From: Fry, Michael (Houston)
Sent: Tuesday, February 16, 2010 5:04 PM
To: DWH, SubSeaSup (Deepwater Horizon)
Subject: Battery replacement
Attachments: eb891d.pdf; er-2768.pdf

Some reading material for you…
Regards,

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PROPERTY OF CAMERON	DRAWN BY	DATE	REVISION	Engineering Bulletin
	R. Jahn	September 8, 2004	01	
	APPROVED BY	DATE		EB 891 D
	E. Gaude	September 8, 2004		Page 1 of 2

AMF/Deadman Battery Replacement

A. BACKGROUND

This AMF/Deadman feature provides a means of commanding the SEM to initiate an ESD sequence if four circumstances occur simultaneously. These are:
Loss of Conduit Pressure
Loss of Hydrostatic Head Pressure
Loss of SEM power
Loss of Communications (between PODs).

The AMF/Deadman system uses batteries to power up the SEM electronics (9VDC regulated to 5VDC) and also provides solenoid valve electrical power (27VDC).

The original manufacturer of the batteries was sold to another battery manufacturer. The new manufacturer's upper management decided there was not enough quantity of the existing battery to justify setting up a new production line. The new manufacturer has a similar battery and offered to utilize these batteries in a new pack. The new battery is of the same chemical makeup (Li-MnO2) but of different amp-hour rating. Due to this smaller amp-hour rating more batteries will be required to equal the original battery amp-hour rating.

B. RECOMMENDED COURSE OF ACTION

Due to obsolescence of the existing AMF lithium battery a replacement will be introduced. The part numbers that will be obsolete are:

619083-01-13 – Battery Pack Assembly
2021604-01 – 3 Cell Battery Pack Assembly
2021604-02 – 6 Cell Battery Pack Assembly
2711396-01 – Lithium Battery Cell

Cameron engineering, working with the new battery manufacturer came up with a 9 VDC battery pack that would be used to make up the SEM 9VDC and 27VDC requirement. There will be two battery packs, one for SEM A and one for SEM B 9VDC. Three other battery packs, connected in series, are for the 27VDC. This gives a total of 5 battery packs for each POD.

This arrangement will be for Mk I and Mk II PODs.

Systems that have battery packs located in the STM will convert to having all AMF/Deadman batteries located in the SEM.

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For first time installation a kit (P/N 218637-04) will be ordered. This kit would include mounting hardware, battery packs and installation instructions. After the initial installation only the battery packs (P/N 2232368-01) need to be ordered.

Cameron is making the same recommendations for battery replacement:

It is recommended that the 9VDC and 27VDC battery packs be replaced after:

- **One year of on-time operation.**
- **When the number of actuations has been exceeded for that year (33).**
- **Five years after date of purchase.**
- **Whichever of the above events happens first**

ENGINEERING REPORT
Cameron Controls Corporation
Houston, Texas

SUBJECT
DeadMan System Battery life

OBJECT
To determine how many actuations of the DeadMan System the 6-Volt Lithium MnO_2 Battery Pack can sustain at various temperatures.

TEST CONDITIONS
The Battery Pack was tested at temperatures of 24 ° C, 0 ° C and 70 ° C.
First a one year battery drain in the low current monitoring mode was simulated. Then a series of shutdown sequence actuations lasting 98 sec each at a current level of 5.5 A were performed. Actuations were performed at 15-minute intervals and at a rate of 10 to 18 actuations per day. The high current actuations were stopped when the Deadman Controller failed to supply the 6V required to operate the Electronics card cage in the SEM.
A DeadMan Controller, modified to permit remote operation and voltage monitoring, was used throughout the tests.

CONCLUSIONS
A minimum of **38 actuations** were obtained at all three test temperatures. See the last paragraph for details. During the high temperature tests the Battery Pack was maintained at 70 ° C for a period of 8 days and recorded the highest number of actuations. This is significant as we anticipated a rapid deterioration of battery performance at 70 ° C that didn't happen.

RECOMMENDATIONS
Exposure of the Battery Pack to temperatures exceeding 60 ° C (140 ° F) for extended periods of time should be avoided as it will cause accelerated self-discharge.

DATE
Tests at 24 ° C were conducted from October 11, 2000 to October 18, 2000.
Tests at 0 ° C were conducted from October 19, 2000 to October 25, 2000.
Tests at 70 ° C were conducted from May 30, 2001 to June 8, 2001.

ENGINEERING REPORT
Cameron Controls Corporation
Houston, Texas

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MATERIAL
9-Volt Lithium MnO2 Battery Pack, Cameron P/N 3021604-01
AMF Controller card, Cameron P/N 223338-11

CLARIFICATION
Over a one-year period, low current drain on the Battery Pack in the monitoring mode consumes around 15 A-h out of a total capacity of 30 A-h. This represents a substantial part of the Battery Pack total capacity. This is why an accelerated test simulating battery use in the monitoring mode was included in the tests.
For the sake of expediency, the 1.75 mA current drain in the monitoring mode for one year was replaced with 115 mA for 1/100 of a year.

PROCEDURE
The test procedure used is described in Cameron document X-234255-01, REV A01. A copy of the procedure with collected data is included in Appendix A. See Appendix B for details regarding the test set-up.

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Houston, Texas

RESULTS

Previously a one year equivalent low current drain in the monitoring mode, actuations emulating an Emergency Shutdown sequence were performed at a current level of 5.5A for a duration of 60 sec.
Actuations were performed until the Voltage Regulator on the AMF Controller card failed to deliver 5.0 Volts to the back plane of the SEM card cage containing the electronic circuitry.
Results recorded at various temperatures were as follows:

1) **Test results at 24 ° C.**

After the equivalent of **one year** of operation in the monitoring mode, series of 10 actuations per day were carried out at interval of 15 minutes. The **total number of actuations** logged until failure was 72.

2) **Tests at 8 ° C**

After the equivalent of **one year** of operation in the monitoring mode, series of 10 **actuations per day were carried** out at interval of 15 minutes. The **total number of actuations** logged until failure was **36.**

3) **Tests at 70 ° C**

After the equivalent of **one year** of operation in the monitoring mode, series of 10 **actuations per day were carried** out at interval of 15 minutes. The **total number of actuations** logged until failure was 74.