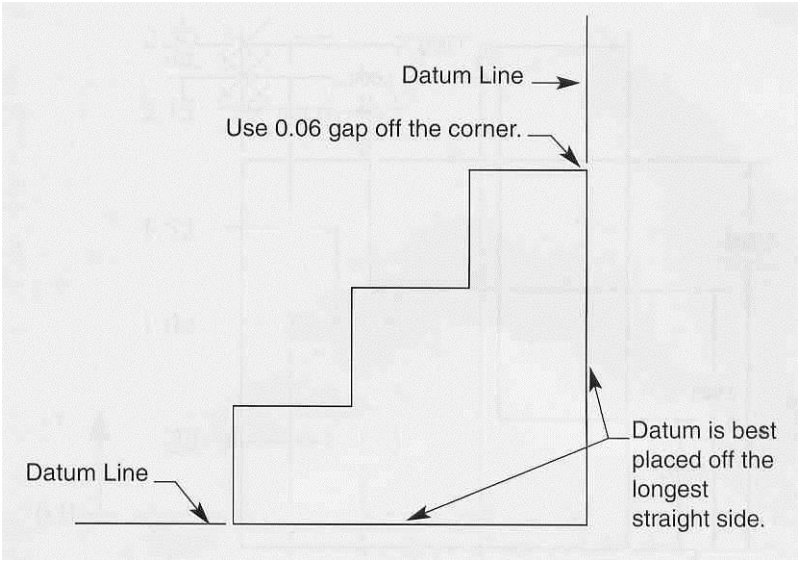
DIMENSIONING

drawing dimensioning schemes- (3) datum dimensioning

Datum (or BASELINE) dimensioning



Setting up a Datum



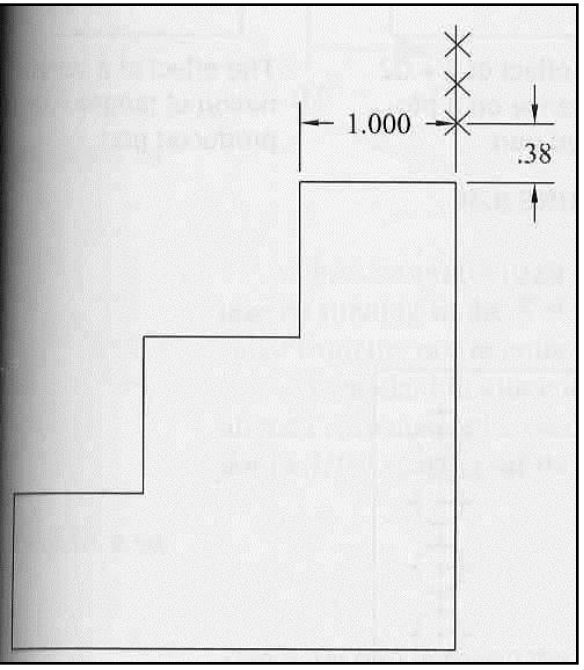
- It is a precise and controlled system that eliminates tolerance accumulation.
- The best way to use a datum system pick the longest outside surface.

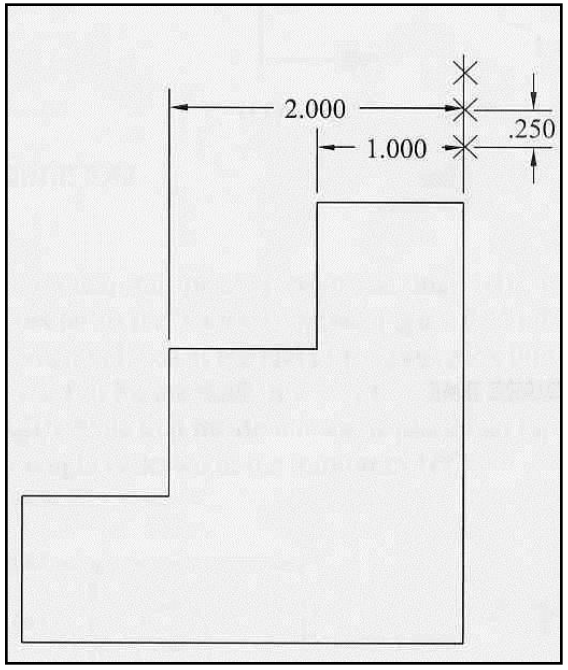
Mech 220: 7th LECTURE

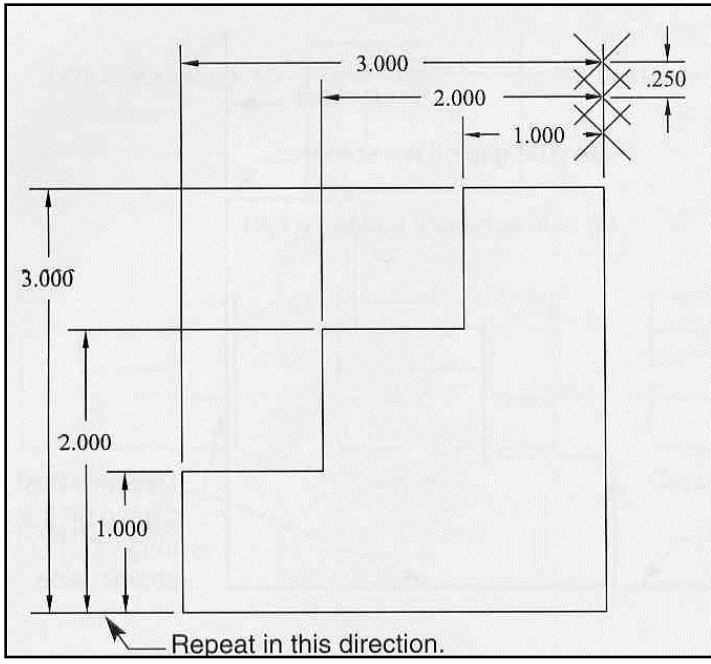
DIMENSIONING

drawing dimensioning schemes- (3) datum dimensioning

Dimensioning







- Identify your datum, then place points on the baseline representing the minimum spacing for stacking dimension lines according to standards.
- Begin dimensioning to the closest feature, then dimension to the next features placing them on the next baseline points

Mech 220: 7th LECTURE

DIMENSIONING

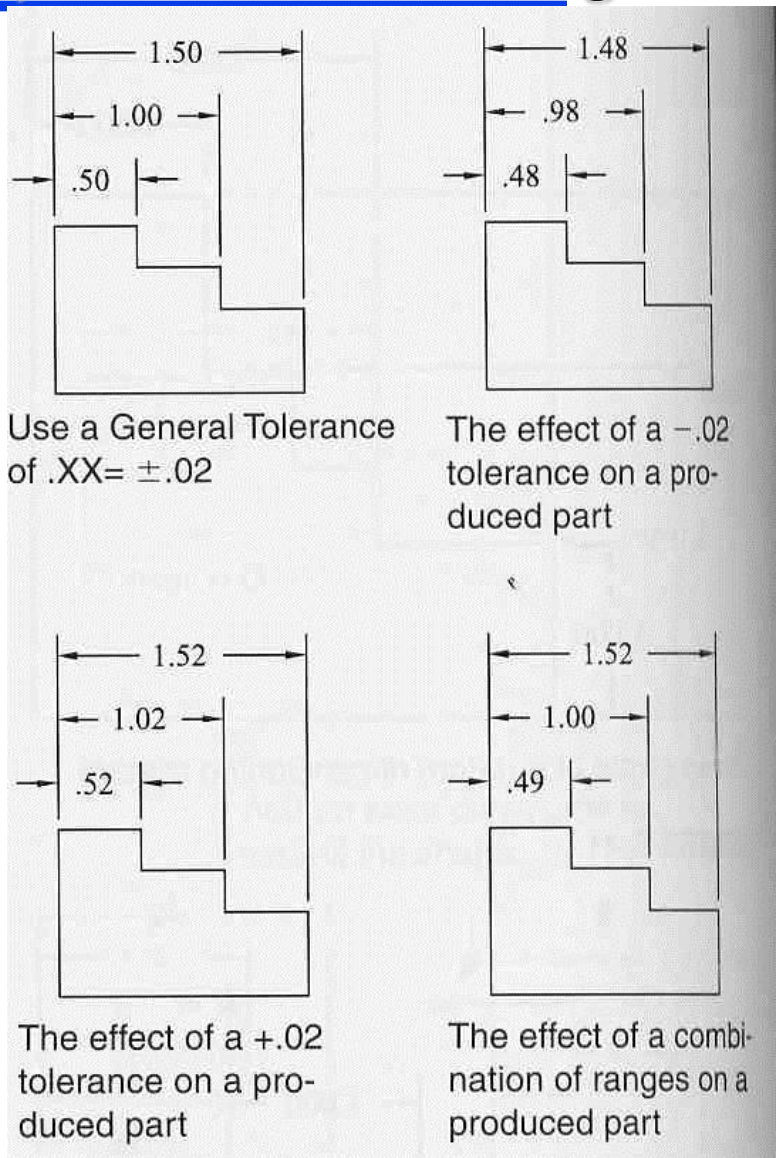
drawing dimensioning schemes- (3) datum dimensioning

Principal advantages:

1) Precise method
2) Reflects how a part is machined
3) ELIMINATES Tolerance accumulation

Principal dis-advantage:

Takes up too much space

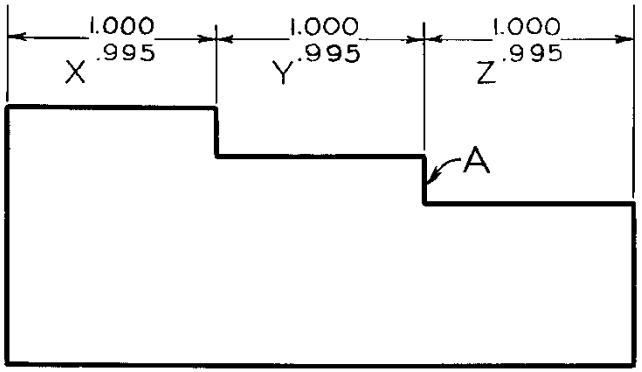


Mech 220: 7th LECTURE

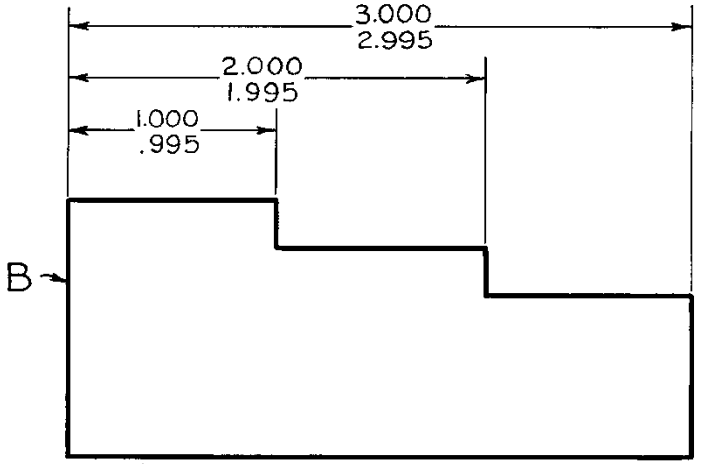
DIMENSIONING

drawing dimensioning schemes- (3) datum dimensioning

- **Chained**
  - Each dimension continues from the previous one.
  - Tolerances stack
  - Saves drawing space
- **Datum**
  - Each dimension is specified from a common baseline.
  - Tolerances do not stack.
  - Takes up too much of drawing space



(a) CUMULATIVE TOLERANCES

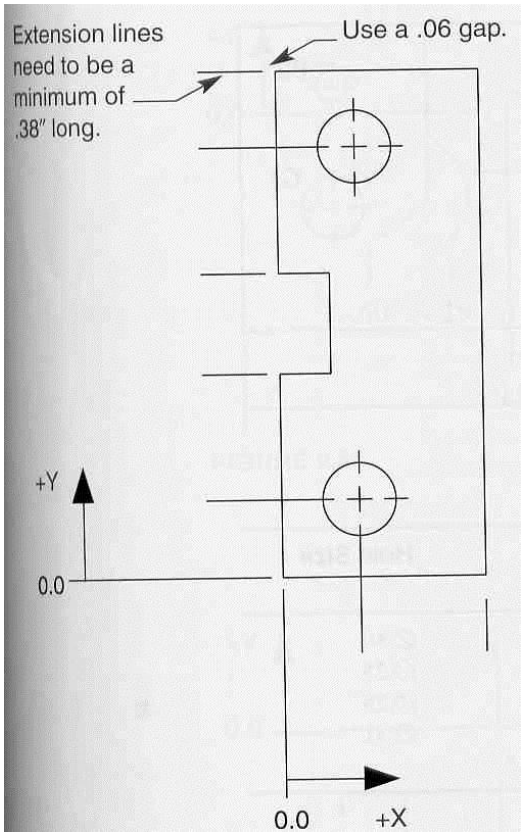


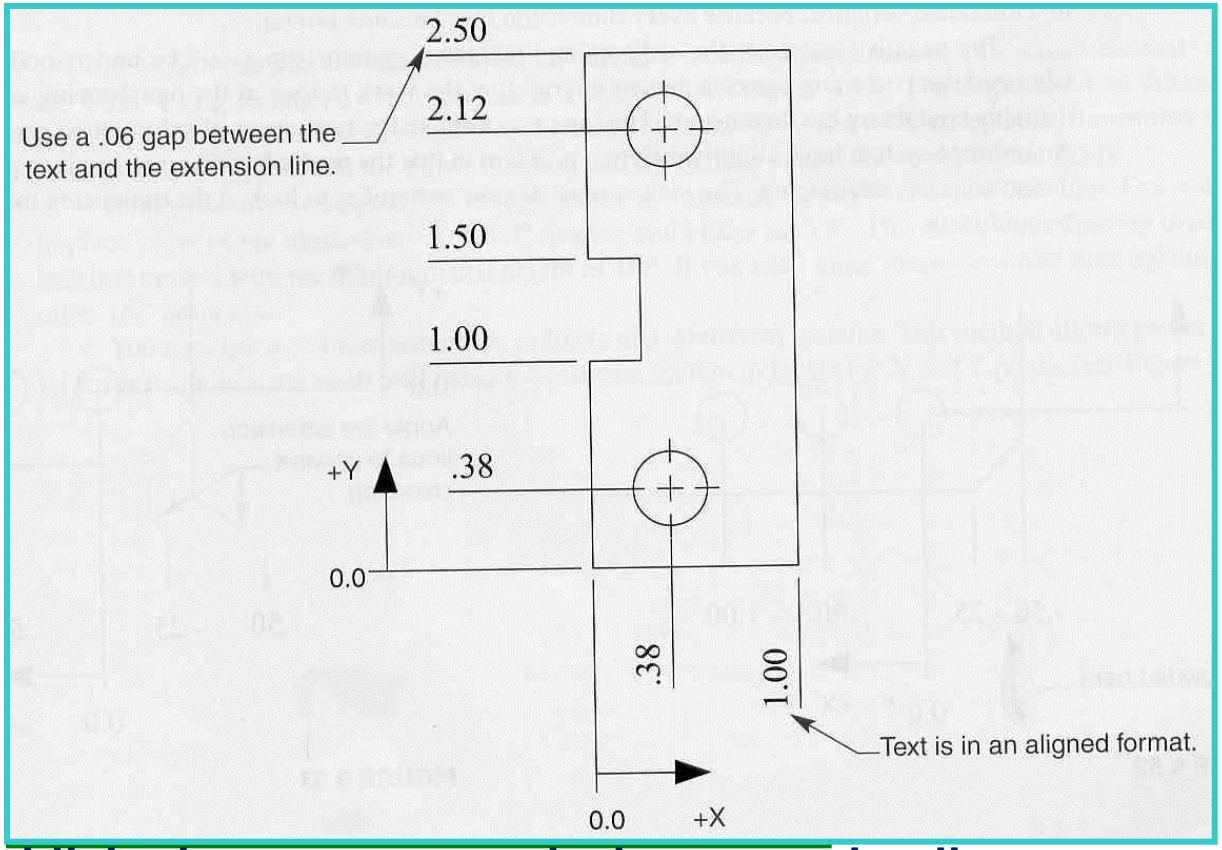
(b) BASE-LINE DIMENSIONING

Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (4) ordinate dimensioning





- Once the origin is established you can start placing extension lines 1/16" off the feature.
- Each distance is measured in the X or Y direction and placed at the end of the extension line.

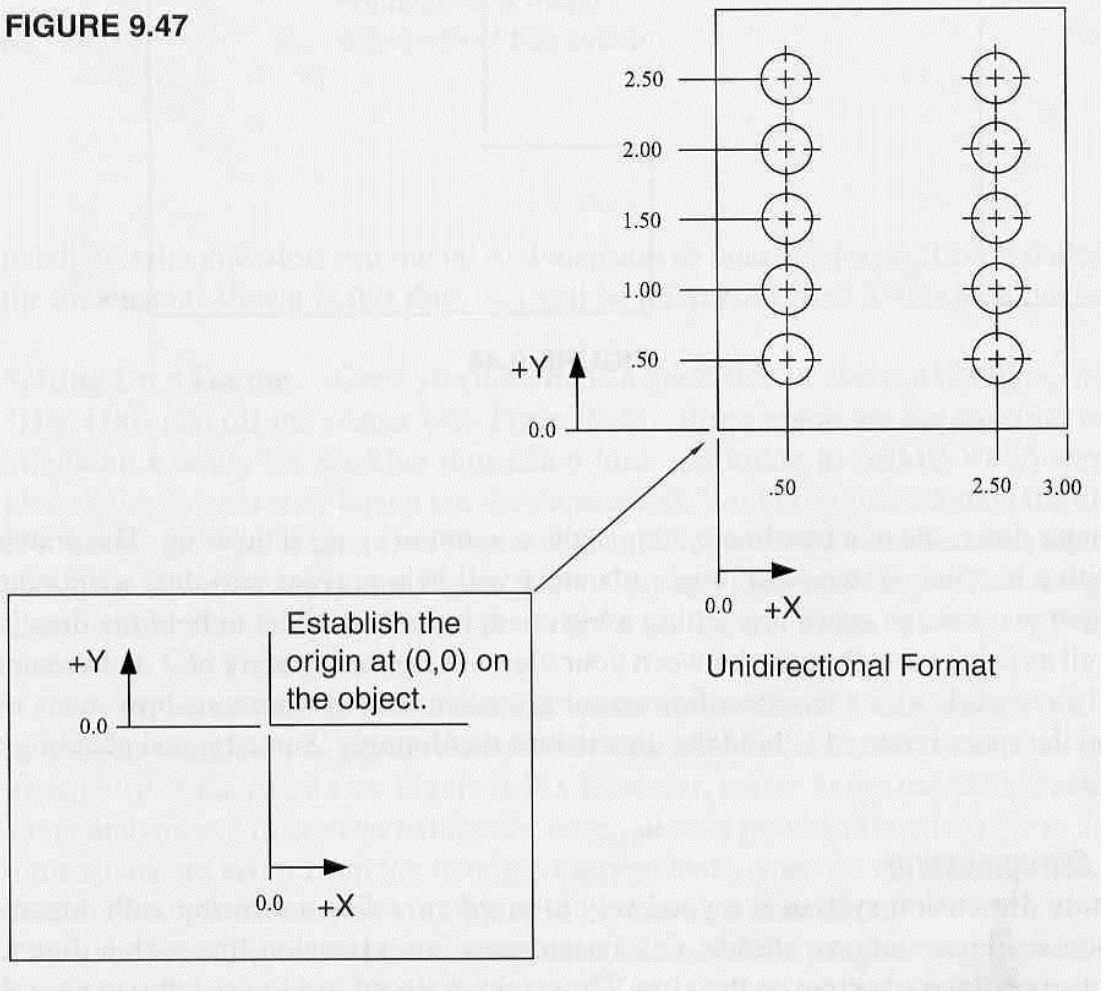
Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (4) ordinate dimensioning

Ordinate dimensioning

FIGURE 9.47



Principal advantages:

1) Saves space by using only one (1) extension line per dimension.
2) Eliminates tolerance stack-up

Principal dis-advantage:

Potential crowding around fine features

Mech 220: 7th LECTURE

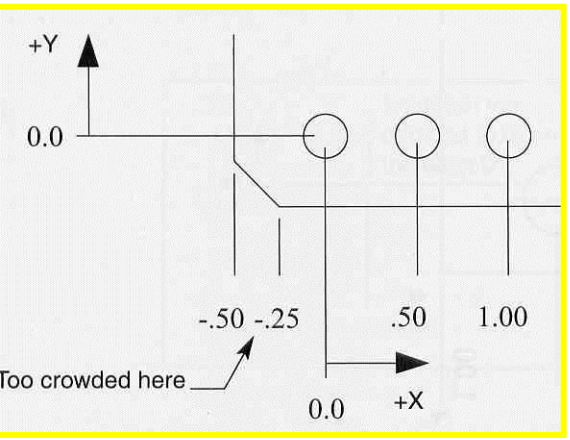
DIMENSIONING

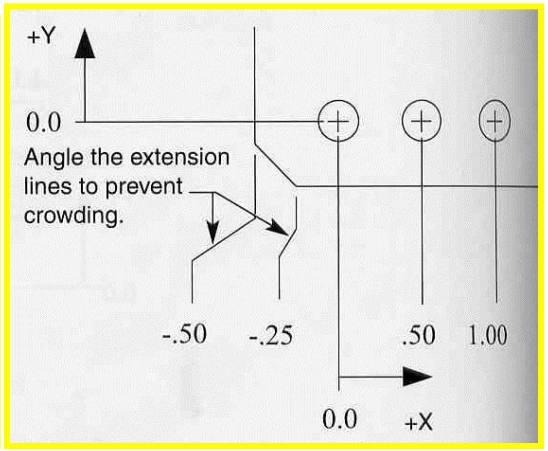
drawing dimensioning schemes- (4) ordinate dimensioning

Principal dis-advantage:

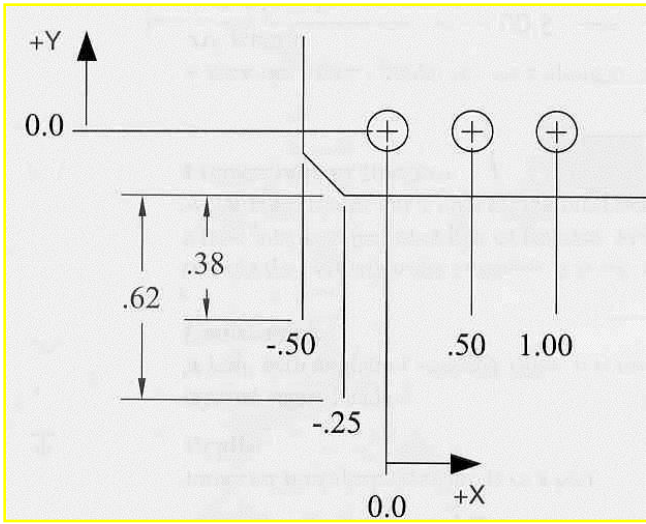
Potential crowding around fine features

Drafting tip: use angled extension lines





Drafting tip: Stagger dimensions

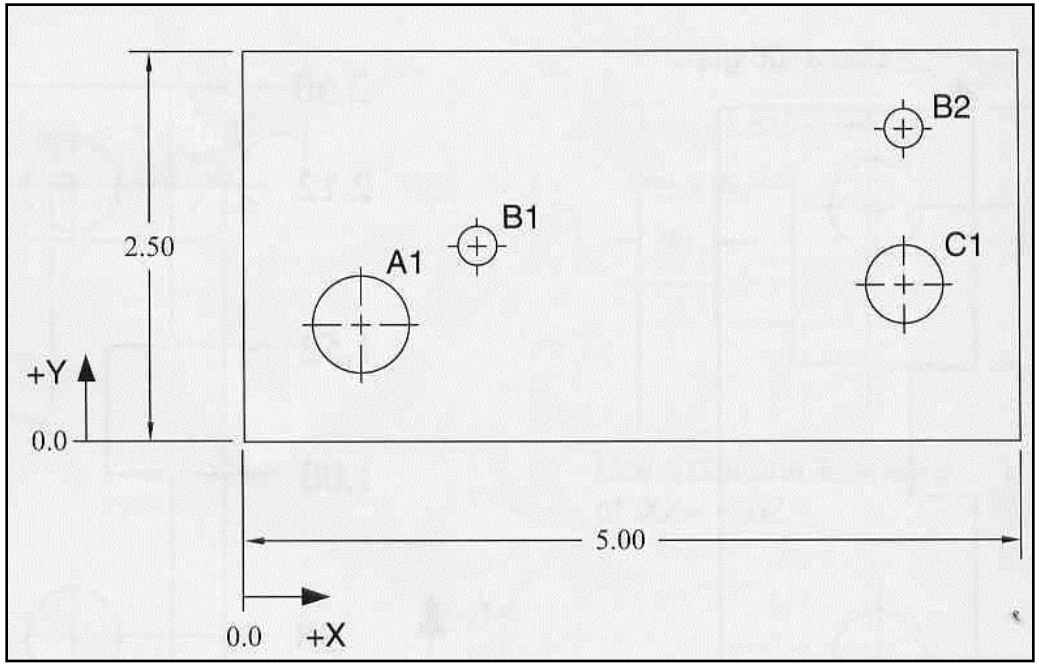


Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (5) tabulated dimensions

- Is a basic use of the ordinate system.
- Each Feature is given a symbol that us an alphanumeric code.
- An origin of the drawing is established.
- Table or a chart is drawn showing the coordinate of the feature and its dimensions.



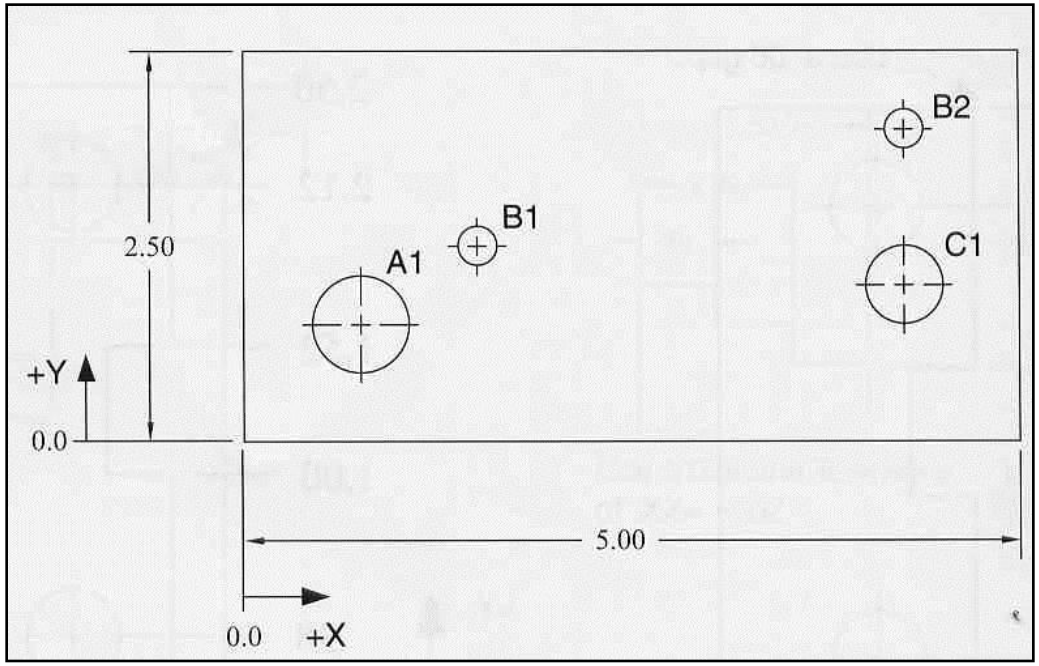
Holes with the same diameter may use the same letter but are assigned different numbers.

Symbol	Hole Location +X	Hole Location +Y	Hole Size
A1	.75	.75	∅.50
B1	1.5	1.25	∅.25
B2	4.25	2.00	∅.25
C1	4.25	1.00	∅.31

Mech 220: 7th LECTURE

DIMENSIONING

drawing dimensioning schemes- (5) tabulated dimensions



Holes with the same diameter may use the same letter but are assigned different numbers.

Symbol	Hole Location +X	Hole Location +Y	Hole Size
A1	.75	.75	Ø.50
B1	1.5	1.25	Ø.25
B2	4.25	2.00	Ø.25
C1	4.25	1.00	Ø.31

Principal advantages:

1) Saves space
2) Eliminates tolerance stack-up

Principal dis-advantages:

(1) Constantly moving attention from view to dimension table.

Mech 220: 7th LECTURE

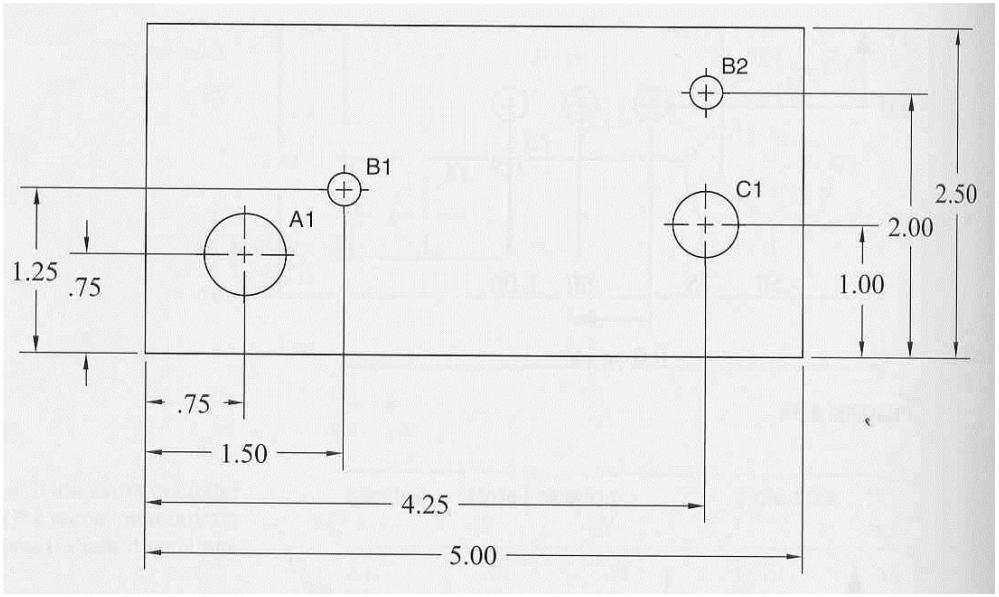
DIMENSIONING

drawing dimensioning schemes- (5) tabulated dimensions

Principal dis-advantage:

(1) **Constantly moving attention from view to dimension table.**

Drafting tip: use a hybrid ordinate/tabulated scheme



Holes with the same diameter may use the same letter but are assigned different numbers.

Symbol	Hole Size
A1	∅.50
B1	∅.25
B2	∅.25
C1	∅.31

DIMENSIONING:

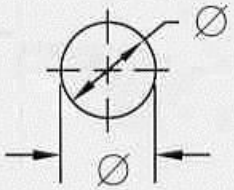
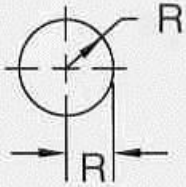
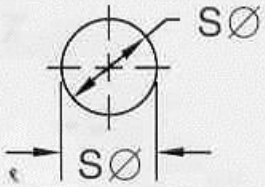
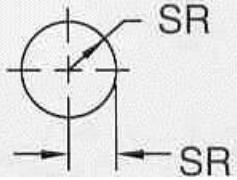
dimensioning a drawing- *shape & size* dimensioning

DIMENSIONING A DRAWING:

shape & size dimensioning

Mech 220: 7th LECTURE

DIMENSIONING

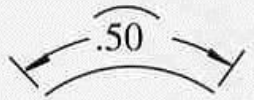
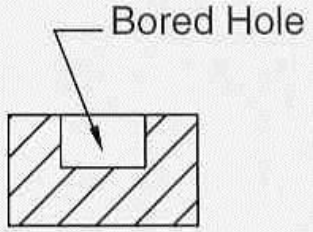
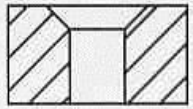
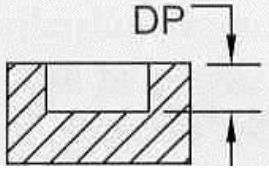
Symbols	Purpose	Abbreviations	Example
∅	**Diameter** A measurement indicating the length of a line segment passing through the center point of a circle or circular arc and extending from one side to another.	**DIA.**	
R	**Radius** A measurement indicating the length of a line segment passing from the center point of a circle or circular arc to one side.	**R**	
S∅	**Diameter of a sphere** A measurement indicating the length of a line segment passing through the center point of a sphere or partial spherical shape and extending from one side to another.	**S∅**	
SR	**Radius of a sphere** A measurement indicating the length of a line segment passing from the center point of a sphere or partial spherical shape to one side.	**SR**	

- **Symbols play a large part in dimensioning different geometrical shapes**

Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

⌒	**Arc length** A measure of the circular distance along an arc.	**None**	
⌴	**Counterbore or Spotface** A flat bottom hole cut with a boring bit. Used to recess a hole into an object so a bolt or fastener will not stick outside the part when the assembly is completed.	**CBORE, SFACE**	
⌵	**Countersink** A hole with angled or tapering sides. It is used to recess tapered screw heads.	**CSK**	
↧	**Depth** Indicates how deep a feature is in a part.	**DP**	

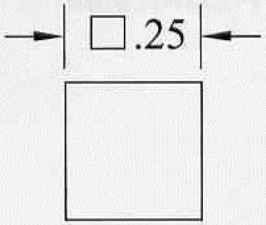
Mech 220: 7th LECTURE

DIMENSIONING

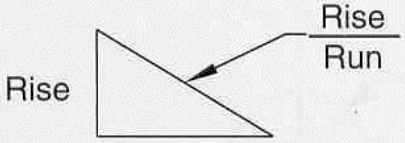
dimensioning a drawing- *shape* & *size* dimensioning

Square
Indicates the shape of the object or that it is equal in length and width.

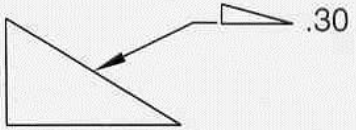
SQ



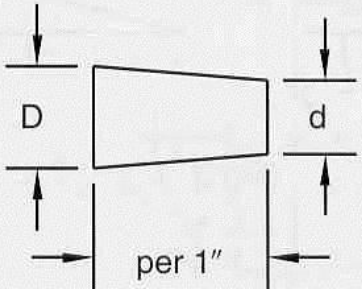
Slope
The slope symbol is used to call out the ratio of the rise over run for flat surfaces.



None

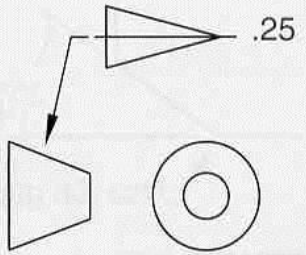


Conical Taper
This symbol is used for shapes with a cone taper.



$$\frac{D-d}{1.00} = \text{conical taper}$$

None

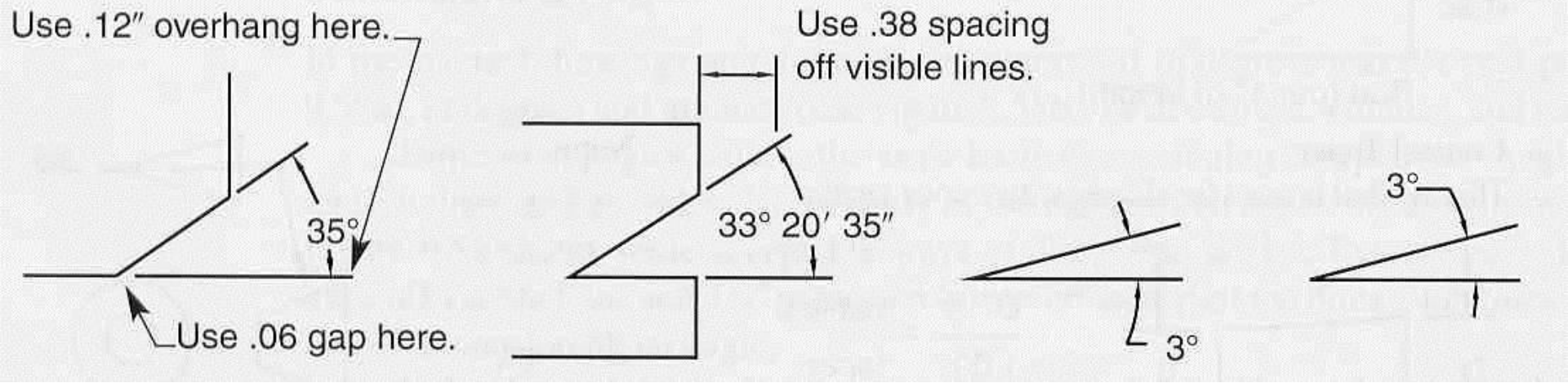


Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

Dimensioning Angles



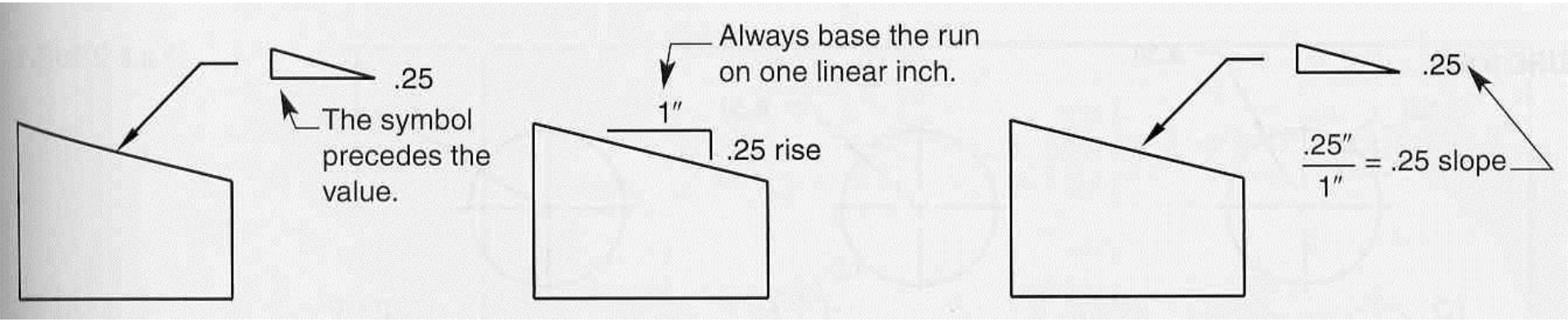
- **In Technical Drawings angular units are expressed in**
  - Degrees and decimal parts of a degree.
  - Degrees and minutes
  - Degrees minutes and seconds
- **Dimension lines are curved in nature.**

Mech 220: 7th LECTURE

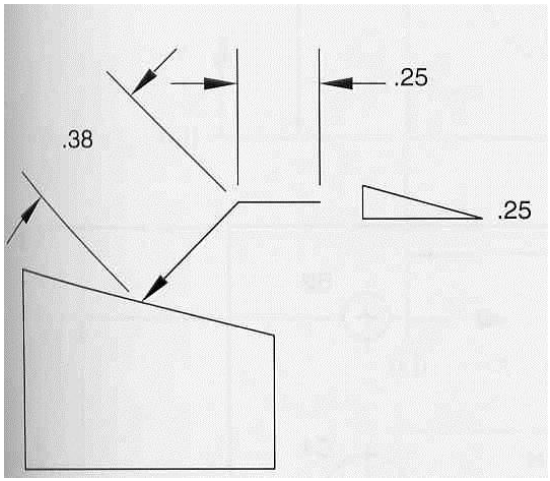
DIMENSIONING

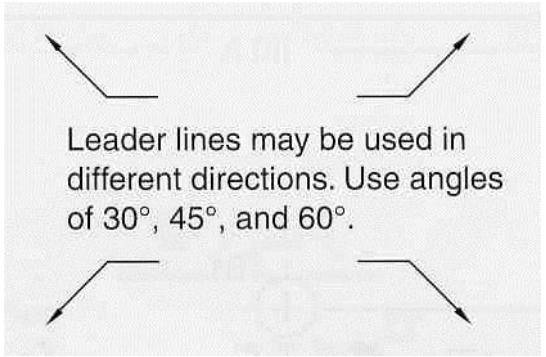
dimensioning a drawing- *shape* & *size* dimensioning

Dimensioning Slopes



Using Leader Lines





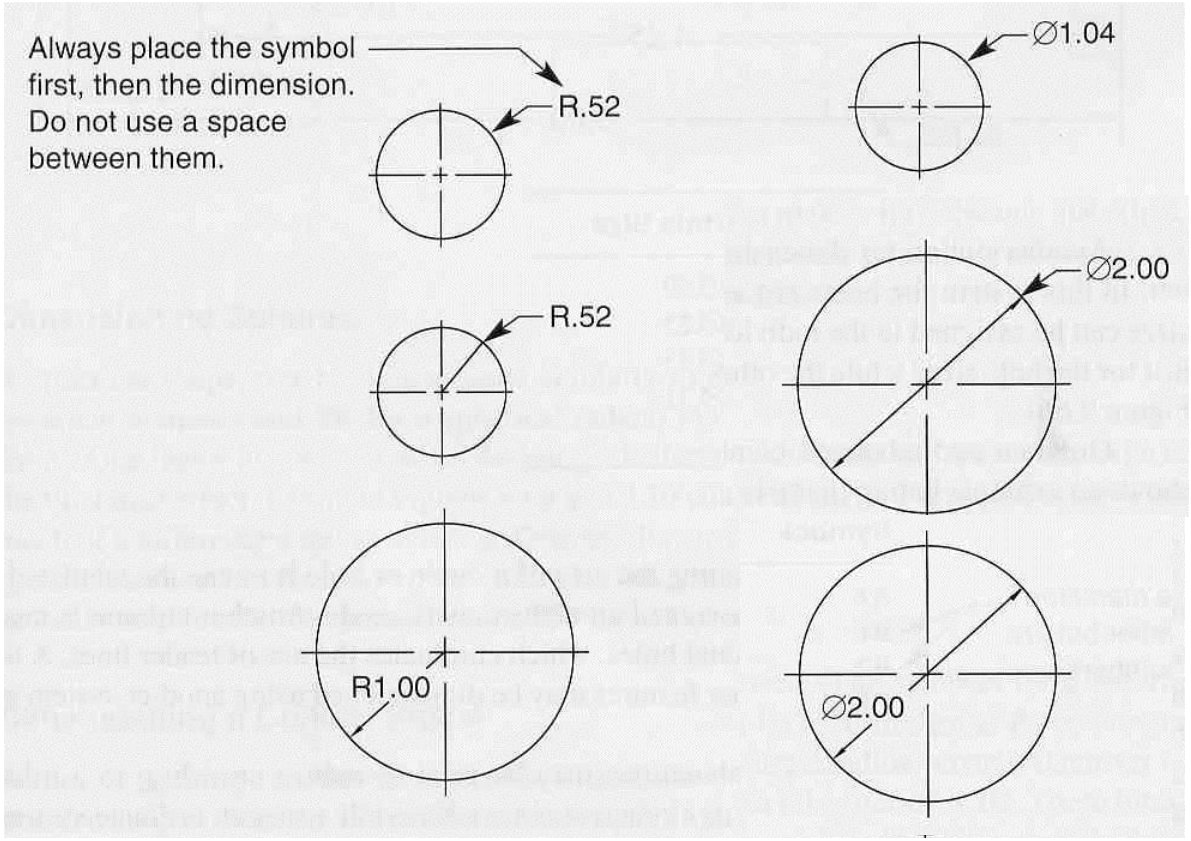
- **Slope of an angle may be used instead of an angle dimensioning.**

Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

Dimensioning Circles



Leader lines may be used as well to dimension circles

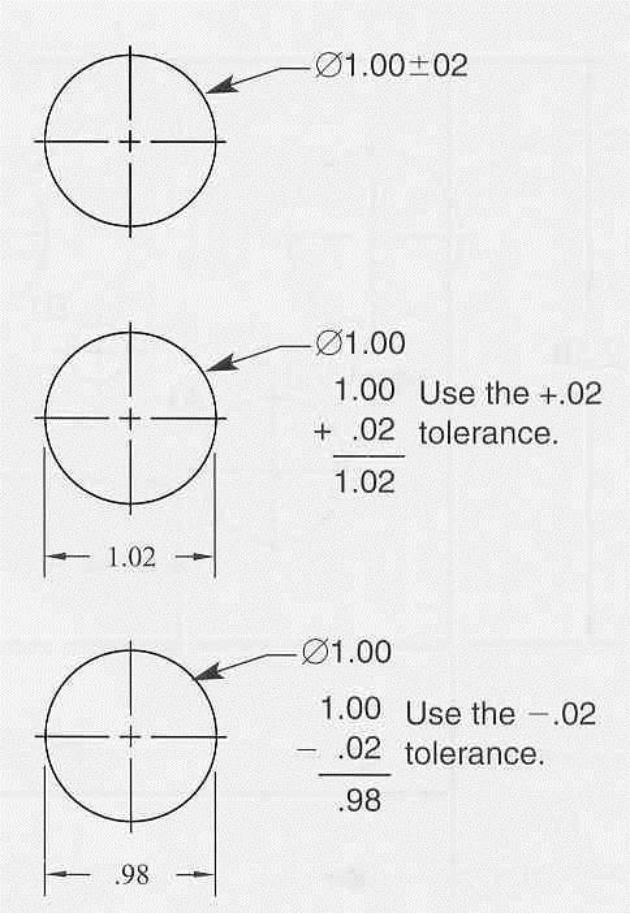
- **To Dimension a circle, radius or diameter a symbol must be used**

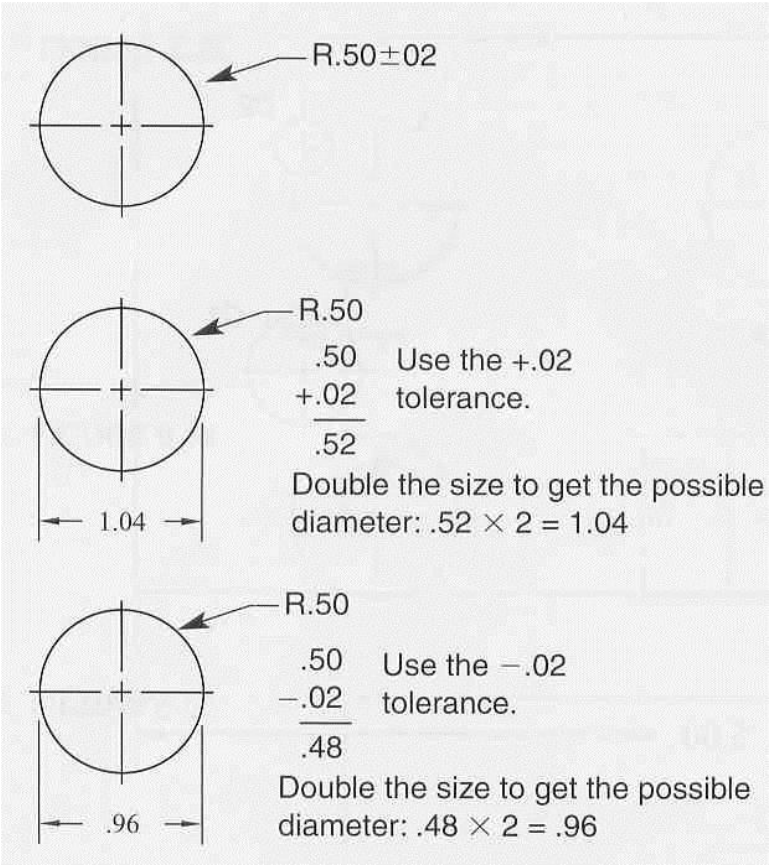
Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

Dimensioning Circles: R vs. DIA.



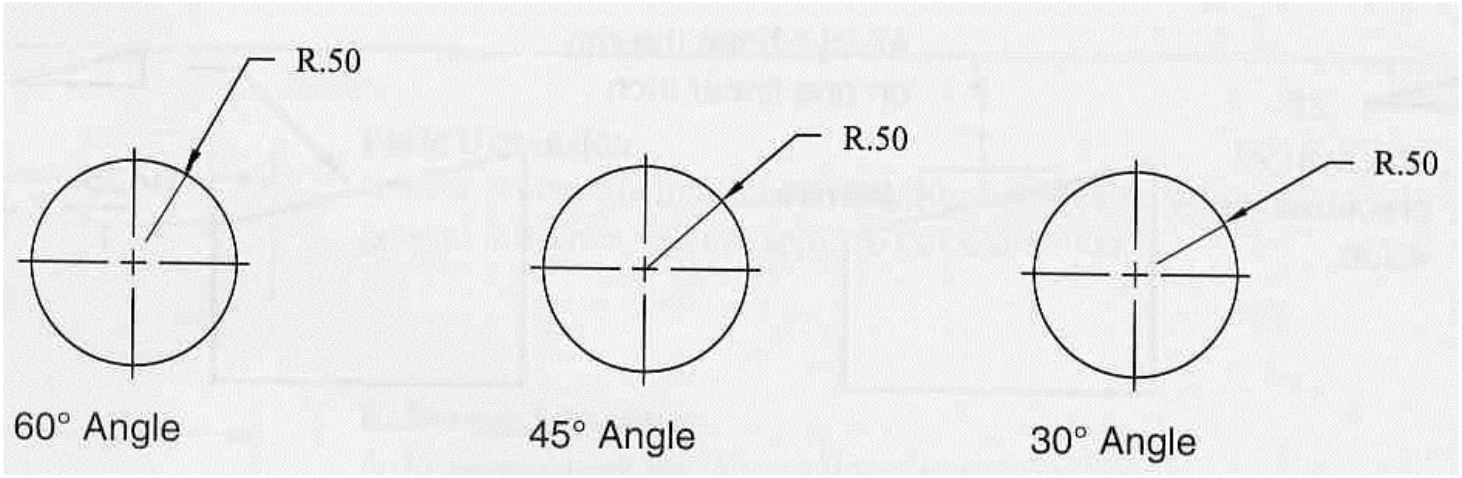


Mech 220: 7th LECTURE

DIMENSIONING

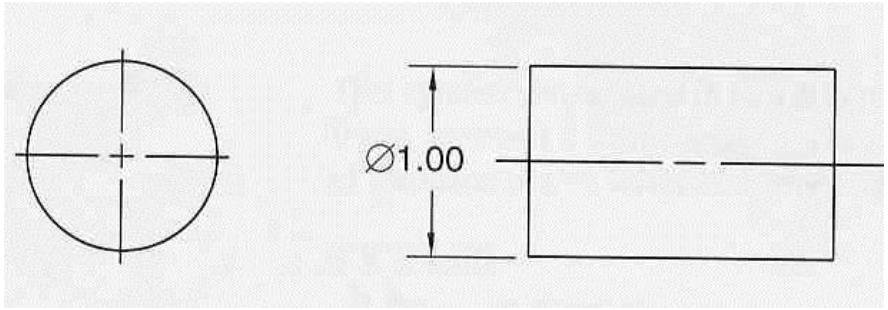
dimensioning a drawing- *shape* & *size* dimensioning

Dimensioning Circles



Leader lines may be at 30, 45, or 60°

Dimensioning Shafts

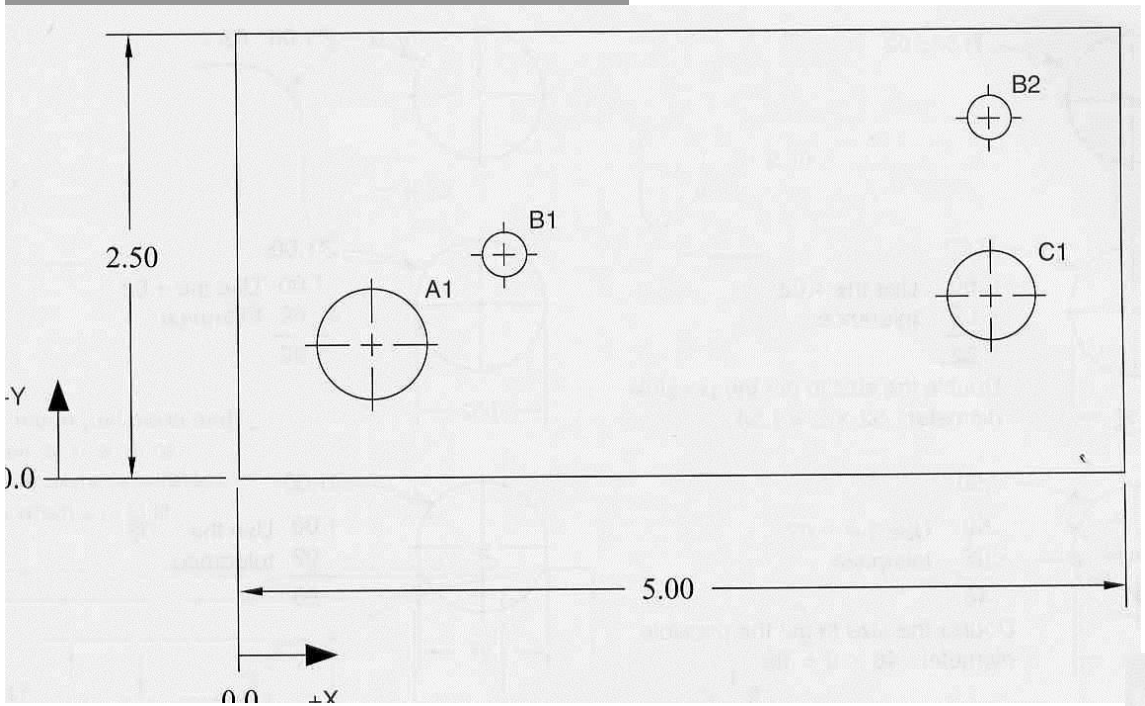


Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

Dimensioning Circles



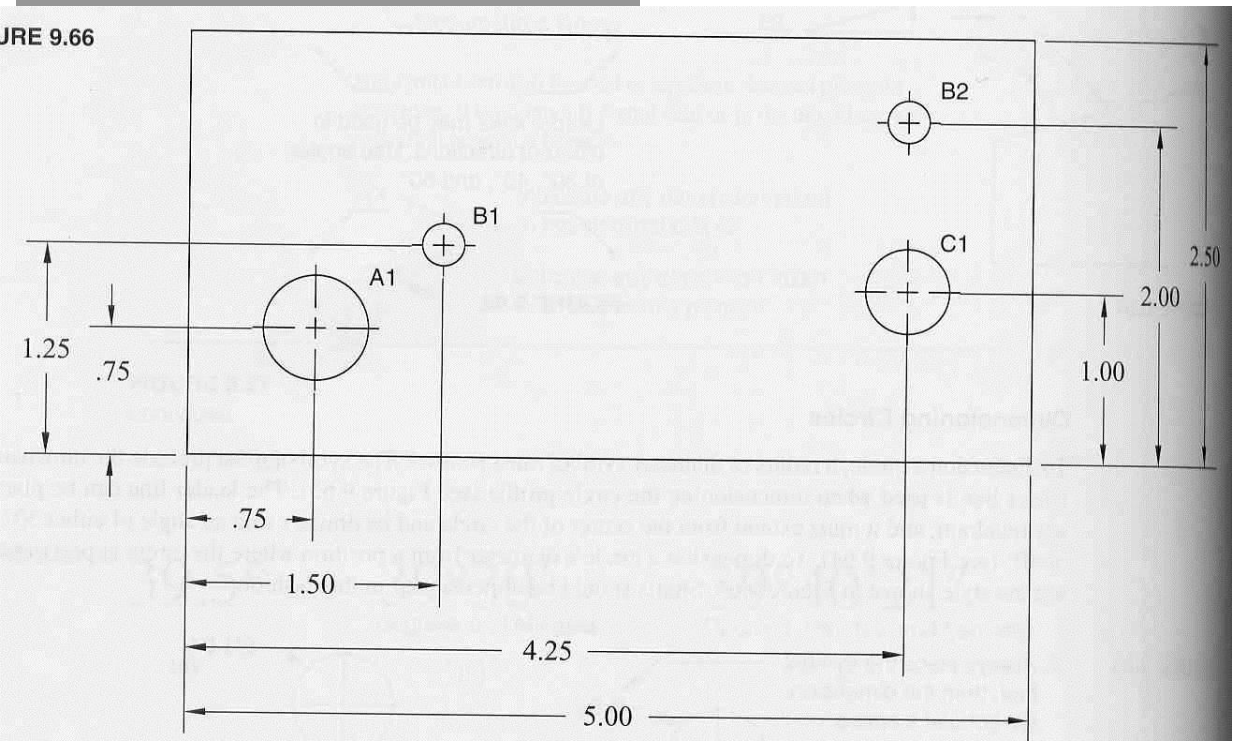
Symbol	Hole Location +X	+Y	Hole Size
A1	.75	.75	Ø.31
B1	1.5	1.25	Ø.25
B2	4.25	2.00	Ø.25
C1	4.25	1.00	Ø.50

Mech 220: 7th LECTURE

DIMENSIONING

dimensioning a drawing- *shape & size* dimensioning

Dimensioning Circles

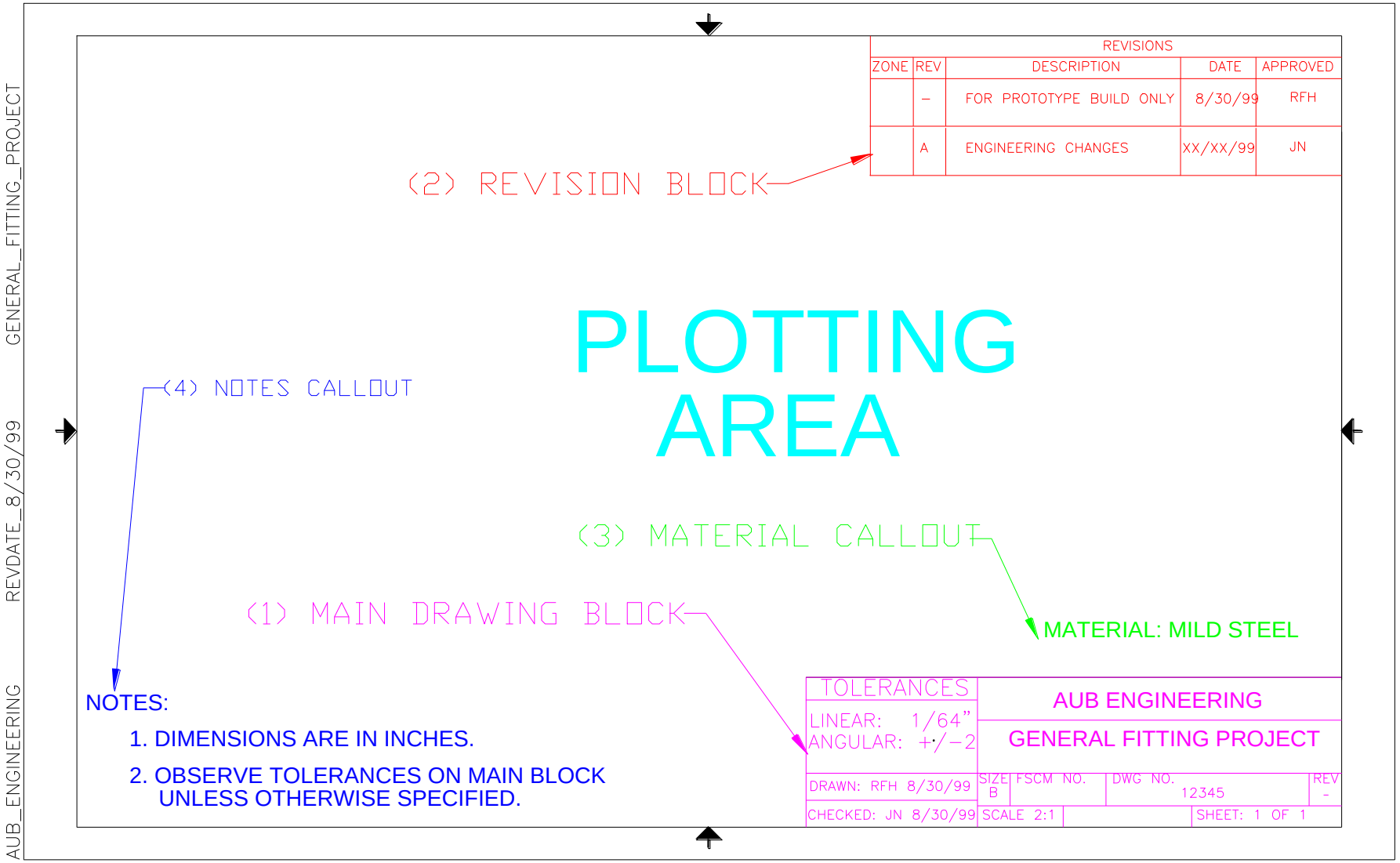


Holes with the same diameter may use the same letter but are assigned different numbers.

Symbol	Hole Size
A1	Ø.50
B1	Ø.25
B2	Ø.25
C1	Ø.31

Mech 220: MECHANICAL DRAWINGS

MECHANICAL DRAWINGS: the anatomy of a drawing



Mech 220: 7th LECTURE

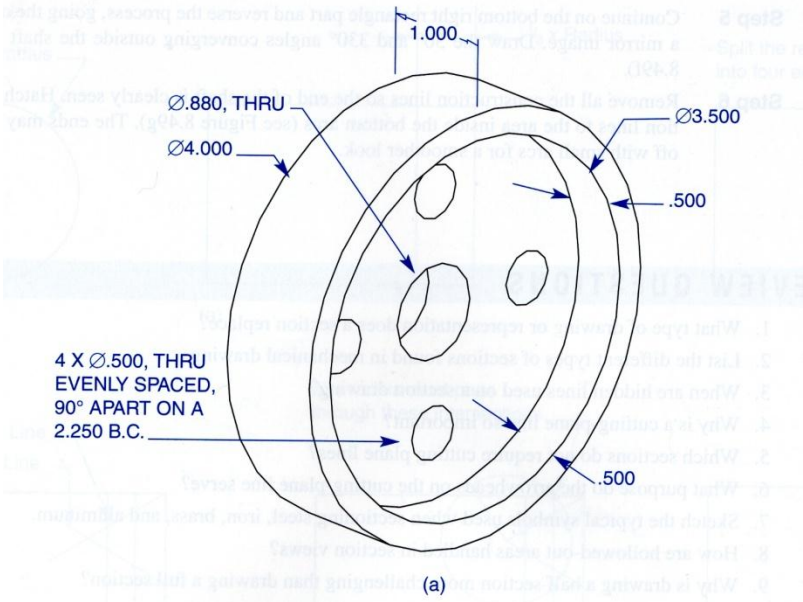
DIMENSIONING:

Assignment Due next week

- Submitted in AutoCAD on Moodle.

Mech 220: 7th LECTURE

DIMENSIONING: Sketching exercise



Generate the necessary front and section view of the above model using the top and front views.

Thank you