IE-352
Section 1, CRN: 5022/5030/5041
Section 2, CRN: 32997/32999/32998
Second Semester 1433-34 H (Spring-2013) – 4(4,1,1)
MANUFACTURING PROCESSES – 2

Wednesday, Mar 13, 2013 (01/05/1434H)

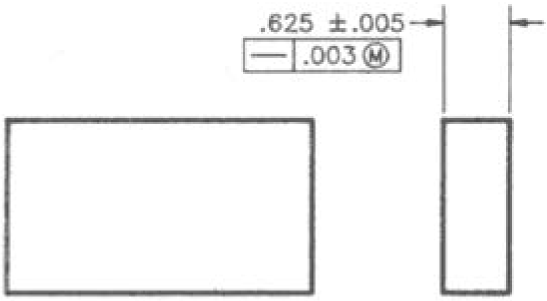
Exercise: Geometric Tolerance (Straightness of a Center Plane)

Name:	Student Number: 4	Section: 8:00 / 10:00

Straightness of a Center Plane

Examine the dimensioned plane shown on the right (units in *mm*). Calculate the geometric tolerance for cross sections in the plane having the following sizes:

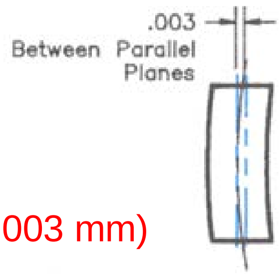
a) 0.632
b) 0.628
c) 0.621
d) 0.619



Given:

a) $BS = 0.625\ mm$

- $Size\ Tol. = \pm 0.005$
- $\Rightarrow MMC = BS + 0.005 = 0.625 + 0.005 = 0.630$
- $\Rightarrow LMC = BS - 0.005 = 0.625 - 0.005 = 0.620$
- $\Rightarrow \mathbf{0.620 \leq size \leq 0.630}$
- Note, this is the allowable range of sizes (or size zone) along the different cross sections of the plane



b) Feature control frame:

- Straightness geometric tolerance (plane)
- $GT = 0.003\ @\ MMC$ (i.e. allowable GT at MMC is 0.003 mm)

- $\Rightarrow$ Virtual Condition: $V_c = MMC + 0.003 = 0.630 + 0.003 = 0.633$
- $\Rightarrow$ @ LMC: $GT_{LMC} = V_c - LMC = 0.633 - 0.620 = 0.013$
- $\Rightarrow \mathbf{0.003}\ (@MMC) \leq \boldsymbol{GT} \leq \mathbf{0.013}\ (@LMC)$
- This is the allowable GT range (or GT zone) for this feature

Required:

a) $GT_{0.632} = ?$

b) $GT_{0.628} = ?$

c) $GT_{0.621} = ?$

d) $GT_{0.619} = ?$

Solution:

a) $size = 0.632$

- Check if within size limits: $0.632 > 0.630 \Rightarrow$ **part is rejected** (note, remachining may be possible here)

b) $size = 0.628$

- Check size: $0.620 < 0.628 < 0.630 \Rightarrow$ part is acceptable
- $GT_{0.628} = V_c - size = 0.633 - 0.628 = 0.005$
- Check if within GT limits: $0.003 < 0.005 < 0.013$ ($\Rightarrow$ ok)

$$\boldsymbol{GT_{0.628}} = \mathbf{0.005}$$

c) $size = 0.621$

- Check size: $0.620 \leq 0.621 \leq 0.630$ ($\Rightarrow$ ok)
- $GT_{0.621} = V_c - size = 0.633 - 0.621 = 0.012$
- Check GT: $0.003 < 0.012 < 0.013$ ($\Rightarrow$ ok)

$$\boldsymbol{GT_{0.628}} = \mathbf{0.012}$$

d) $size = 0.619$

- Check size: $0.619 < 0.620 \Rightarrow$ **part is rejected** (note, remachining is not possible in this case)

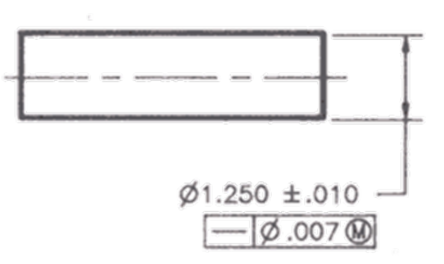
IE-352
Section 1, CRN: 13536
Section 2, CRN: 30521
First Semester 1434-35 H (Fall-2013) – 4(4,1,2)
"MANUFACTURING PROCESSES – 2"

Sunday, November 10, 2013 (07/01/1435H)

Quiz 3 ANSWERS

Name:	Student Number:	Section:
AHMED M. EL-SHERBEENY, PHD	4	11:00 / 1:00

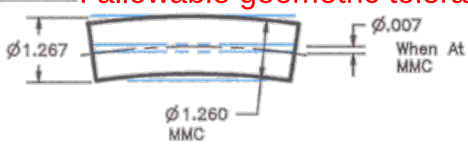
Examine the drawing below and answer the following questions. [units: *in*]



1. **What type of geometric tolerance is involved here (form, orientation, or location)?** [*1 Point*] ANSWER: form

2. ***Describe* below each element of the *feature control frame*.** [*3 Points*]

- : geometric – form – **straighness** tolerance
- — | Ø .007 Ⓜ: allowable geometric tolerance is a **0.07 *in* cylindrical error zone** measured around the central axis (or axis error) and is taken at the ***MMC* of the shaft**



3. **What is the basic size?** [*1 Point*] ANSWER: $1.250\ in$

4. **What is the MMC and LMC?** [*1 Point*]

MMC: $1.260\ in$

LMC: $1.240\ in$

$MMC = BS + 0.010 = 1.260;\ LMC = BS - 0.010 = 1.240$

5. What is the size of the *virtual hole*? [*2 Points*] **ANSWER:** $\boldsymbol{1.267\ in}$

$\boldsymbol{virtual\ hole: V_c = \phi_{shaft@MMC} + GT_{MMC} = 1.260 + 0.007 = 1.267\ in}$

6. What is the geometric tolerance for cross sections in the shaft having the following sizes? [*2 Points*]

a. 1.256 **ANSWER:** $\boldsymbol{0.011\ in}$

b. 1.238 **ANSWER:** **part rejected**

a) $size = 1.256$

- Check size: $1.240 < 1.256 < 1.260$ ($\Rightarrow$ ok)
- $GT_{1.256} = V_c - size = 1.267 - 1.256 = \mathbf{0.011}$

b) $size = 1.238$

- Check size: $1.238 < 1.240\ (LMC)$ ($\Rightarrow$ **part is rejected**)

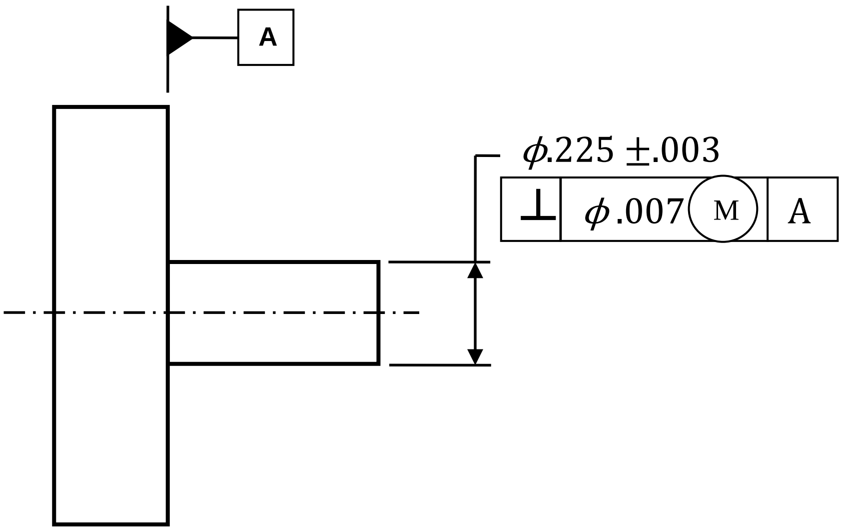
IE-352
Section 1, CRN: 32997
Section 2, CRN: 5022
Second Semester 1431-32 H (Spring-2011) – 4(4,1,1)
MANUFACTURING PROCESSES - 2

Sunday, Apr 17, 2011 (13/5/1432H)

Quiz 3 ANSWERS

Name:	Student Number: 42

Examine the shaft system below (dimensions in mm) and answer the following questions.



1. **Describe below each element of the *feature control frame*.** [3 Points]

The shaft must lie perpendicular within a tolerance zone of 0.007 mm diameter (ϕ) at the maximum material condition (MMC), with respect to datum axis A.

2. **What type of geometric tolerance is involved here (form, orientation, or location)?** [1 Point] ANSWER: orientation

3. **What is the basic size?** [2 Points] ANSWER: 0.225 mm

4. **What is the feature size at *MMC*?** [2 Points] ANSWER: 0.228 mm

At MMC: $\phi = 0.225 + 0.003 = 0.228$ mm

5. **What is the feature size at V_C?** [2 Points] ANSWER: 0.235 mm

$V_c = \phi_{MMC} + Geom.Tol = 0.228 + 0.007 = 0.235 \text{ mm}$

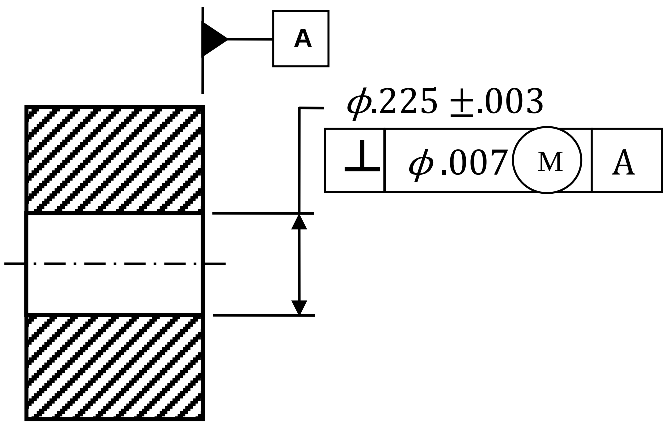
IE-352
Section 1, CRN: 32997
Section 2, CRN: 5022
Second Semester 1431-32 H (Spring-2011) – 4(4,1,1)
MANUFACTURING PROCESSES - 2

Sunday, Apr 17, 2011 (13/5/1432H)

Quiz 3 ANSWERS

Name:	Student Number: 42

Examine the hole system below (dimensions in mm) and answer the following questions.



1. **Describe below each element of the *feature control frame*.** [3 Points]

The hole must lie perpendicular within a tolerance zone of 0.007 mm diameter (ϕ) at the maximum material condition (MMC), with respect to datum axis A.

2. **What type of geometric tolerance is involved here (form, orientation, or location)?** [1 Point] ANSWER: **orientation**

3. **What is the basic size?** [2 Points] ANSWER: **0.225 mm**

4. **What is the feature size at *MMC*?** [2 Points] ANSWER: **0.222 mm**

At MMC: $\phi = 0.225 - 0.003 = 0.222$ mm

5. **What is the feature size at V_C?** [2 Points] ANSWER: **0.215 mm**

$V_c = \phi_{MMC} + Geom.Tol = 0.222 - 0.007 = 0.215$ mm

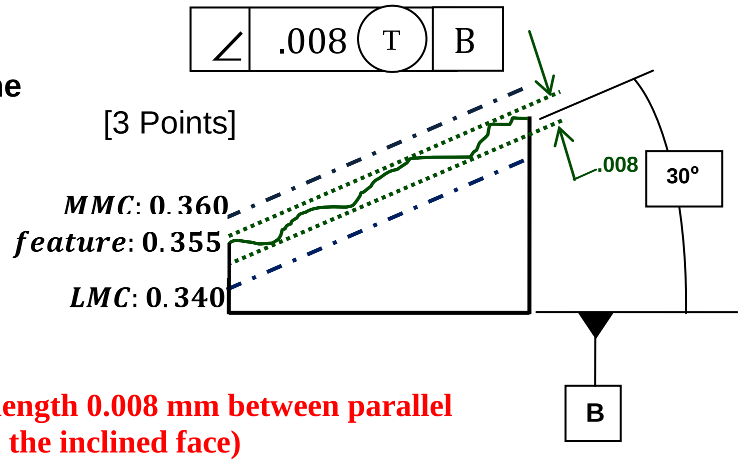
IE-352
Section 1, CRN: 13536
Section 2, CRN: 30521
First Semester 1432-33 H (Fall-2011) – 4(4,1,1)
MANUFACTURING PROCESSES - 2

Sunday, Nov 20, 2011 (24/12/1432H)

Quiz 4 ANSWERS

Name:	Student Number: 4	Section: 8:00 / 10:00

Examine the feature below (dimensions in *mm*) and answer the following questions.



1. **Describe below each element of the *feature control frame*.** [3 Points]

The featured dimension must lie,

- at a 30-degree angle
- with respect to datum axis B,
- and within a tolerance zone of length 0.008 mm between parallel planes (containing all points on the inclined face)
- where the top plane is tangent to high point(s) of the face.

2. **What type of geometric tolerance is involved here,**

   (form, orientation, or location)? [1 Point] ANSWER: orientation

3. **What is the basic size?** [2 Points] ANSWER:

   0.350 mm

4. ***Use the diagram above* to sketch the two planes that contain the MMC and LMC.** (see diagram) [1 Point]

5. **If the feature size is $0.355\,mm$, *use the diagram above* to sketch the two planes that must contain all points on the part.** [2 Points]
   (see diagram)

- Note, feature size ($0.355\,mm$) lies within the size zone ($0.340 - 0.360\,mm$)
- Also note, lowest point on face lies at:

$\mathbf{0.355 - 0.008 = 0.347}\ \boldsymbol{mm}\ (\boldsymbol{i.e. within\ zone, since} > LMC)$

6. If the datum (B) is removed from the FCF above, what is the resulting geometric tolerance type? [1 Point] **ANSWER:** form (flatness)

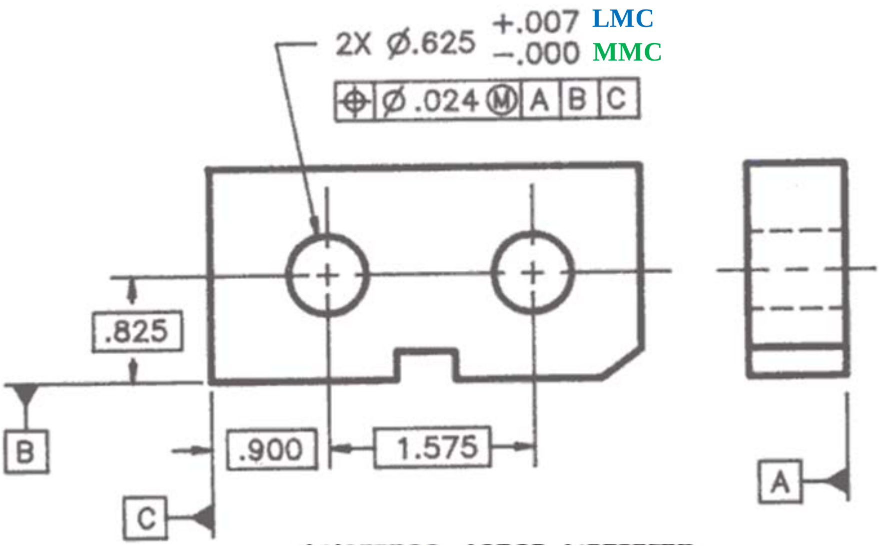
IE-352
Section 1, CRN: 5022/5030/5041
Section 2, CRN: 32997/32999/32998
Second Semester 1433-34 H (Spring-2013) – 4(4,1,1)
MANUFACTURING PROCESSES – 2

Monday, Mar 18, 2013 (06/05/1434H)

Quiz 4 ANSWERS

Name: Ahmed M. El-Sherbeeny, PhD	Student Number: 4	Section: 8:00 / 10:00

Examine the drawing below and answer the following questions. [units: *in*]



1. **What type of geometric tolerance is involved here (form, orientation, or location)?** [*1 Point*] ANSWER: location

2. ***Describe* below each element of the *feature control frame*.** [*3 Points*]

- : geometric – location – **position** tolerance
- Ø.024 Ⓜ: allowable geometric tolerance is a **0.024 *in* cylindrical error zone** 

measured around center point (or "centered on true positions"), and is taken at the **MMC of the hole**
- A | B | C: the tolerance is determined with reference to datums **A (primary datum)**, **B (secondary datum)**, and **C (tertiary datum)**

3. **What is the basic size?** [*1 Point*] **ANSWER:** $\boxed{\mathbf{0.625\ in}}$

4. **Is this a "basic hole" or "basic shaft" system (and why)?** [*1 Point*]

ANSWER: **Basic hole system**

From the drawing $\varnothing.625\ ^{+.007}_{-.000}$ we can see that the $\boldsymbol{hole_{MMC}} = \boldsymbol{BS} = 0.625$

This must, thus, be a **basic hole system**

5. **What is the size of the *virtual shaft*?** [*2 Points*] **ANSWER:** $\boxed{\mathbf{0.601\ in}}$

$\boldsymbol{virtual\ shaft}: \boldsymbol{V_c} = \boldsymbol{\phi_{hole@MMC} - GT_{MMC} = 0.625 - 0.024 = 0.601\ in}$

6. **What is the $\boldsymbol{shaft_{MMC}}$ and $\boldsymbol{shaft_{LMC}}$ given that an allowance of $5\ \boldsymbol{thousands}$ is required, and that the shaft has the *same* tolerance as the hole?** [*2 Points*]

$\boldsymbol{shaft_{MMC}}$: $\boxed{\mathbf{0.596\ in}}$

$\boldsymbol{shaft_{LMC}}$: $\boxed{\mathbf{0.589\ in}}$

$$\boldsymbol{\phi_{shaft@MMC} = V_c - allowance = 0.601 - 0.005 = 0.596\ in}$$
$$\boldsymbol{\phi_{shaft@LMC} = \phi_{shaft@MMC} - DT_{shaft} = 0.596 - 0.007 = 0.589\ in}$$