U.S. Department of Transportation
Research and Special Programs Administration

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

**DOT-E 7052 (PTE)**
**TWENTY-FIRST REVISION October 1, 1992**

In accordance with 49 CFR 107.111 of the Department of Transportation (DOT) Hazardous Materials Regulations the party(ies) listed below is granted the status of party to DOT-E 7052. The expiration date of the exemption for the party(ies) is September 30, 1993.

This party status applies to the party(ies) listed below based on the application(s) submitted in accordance with 49 CFR 107.111 and the public proceeding thereon. All terms of the exemption remain unchanged. This authorization forms part of the exemption and must be attached to it.

Alan I. Roberts
Associate Administrator
for Hazardous Materials Safety

DEC 3 1992
(DATE)

Dist: FHWA FRA USCG FAA

| EXEMPTION HOLDER | APPLICATION DATE |
|---|---|
| Baker Hughes MWD<br>Houston, TX | October 21, 1991 |
| Graseby Dynamics Ltd.<br>Watford, Herts, England, | December 18, 1991 |
| Catalyst Research<br>Owings Mills, MD | December 20, 1991 |
| Stuart Cody Inc. d/b/a Automated Media Systems<br>Allston, MA | April 6, 1992 |
| Magellan Systems Corporation<br>San Dimas, CA | June 26, 1992 |

CONTINUATION OF DOT-E7052 (PTE) TWENTY-FIRST REVISION October 1, 1992

| EXEMPTION HOLDER | APPLICATION DATE |
|---|---|
| SMTEK, Inc.<br>Newbury Park, CA | June 29, 1992 |
| Celtic Trading of Florida, Inc.<br>Seminole, FL | August 10, 1992 |
| Mine Safety Appliances Co.<br>Sparks, MD | September 30, 1992 |

U.S. Department
of Transportation

Research and
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Administration

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

OCT 1 1991

DOT-E 7052
(TWENTY-FIRST REVISION)

1. Power Conversion, Inc., Elmwood, New York, is hereby granted an exemption from certain provisions of this Department's Hazardous Materials Regulations to offer packages prescribed herein of certain lithium batteries for transportation in commerce subject to the limitations and special requirements specified herein. This exemption authorizes the shipment of lithium batteries and lithium batteries contained in equipment and provides no relief from any regulation other than as specifically stated. Each of the following is hereby granted the status of a party to this exemption (SEE APPENDIX I).

2. BASIS. This emergency exemption is based on Power Conversion's application dated September 2, 1987, submitted in accordance with 49 CFR 107.105. The granting of party status is based on the following applications submitted in accordance with 49 CFR 107.111 and the public proceeding thereon (SEE APPENDIX I).

3. HAZARDOUS MATERIALS (Descriptor and class). Lithium batteries and cells containing Metallic lithium, Vanadium pentoxide, Chromium oxide, Lithium cobalt dioxide, Manganese dioxide, Monofluorographite, Sulfur dioxide, Lithium bromide salts, Acetonitrile, or mixtures of Acetonitrile and Propylene carbonate, Methyl formate and Methyl acetate; also Lithium batteries and cells containing Lithium copper oxide and Lithium copper oxyphosphate, Lithium ferrosolfate, Lithium metal, a depolarizer such as Titanium disulfide, Thionyl chloride or Sulphuryl chloride or Polycarbonmonofluoride and a Lithium salt such as Lithium tetrachloroaluminate or Lithium perchlorate or Lithium tetrafluoroborate, Lithium molybdenum disulfide and Lithium hexafluoroarsenate, Vanadium pentoxide - classed as flammable solid; or miscellaneous Class 9, of International Civil Aviation Organization (ICAO).

Rechargeable lithium batteries and devices containing any lithium batteries other than those excepted under Section 173.206(f) or Special Provisions A45 of ICAO, must be specifically identified to, and acknowledged in writing by, the Office of Hazardous Materials Exemptions and Approvals (OHMEA), prior to the first shipment.

**DOT E-7052 IS INCORPORATED INTO THE 49 CFR REGULATION BOOK. SEE SEC.173.185 LITHIUM BATTERIES AND CELLS.**

See following Pages

FAX

NOTE: Those rechargeable lithium batteries and devices or equipment containing lithium batteries, not excepted as described above and not acknowledged in writing by OHMEA prior to September 1, 1991, must be identified, approved, and shipped under the provisions of 49 CFR Section 173.185. This exemption does not authorize the transportation of cells containing lithium metal which have been discharged to the extent that the open circuit voltage is less than two volts, or batteries containing one or more such cells. However, cells or batteries discharged to below 2 volts, not to exceed 100 cells or batteries per shipment, may be shipped for testing purposes by highway only.

4. PROPER SHIPPING NAME (49 CFR 172.101). Lithium batteries, liquid cathode; Lithium battery, solid cathode (UN 3090) or Lithium batteries contained in equipment (UN 3091) which have been identified to and acknowledged in writing by OHMEA prior to September 1, 1991.

5. REGULATION AFFECTED. 49 CFR 172.101, 172.400, 175.3.

6. MODES OF TRANSPORTATION AUTHORIZED. Motor vehicle, rail freight, cargo vessel and cargo-aircraft only and crew carrying helicopter used to service off-shore oil rigs only.

7. SAFETY CONTROL MEASURES. Packaging prescribed is as follows:

a. Cells and batteries must be packed in strong inner fiberboard containers limited to a maximum of 500 grams of lithium in one inner container. No cell containing more than 12 grams of lithium may be shipped under this exemption.

b. When drums are used, the inner containers must be separated from each other and all inner surfaces of the drum by at least one inch thickness of vermiculite or other equivalent noncombustible cushioning materials.

c. Inside boxes must be further overpacked as specified in paragraphs (8.c.) or (8.d.).

d. Packages must be marked as prescribed in Subpart "D" of 49 CFR Part 172. Packages must be labeled with the FLAMMABLE SOLID label shown in 49 CFR 172.420 or MISCELLANEOUS label shown in Fig. 4-20 OF ICAO Technical Instructions.

e. Each cell and battery must be equipped with an effective means of preventing external short circuits.

f. Each cell and battery must incorporate a safety venting device or be designed in such a manner that will preclude a violent rupture under any condition incident to transportation such as a "dead short". The design of cells and batteries not equipped with a safety venting device must be specifically identified to this office prior to the first shipment of package. Batteries containing cells or series of cells connected in parallel must be equipped with diodes to prevent reverse current flow.

g. Three representative cells must be taken from each week's production of each cell type and be subjected to the test prescribed in Section 3.2.1(1) of Appendix B, Report ECOM730242F on file with the OHMEA.

h. One representative battery must be taken from each week's production of each battery type and must be subjected to the test prescribed in Section 3.2.2(1) of the above reference report.

i. At least 10 cells and one battery of each type of each week's production must be subjected to a thermal stability test at 75°C. for 48 hours and show no evidence of distortion, leakage or internal heating.

j. When shipped in oil rig service helicopter, maximum amount of lithium in one inner packaging shall not exceed 300 grams.

8. SPECIAL PROVISIONS.

a. Persons who receive packages covered by this exemption may reoffer them for transportation provided no modifications or changes are made to the packages, all terms of this exemption are complied with, and a current copy of this exemption is maintained at each facility from which such reoffering occurs.

b. In accordance with the provisions of 49 CFR Part 107, Appendix B to Subpart B, Paragraph 3, the shipper shall furnish a copy of this exemption to the air carrier before or at the time the shipment is tendered. In addition, a copy of this exemption must be carried aboard each aircraft, and cargo vessel used to transport packages covered by this exemption.

c. For shipment by cargo-aircraft only, the outside container must be a removable head drum of the DOT Specification 17H or 17C series (or equivalent) and be equipped with a gastight gasket.

d. For shipment by water, motor vehicle, or rail freight, the outside container must be either a : (1) strong wooden box, (2) DOT Specification 12B fiberboard box (or equivalent), (3) DOT Specification 21C fiber drum, or equivalent, or (4) metal drum as authorized in paragraph (c) above.

e. Cells containing no more than 12 grams of lithium metal and also containing lithium molybdenum disulfide and lithium hexafluoroarsenate or vanadium pentoxide, polycarbonmonofluoride, manganese dioxide, titanium disulfide, thionyl chloride and lithium tetrachloroaluminate, lithium tetrafluorobonate or acetonitrile and sulfur dioxide,or thionyl chloride/bromine complex or sulfuryl chloride and chlorine which are hermetically sealed, and batteries constructed of such cells, are excepted from the requirements of paragraphs 7.g., 7.h., and 7.i., and 8.c. of this exemption when in conformance with the following:

Prior to the first shipment, 10 cells or 4 batteries of each type to be offered for transportation must be tested as follows, without showing any evidence of out-gassing, leakage, loss of weight, or distortion:

i. The cells or batteries shall be stored for 6 hours at a pressure corresponding to an altitude of 50,000 feet at 24°C + 4°C.

ii. The cells or batteries shall then be subjected to the thermal stability test at 75°C for 48 hours as required in paragraph 7.i.

iii. The cells or batteries shall be rigidly clamped to the platform of a vibration machine. A simple harmonic motion having an amplitude of 0.03inch (0.06 inch maximum total excursion) shall be applied. The frequency shall be varied at the rate of 1 cycle per second per minute between the limits of 10 and 55 cycles per second. The entire range of frequencies and return shall be traversed in 95 ± 5 minutes for each of three mutually perpendicular mounting positions of the battery and two perpendicular positions of the cells. One of the directions of vibration shall be perpendicular to the terminal face of the battery or cell. Open circuit voltage shall be observed for 30 seconds during the last quarter of each vibration period. Periodic retesting is not required.

iv. The batteries (not cells) must be subjected to a shock test as follows:

The battery shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of the battery. Each battery shall be subjected to a total of three shocks of equal magnitude. The shocks shall be applied in each of three mutually perpendicular directions. Each shock shall be applied in a direction normal to a face of the battery. For each shock, the battery shall be accelerated in such a manner that during the first 3 milliseconds the minimum average acceleration is 75 gravity units (G). The peak acceleration shall be between 125 and 175 G. Cells and batteries meeting the requirements of this paragraph must be packaged in accordance with paragraphs 7.a. and 8.d. of this exemption.

f. For transportation by motor vehicle, the labeling requirements in paragraph 7.d. of this exemption do not apply to package(s) containing lithium/manganese dioxide batteries provided:

1. The batteries contain no more than 4 cells with each cell containing not more than 0.5 grams of lithium, and

2. The gross weight of a package(s) in one motor vehicle does not exceed 65 pounds.

g. This exemption also constitutes the approval of the appropriate authority of the United States for shipment of these batteries on cargo aircraft pursuant to State Variation US25 of the International Civil Aviation Organization (ICAO) Technical Instructions.

h. The "FLIGHTS OF CARGO-AIRCRAFT ONLY" requirements of Appendix B to 49 CFR Part 107 do not apply to operations subject to this exemption.

9. REPORTING REQUIREMENTS.

a. Any incident involving loss of packaging contents or packaging failure must be reported to the Associate Administrator for Hazardous Materials Safety as soon as practicable.

b. Test data obtained under paragraph 7.g., 7.h., and 8.e. of this exemption must be kept on file and be made available upon request by the OHMEA.

10. EXPIRATION DATE. September 30, 1993.

Issued at Washington, D.C.

OCT 1 1991
(DATE)

Alan I. Roberts
Associate Administrator
for Hazardous Materials Safety

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Research and Special Programs Administration, U.S. Department of Transportation, Washington, D.C. 20590. Attention: Exemptions Branch.

Dist: USCG, FAA, FHWA, FRA.

M052

(3)

REPORTS CONTROL SYMBOL
OSD-1366

FAX

# Research and Development Technical Report

Report ECOM-73-0242-F

## NON-HAZARDOUS LITHIUM ORGANIC ELECTROLYTE BATTERIES


Sandors Abens
Power Conversion Inc.
70 MacQuesten Parkway South
Mount Vernon, NY 10550


August 1974

Final Report for Period June 1973 - May 1974

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AMCPM-RBS
Fort Monmouth, NJ 07703

**ECOM**

US ARMY ELECTRONICS COMMAND FORT MONMOUTH, NEW JERSEY 07703

HISA FM 2958-73

(1)

Will be demonstrated to be completely safe under the following test conditions. Some of the conditions given below are extreme in nature but still representative of situations which may arise in the field and be potentially hazardous to personnel. At a minimum, it is necessary to know what can be done.

3.2.1 Cell Tests. (All at 75°F ± 7°F unless otherwise indicated).

3.2.1(1) Short Circuit Test. Under application of a direct short, the cell shall be rendered inert, preferably without venting (through the use of internal fuzing devices). If venting does occur, an open flame shall be applied to the venting fumes to prove that an explosive condition does not exist. Thermocouples attached to the cell case shall indicate the temperature at which fuzing or venting occurs.

3.2.1(2) Increasing Load Test. The cell shall be placed on discharge at the C/5 rate. The discharge rate shall be increased linearly and slowly until fuzing (preferable) or venting occurs. The temperature monitoring conditions of 3.2.1(1) shall apply.

3.2.1(3) Hot Plate Test. The cell shall be placed on a hot plate with a case temperature thermocouple applied and voltage leads. The hot plate temperature shall be increased such that the cell case temperature increases linearly at a rate of approximately 20°F per minute. Time and temperature of cell fuzing shall be recorded and the test continued until cell venting occurs.

3.2.1(4) Cell Deformation Test. The cell shall be placed, insulated, between the jaws of a viselike apparatus with voltage leads and a case temperature thermocouple applied. The lower half of the cell only shall be deformed (leaving the crimp seal section intact). Pressure shall be applied slowly until a voltage drop indicates that an internal short has occurred. At this point the pressure will be maintained until increasing case temperature levels off or until venting occurs.

3.2.1(5) Dynamic Environmental Test. Either high g shock, or high g vibration at the cell resonance point, shall be applied until open circuit voltage readings indicate that substantial internal shorting has occurred. Case temperatures shall then be monitored until venting occurs.

3.2.1(6) Case Rupture Test. The cell, with voltage and case temperature sensing devices attached, shall be bored completely through with a high speed drill bit of approximately 0.25" diameter. The bit shall be removed and observations made. If the cell is not spontaneously consumed, then after ten minutes an open flame shall be applied to the hole and further observations made.



2

3.2.1(7) Incineration Test. The cell shall be mounted in an appropriate fixture with one side bare to the flame of a blowtorch, applied until a non-explosive venting occurs.

3.2.1(8), 3.2.1(9) and 3.2.1(10) Partially Discharged Cell Tests. The above cell tests are to be performed with fresh, full capacity cells. Tests 3.2.1(4), 3.2.1(6) and 3.2.1(7) are to be repeated with cells predischarged to 50% of initial capacity.

3.2.2 Battery Tests (All at 75°F ± 7°F unless otherwise noted).

3.2.2(1) Same as 3.2.1(1)

3.2.2(2) Same as 3.2.1(2)

3.2.2(3) Same as 3.2.1(3)

3.2.2(4) Immersion Test (Tap Water). The battery connector shall be covered with a waterproof tape. The battery shall be fully immersed in water until air bubbles no longer emerge. The battery shall be removed from the water, shaken vigorously, the tape shall be removed and the battery shall then be placed on discharge at the C/5 rate and discharged to 0 volts.

3.2.2(5) Immersion Test (Salt Water). The test of 3.2.2(4) shall be repeated with water with a 3.5% ± 0.1% concentration of sodium chloride.

3.2.2(6) Reverse Discharge Test. The battery shall be discharged in series with an external power source at the C/5 rate. This current shall be maintained for a total period of 15 hours or until it becomes evident that the majority of the battery cells have safely vented.

4. TEST AND EVALUATION:

4.1 Design Test Phase.

The contractor shall demonstrate adequate safety mechanisms by fabricating sufficient cells to conduct five cell tests for each of test conditions 3.2.1(1) through 3.2.1(10) and three battery tests for each of conditions 3.2.2(1) through 3.2.2(6).

4.1.1 Preliminary Design & Visualization Plan. Upon successful completion of the above cell and battery tests, the plan shall be prepared and submitted to USAECOM for approval. The batteries as tested and described shall contain all of the safety mechanisms resulting from the investigations covered by the technical guidelines. The Preliminary Design and Visualization Plan shall contain all test data and comments and/or recommendations made on any deficiencies noted in the testing.

FAX

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APPENDIX I

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Eagle-Picher Industries, Inc., Joplin, Missouri - PTE-3
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Ray-O-Vac Corporation, Madison, Wisconsin - PTE-5
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National Aeronautics and Space Administration, Washington, DC - PTE-7
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APPENDIX II

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Saft America, Inc.'s, (Formerly Durcell International, Inc.) application dated September 18, 1989
Eagle-Picher Industries, Inc.'s application dated August 7, 1989
U.S. Department of Defense's application dated September 9, 1989
Ray-O-Vac Corporation's October 25, 1989
U.S. Department of Energy's application dated October 4, 1989
National Aeronautics and Space Administration's July 10, 1989
The Boeing Company, Seattle's September 18, 1989
The Jet Propulsion Laboratories' application dated April 18, 1989
MODICON, Incorporated's application dated October 31, 1989
Electrochem Industries, Inc.'s application dated September 15, 1989
Sonatech, Incorporated's application dated January , 1990
Altus Corporation's application dated October 1, 1989
Plainveiw Electronics Corporation's application dated October 27, 1989
Hazeltine Corporation's application dated November 21, 1989
Magnavox Government & Industrial Electronics Co.'s application dated September 15, 1989
Geophysical Research Corporation's application dated October 23, 1989
Northrop Corporation's application dated June 6, 1989
In-Situ, Incorporation's application dated November 8, 1989
DME Corporation's application dated November 21, 1989
Moli Energy Limited's application dated September 19, 1989
McDonnell Douglas Corporation's application dated September 11, 1989
Sippican Ocean Systems, Incorporated's application dated September 29, 1989
Martin Marietta Corporation's application dated October 19, 1989
TNR Technical, Incorporated's application dated January 22, 1990
General Motors Corporation's application dated September 27, 1989
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Syntron, Incorporated's application dated December 6, 1989
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Tadiran Electronic Industries' application dated September 29, 1989
Beckman Instruments' application dated February 22, 1990
Aluminum Company of America's application dated December 13, 1989
Smith International's application dated December 6, 1989
ITT Barton Instruments, Co.'s application dated July 11, 1989
Eveready Battery Co., Inc.'s application dated December 13, 1989
Telonics, Incorporated's application dated September 22, 1989
Toshiba Battery Co., Ltd.'s application dated May 18, 1990
Schlumberger Well Service's application dated September 20, 1989
EIC Laboratories, Incorporated's application dated April 26, 1990
Clifton Precision Systems Division's application dated October 31, 1989
ENDECO, Incorporated's application dated October 6, 1989
Hughes Electronic Products, Corporation's application dated September 7, 1989
Priebe Electronics' application dated March 20, 1990
Engineered Assemblies Corporation's application dated November 22, 1989
Tracor Applied Sciences, Incorporated's application dated March 22, 1989
FABRIKA Ni-cd Baterija "TREPC"'s application dated February 9, 1990
American Meter Company's application dated November 28, 1989
Eastman Christensen's application dated February 12, 1990
Teledyne Systems Company's application dated October 9, 1989
Interstate Electronics' application dated November 15, 1989
Wilson Greatbatch Ltd.'s application dated October 5, 1989
ECO Energy Conversion's application dated November 13, 1989
Siemens Corporation Research & Support, Incorporated's application dated October 31, 1989
Siemens, Ag.'s application dated October 31, 1989
Battery Assemblies, Incorporated's application dated April 13, 1990
Wildlife Materials, Incorporated's application dated November 1, 1990
Lockheed Aeronautical System Company's application dated October 22, 1990
Tauber Electronics, Incorporated's application dated March 26, 1990
Adcour, Incorporated's application dated June 29, 1990
EnScan, Incorporated's application dated October 16, 1989
Acme Aerospace Products Group's application dated November 20, 1989

Hoppecke Battery Company's application dated August 4, 1989
Maxell Corporation of America's application dated September 5, 1989
Hatachi-Maxell, Ltd.'s application dated May 22, 1990
Beta Phase, Inc.'s application dated October 23, 1989
3M's application dated September 1, 1989
Hydril Production Technology Division's application dated November 2, 1989
DigiCourse, Incorporated's application dated December 20, 1989
GE Reuter Stokes's application dated September 29, 1989
DC - Battery Products' application dated February 13, 1991
Tracor Aerospace's application dated December 12, 1989
TDW Pipeline Surveys' application dated December 12, 1989
R-Con International's application dated June 5, 1990
Mercury Instruments' application dated September 1, 1989
Honeywell, Inc.'s application dated October 18, 1990
Ocean Technology, Inc.'s application dated September 15, 1989
SAB/NIFE, Inc.'s application dated September 27, 1989
Medtronic, Incorporated's application dated October 31,1989
Fairchild Industries, Inc.'s application dated November 27, 1990
Environmental Pacific Corporation's application dated June 1, 1989
DURACELL, Inc.'s application dated July 20, 1989
LO-KATA Communication Electronics' application dated July 27, 1989
Foxboro Company's application dated August 1, 1989
FDK America, Inc.'s application dated August 21, 1989
Fuji Electrochemical Company, Limited's application dated August 21, 1989
Multiplier Industries Corp.'s application dated August 21, 1989
Unitech Industries Inc.'s application dated August 28, 1989
Ansul Fire Protection Wormald U.S., Inc.'s application dated September 12, 1989
Computalog Wireline Services, Inc.'s application dated September 22, 1989
TOTCO's application dated September 26, 1989
Halliburton Logging Services, Inc.'s application dated September 27, 1989
Baker Hughes Drilling Systems, Inc.'s application dated September 28, 1989
Sperry-Sun Drilling Services, Inc.'s application dated September 29, 1989
Yardney Technical Products, Inc.'s application dated October 1, 1989
Starburst Electronics Inc.'s application dated October 1, 1989
Dukane Corporation/Seacom Division's application dated October 6, 1989
FME Corporation's application dated October 18, 1989
K Power Electronics' application dated October 27, 1989
Pointer Inc.'s application dated October 27, 1989
Sony Energytec, Inc.'s application dated October 30, 1989

Ferranti International Signal, Inc.'s application dated November 13, 1989
S&G Photographic's application dated November 17, 1989
Informatique Electronique Securite Martime's application dated November 28, 1989
Mid-Atlantic Electronics Corp's application dated December 11 1989
AVT, Inc.'s application dated application dated December 20, 1989
EMF Systems' application dated December 21, 1989
Sanyo Electric Trading Co., Ltd's application dated December 28, 1989
Sanyo Energy Corporation's application dated December 28, 1989
Digit Nav Company's application dated January 10, 1990
Battery Specialties' application dated January 30, 1990
Nautronix, Inc.'s application dated February 8, 1990
Computer Components Corp.'s application dated February 9, 1990
Raynet Electronics Company's application dated February 16, 1990
Micro Power Electronics' application dated March 15, 1990
Amtech Technology Corporation's application dated March 29, 1990
Pacific Electro Dynamics' application dated April 12, 1990
SimTronix's application dated April 18, 1990
Southwest Electronics, Inc.'s application dated May 29, 1990
Gould, Inc.'s application dated June 21, 1990
Sand Dollar Instruments, Inc.'s application dated June 25, 1990
Ensco Technology Company application dated June 27, 1990
Chamberlain MFG. Corporation's application dated June 30, 1990
Artex Aircraft Supplies, Inc.'s application dated July 17, 1990
Texas Instruments Incorporated's application dated July 25, 1990
Alden Electronics, Inc.'s application dated August 8, 1990
General Dynamics/Convair Division's application dated August 30, 1990
Ross Laboratories, Inc.'s application dated September 24, 1990
SuperFlow Corporation's application dated October 23, 1990
Honeywell Inc's application dated October 16, 1990
Promark Electronics, Inc.'s application dated October 24, 1990
Ball Aerospace Systems Group's application dated October 30, 1990
Northrop Corporation Aircraft Division's application dated November 1, 1990
LSM International/Lone Star Marketing's application dated November 1, 1990
Smith Industries's application dated November 30, 1990
Advanced Telemetry Systems, Inc.'s application dated December 3, 1990
Household Data Service's application dated February 1, 1990

E-7052

**§ 173.185 Lithium batteries and cells.**

(a) Except as otherwise provided in this subpart, a lithium cell or battery is authorized for transportation only if it conforms to the provisions of this section.

(b) *Exceptions.* Cells and batteries are not subject to the requirements of this subchapter if they meet the following requirements:

(1) Each cell with a liquid cathode may contain no more than 0.5 g of lithium or lithium alloy, and each cell with a solid cathode may contain no more than 1.0 g lithium or lithium alloy;

(2) Each battery with a liquid cathode may contain an aggregate quantity of no more than 1.0 g lithium or lithium alloy, and each battery with a solid cathode may contain an aggregate quantity of no more than 2.0 g of lithium or lithium alloy;

(3) Each cell or battery containing a liquid cathode must be hermetically sealed;

(4) Cells and batteries must be packed in such a way so as to prevent short circuits and must be packed in strong packagings, except when installed in equipment; and

(5) If a liquid cathode battery contains more than 0.5 g of lithium or lithium alloy or a solid cathode battery contains more than 1.0 g lithium or lithium alloy, it may not contain a liquid or gas that is a hazardous material according to this subchapter unless the liquid or gas, if free, would be completely absorbed or neutralized by other materials in the battery.

(c) Cells and batteries also are not subject to this subchapter if they meet the following requirements:

(1) Each cell contains not more than 5 g of lithium or lithium alloy;

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(2) Each battery contains not more than 25 g of lithium or lithium alloy;

(3) Each cell or battery is of the type proven to be non-dangerous by testing in accordance with tests in the UN Manual of Tests and Criteria, such testing must be carried out on each type prior to the initial transport of that type; and

(4) Cells and batteries are designed or packed in such a way as to prevent short circuits under conditions normally encountered in transportation.

(d) Cells and batteries and equipment containing cells and batteries which were first transported prior to January 1, 1995, and were assigned to Class 9 on the basis of the requirements of this subchapter in effect on October 1, 1993, may continue to be transported in accordance with the applicable requirements in effect on October 1, 1993.

(e) Cells and batteries may be transported as items of Class 9 if they meet the requirements in paragraphs (e)(1) through (e)(9) of this section:

(1) Cells must not contain more than 12 g of lithium or lithium alloy.

(2) Batteries must not contain more than 500 g of lithium or lithium alloy.

(3) Each cell and battery must be equipped with an effective means of preventing external short circuits.

(4) Each cell and battery must incorporate a safety venting device or be designed in a manner that will preclude a violent rupture under conditions normally incident to transportation.

(5) Batteries containing cells or series of cells connected in parallel must be equipped with diodes to prevent reverse current flow.

(6) Cells and batteries must be packed in strong inner packagings containing not more than 500 g of lithium or lithium alloy per inner packaging.

(7) Cells and batteries must be packed in inner packagings in such a manner as to effectively prevent short circuits and to prevent movement which could lead to short circuits.

(8) Cells and batteries must be packaged in packagings conforming to the requirements of part 178 of this subchapter at the Packing Group II performance level: Inner packagings must be packed within metal boxes (4A or 4B), wooden boxes (4C1, 4C2, 4D, or 4F), fiberboard boxes (4G), solid plastic boxes (4H2), fiber drums (1G), metal drums (1A2 or 1B2), plywood drums (1D), plastic jerricans (3H2), or metal jerricans (3A2 or 3B2).

(9) Each cell or battery must be of the type proven to meet the criteria of Class 9 by testing in accordance with tests in the UN Manual of Tests and Criteria.

(10) Except as provided in paragraph (h) of this section, cells or batteries may not be offered for transportation or transported if any cell has been discharged to the extent that the open circuit voltage is less than two volts or is less than ⅔ of the voltage of the fully charged cell, whichever is less.

(f) Equipment containing or packed with cells and batteries meeting the requirements of paragraph (b) or (c) of this section is excepted from all other requirements of this subchapter.

(g) Equipment containing or packed with cells and batteries may be transported as items of Class 9 if the batteries and cells meet all the requirements of paragraph (e) of this section and are packaged as follows:

(1) Equipment containing cells and batteries must be packed in a strong outer packaging that is waterproof or is made waterproof through the use of a liner unless the equipment is made waterproof by nature of its construction. The equipment must be secured within the outer packaging and be packed as to effectively prevent movement, short circuits, and accidental operation during transport; and

(2) Cells and batteries packed with equipment must be packed in inner packagings conforming to paragraph (e)(8) of this section in such a manner as to effectively prevent movement and short circuits. The quantity of lithium contained in any piece of equipment must not exceed 12 g per cell and 500 g per battery. Not more than 5 kg of cells and batteries may be packed with each item of equipment.

(h) Cells and batteries, for disposal, may be offered for transportation or transported to a permitted storage facility and disposal site by motor vehicle when they meet the following requirements:

(1) Cells, when new, may not contain more than 12 g and batteries may not

contain more than 500 g of lithium or lithium alloy;

(2) Be equipped with an effective means of preventing external short circuits; and

(3) Be packed in a strong outer packaging conforming to the requirements of §§173.24 and 173.24a. The packaging need not conform to performance requirements of part 178 of this subchapter.

(i) Cells and batteries and equipment containing or packed with cells and batteries which do not comply with the provisions of this section may be transported only if they are approved by the Associate Administrator for Hazardous Materials Safety.

(j) For testing purposes, when not contained in equipment, cells containing not more than 12 g of lithium or lithium alloy and batteries containing not more than 500 g of lithium or lithium alloy may be offered for transportation or transported by highway only as items of Class 9. Packaging must conform with paragraph (e)(8) of this section with not more than 100 cells per package.

[Amdt. 173-261, 62 FR 24733, May 6, 1997]

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Exh 4