Chapter 2
Commodity Description

2.1 FM Global Standard Commodities

Two FM Global standard commodities were selected for this project: Class 2 and Cartoned Unexpanded Plastic (CUP). The Class 2 commodity consists of three double-walled corrugated paper cartons. Inside the cartons is a five-sided sheet metal liner, representing non-combustible content and the cartoned liner is supported on an ordinary, two-way, slatted deck, hardwood pallet (see Fig. 2.1).

The FM Global standard CUP commodity consists of Group A unexpanded rigid crystalline polystyrene cups packaged in single-walled, corrugated paper cartons. Cups are individually compartmentalized with corrugated paper partitions and are arranged in five layers (see Fig. 2.2).

2.2 Li-ion 18,650 Cylindrical Cells

The Li-ion 18,650-format cylindrical cell has approximate dimensions of 0.7 inches in diameter and 2.6 inches long. The cell is constructed by winding long strips of electrodes into a "jelly roll" configuration, which is then inserted into a hard metal case and sealed with gaskets (see Fig. 2.3). The packaging, as received from the manufacturer, consisted of two inner corrugated board cartons within an outer corrugated board carton. Each inner carton contained 100 cylindrical cells separated by paperboard partitions (see Fig. 2.4).

2.3 Li-ion 18 V Power Tool Packs

The power tool packs tested were comprised of ten 18,650-format cylindrical cells encased in a plastic case. The individual battery packs were encased in plastic blister packs for display, as shown in Fig. 2.5. The power tool packs are comprised

R. T. Long Jr. et al., *Flammability of Cartoned Lithium Ion Batteries*,
SpringerBriefs in Fire, DOI: 10.1007/978-1-4939-1077-9_2,
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Fig. 2.1 FM Global standard class 2 commodity (courtesy of FM Global)

Fig. 2.2 FM Global standard CUP commodity (courtesy of FM Global)

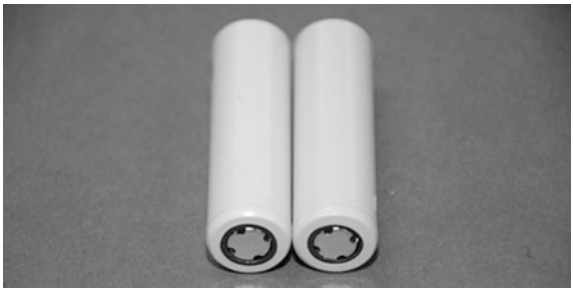

Fig. 2.3 Li-ion 18,650-format cylindrical cell (courtesy of FM Global)

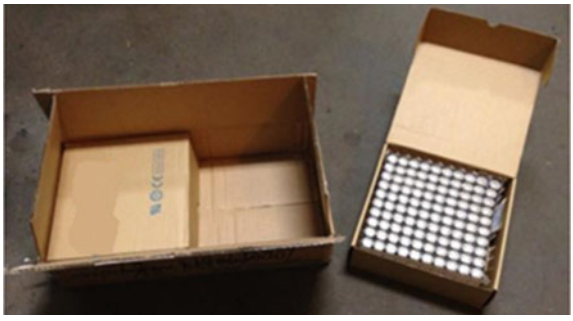

Fig. 2.4 Li-ion cylindrical cell packaging as received from manufacturer (courtesy of FM Global)

Fig. 2.5 Li-ion power tool pack shown with blister case (courtesy of FM Global)

Fig. 2.6 Li-ion power tool packs in cartons on a pallet (courtesy of FM Global)

of significant quantities of plastics (i.e., the battery case itself and the clear blister packaging), unlike the cylindrical and polymer cells. Figure 2.6 depicts the Li-ion 18 V power tool packs in cartons on a pallet. Each carton contained four power tool packs.

2.4 Li-ion Polymer Cells

The Li-ion polymer cells are enclosed in a soft-case to reduce the overall size and weight and have approximate dimensions of 3.9 inches in length, 1.6 inches in width, and 0.23 inches in thickness. The cell is constructed by winding long strips of electrodes into a "jelly roll" configuration, which is then enclosed in a polymer-coated aluminum pouch with heat-sealed seams (see Fig. 2.7). There were 144 cells in each carton, as shown in Fig. 2.8. Each of those cartons contained two smaller cartons of 72 cells.

Fig. 2.7 Li-ion polymer cell (courtesy of FM Global)

Fig. 2.8 Li-ion polymer cells in cartons on a pallet (courtesy of FM Global)

Table 2.1 Summary of battery cell characteristics

Parameter	Power tool 18,650	18,650	Li-polymer
Nominal voltage	3.7 V	3.7 V	3.7 V
Nominal capacity	1,300 mAh	2,600 mAh	2,700 mAh
Mass of cell	42.9 g	47.2 g	50.0 g
Approximate mass of electrolyte solvent	3.3 g	2.6 g	4.0 g
Cell chemistry	Lithium nickel maganese cobalt oxide (NMC)	Lithium cobalt oxide (LCO)	Lithium cobalt oxide (LCO)
Approximate state of charge (SOC) as received	50%	40%	60%

2.5 Li-ion Battery Cell Characteristics

A summary of the characteristics of battery cells tested is provided in Table 2.1.

Refer to Sect. 4.3 of the FM Global report [1] for further detail on information presented in this section.

Reference

1. B. Ditch et al., Flammability characterization of lithium-ion batteries in bulk storage. FM Global, March 2013

http://www.springer.com/978-1-4939-1076-2

Flammability of Cartoned Lithium Ion Batteries

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2014, XX, 31 p. 13 illus., Softcover
ISBN: 978-1-4939-1076-2