Interpretation of AGMA Standards

When AGMA receives questions about standards, the questions are submitted to the appropriate Technical Committee for a response. The questions and AGMA's response are published in the AGMA Business Journal to ensure wide distribution of the information.

An archive of these questions is located on the AGMA website, www.agma.org. Send your questions to tech@agma.org.

Question #1

Comment restated:

We are requesting clarification of the definition of "mean helix line and mean profile line" in ANSI/AGMA 2015-1-A01, clause 3.2 on page 7. The standard states:

> **mean helix line:** A line (or curve) that has the same shape as the design helix, but aligned with the measured trace. It is developed by subtracting the ordinates of a straight-line gradient from the ordinates of the design helix. Within the evaluation range, L , the straight-line gradient is found by applying the least squares method to the deviation of the measured helix trace from the specified design helix.
>
> NOTE: This helix is an aid in the determination of the deviations $f_{f\beta}$ (figure 1b) and $f_{H\beta}$ (figure 1c).
>
> **mean profile line:** A line (or curve) that has the same shape as the design profile, but aligned with the measured trace. It is developed by subtracting the ordinates of a straight-line gradient from the ordinates of the design profile. Within the functional profile length, Lac, the straight-line gradient is found by applying the least squares method to the deviation of the measured profile trace from the specified design profile.
>
> NOTE: This profile is an aid in the determination of $f_{f\alpha}$ (figure 2b) and $f_{H\alpha}$ (figure 2c)

Our understanding is that to create the mean line according to AGMA 2015-1-A01 by taking apart the definition of a mean profile line:

"It is developed by subtracting the ordinates of a straight-line gradient from the ordinates of the design profile, Within the functional profile length, Lac, the straight-line gradient is found by applying the least squares method to the deviation of the measured profile trace from the specified design profile".

As we understand it, to create the mean line according to AGMA 2015 you must:

1. Take the difference between the actual data points and the design data points to create a set of "difference values"
2. Use least squares fit to draw a line through the set of "difference values" NOT the actual values
3. Subtract the resulting line from the design curve to get the mean line.

Also, tip modification (or tip relief) is part of the functional profile and should be included in the evaluation as part of the design profile as shown in Figure 2, example ii).

During the implementation of AGMA 2015 in our gear inspection machines, we have encountered software programmers who have been interpreting AGMA 2015 differently than this. They claim their interpretation is consistent with ISO 1328-1 and DIN, which is the following:

1. In the case of a crowned helix or profile, they believe a best fit parabola is fit by the least squares method to the measured data and it is this best-fit parabola used to determine form and slope deviation – not the original design shape.
1. They believe the tip relief portion is evaluated as a separate segment so that there are essentially two best-fit lines for a profile with tip relief.

Our questions are:

Which interpretation is correct? If our interpretation is correct, does the Gear Accuracy Committee believe that the AGMA 2015 method is different than or the same as the ISO 1328-1 method for determining mean helix and profile lines?

AGMA's response:

The committee concurs with the interpretation of mean line construction, which involves the following steps:

1. Take the difference between the actual data points and the design data points to create a set of "difference values";
2. use least squares fit to draw a line through the set of "difference values", NOT the actual values;
3. subtract the resulting line from the design curve to get the mean line.

Further, the committee concurs with the interpretation that, "Tip modification (or tip relief) is part of the functional profile and should be included in the evaluation as part of the design profile as shown in Figure 2, example ii)."

Further, the committee concurs with the interpretation that the methods provided in the subject standard do NOT involve either:

1. use of a best fit parabola; or
2. separate and distinct evaluation of profile tip relief regions.

It is the opinion of the committee that the methods discussed with regard to the subject standard generally correspond with those specified by ISO 1328-1.

Question #2

Comment restated:

I've been working with AGMA 925-A03, Effects of Lubrication on Gear Surface Distress. I've followed the example calculation in Annex D starting on page 43. I've been able to duplicate all the results, with the exception of the last result for "Probability of wear" on page 48. The result listed is Pwear = 5% or lower.

I've been able to duplicate all the numbers that go into the result:

(y) = 0.425354
(muy) = 0.215956
(Sigmay) = 0.112623
and x = ((y-muy)/Sigmay) = 1.859273

These results are calculated per Annex B - Normal or Gaussian probability.

On page 39, under "Evaluation of Q" it states that if the absolute value of x is greater than 1.6448, then Q = 0.05. Since our value for x, 1.859273 is greater than 1.6448, our value for Q is 0.05.

The section goes on to state that if x is greater than 0, then the probability of failure = 1 - Q. Since our value for x is positive, our probability of failure is 1 - .05 = .95 or 95%. This does not agree with the 5% given on page 48.

What am I doing wrong?

AGMA's response:

After considerable discussion, the Helical Gear Rating Committee concluded that the calculated results of the example problem in annex D of AGMA 925-A03 are correct. However, there may have been confusion introduced into the document when the reader compares the discussions in annex B, "Normal or Gaussian Probability", clause 8.2.2 of the information sheet, and annex D.

To clarify the intent of the example problem, on page 48, where the risk of scuffing and the risk of wear are calculated using the discussion in annex B, the conclusion statements would be clearer if worded as:

- Probability of scuffing failure ε = 5% or lower
- Probability of wear failure ε = 5% or lower

The committee intends to discuss the text related to this subject during their periodic review of the document.

Question #3

Comment restated:

There appears to be an error in table 8 of ANSI/AGMA 6123-B06 for six planets under application level 2.

For all the other number of planets, the Mesh Load Factor goes down or remains the same as you move from application level 1 to application level 2 (as would be expected). However, for six planets the Mesh Load Factor actually increases from 1.38 to 1.44, indicating a higher worst case load (poorer load distribution) for improved quality and floating member.

Please let me know if the value is correct, and, if so, what the intended value for application level 2 and six planets should be.

AGMA's response:

The values given in table 8 of ANSI/AGMA 6123-B06 are Mesh Load Factors. They were intended to be consistent with the product of the Load Share per Planet factors provided in table 8-1 of ANSI/AGMA 6123-A88 times the number of planets.

The value of 1.44 for Mesh Load Factor for six planets and application level 2 in table 8 has been reviewed by the committee and determined to be an editorial error. The correct value should be 1.38. ☐