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100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA
19428-2959 USA

tel +1.610.832.9500
fax +1.610.832.9666
www.astm.org

COMMITTEE D02 on PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

CHAIRMAN: Randy F Jennings, Tennessee Dept Of Agric, P O Box 40627, Nashville, TN 37204, United States (615) 837-5150, Fax: (615) 837-5327, e-mail: randy.jennings@tn.gov

FIRST VICE CHAIRMAN: James J Simnick, Bp America, 150 Warrenville Rd, Naperville, IL 60563, United States (630) 420-5936, Fax: (630) 420-4831, e-mail: simnicj@bp.com

SECOND VICE CHAIRMAN: Michael A Collier, Petroleum Analyzer Co Lp, 21114 Hwy 113, Custer Park, IL 60481, United States (815) 458-0216, Fax: (815) 458-0217, e-mail: michael.collier@paclp.com

SECOND SECRETARY: Hind M Abi-Akar, Caterpillar Inc, Building H2000, Old Galena Road, Mossville, IL 61552, United States (309) 578-9553, e-mail: abi-akar_hind@cat.com

SECRETARY: Scott Fenwick, National Biodiesel Board, PO Box 104848, Jefferson City, MO 65110-4898, United States (800) 841-5849, Fax: (537) 635-7913, e-mail: sfenwick@biodiesel.org

STAFF MANAGER: Alyson Fick, (610) 832-9710, e-mail: afick@astm.org

DACA II Review Task Force Conference Call Minutes
Tuesday May 11, 2021
9:00-10:00 AM Central

Minutes recorded by Patrick Lang

Direct any comments or corrections to: patrick.lang@swri.org

Membership:

The attendance list can be found as attachment # 1.

Agenda:

The proposed agenda can be found as attachment # 2.

Pat Lang started the meeting with a brief overview of the Data Acquisition and Control Automation II document (DACA II). The task force that generated the document was formed in August 1996 and the document was written in June of 1997. It is clear that there has been a lot of technology changes since this document was written and it has needed a review and update for a long time.

Pat further commented that the purpose of this first meeting was to determine the best way to perform the review. He recommended that the document be broken up into sections and the group address one section at a time. The task force members would be advised of the topic in advance and given time to prepare their comments and input prior to the meeting. The group agreed that this approach made sense.

There were a lot of questions on the actual goal of the task force. Are we looking to upgrade what is required or simply make sure the wording in the document is appropriate?

Jeff Clark from the TMC made the following comments on his viewpoint for this task:

- 1) The document should establish guidelines for setting up new test methods.
- 2) The document should be geared towards ensuring that the same event is characterized the same at every test lab. As an example the assessment of a step change in a process such as a temperature should allow an apple-to-apples comparison of results between labs.
- 3) The TMC refers to this document frequently; it is used for stand auditing.
- 4) The equations in the current document are a clunky and need some refining. Jeff mentioned that the TMC would be willing to take the lead on reviewing these equations.

Andy Ritchie of Infineum commented that we need to ensure that people with the proper skill set are involved with this review.

Bob Campbell of Afton stated that the test lab (engineer) owns the operational data. The test engineer needs to know the DACA document and ensure their lab adheres to it. As a result, the test engineers and the lab's instrument shop need to be involved with the review and the determination of the needs for this document.

Randy Harmon of SwRI stated that it is important for the test engineer to advise the instrumentation people what they need.

David Doerr from Lubrizol also agreed that the test engineers need to advise what they need. He feels that accuracy is a very important topic. How tight do we need to go with accuracy? Do the best that we can or just what is needed?

David provided the attached presentation on accuracy vs. uncertainty. The group went through the presentation fairly quickly due to limited time. This topic will be discussed more in future meetings of this group. The presentation can be found as attachment #3.

Next meeting Topic:

Pat Lang recommended that for the next meeting we consider making the topic of discussion "System Time Response".

Adjournment:

The meeting was adjourned at 10:00 AM CDT.

Next meeting at the call of the chairman with a tentative date of June 8th.

Attachment #1

Attendance List

Attendance List for DACA II Document Review Task Force

Name	Company	Present 5-11-21 X= present
Amol Savant	Valvoline	X
Al Lopez	Intertek	X
Bill Buscher		X
Andrew Stevens	Lubrizol	X
George Szappanos		X
David Doerr		X
Jim Matasic		X
Randy Harmon	Southwest	X
John White		X
Ron Barthold		X
Khaled Rais		Not Present
Bob Warden		X
Bob Campbell	Afton	X
Tim Cushing	General Motors	X
Jim Gutzwiller	Infineum	X
Andy Ritchie		X
Michael Tucker	Exxon Mobil	X
Rohit Rao		Not present
Jason Griffin		X
Robert Stockwell	Oronite	Not present
Jeff Clark	Test Monitoring Center	X
Rich Grundza		Not present
Sean Moyer		X

Attachment #2

Agenda

AGENDA

Data Acquisition and Control Automation II (DACA II) Review Task Force Virtual Meeting (WebEx)

Patrick Lang – Acting Chairman

Tuesday May 11, 2021– 9:00 AM to 10:00 AM (CDT)

1. Establish membership list
2. Background on the need to review the DACA II document
3. Recommended review method:
 - 3.1. Break current document into major topics
 - 3.2. Team members can prepare their input for discussion at the next meeting
 - 3.3. Each meeting covers the identified topic
 - 3.4. Keep meetings to 1 to 1.5 hour maximum

Other thoughts on method?
4. New Business
5. Next Meeting: Tentatively June 8, 2021 at 10:00 Eastern
6. Adjournment

Attachment # 3

Presentation by Lubrizol on Accuracy vs. Uncertainty



Lubrizol

DACA II Accuracy; DACA III Measurement Uncertainty

Dave Doerr, 5/10/2021

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LIVE BETTER

DACA II Accuracy Table

Current Measurement System Capabilities

Measurement Type	System Type	System Accuracy
Temperature	Thermocouple	0-200° ± 0.50 °C 200-1000° ± 2.00 °C
	RTD	± 0.12 °C
Pressure High (> 6.9 kPa)	Capacitive	± 0.2 % of Full Scale
	Strain	± 0.25 % of Full Scale
Pressure Low (0 - 6.9 kPa)	Capacitive	± 15 Pa
	Strain	± 14 Pa
Flow	Orifice Venturi	0.75% of reading
	Vortex (Liquid)	± 0.75 % of reading
	Vortex (Gas)	± 3.0 % of Full Scale
	Magnetic	± 1 % of reading
	Coriolis	± 0.25 % of reading
Speed	Frequency	± 1 rpm
Load	Strain Gage	± 0.25% of Full Scale

Key statements in DACA II regarding accuracy

Page 10: Accuracy is the degree of agreement of an individual measurement with an accepted reference level.

Page 5: The instruments used to calibrate the data acquisition system must have an accuracy four times that of the system it is calibrating.

Page 6: The recommended method to calculate the system accuracy is the Square Root of the Sum of the Squares of the component accuracy

Page 4: regarding table on page 5:

- Table gives the generic capability measurement systems based on current conventional cost-effective technology, taking into account reasonable environmental effects.
- Table is intended to serve as a guide to the test developers and surveillance panels as to what is commonly possible using current technology.

DACA II Accuracy Predates Measurement Uncertainty

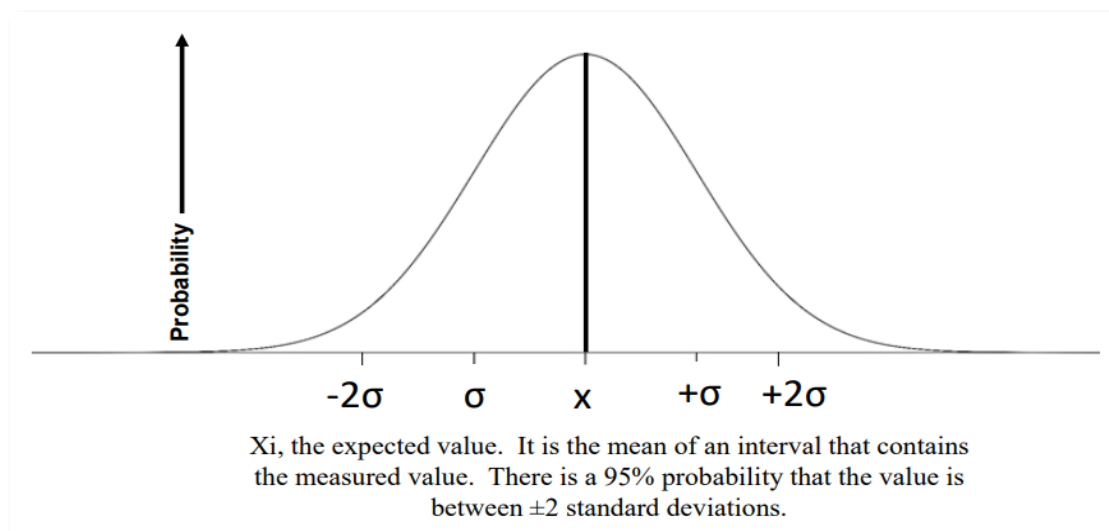
DACA II hints at, but does not use the now well-defined, industry-accepted terminology of *measurement uncertainty* as specified in ISO17025 and defined by GUM: Guide to the expression of Uncertainty in Measurement, JCGM 100:2008.

DACA II says to calculate system accuracy using the Square Root of the Sum of the Squares of the component accuracy which Lubrizol interprets as the *combined standard uncertainty* (coverage factor of $k=1$)

Combined vs Expanded Measurement Uncertainty

Combined Standard Uncertainty is calculated by squaring all the significant uncertainties, adding them together, and then taking the square root of the sum (DACA II) resulting in a confidence level of 68%

Expanded Uncertainty is the combined standard uncertainty multiplied by a coverage factor of 2 resulting in a confidence level of 95%



CEC - The Coordinating European Council

- **From CEC Website:** *CEC is an organization that represents the motor, oil, petroleum additive and allied industries in the development of test methods to evaluate the performance of transportation fuels, lubricants and other fluids.*
- Formed the ***Measurement Uncertainty Panel*** in 2014
- Adopted methods specified in ISO17025 and defined by JCGM 100:2008 *Guide to the Expression of Uncertainty in Measurement* (GUM)
- Specifies ***Expanded Measurement Uncertainty*** for engine test parameters for all engine tests

DACA II Accuracy vs. CEC Measurement Uncertainty

Current Measurement System Capabilities from DACA II			CEC Class A Expanded (k=2) Measurement Uncertainty
Measurement Type	System Type	System Accuracy	
Temperature	Thermocouple	0-200° ± 0.50 °C 200-1000° ± 2.00 °C	1.5 °C (-10-200) 2 °C (200-375) 15 °C (0-1200)
	RTD	± 0.12 °C	0.5°C (-10-375)
Pressure High (> 6.9kPa)	Capacitive	± 0.2 % of Full Scale	1.5 kPa (0-300)
	Strain	± 0.25 % of Full Scale	10 kPa (0-2000)
Pressure Low (0 - 6.9 kPa)	Capacitive	± 15 Pa	n/a
	Strain	± 14 Pa	
Flow	Orifice Venturi	0.75% of reading	0.1+1%Reading kg/hr (0-100) fuel 1+3%Reading l/m (0-500) water 5 l/m (0-300) gaseous 0.5 l/m (0-10) air
	Vortex (Liquid)	± 0.75 % of reading	
	Vortex (Gas)	± 3.0 % of Full Scale	
	Magnetic	± 1 % of reading	
	Coriolis	± 0.25 % of reading	
Speed	Frequency	± 1 rpm	10 rpm
Load	Strain Gage	± 0.25% of Full Scale	4+1%MaxReading Nm

Conclusion

DACA III should adopt expanded measurement uncertainty as a means of specifying measurement quality for engine tests.

DACA III specifications for measurement uncertainty should adhere to the DACA II guideline that measurement systems are **based on current conventional cost-effective technology**, i.e., DACA III must take care to avoid specifications that are too tight.

DACA III specifications for measurement uncertainty will be much larger than DACA II specifications for accuracy due to the $k=2$, 95% coverage factor and inclusion of more sources of error.



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