

Boulton

Foreword

Typo, third sentence: OP.002 should be OP1.002.

I suggest “a” before Visibility Tolerancing System....

Third paragraph, put MIL-C-48497A before MIL-F-48616, since the first edition of MIL-C-48497 predated MIL-F-48616.

1.1 Scope

Delete footnotes 1 and 2. We understand these points.

Footnote 3: discuss.

2.1: Discuss change to Dave’s drawing. I am in favor of referencing it.

3.1.1.6: second paragraph, this doesn’t seem sufficient to always differentiate a scratch from a dig. I guess the 4:1 ratio was not accepted but I don’t recall the rationale.

3.1.2.1.1: Fourth paragraph, discuss changing to Dave’s drawing.

Footnote 6: Perhaps on Dave’s drawing we could have the limits of a #120 measured on a SavvyInspector with no corresponding Sira polarization angle. I believe Dave has found sample-to-sample variation of plastic paddles, for example, to be quite small. Do any commercially available scratch standards have a #100, or do they jump from #80 to #120?

3.1.2.1.3: Paragraph under Table 2, I think we should discuss with Dave wrt what he is saying in his class. Or delete it altogether, per my suggestion in version 007.

Footnote 7: We have been debating what to do here since we decided on the “least – greater brightness” rule rather than a “closest to” or “not greater than” rules. By that I mean it used to be common practice to say that scratches less bright than the #10 artifact were “less than a #10” when applying the accumulation rules to tightly toleranced optics. Anyway, my response to the Footnote 7 question is “yes.”

Footnote 8: My response is “yes.”

Footnote 9: The scratch-dig spec. outside the CA applies to smooth polished surfaces only, not fine-ground or etched or anything else. Chips and fractures are all we care about.

Footnote 10: I offered a solution in my comments to version 007 which was to add “...which may be the case when some commercially available comparison standards are being used, ...” That is why under Table 1 I proposed the words “Some commercially available comparison standards have scratch numbers greater than #80” which you changed to “Some suppliers offer a #120 scratch artifact.”

3.1.3.1.1: Third paragraph, first line, change “A”, to “A,” (comma inside the quotation mark).

3.1.3.1.2: Correct “Table 3:” to “Table 4:” I also think it would be better both here and in 3.1.3.1.1 to change the colon to a period.

Footnote 11: Haven’t we already covered the cutoff for scratches below A as $n/4$? I think since you would be using a microscope you would be measuring the actual average widths for accumulation.

Footnote 12: Haven’t we already covered the cutoff for digs below A as $n/4$? Maybe I don’t understand the question. Do you mean what is the smallest allowed value of n ?

3.1.3.2: There is something wrong with the vertical spacing of line 3, first paragraph.

Third paragraph, you need to say “average diameter of each dig.”

Fourth paragraph: I don’t agree that the example in Annex B is used as a reticle. A reticle typically is in the *eyepiece* of a microscope. Annex B shows a dimensional comparison plate. If you take out “as reticles” the second sentence is correct. In my experience they are not “typically” used in conjunction with a microscope. “They may be used in conjunction with a microscope” is more correct. Delete the last sentence; the first clause deals with dimensional calibration issues that we don’t need to get into but are straight forward for any QA department; the second clause makes no sense to me. On second thought, reword the entire paragraph as follows:

Several companies manufacture dimensional scratch artifacts. Although they are not required for the measurement and grading of scratches, they can be used to quickly grade the dimension of a scratch or dig by direct comparison. They may be used in conjunction with a microscope. See Annex B for an example of a dimensional artifact.

Footnote 13: If you follow the wording above (3.1.3.2, third para.), the width of a tapered scratch is its widest width. A tapered scratch “ends” when its width is zero. In practice this is not difficult to determine.

3.1.4.1.2.3: My comment from the review of version 007 still stands. It is not correct to say W “Where: S is the magnitude of the specified tolerance grade; ...” when S is not in the formula. You should change the first sentence to read “If there are any graded scratches that match the specified tolerance grade, S, then their...” and delete S from the definitions below the word “Where.”

Footnote 15: You can get around this by saying “Scratches less visible than the #10 comparison artifact or narrower than grade B are disregarded for the concentration rule.” Less visible than a #10 is NOT the same thing as saying that visibility grades below 10 do not exist.

Or, we can say “For a dimensional specification, scratches of grade less than B [should we say Grade A or less?] are disregarded for the concentration rule.” Or do we mean “narrower than Grade B,” e.g., 9 micron and narrower scratches? In either case this means that for the visibility specification all faint visible scratches count because there is no grade $< \#10$.

Footnote 16: Yes. No.

Footnote 18: The actual shape of the aperture is irrelevant. Keep it simple. See my more extensive comments on this point in my review of version 007.

3.1.4.2.3.2: Typo, delete the space between "10" and the comma.

3.1.4.3.1: Why is only one suffix allowed? Why not allow, for example, 80-50/C/Z?

3.1.4.3.2: In the first line, two places, the comma goes inside the closing quotation mark.

3.3: This is unacceptable to me. See my comments on version 007.

Footnote 19: We cannot address every possible situation. This has to be resolved by the buyer and seller. Delete the footnote.

Footnote 20: If we can't agree on what is implied by acceptable surface we should revert to the original wording of MIL-PRF-13830B, 3.7.9.2, which says the reason for stoning a chip larger than 0.5 mm is "to roughen it and lessen the possibility of annoying reflections and additional chipping."

Footnote 21: These questions are already answered by 3.2.

Footnotes 22 and 23: No, 4.2.1 takes precedence over 4.4.4 and 4.4.5. That is, if the CA extends to within 1 mm on the short edge and 2 mm on the long edge, the "no chips in the CA" overrides.

6.1 and Footnote 24: I think coating imperfections should be evaluated as scratches and digs, not as internal inclusions. Many times drawings and specifications will say "internal inclusions shall be treated as digs" anyway, so the requirements tend to merge.

6.2 Fractures in a Coating: We usually refer to fractures in a coating as "cracks" or "crazing." I think it would be good to include this parenthetically in the sentence.

6.3: Do not hyphenate "unacceptable."

7.3.1: Do not hyphenate "unacceptable."

Footnote 26: I think you have already covered all other areal cement imperfections in 7.1 and 7.3.1, so edge separations are all that are left to address in 7.3.2.

Footnote 27: Seems OK to me but your paragraph reference seems off.

8 Methods of Inspection: Second paragraph, delete the space between Annex C and the period.

Footnote 28: You are correct. #5 and #10 digs are very, very hard to see and very hard to see, respectively, so when in doubt people want to measure.

8.2.1 Equipment: Fix the "Error! Reference source not found" warning.

8.3.2: "and / or" should be "and/or." The font changes part way through the last sentence.

9 Glossary: Inconsistent use of periods at the end of clauses throughout the section.

9.1.3 Linear Dimension and Footnote 29: Dave Aikens (Savvy Inspector) and or Trey Turner (Annex D author) needs to weigh in on this.

9.4.1 Aperture and Footnote 30: Are we getting too precise and convoluted for our own good? The book *Practical Optics* defines aperture as “an opening through which light can pass.” Having been a QE I tend to think of its 2D representation that I can use to generate a surface quality map.

9.4.2 Clear Aperture: Many sources define the clear aperture as “the minimum area over which the optical requirements apply.”

9.7.1.3 and 9.7.4 Rim: ISO 9211-1 defines rim as “any area outside the clear aperture.” Works for me!

9.7.5 and 9.7.6 Bevel and Chamfer: JDSU defines a bevel as “visible to some max size and the angle is always 45°” and a chamfer is fully dimensioned with min and max and angle. Thus typically a bevel is applied to remove a sharp edge to improve resistance to chipping (a “protective bevel”), whereas a chamfer has a more functional purpose, such as mating with a bezel. But many sources use them synonymously.

9.8.4 Roof Edge: How about “the edge of the two reflecting surfaces of the prism that intersect at 90°”? Or “the intersection of the two reflecting surfaces of the prism”?

9.9.10: Do not hyphenate “undissolved.”

9.9.11 Bulk Material Imperfections: There is also a phenomenon called devitrification in which small crystals (“devit”) form in the otherwise amorphous glass. I think it would be better to delete “foreign matter” and substitute “inclusions,” which would include foreign matter and devit.

9.10.4 Haze: Some coatings can exhibit haziness. There is nothing incorrect with the current definition, but I question the need for the comment about plastic optics.

9.12.1.3 Dig: I am trying to visualize what this definition means.

Footnote 36: I prefer “void” to “hole.” Since coatings are nanometers to microns thick you could not detect a bubble in a coating under the inspection conditions this standard is supposed to address. It is possible to section coated substrates and look at each layer of a coating, but you are talking SEM microphotographs. I can’t say I have ever seen a hole in a coating cross section except when photolithography processes are being used. I recommend the definition for pinhole say “A regular or irregular void in a coating” and let it go at that.

Footnote 37: It is certainly possible to have foreign particles or spatter be introduced into a coating during deposition, i.e., part way through the total thickness of the coating. The coating layers get disturbed and form a conical imperfection that gets larger in diameter as the coating thickness increases. If a large foreign particle or spatter gets dislodged after coating it can leave a void in the coating. From a practical matter we would evaluate it as a dig for inspection purposes.

Footnote 38: Bill R. is correct. The update definition is OK with me.

Footnote 39: No, we do not need an example of feathering. Too hard to get a decent image and we don’t mentioning feathering elsewhere in the standard.

Annex B and Footnote 40: I agree that “Example of” is better than “Recommended” throughout. It is an Informative Annex, not Normative.

Annex B: Second paragraph, delete the space after 3.1.3 so the closing parenthesis does not end up on the next line.

Footnote 41: Per the Army drawing the #10 scratch is at the top and the #80 is at the bottom. So my answer is “No.”

Annex C: The first “sentence” is supposed to be a heading. In the real first sentence delete the space between “3.1.3” and the closed parenthesis. That will preclude the parenthesis from being on a different line.

Annex D: Change “um” to “ μm ” throughout.