MechNEWS

June 2003

Welcome

Welcome to the June edition of Mech*NEWS*™, a service provided by MechSigma Consulting, Inc. In last month's article, Fixed and Floating Fasteners, we discussed formulas to calculate tolerances that give "no interference, no clearance" fits. Sometimes, these calculated tolerances are small and not manufacturable. In this issue, we discuss how composite position tolerancing can rescue this situation.

We hope you enjoy this issue of Mech*NEWS*™ and continue to tell your colleagues about it.

Composite Position to the Rescue

In last month's newsletter, we showed formulas that ensure "line-to-line" assembly fits. These formulas work well if the calculated tolerances are manufacturable. Sometimes, these equations generate tolerances that are not manufacturable. In cases where these tolerances are *not* manufacturable we can use composite position tolerancing to "have our cake" and "eat it" too.

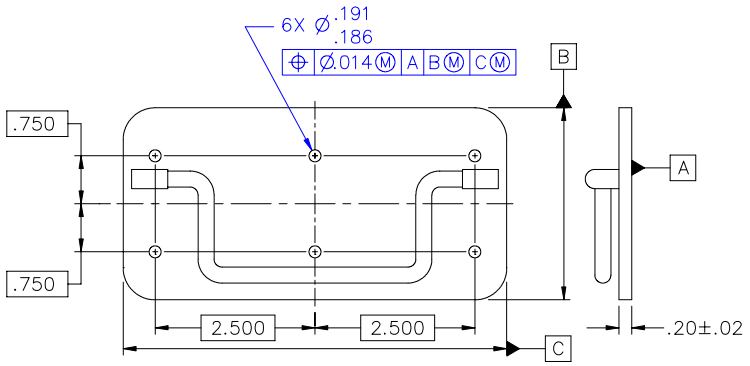

Figure 1

The handle shown in Figure 1 is to be attached to the "box" shown in Figure 2. The handle is a standard catalog item, so the dimensions and tolerances cannot be changed. The handle is mounted with six 8-32 machine screws onto the box, which has blind tapped holes. Since this is a Fixed Fastener Case, the calculated tolerance for the tapped holes is Ø.008 (Ø.186-Ø.014-Ø.164). As we mentioned last month, this tolerance ensures that the handle will always fit.

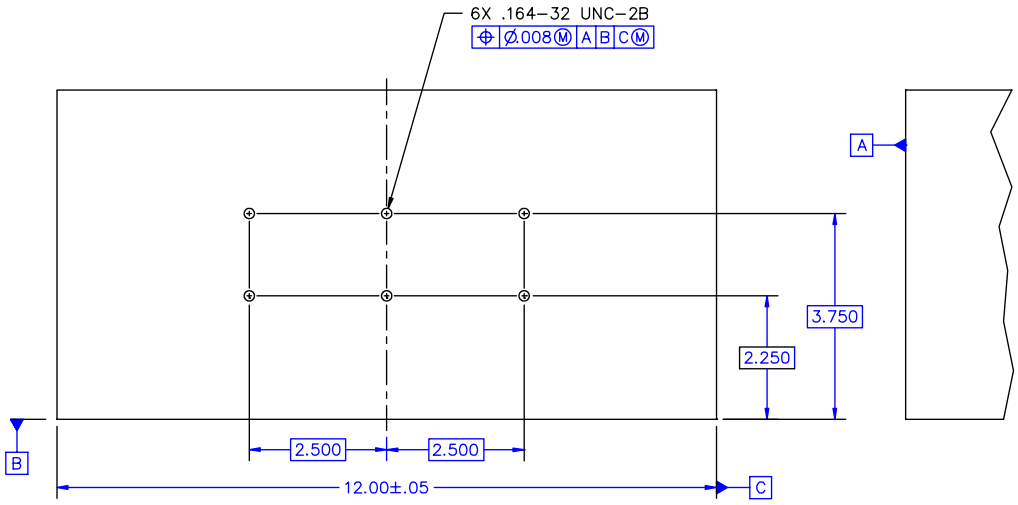

Figure 2

(Continued)

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GD&T Overview • Sept. 16
GD&T Fundamentals • Sept. 17-19

If assembly fit is our only concern, then our problem is solved. As always, however, we are also interested in minimizing manufacturing scrap. What if the manufacturing process is not capable of producing the tapped holes to ⌖ Ø.008 A B CⓂ ? Our first option might be to increase the tolerance. If we do this, then the handle may not fit all the time.

As we study this further, we realize that we only need to control the hole-to-hole spacings in order for the handle to fit, but we *don't* need to control the pattern within Ø.008 to A B CⓂ . If the entire pattern of holes shifted relative to datums B or C, this would be acceptable. "Unlocking" the location of the pattern to the datums B and C should also reduce our scrap since many manufacturing processes can produce hole-to-hole spacings to smaller tolerances than the overall location of the pattern.

Composite Feature Control Frame

A *composite positional tolerance* feature control frame does just this (Figure 3). It unlocks the Ø.008 location to the datum reference frame, while keeping hole-to-hole relationship to Ø.008. Y14.5 refers to the upper segment as the *Pattern Locating Tolerance Zone Framework (PLTZF)* and the lower segment as the *Feature Relating Tolerance Zone Framework (FRTZF)*.

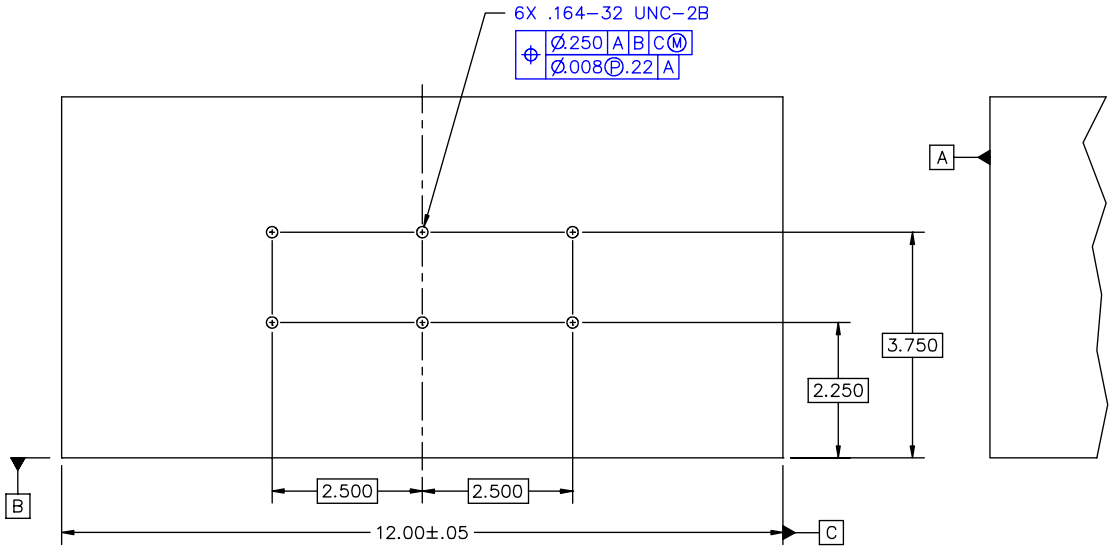


Figure 3 *(Continued)*

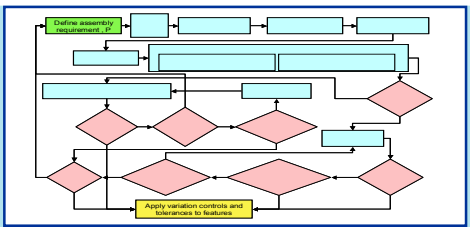
Digital Product Data Practices (ASME Y14.41-2003)

ASME will release their new Digital Product Definition Data Practices (ASME Y14.41-2003) standard in August. The Y14.41 standard extends ASME Y14.5M into the 3D world. It establishes requirements and reference documents applicable to the preparation and revision of digital product definition data, referred to as data sets. Y14.41 defines the exceptions and additional requirements to existing ASME standards for using product definition data sets or drawings in 3D digital format.

For complete details, visit http://www.asme.org/codes/pr/y1441.html

Mechanical Tolerancing Methodology

We offer a comprehensive methodology, *MechPRO*™, that takes your assembly tolerance requirements and automatically defines the (GD&T) controls and allowable tolerances to control part variation to Six Sigma quality. We offer: an analysis software tool, *MechTOL*™ ; a database software tool, *MechDATA*™, and a three-day workshop to support this methodology.



The PLTZF establishes six virtual condition boundaries for the holes that are basically located and oriented to the datum reference frame (see Figure 4). The PLTZF controls the location of each hole within (a much larger tolerance) Ø.250 to A B C Ⓜ . By itself, the upper segment does not ensure that the handle will fit. (For example, if one hole is shifted .125 to the left of it's basic location and another hole is shifted .125 to the right of it's basic location, the handle would not fit.)

The lower segment ensures that the handle will fit. The FRTZF establishes six virtual condition boundaries for the holes, all basically located to each other and perpendicular (oriented) to datum A (see Figure 5). The FRTZF is allowed to shift and/or tilt within the restraints of the PLTZF. A part is deemed good if all holes are within the boundaries of both the FRTZF and the PLTZF.

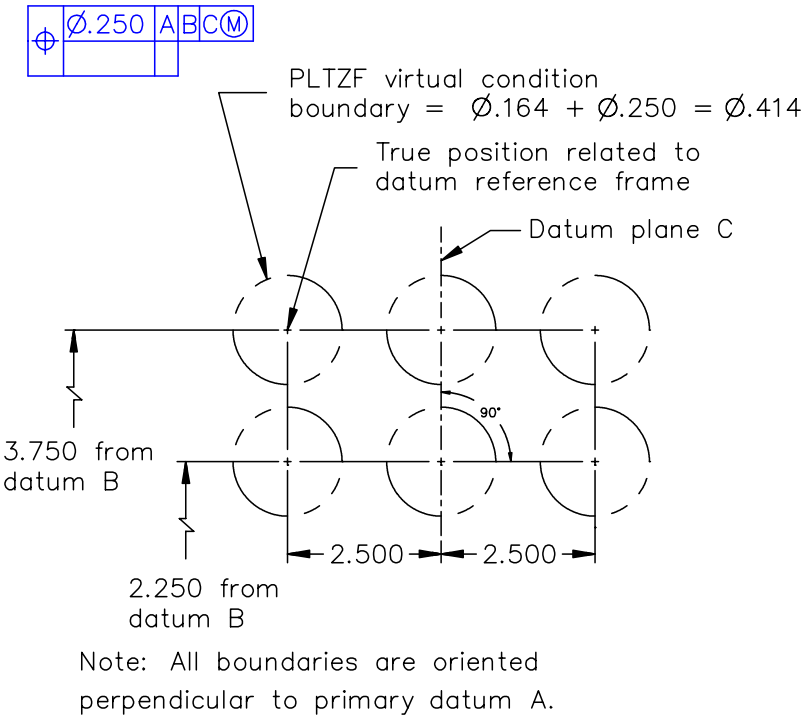


Figure 4

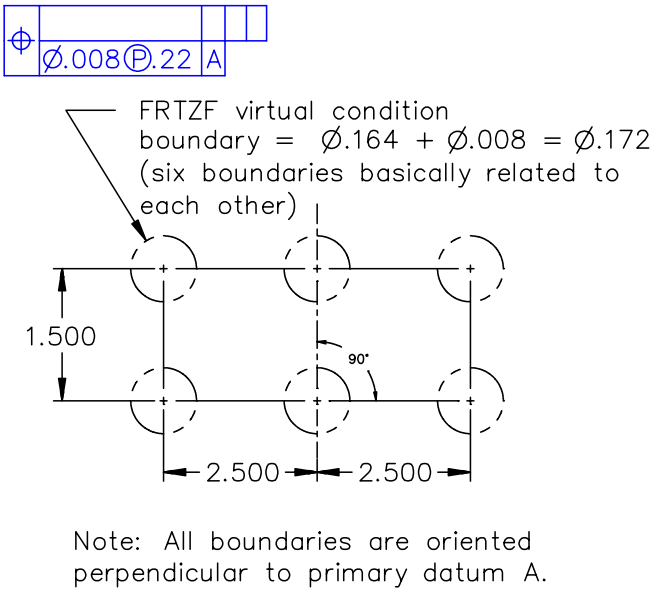


Figure 5

Summary

To summarize, we've solved our handle mounting problem and our manufacturing problem with a composite positional tolerance. The tolerance in the lower segment of the composite feature control frame is determined by the Fixed Fastener calculations. The tolerance in the upper segment is determined by how much the handle is allowed to shift and/or tilt on the box.

A

Engineering Services

Having problems with your designs? MechSigma offers consulting in mechanical tolerancing. Contact us at:

info@mechsigma.com

Whoops

Donald Coon (GDTP S-0136) let us know about a couple of errors in last month's newsletter. Donald noticed that we left off Datum Identification Symbol 'B' on each figure, and that all the feature control frames were referenced at RFS. We corrected these in the May 2003 (Rev. 1) issue.

Thanks, Donald.

Joke of the Month

A young boy was just learning his addition tables in school and needed some help.

He went up to his father, a mechanical engineer, and asked him, "Daddy, what's one plus one?" His father promptly replied, "Two".

Now, having grown up in a technical household, he knew enough to seek confirmation. So he went up to his mother, a software engineer, and asked her, "Mommy, what's one plus one?" His mother promptly responded, "One zero."

Being thoroughly confused at this point, he sought out the counsel of his uncle, an accountant, and asked him, "Uncle, what's one plus one?"

Upon hearing this, his uncle set down his newspaper, got out of his chair and walked over to the boy, hiked up his pants legs, put his arms on the boy's shoulders, squatted down so as to look the boy straight in the eye and asked, "What would you LIKE it to be?"

Other Links

- Deploying Mechanical Tolerancing for Six Sigma http://www.sme.org/cgi-bin/get-newsletter.pl?SIGMA&20020523&1&
- MechSigma Executive White Paper: http://www.mechsigma.com/Exec_White_Paper.pdf
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Events:

The next GD&T committee meeting is scheduled for the week of Oct. 13 in Kansas City, MO. These meetings are open to the public. For more information, contact ASME.

We need your input!

If you have a mechanical tolerancing question, a GD&T application, or if you want to submit an article for publication, please let us know at:

NEWS@mechsigma.com