U.S. Department
of Transportation

**Pipeline and
Hazardous Materials Safety
Administration**

400 Seventh Street, S.W.
Washington, D.C. 20590

JUL 27 2007

Mr. Anthony J. Serventi
Senior Counsel
Cobasys
3740 Lapeer Road South
Orion, MI 48359

Ref. No.: 07-0106

Dear Mr. Serventi:

This is in response to your letter dated May 23, 2007 requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to design-type testing of lithium-ion cells and batteries. The specific requirements you address are contained in section 38.3 of the United Nations Manual of Tests and Criteria and are implemented through the provisions of § 173.185 of the HMR.

In your letter you describe a hybrid electric vehicle battery system consisting of 192 - 3.3 volt A123 cylindrical lithium-ion cells utilizing approximately 518 grams of aggregate equivalent lithium content. The battery system is equipped with a system that monitors cell voltage and temperature and incorporates a service disconnect feature. Each cell passed the design-type tests in section 38.3 of the UN Manual of Tests and Criteria and the cells in this assembly are electrically connected by a circuit board. It is your opinion that since the individual cells passed the applicable tests and incorporate additional safety systems, the cell assembly constitutes a "battery assembly" as described in 38.3.3 of the UN Manual of Tests and Criteria and thus the assembly is not required to be tested in accordance with the design-type tests outlined in section 38.3.

We do not agree. The system you described meets the definition of a battery or a battery pack, defined in section 38.3 of the UN Manual of Tests and Criteria as one or more cells electrically connected together by permanent means, including case, terminals and markings. Except for single cell batteries, each new lithium cell and battery design-type is subject to the tests in the UN Manual of Tests and Criteria, even if the cells that make up the battery have been tested. The fact that the cells are electrically connected by a circuit board that can be disconnected does not mean this assembly of cells constitutes a battery assembly.

070106

173.185(e)

If you believe your hybrid electric vehicle battery system provides and equivalent level of safety to the HMR requirements without additional testing, you may wish to apply for a special permit through the Office of Hazardous Materials Special Permits and Approvals at 202-366-4535.

I hope this information is helpful.

Sincerely,

John A. Gale
Chief, Standards Development
Office of Hazardous Materials Standards

COBASYS

Leary
§173.185(e)
Lithium Batteries
07-0106

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May 23, 2007

Edward Mazzullo, Director
US Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Office of Hazardous Materials Safety
1200 New Jersey Avenue
SE East Building, 2nd Floor
Washington, DC 20590

Re: Letter of Interpretation for 49 CFR §173.185(e)

Dear Mr. Mazzullo:

This correspondence is a formal request for a Letter of Interpretation regarding 49 CFR §173.185(e) ("Section 185(e)") and Section 38.3 of the UN Manual of Tests and Criteria ("UN Manual"), as it relates to Section 185(e). Cobasys LLC ("Cobasys") is a developer and integrator of batteries, battery packs and battery systems for transportation and stationary applications.

Cobasys is currently developing a hybrid electric vehicle (HEV) battery system, which incorporates lithium battery cells. The next generation of HEV battery systems are under development to further improve the fuel economy of HEVs. Cobasys intends to deliver prototypes of the HEV battery system to a customer, a US based automotive OEM, in early July 2007. Initially, Cobasys intends to use ground transportation to deliver the HEV battery systems to our customer.

Section 185(e) provides the requirements of subsections 1-7, which must be met for lithium cells or batteries to be transported as items of Class 9. As subsection 5 has been Reserved, it is not addressed. With respect to the Cobasys HEV battery system, the lithium cells have passed all the tests required under Section 38.3 of the UN Manual. Further, as incorporated into the Cobasys HEV battery system, the lithium cells and Cobasys HEV battery system meet the all the requirements of Section 185(e). The focus of our inquiry is the necessity to test the subject Cobasys HEV battery system according to subsection 6 of Section 185(e), in view of the fact that the lithium cells, which make up the system, meet the requirements subsection 6 of Section 185(e). A description of the Cobasys HEV battery system is provided in Exhibit A.

The UN Manual provides a series of 8 tests for cells and batteries. For the purposes of Section 38.3 of the UN Manual, "cell" is defined as "a single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across two terminals"

and "battery" is defined as "one or more cells which are electrically connected together by permanent means, including case, terminals, and markings." Referring to Exhibits B and C, the cells of the Cobasys HEV battery system are electrically connected utilizing a circuit board. Although the cells are electrically connected by a circuit, the cells are not permanently connected, because the circuit board may be disengaged from the lithium cell assembly.

Section 38.3.3 of the UN Manual provides as follows:

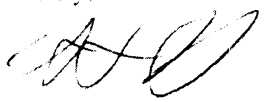
> "When batteries that have passed all applicable tests are electrically connected to form a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is more than 500g, that assembly does not need to be tested if it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries of the assembly and any overheat or overcharge of the battery assembly.

As indicated earlier, the lithium cells have passed all the tests required under Section 38.3 of the UN Manual. Cobasys has drawn the conclusion that the Cobasys HEV battery system is a "battery assembly" under Section 38.3.3 of the UN Manual, wherein the "battery assembly" is an assembly of cells. The aggregate lithium content of the Cobasys HEV battery system is more than 500g. The Cobasys HEV battery system utilizes approximately 518 g of equivalent lithium content. Therefore, the Cobasys HEV battery system does not require testing under Section 38.3 of the UN Manual, because "it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries of the assembly and any overheat or overcharge of the battery assembly," as described in Exhibit A. For example, the Cobasys HEV battery system includes an electronic controller which monitors cell voltage and temperature, and controls contactors which are, essentially, high-voltage switches. Further, the contactors require external 12 V power to be applied to the controller in order to close and become conductive. Since the Cobasys HEV battery system will be shipped in an unpowered state, the contactors will be in an open state, also breaking the conductive path through the cell stack. Additionally, the Cobasys HEV battery system incorporates a service disconnect system as illustrated in Exhibit D. The service disconnect system incorporates a service disconnect which is removed from the Cobasys HEV battery system during transport. The service disconnect is an integral part of the high-voltage current path. When the service disconnect is removed from the pack, the conductive path is broken and no current may flow through the cell stack of the Cobasys HEV battery system.

Attached are 1) Exhibit A, a written description of the Cobasys lithium HEV system; 2) Exhibits B and C, illustrations of the Cobasys lithium HEV system; and 3) Exhibit D, an illustration of the service disconnect system.

Thank you for your time and help. Please contact me with any questions or concerns.

Sincerely,



Anthony J. Serventi

Exhibit - A

Cobasys Lithium Hybrid Electric Vehicle Battery system

Description

The Cobasys Plug-in hybrid battery system is intended for automotive and light duty truck markets that can utilize a plug-in charging scheme, which provides longer driving distance, and offers improved net fuel economy to the consumer. The Cobasys battery system utilizes A123 Lithium-Ion cells. A single enclosure is mounted into the vehicle, only the low-voltage wiring harness, high-voltage cabling, and vehicle air ducts are required to be attached, allowing for ease of installation.

The Li-ion battery system contains one-hundred-ninety-two (192) 3.3 Volt cylindrical cells which are connected in a series-parallel arrangement (2-parallel, 96-series). The nominal system voltage is 370VDC (9.0 Ah per cell). A service disconnect is implemented to divide the battery system into two separate 185VDC strings. A centralized Battery Pack Control Module (BPCM) is included for contactor control and provides energy storage system status information necessary for optimized energy management. The BPCM interfaces with all cell sensors and controllers that offer voltage and temperature monitoring as well as cell balancing for optimized cell usage. The other electronic components needed for a complete system are included. BPCM communication to the vehicle via LAN allows full reporting to the vehicle control system including monitored variables, diagnostics and battery SOC/SOH/power-available. The thermal management system utilizes air-cooling.

1. Cell Assemblies
    - Lithium Ion Cells
    - Bus Bars / Interconnects
    - Temperature Sensors
    - Sense Leads for Battery Voltages and Temperatures
    - Cell Restraint Structures

2. Battery Pack Control Module. The following sets of functions are implemented:
    - A Battery Monitoring Functions
        - Measure HV Battery Voltage, Temperature, and Current.
        - Monitor each Cell.
        - Diagnose each input.
        - Balance Cells (if necessary).
        - Monitor Isolation of cells with Contactor Open, once per key cycle.
        - Communicate on high speed LAN.
    - B. HV Safety, Disconnect, and Thermal Functions

Control Pre-Charge and Main Contractors.
Control and Diagnose of a Variable Speed Cooling Fan.
Source and Sense High Voltage Interlock Circuit (Simple Open / Closed circuit).

C. Battery State Estimator Functions

Cobasys Battery State Estimator (BSE) Algorithms to Calculate:
State of Charge,
State of Health,
Power Limits, and
Voltage Limits.

D. Manage Charging

Wake-Up when Charger provides 12V power and "Ready signal"
Determine need for charging
Control charging with PWM signal to charger
Open contactors on fault
Control cooling system while charging lower battery temperature (if needed)

E. Precondition Battery Temperature

Manage battery heater to raise battery temperature during cold weather soaks to provide energy and power upon next use.
Only active while connected to charger

3. High Voltage Battery Disconnect Unit includes the following subcomponents and functions:
Main Serviceable Fuse.
2 Main Contactors.
2 Charger Contactors
Pre-Charge Contactor.
Pre-Charge Resistor (~10 Ohm).
Current Sensor.
Voltage Sense Leads.
Main Positive/Negative Lugged Ring Terminal Connections for Propulsion HV Bus
Secondary Positive/Negative Lugged Ring Terminal Connections for 15 A Charger

4. Service Disconnect
With Fuse rated for increased EV type driving duty cycle
High Voltage Interlock (Shorting Plug Style)

5. Thermal Management System.
External Fan assumed.
Battery Heater.

Shipping conditions of battery system

1. Transported ground only Class 9 (Class 9 UN 3090 Packing Group II) Hazardous Material following requirements of 49 CFR 173.185(e)(1-7).
2. Service disconnect handle removed.
3. All Battery Disconnect Unit contactors open. See Exhibit D.
4. Protective cover on/over high voltage terminals.

EXHIBIT - B

PHEV BATTERY PACK ASSEMBLY

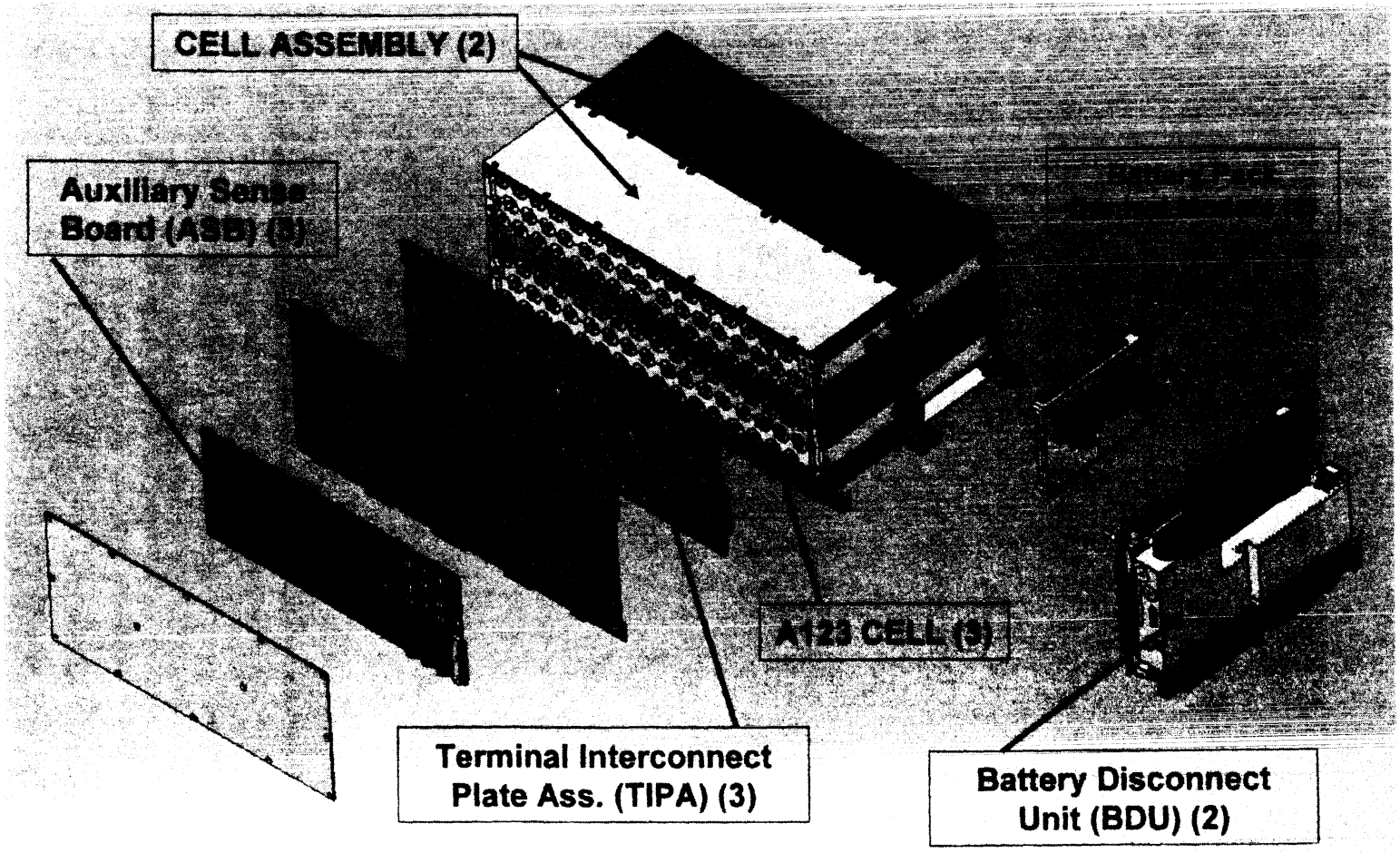


EXHIBIT - C

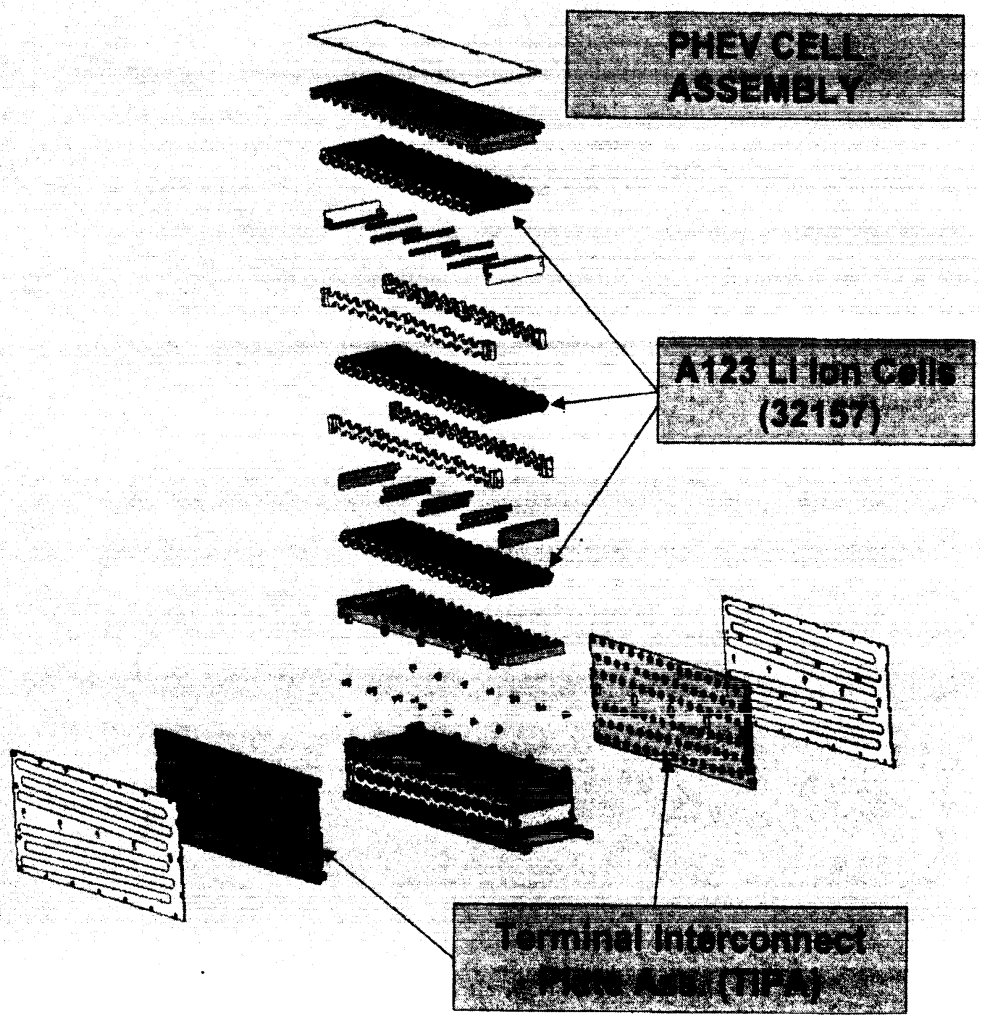

PHEV CELL ASSEMBLY
A123 Li Ion Cells (32157)
Terminal Interconnect

EXHIBIT - D

PHEV Battery Disconnect Unit Power Distribution