

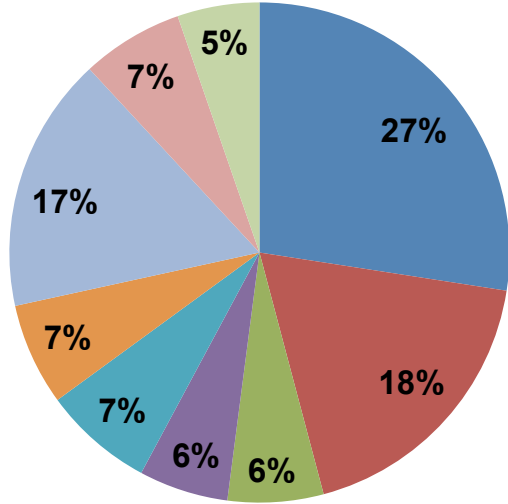
Cost Breakdown Analysis
LiNi0.80Co0.15Al0.05O2-Graphite

| | Battery 1 | Battery 2 | Battery 3 | Battery 4 | Battery 5 | Battery 6 |
|-------------------------------------------------------|------------------|------------------|------------------|-----------------|-----------------|-----------------|
| Calculated Battery Parameters | | | | | | |
| Vehicle electric range, miles | 284.76771 | 201.01496 | 201.01496 | 201.01496 | 201.01496 | 201.01496 |
| Number of battery packs | 1 | 1 | 1 | 1 | 1 | 1 |
| Packs in series or parallel | | | | | | |
| Number of cells per pack | 7104 | 6216 | 6216 | 6216 | 6216 | 6216 |
| Number of modules per pack | 16 | 14 | 14 | 14 | 14 | 14 |
| Battery system total energy storage, kWh | 83.8 | 59.1 | 59.1 | 59.1 | 59.1 | 59.1 |
| Cell capacity, Ah | 3.3 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| Nominal battery system voltage (OCV at 50% SOC),V | 353.3 | 309.1 | 309.1 | 309.1 | 309.1 | 309.1 |
| Battery system power at target % OCV, kW | 511.0 | 361.3 | 361.3 | 361.3 | 361.3 | 361.3 |
| Required battery system power, kW | 60 | 60 | 60 | 60 | 60 | 60 |
| Target % OCV at full power | 80 | 80 | 80 | 80 | 80 | 80 |
| % OCV at full power adjusted for thickness limit | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 |
| Battery system volume (all packs), L | 510.2 | 400.2 | 400.2 | 400.2 | 400.2 | 400.2 |
| Battery system weight (all packs), kg | 723.0 | 548.0 | 548.0 | 548.0 | 548.0 | 548.0 |
| Cooling system power requirement, W | 3.7 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |
| Materials and Purchased Items Summary, \$/Pack | | | | | | |
| Positive Active Material | 2,724.19 | 2,021.23 | 1,885.87 | 1,759.58 | 1,689.66 | 1,641.75 |
| Negative Active Material | 1,284.97 | 962.00 | 897.58 | 837.47 | 804.19 | 781.39 |
| Carbon and Binders | 190.14 | 134.59 | 134.59 | 134.59 | 134.59 | 134.59 |
| Positive Current Collector | 165.97 | 119.25 | 119.25 | 119.25 | 119.25 | 119.25 |
| Negative Current Collector | 755.86 | 548.11 | 548.11 | 548.11 | 548.11 | 548.11 |
| Separators | 1,256.26 | 905.82 | 905.82 | 905.82 | 905.82 | 905.82 |
| Electrolyte | 905.19 | 644.08 | 644.08 | 644.08 | 644.08 | 644.08 |
| Cell Hardware | 2,272.78 | 2,086.87 | 1,816.72 | 1,581.55 | 1,458.36 | 1,376.82 |
| Module Hardware | 1,100.23 | 917.92 | 876.08 | 839.66 | 820.58 | 807.95 |
| Battery Jacket | 1,516.46 | 1,272.03 | 1,272.03 | 1,272.03 | 1,272.03 | 1,272.03 |
| Battery Pack Total | 12,172.04 | 9,611.89 | 9,100.13 | 8,642.13 | 8,396.67 | 8,231.78 |
| Battery Management System | 635.00 | 595.00 | 595.00 | 595.00 | 595.00 | 595.00 |
| Thermal Management System | 40.00 | 40.00 | 40.00 | 40.00 | 40.00 | 40.00 |
| Direct Labor Summary, hours/year | | | | | | |
| Electrode processing | 480,702 | 368,153 | 534,011 | 777,379 | 970,057 | 1,136,016 |
| Cell assembly | 1,892,668 | 1,577,014 | 2,466,178 | 3,872,666 | 5,051,501 | 6,104,166 |
| Formation cycling, testing and sealing | 1,350,253 | 1,121,361 | 1,767,911 | 2,798,998 | 3,668,442 | 4,447,767 |
| Module and battery assembly | 716,589 | 621,840 | 879,414 | 1,243,680 | 1,523,191 | 1,758,829 |
| Cell and materials rejection and recycling | 695,924 | 570,602 | 926,946 | 1,505,828 | 2,000,042 | 2,446,225 |
| Receiving and shipping | 96,812 | 76,599 | 106,103 | 147,116 | 178,189 | 204,180 |
| Control laboratory | 68,134 | 53,105 | 75,102 | 106,211 | 130,081 | 150,205 |
| Total | 5,301,082 | 4,388,675 | 6,755,665 | ##### | ##### | ##### |
| Capital Equipment Summary, \$millions | | | | | | |
| Electrode processing | 112 | 77 | 130 | 218 | 296 | 367 |
| Cell assembly | 363 | 293 | 483 | 802 | 1,080 | 1,336 |
| Formation cycling, testing and sealing | 547 | 419 | 716 | 1,227 | 1,682 | 2,103 |
| Module and battery assembly | 292 | 234 | 379 | 616 | 819 | 1,001 |
| Cell and materials rejection and recycling | 48 | 40 | 64 | 105 | 139 | 170 |
| Receiving and shipping | 27 | 19 | 31 | 48 | 63 | 77 |
| Control laboratory | 5 | 4 | 6 | 9 | 12 | 15 |
| Total | 1,394.37 | 1,084.95 | 1,809.58 | 3,025.39 | 4,090.59 | 5,069.00 |
| Building, Land and Utilities, square meters | | | | | | |
| Electrode processing | 15,504 | 11,064 | 17,714 | 28,495 | 37,713 | 46,056 |
| Cell assembly | 54,729 | 44,542 | 73,788 | 122,814 | 165,793 | 205,308 |
| Formation cycling, testing and sealing | 47,674 | 37,270 | 61,641 | 102,397 | 138,063 | 170,818 |
| Module and battery assembly | 18,993 | 16,021 | 24,283 | 36,807 | 46,944 | 55,788 |
| Cell and materials rejection and recycling | 7,597 | 6,408 | 9,713 | 14,723 | 18,778 | 22,315 |
| Receiving and shipping | 4,659 | 3,535 | 5,190 | 7,628 | 9,561 | 11,225 |
| Control laboratory | 843 | 625 | 948 | 1,436 | 1,832 | 2,177 |
| Total | 149,999 | 119,465 | 193,278 | 314,300 | 418,684 | 513,688 |

Breakdown of Cost with Overhead Items Distributed to Basic Cost Factors

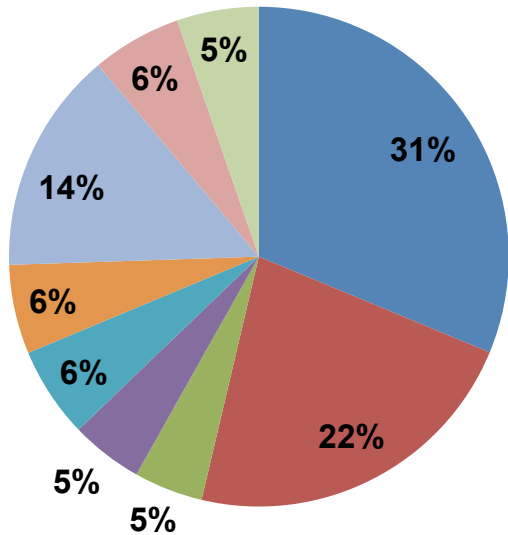
| | Battery 1 | Battery 2 | Battery 3 | Battery 4 | Battery 5 | Battery 6 |
|--------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Direct Labor Summary, \$/pack | | | | | | |
| Electrode processing | 277.98 | 247.37 | 179.41 | 130.59 | 108.64 | 95.42 |
| Cell assembly | 1,094.48 | 1,059.65 | 828.55 | 650.54 | 565.71 | 512.70 |
| Formation cycling, testing and sealing | 780.82 | 753.48 | 593.96 | 470.18 | 410.82 | 373.58 |
| Module and battery assembly | 414.39 | 417.83 | 295.45 | 208.92 | 170.58 | 147.73 |
| Cell and materials rejection and recycling | 402.44 | 383.41 | 311.42 | 252.95 | 223.98 | 205.46 |
| Receiving and shipping | 55.98 | 51.47 | 35.65 | 24.71 | 19.96 | 17.15 |
| Control laboratory | 39.40 | 35.68 | 25.23 | 17.84 | 14.57 | 12.62 |
| Total | 3,065.48 | 2,948.90 | 2,269.68 | 1,755.74 | 1,514.26 | 1,364.64 |
| Capital Equipment, \$/pack | | | | | | |
| Electrode processing | 748.45 | 600.66 | 503.30 | 422.66 | 382.00 | 355.69 |
| Cell assembly | 2,420.47 | 2,270.46 | 1,873.60 | 1,553.89 | 1,395.66 | 1,294.33 |
| Formation cycling, testing and sealing | 3,652.91 | 3,245.27 | 2,776.82 | 2,378.08 | 2,172.80 | 2,038.34 |
| Module and battery assembly | 1,946.88 | 1,810.94 | 1,470.94 | 1,194.77 | 1,057.93 | 970.46 |
| Cell and materials rejection and recycling | 322.45 | 307.21 | 249.53 | 202.68 | 179.47 | 164.63 |
| Receiving and shipping | 178.88 | 149.46 | 118.24 | 93.64 | 81.74 | 74.24 |
| Control laboratory | 33.41 | 27.39 | 22.25 | 18.07 | 16.00 | 14.68 |
| Total | 9,303.45 | 8,411.38 | 7,014.67 | 5,863.80 | 5,285.59 | 4,912.37 |
| Building, Land and Utilities, \$/pack | | | | | | |
| Electrode processing | 122.69 | 101.73 | 81.44 | 65.50 | 57.80 | 52.94 |
| Cell assembly | 433.10 | 409.57 | 339.25 | 282.32 | 254.08 | 235.98 |
| Formation cycling, testing and sealing | 377.26 | 342.70 | 283.40 | 235.39 | 211.58 | 196.34 |
| Module and battery assembly | 150.30 | 147.31 | 111.64 | 84.61 | 71.94 | 64.12 |
| Cell and materials rejection and recycling | 60.12 | 58.93 | 44.66 | 33.84 | 28.78 | 25.65 |
| Receiving and shipping | 36.87 | 32.51 | 23.86 | 17.54 | 14.65 | 12.90 |
| Control laboratory | 6.67 | 5.75 | 4.36 | 3.30 | 2.81 | 2.50 |
| Total | 1,187.01 | 1,098.50 | 888.61 | 722.51 | 641.64 | 590.43 |
| Summary Breakdown to Basic Cost Factors | | | | | | |
| Materials, \$ | 7,767 | 5,690 | 5,477 | 5,278 | 5,168 | 5,093 |
| Purchased items, \$ | 5,215 | 4,561 | 4,229 | 3,939 | 3,787 | 3,687 |
| Labor, \$ | 3,065 | 2,949 | 2,270 | 1,756 | 1,514 | 1,365 |
| Capital Equipment and Building, \$ | 10,490 | 9,510 | 7,903 | 6,586 | 5,927 | 5,503 |
| | 26,538 | 22,710 | 19,879 | 17,559 | 16,397 | 15,647 |
| Cost Breakdown with Overhead Distributed to Processes | | | | | | |
| Materials, \$ | 7,767 | 5,690 | 5,477 | 5,278 | 5,168 | 5,093 |
| Purchased items, \$ | 5,215 | 4,561 | 4,229 | 3,939 | 3,787 | 3,687 |
| Manufacturing, \$ | | | | | | |
| Electrode processing | 1,149 | 950 | 764 | 619 | 548 | 504 |
| Cell assembly | 3,948 | 3,740 | 3,041 | 2,487 | 2,215 | 2,043 |
| Formation cycling, testing and sealing | 4,811 | 4,341 | 3,654 | 3,084 | 2,795 | 2,608 |
| Module and battery assembly | 2,512 | 2,376 | 1,878 | 1,488 | 1,300 | 1,182 |
| Cell and materials rejection and recycling | 785 | 750 | 606 | 489 | 432 | 396 |
| Receiving and shipping | 272 | 233 | 178 | 136 | 116 | 104 |
| Control laboratory | 79 | 69 | 52 | 39 | 33 | 30 |
| Total | 13,556 | 12,459 | 10,173 | 8,342 | 7,441 | 6,867 |
| Battery pack total | 26,538 | 22,710 | 19,879 | 17,559 | 16,397 | 15,647 |
| Pack integration (BMS & disconnects), \$ | 635 | 595 | 595 | 595 | 595 | 595 |
| Estimated cost to OEM for thermal management, \$ | 40 | 40 | 40 | 40 | 40 | 40 |
| Total cost to OEM for complete battery system, \$ | 27,213 | 23,345 | 20,514 | 18,194 | 17,032 | 16,282 |

Overall Cost Breakdown Battery 1



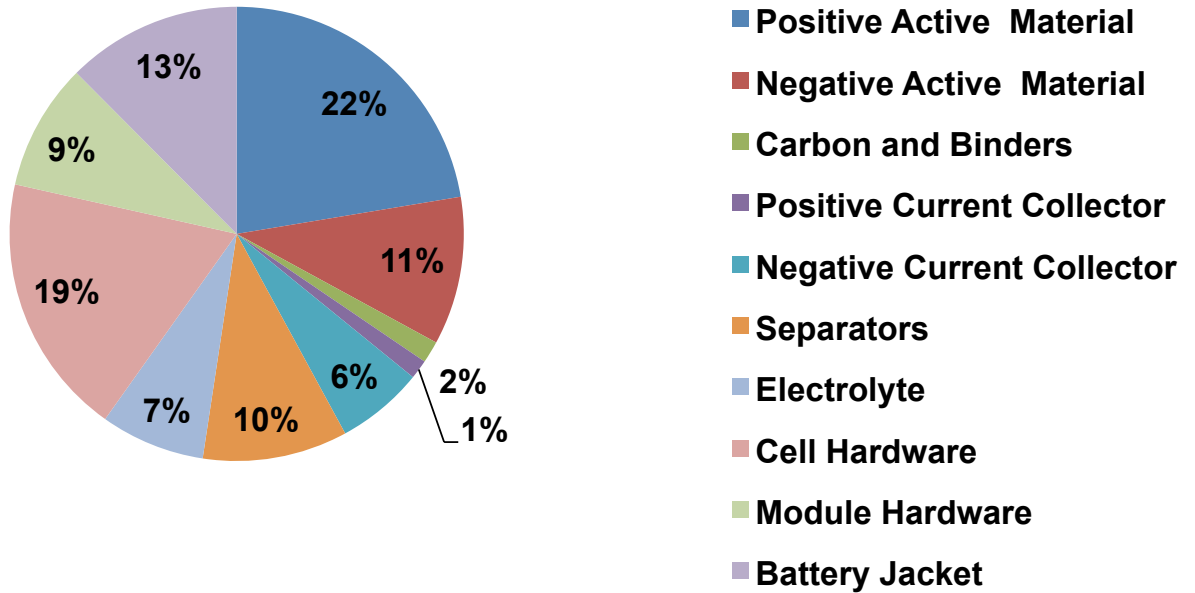
- Materials
- Purchased Items
- Direct Labor
- Variable Overhead
- General, Sales, Administration
- Research and Development
- Depreciation
- Profit
- Warranty (includes battery pack(s) only)

Overall Cost Breakdown Battery 7

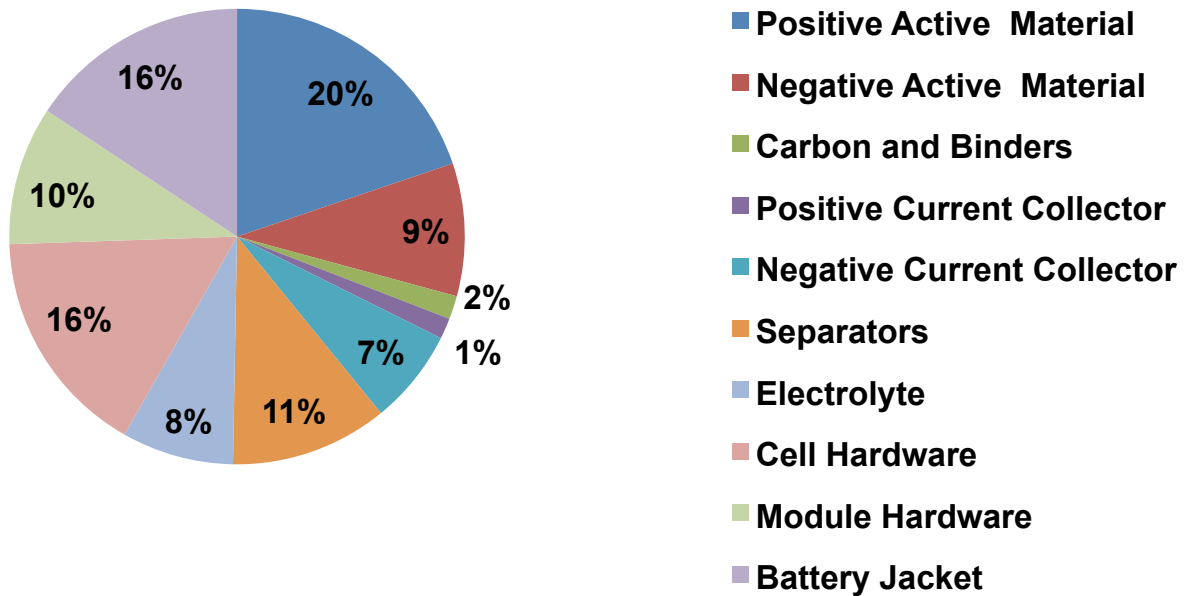


- Materials
- Purchased Items
- Direct Labor
- Variable Overhead
- General, Sales, Administration
- Research and Development
- Depreciation
- Profit
- Warranty (includes battery pack(s) only)

Materials and Purchased Items Cost Breakdown Battery 1

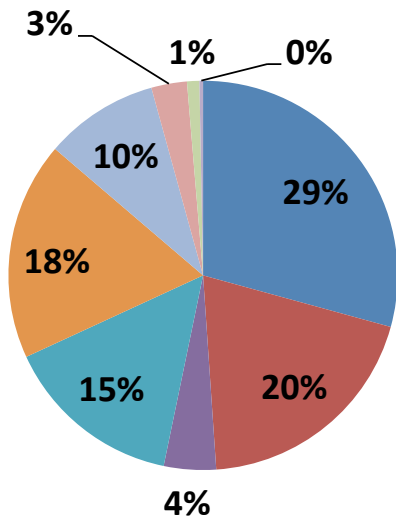


Materials and Purchased Items Cost Breakdown Battery 7



Cost Breakdown with Overhead Distributed to Processes

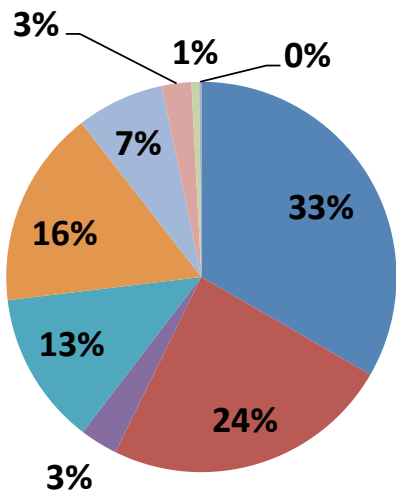
Battery 1



- Materials, \$
- Purchased items, \$
- Manufacturing, \$
- Electrode processing
- Cell assembly
- Formation cycling, testing and sealing
- Module and battery assembly
- Cell and materials rejection and recycling
- Receiving and shipping
- Control laboratory

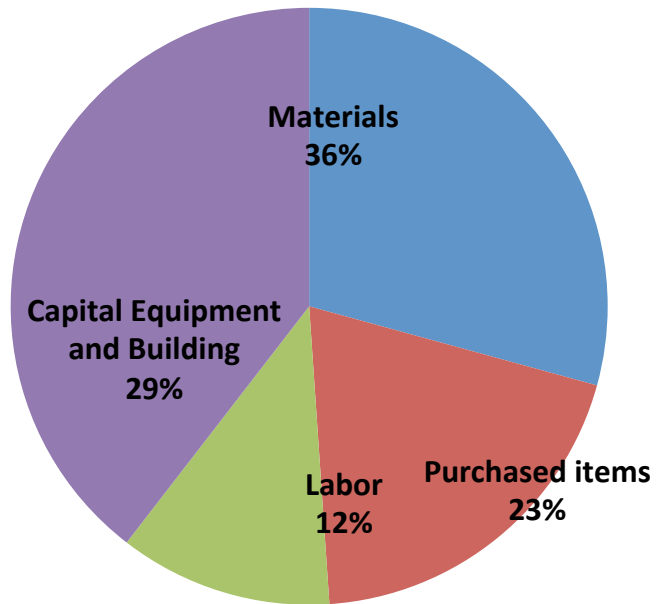
Cost Breakdown with Overhead Distributed to Processes

Battery 7

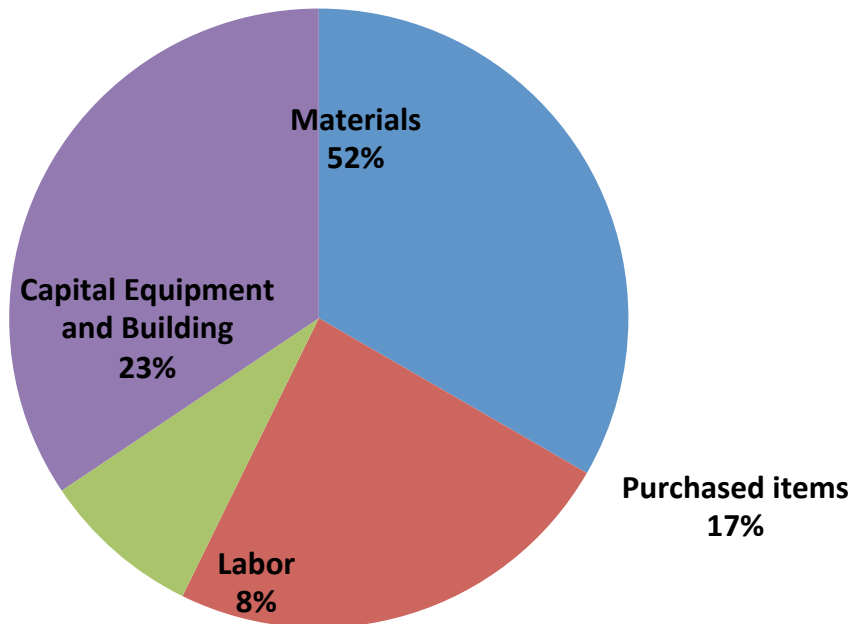


- Materials, \$
- Purchased items, \$
- Manufacturing, \$
- Electrode processing
- Cell assembly
- Formation cycling, testing and sealing
- Module and battery assembly
- Cell and materials rejection and recycling
- Receiving and shipping
- Control laboratory

**Breakdown of Costs to Basic Cost Factors
Battery 1**



**Breakdown of Costs to Basic Cost Factors
Battery 7**



Battery 7

201.01496
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6216
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59.1
2.6
309.1
361.3
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80.0
400.2
548.0
5.3

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134.59
119.25
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798.64
1,272.03

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40.00

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18

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Battery 7

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5,036
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