Meeting Minutes

Re: Battery Condition Monitoring Workgroup Meeting
Johnson Controls, Plymouth, Michigan

Date: June 22, 2001

LIST OF PARTICIPANTS:

Dell Crouch, Delphi
Ron Brost, *Ford*
Tariq Buchh, *Visteon*
Michael Cox, *Midtronics*
Gary DesGroseilliers, *MIT*
Thomas Dougherty, *Johnson Controls*
James Geraci, *MIT*
Steven Gladstein, *Robert Bosch*
Jim Gracyalny, *Johnson Controls*
Nick Kapsokavathis, *General Motors*
Thomas Keim, *MIT*
Michael Mullin, *General Motors*
Thirumalai Palanisamy, *Honeywell*
Christophe Picod, *Valeo*
Shawn Sarbacker, *General Motors*

AGENDA

- Tom Dougherty ➔
- Agreement Topics and Status ➔
- Future Meetings ➔

TOM DOUGHERTY

Tom Dougherty gave a review of the eight battery discharge performance parameters that he has proposed, together with a recommended test procedure to be run on a brand new fully charged battery for measuring each parameter. He also introduced a second group of eight charge acceptance and life parameters. Dougherty stressed that this workgroup is NOT about designing battery models. Instead, it is about defining a base set of parameters from which you could design a battery model. A copy of Dougherty's presentation materials can be found on the workgroup's web page[†] ➔. (Note: the previous link is to an updated version of Dougherty's presentation but the file size is very large. A compressed version of this file will not be available before the week of July 16th. In the meantime, the original version of the file is still available on the web site ➔ and the file size is considerable smaller.)

[†] Username is "Ford" and Password is "Formula1"

ISSUES RAISED:

Issue 1 .....Responding to a question about parameter accuracy, Dougherty said that each of the parameters has a term of accuracy associated with it; however, how these parameters will be stored and transmitted to the battery model has yet to be decided.

Issue 2 .....When slide 6 was presented, the issue of what is meant by "Deliverable Power" and "Deliverable Energy" was raised. "Deliverable Power" can be thought of as the maximum amount of power that a battery can deliver under its present operating condition given that battery's history. It was argued that "Deliverable Power" is a meaningless term because it is timeless, so we really should be talking about "Deliverable Energy." Further work is needed to clarify these terms.

Issue 3 .....Slide 7 is to be modified to show both the charge and discharge curves and it should also indicate that it means capacity at the 20-hour rate.

Issue 4 ..... "Age" and "condition" effects were discussed at great length. "Age" effect refers to the aggregate effect of irreversible processes that have modified the battery's behavior over the long term. "Condition" effect refers to the effect that short-term reversible processes have on a battery's performance.

Issue 5 .....The group agreed to define positive current as charging and negative current as discharge.

Issue 6 .....Slide 12 contains a modification for the "Capacity Point" parameter. It used to be defined as the battery's ability to deliver charge at the 20-hour rate. The 2-hour rate, however, was arguably a better measurement because it is not as error prone as the 20-hour rate measurement. It will be checked to see if the "Reserve Capacity" test could be used for the "Capacity Point" test.

Issue 7 .....After looking at slide 33, it was agreed that the thermal time constant test should be conducted in a bath of moving water.

Issue 8 .....It was suggested that the battery should also include some type of born on date; however, there might be significant resistance to this for various reasons from various corporate types.

Issue 9 .....Slide 39, Term 13, listed as "Over Charge Resistance" should be "Over Charge Corrosion."

Issue 10 .....Slide 41 the curves actually go from –20C to 80C and do not key to the legend on the graph. Also, the test was conducted at 14.4V for every curve on the graph.

Issue 11 .....There is concern that the group is defining parameters without really being in a position to say whether or not those parameters can actually be gainfully used in a battery model. This is a valid concern, but it is important that this group is defining the smallest common set of parameters from which a model might be produced. System designers would be free to add information in the future. However, because the interface to the original 16 parameters has yet to be defined, the rules for adding parameters have yet to be defined.

Issue 12 .....BCM Workgroup should consider setting standards for testing battery condition models developed by others.

Conclusion..... One of the main things to remember when looking over the subject matter of this group is that the purpose of this group is t o define a base set of parameters from which a battery model can be produced. To that end, there is general agreement that the eight proposed battery discharge performance parameters seem to be useful to a battery model designer. However, the eight proposed charge acceptance and life parameters are not quite as refined. Therefore, comments and recommendations are strongly encouraged.

AGREEMENT TOPICS AND STATUS:

The status of topics under discussion by the BCM Workgroup is summarized in the table below

	Topic	Status
1.	BCM Workgroup "Statement-of-Purpose" ➔ and "Guidelines for Participants" ➔	Accepted
2.	Battery discharge performance parameters to be encoded in 5-bits each, referred to as "Word-1"	Under discussion
3.	Charging Acceptance and life information of the battery to be encoded in separate set of parameters, "Word-2"	Under discussion
4.	"Words" to be provided on a label or electronically coded chip.	Under discussion
5.	Battery discharge performance parameters will include:	
	1. Capacity point	General agreement that the definition be set for the 2-hour
	2. Peukert's slope	Need to know slope
	3. Charged voltage	Agreement to use open circuit voltage.
	4. OCV/SOC slope	Agreement to use OCV/SOC slope as an indicator of acid concentration of a fully discharged and fully charged battery
	5. Initial IR (IIR)	Name of this parameter has been changed to avoid confusion with well accepted definition of "internal resistance"
	6. Ionic/electronic ratio	Proposal to determine both internal resistance and kinetic resistance from a single experiment by fitting an equation with current and log (current) terms
	7. Kinetics	Accepted
	8. Thermal time constant	Agreement that thermal time constant test should be conducted in a bath of moving water.

	Topic	Status
6.	Battery terminal standard should include 4 pins, two for power and two for sensing. The application of the sensing pins (e.g., temperature, disconnect, battery condition monitoring) will be determined later.	Accepted
7.	Charge Acceptance and life parameters will include:	
	9. Charge Acceptance 40C	Under discussion
	10. Charge Acceptance 0C	Under discussion
	11. Charge Acceptance Current	Under discussion
	12. Shallow Cycle Life	Under discussion
	13. Over Charge Corrosion	Under discussion
	14. Gassing (Water Loss)	Under discussion
	15. Over Charge CA	Under discussion
	16. Condition Factors	Under discussion
8.	Measurement convention	Agreement to define positive current as charging and negative current as discharge
9.	Battery Condition Model Testing	BCM Workgroup should consider setting standards for testing of models developed by others

FUTURE MEETINGS:

The next meeting will be a face-to-face meeting on Friday, August 10, 2001, at the JCI office in Plymouth, Michigan, from about 10:00 a.m. until 3:00 p.m., including lunch. The purpose of this meeting is a continuation of the discussion of about the battery discharge performance parameters and the charge acceptance and life parameters. Participants who would like to present alternative proposals are invited to request time on the agenda by notifying Gary DesGroseilliers at gjd@mit.edu.