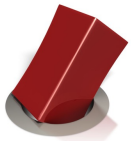
WHAT IS THE GOAL OF GAGING?

- CHECK AND ACCEPT ALL GOOD PARTS
- CHECK AND REJECT ALL BAD PARTS
- IMPOSSIBLE
- WHY?

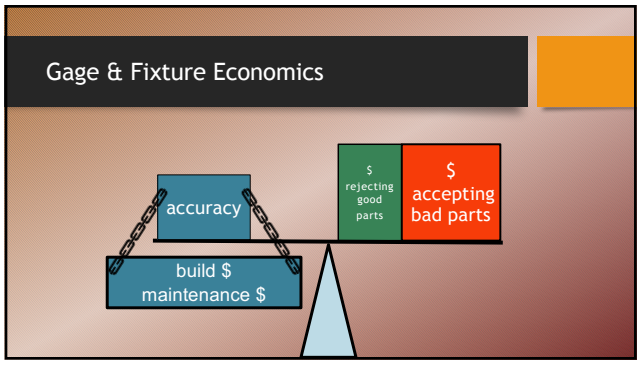


1

VARIATION – NOTHING CAN BE 100% PERFECT

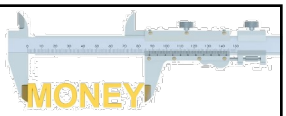
OPTIONS – Gages either ACCEPT or REJECT boarderline features.

2



3

ECONOMICS OF GAGING



- GAGE BENEFIT & VALUE > GAGE COST
- PART QUANTITY AFFECTS GAGE FEASIBILITY
- MAKE GAGES WITH SMALLEST TOLERANCES POSSIBLE WITHIN BUDGET

4

TIGHTER GAGE TOLERANCE RESULTS:

- MORE EXPEN$IVE GAGES
- WEAR OUT FASTER – SHORTER LIFE/USE
- CAN DETECT SMALLER VARIATIONS
- SHOULD BE CHECKED MORE OFTEN

5

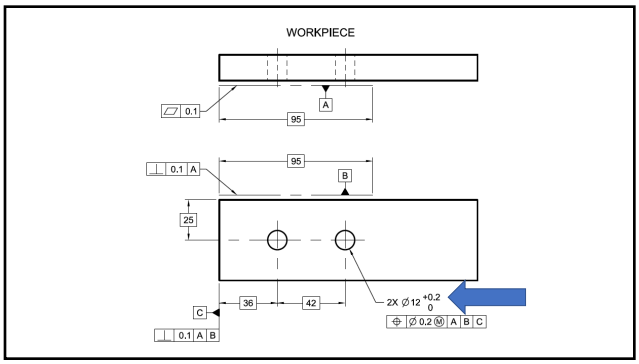
Gaging "Policies" *from Y14.43*:

Absolute: Reject 100% of out-of-spec parts

Tolerant: Reject *most* out-of-spec parts, pass *most* in-spec parts

Optimistic: Accept 100% of in-spec parts

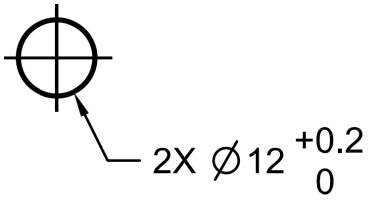
6



7

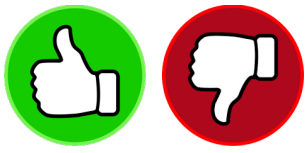
3.3.8 Workpiece/Part Tolerance

workpiece/part tolerance: for tolerancing GO and NOGO gages, this is the difference between the LMC and the MMC.



8

ATTRIBUTE GAGES



- PASS OR FAIL
- GOOD OR BAD
- IN OR OUT OF TOLERANCE
- NO NUMERICAL VALUES REPORTED

9

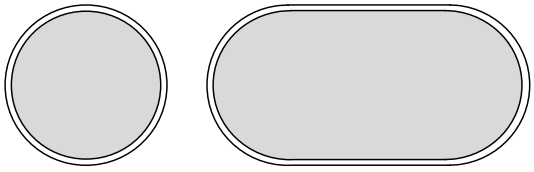
3.2.16 GO Gage

GO gage: a fixed limit gage that checks a feature of size for acceptance within MMC perfect form boundary.

10

3.2.16 GO Gage

GO gage: a fixed limit gage that checks a feature of size for acceptance within MMC perfect form boundary.



11

3.2.21 NOGO Gage

NOGO gage: a fixed limit gage that checks a feature of size for violation of the LMC actual local size. This gage is also referred to as a "NOT GO gage."

12

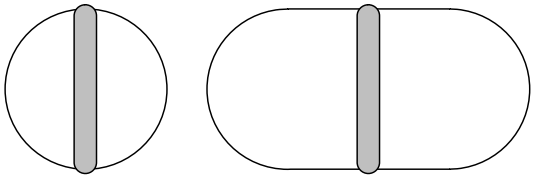
3.2.21 NOGO Gage

NOGO gage: a fixed limit gage that checks a feature of size for violation of the LMC actual local size. This gage is also referred to as a "NOT GO gage."

13

3.2.21 NOGO Gage

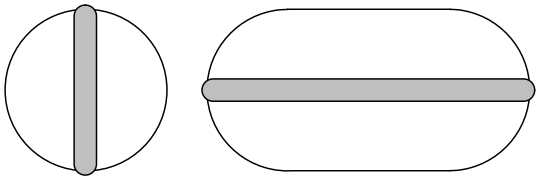
NOGO gage: a fixed limit gage that checks a feature of size for violation of the LMC actual local size. This gage is also referred to as a "NOT GO gage."



14

3.2.21 NOGO Gage

NOGO gage: a fixed limit gage that checks a feature of size for violation of the LMC actual local size. This gage is also referred to as a "NOT GO gage."



15

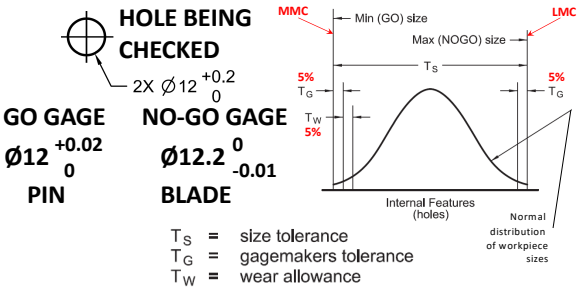
3.3 Tolerancing

3.3.1 Absolute Tolerance (Pessimistic)

absolute tolerance (pessimistic): the policy of tolerancing gages that ensures complete random assemblability of parts by applying gagemakers' tolerances, workpiece limits of size, and geometric control. See para. 4.3.1.

16

Absolute Tolerancing: GO/NOGO Gages



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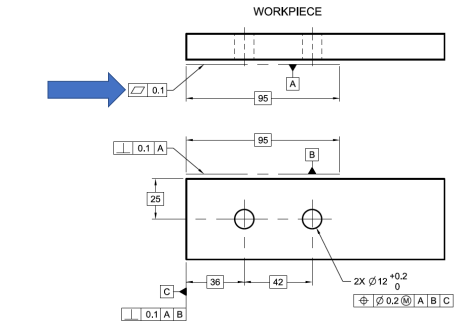
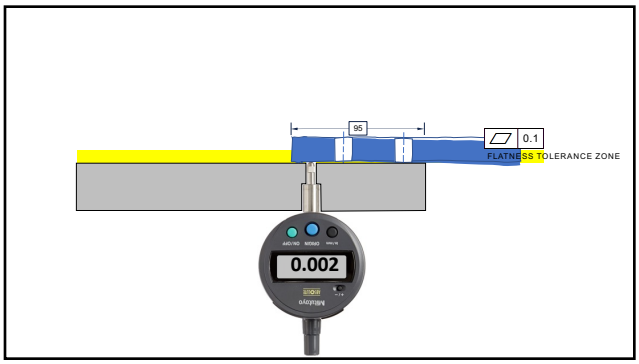


18



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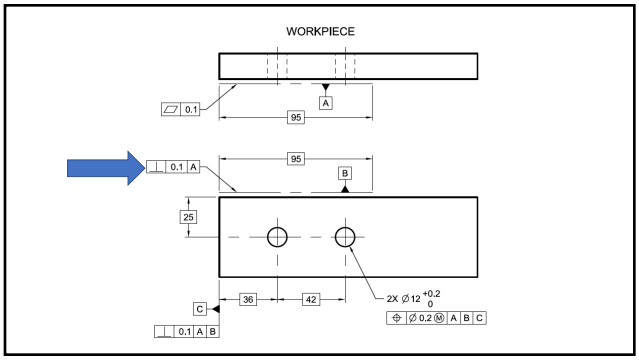
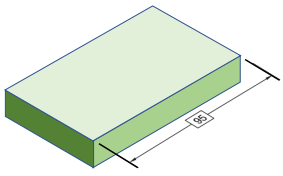


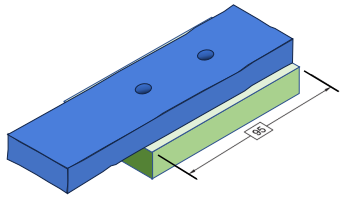
20

Datum A Physical Simulator



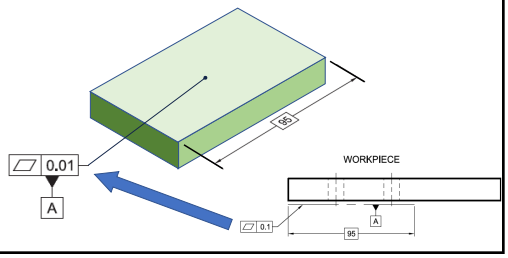
21

Part must contact Datum A



22

How flat should the *simulator itself* be?



23

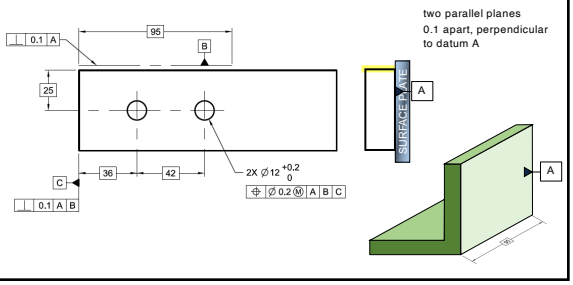
Measuring Surface Perpendicularity

PRECISION HARDENED & GROUND STEEL ANGLE PLATE
(SURFACES SQUARE AND PARALLEL WITHIN .0001")

GRANITE SURFACE PLATE
WITH FIXED GAGE STAND
AND DIGITAL INDICATOR

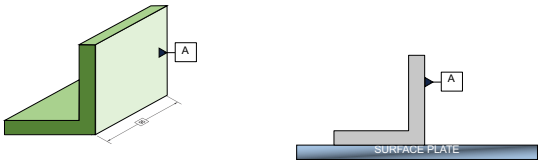
24

Measuring Surface Perpendicularity



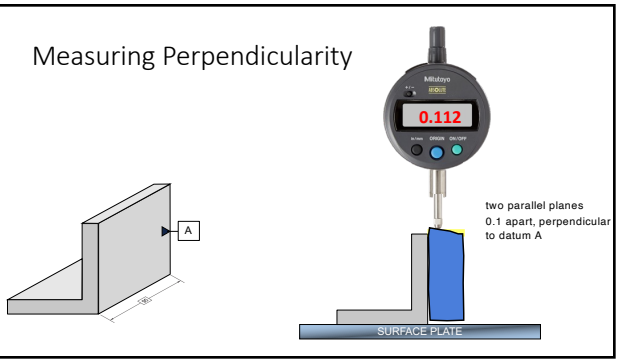
25

Datum A Simulator



26

Measuring Perpendicularity



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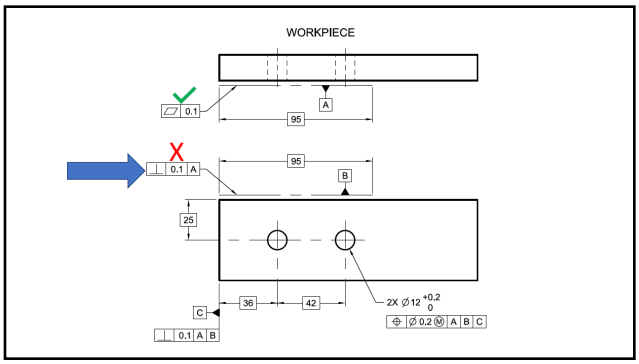
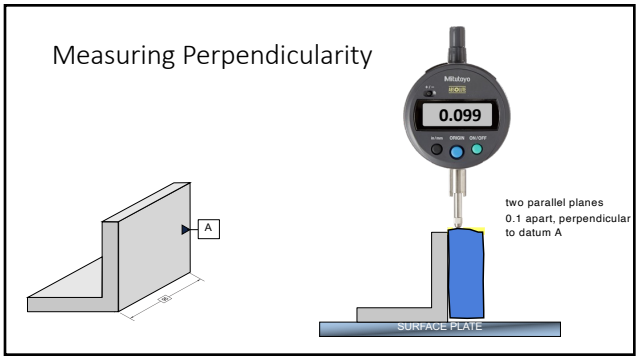
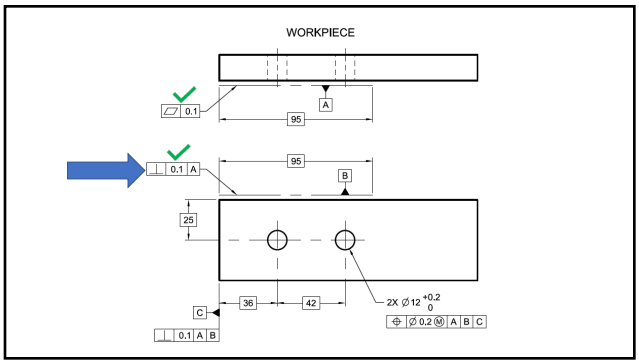

WORKPIECE
0.1
A
95
X
0.1 A
95
B
25
36
42
C
2X Ø 12 +0.2 0
Ø 0.2 M A B C
0.1 A B

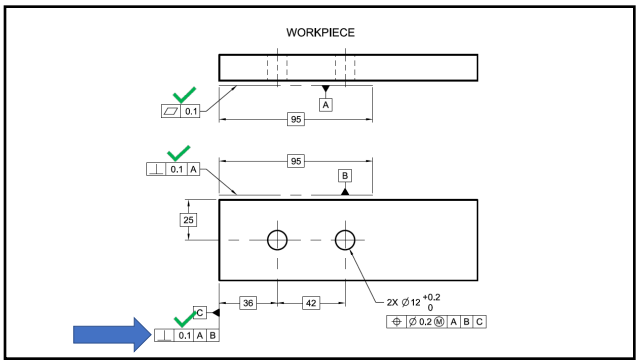
28


Measuring Perpendicularity
A
Mitutoyo
0.099
two parallel planes
0.1 apart, perpendicular
to datum A
SURFACE PLATE

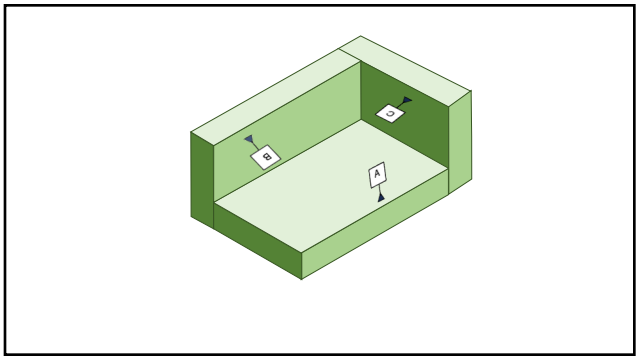
29


WORKPIECE
0.1
A
95
0.1 A
95
B
25
36
42
C
2X Ø 12 +0.2 0
Ø 0.2 M A B C
0.1 A B

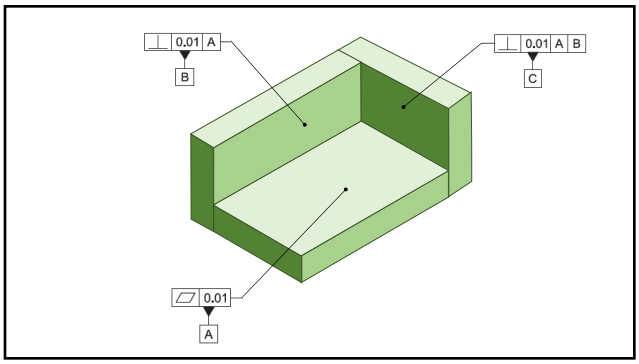
30


WORKPIECE
0.1
A
95
0.1 A
95
B
25
36
42
C
0.1 A B
2X Ø 12 +0,2 0
Ø 0,2 M A B C

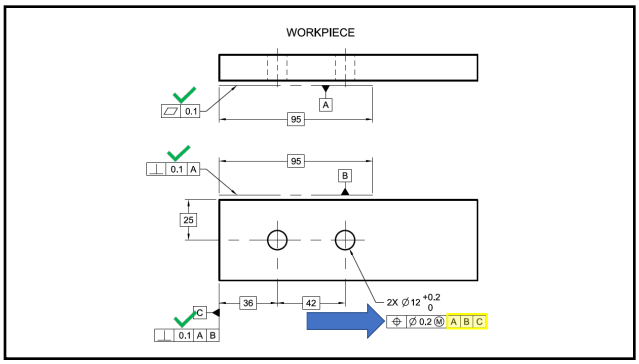
31


C
B
A

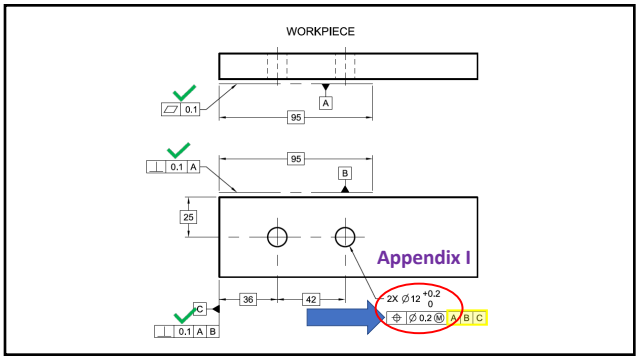
32


0,01 A
B
0,01 A B
C
0,01
A

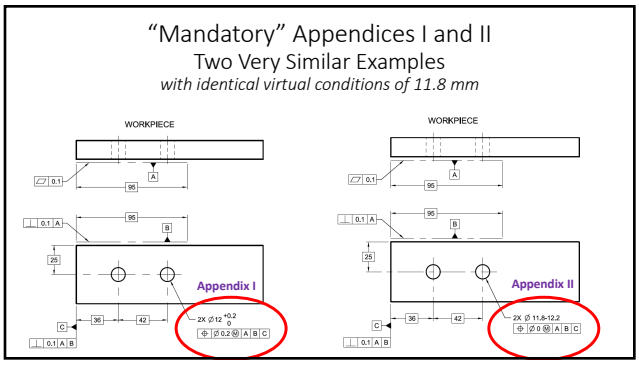
33


WORKPIECE
0.1
A
95
0.1 A
95
B
25
C
36
42
2X Ø 12 +0.2 0
Ø 0.2 Ⓜ A B C
0.1 A B

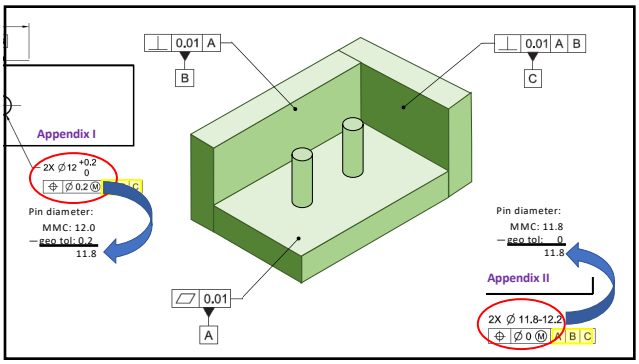
34


WORKPIECE
0.1
A
95
0.1 A
95
B
25
Appendix I
C
36
42
2X Ø 12 +0.2 0
Ø 0.2 Ⓜ A B C
0.1 A B

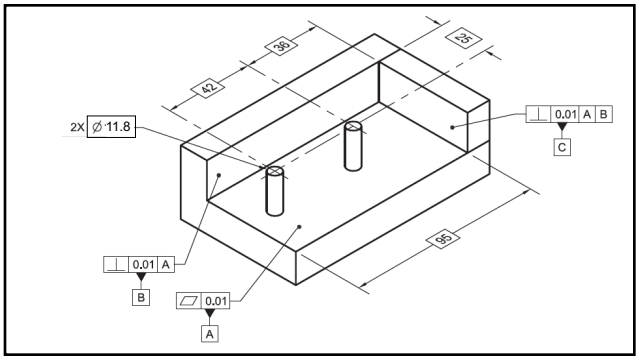
35


"Mandatory" Appendices I and II
Two Very Similar Examples
with identical virtual conditions of 11.8 mm
WORKPIECE
Appendix I
WORKPIECE
Appendix II

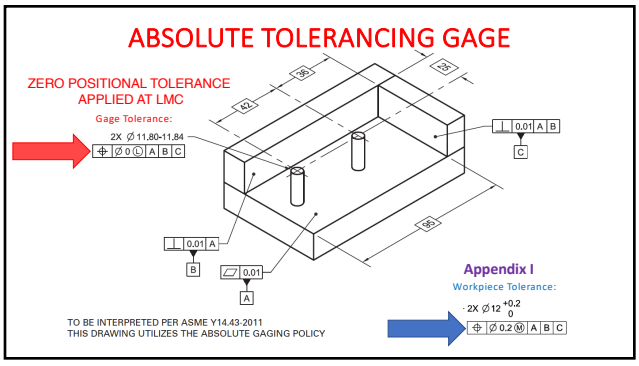
36


0.01 A
B
0.01 A B
C
Appendix I
2X Ø12 +0.2 0
Ø 0.2 M C
Pin diameter:
MMC: 12.0
geo tol: 0.2
11.8
0.01
A
Pin diameter:
MMC: 11.8
geo tol: 0
11.8
Appendix II
2X Ø 11.8-12.2
Ø 0 M A B C

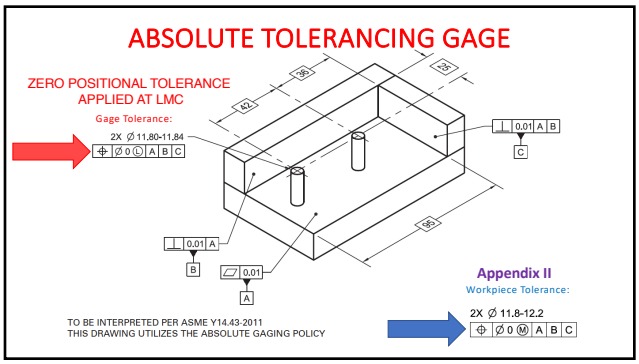
37


2X Ø 11.8
0.01 A B
C
0.01 A
B
0.01
A

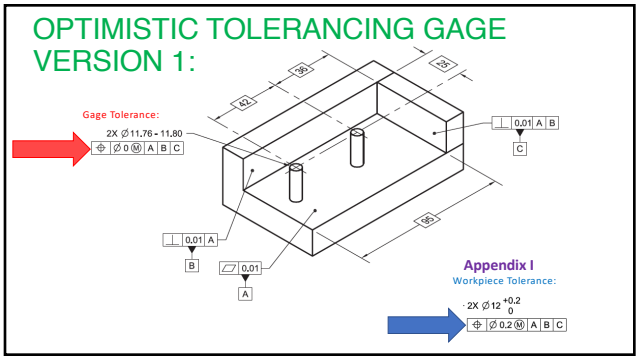
38


ABSOLUTE TOLERANCING GAGE
ZERO POSITIONAL TOLERANCE
APPLIED AT LMC
Gage Tolerance:
2X Ø 11.80-11.84
Ø 0 L A B C
0.01 A B
C
0.01 A
B
0.01
A
Appendix I
Workpiece Tolerance:
2X Ø 12 +0.2 0
Ø 0.2 M A B C
TO BE INTERPRETED PER ASME Y14.43-2011
THIS DRAWING UTILIZES THE ABSOLUTE GAGING POLICY

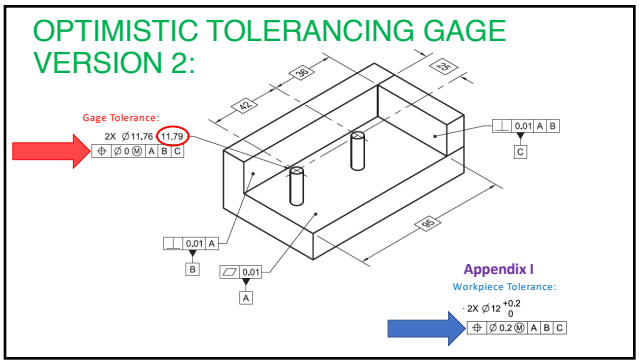
39


ABSOLUTE TOLERANCING GAGE
ZERO POSITIONAL TOLERANCE APPLIED AT LMC
Gage Tolerance:
2X Ø 11.80-11.84
Ø 0 Ⓛ A B C
0.01 A B
C
0.01 A
B
0.01
A
Appendix II
Workpiece Tolerance:
2X Ø 11.8-12.2
Ø 0 Ⓜ A B C
TO BE INTERPRETED PER ASME Y14.43-2011
THIS DRAWING UTILIZES THE ABSOLUTE GAGING POLICY

40

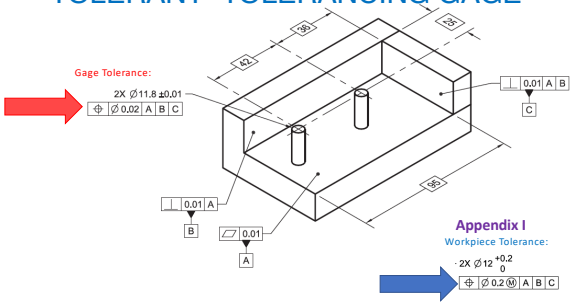

OPTIMISTIC TOLERANCING GAGE VERSION 1:
Gage Tolerance:
2X Ø 11.76 - 11.80
Ø 0 Ⓜ A B C
0.01 A B
C
0.01 A
B
0.01
A
Appendix I
Workpiece Tolerance:
2X Ø 12 +0.2 0
Ø 0.2 Ⓜ A B C

41


OPTIMISTIC TOLERANCING GAGE VERSION 2:
Gage Tolerance:
2X Ø 11.76 11.79
Ø 0 Ⓜ A B C
0.01 A B
C
0.01 A
B
0.01
A
Appendix I
Workpiece Tolerance:
2X Ø 12 +0.2 0
Ø 0.2 Ⓜ A B C

42

"TOLERANT" TOLERANCING GAGE

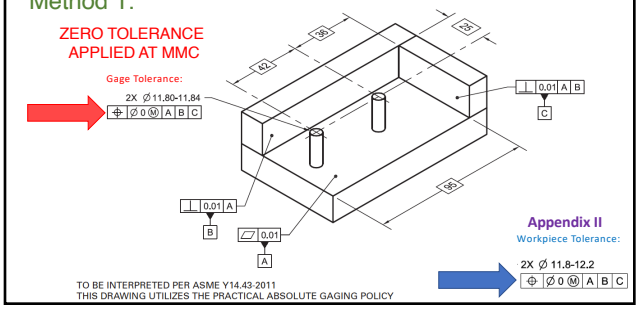


43

"PRACTICAL" ABSOLUTE TOLERANCING

Method 1:

ZERO TOLERANCE APPLIED AT MMC

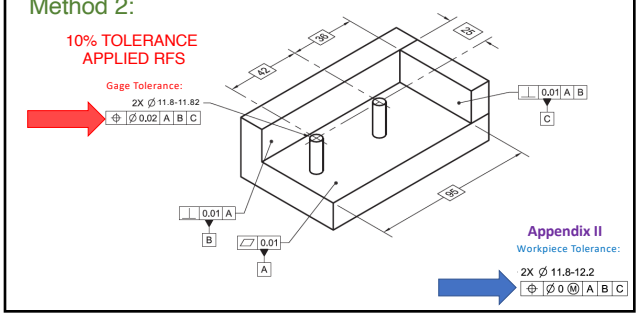


44

"PRACTICAL" ABSOLUTE TOLERANCING

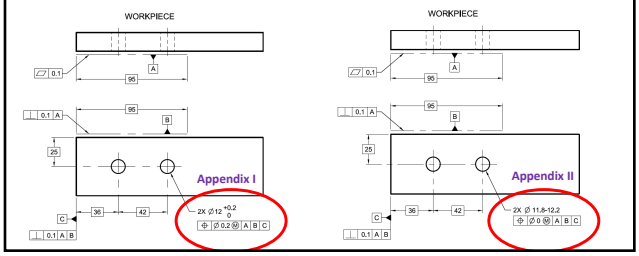
Method 2:

10% TOLERANCE APPLIED RFS



45

“Mandatory” Appendices I and II
Two Very Similar Examples
with identical virtual conditions of 11.8 mm



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