DOE – BCS TSD comments

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CSL's

- For Appliances, each CSL represents a level of technology
  - CSL 0 – "bad" NiCd
  - CSL 1 – "good" NiCd
    - Better conversion efficiency, lower standby
    - Better maintenance power management
    - Still limited by inefficiency of chemistry itself
  - CSL 2 – Li-ion
    - Cell has no maintenance power and better charge acceptance

CSL's

- Appliances have both NiCd and Li-ion in the market
  - NiCd still major proportion
    - Comprises 75% of pro tools
    - Over 90% of small appliances
    - No market driver other than retailers
      - Minimal utility advantage
- For non-appliances (electronics), most are Li-ion
- These share the same Product Classes
- We believe that there are some negative consequences resulting from this combination

Example - Product Class 3 – 23,116K total shipped

Application		2008 Shipments	CSL 0	CSL 1	CSL 2	CSL 3
		(1000's)	(kWh/yr)			
1	Portable DVD Players	7,140	6.4	3.6	0.4	-
2	Camcorders	4,206	0.8	0.4	0.1	-
3	Toy Ride-On Vehicles	3,548	11.3	5.5	2.0	-
4	RC Toys	2,100	2.3	1.1	0.4	-
5	DIY Power Tools (External)	1,753	10.7	5.4	2.1	-
6	Handheld Vacuums	1,377	38.8	21.5	2.2	-
7	DIY Power Tools (Integral)	1,169	20.0	11.1	1.1	-
8	Stick Vacuums	863	38.8	21.5	2.2	-
9	Air Mattress Pumps	250	2.3	1.1	0.4	-
10	Universal Battery Chargers	240	28.1	15.4	1.6	-
11	Wireless Speakers	226	2.3	1.1	0.4	-
12	RC Cars (Hobby Grade)	125	2.3	1.1	0.4	-
13	Blenders	61	2.3	1.1	0.4	-
14	Mixers	58	2.3	1.1	0.4	-
Weighted Average			**10.0**	**5.4**	**1.0**	-

Note: CSL 3 is not defined for this product class.

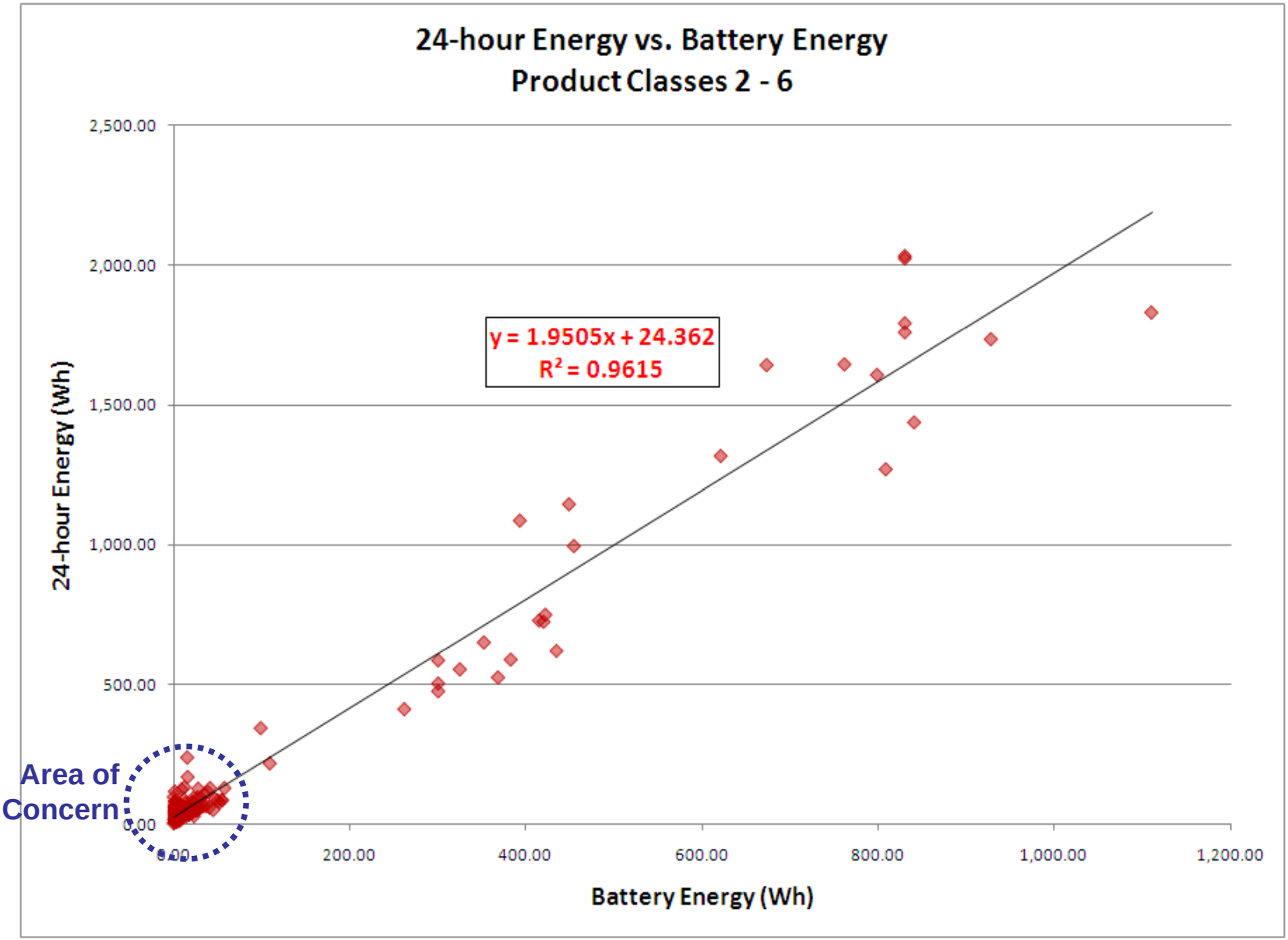
Example – PC 3

- Roughly half the shipments are from DVD players and camcorders
  - Virtually all Li-ion – low UEC
    - These should only be considered in CSL 2
  - But these are included in CSL 0 and CSL 1
    - Distorts CSL 1 because this mixes good NiCd Appliances with Li-ion consumer electronics
    - No energy savings in going to CSL 1 for these products
      - But shipments of these products are included
      - Good NiCd appliances compare against Li-ion consumer electronics
  - Li-ion based consumer electronics should be excluded from CSL 1

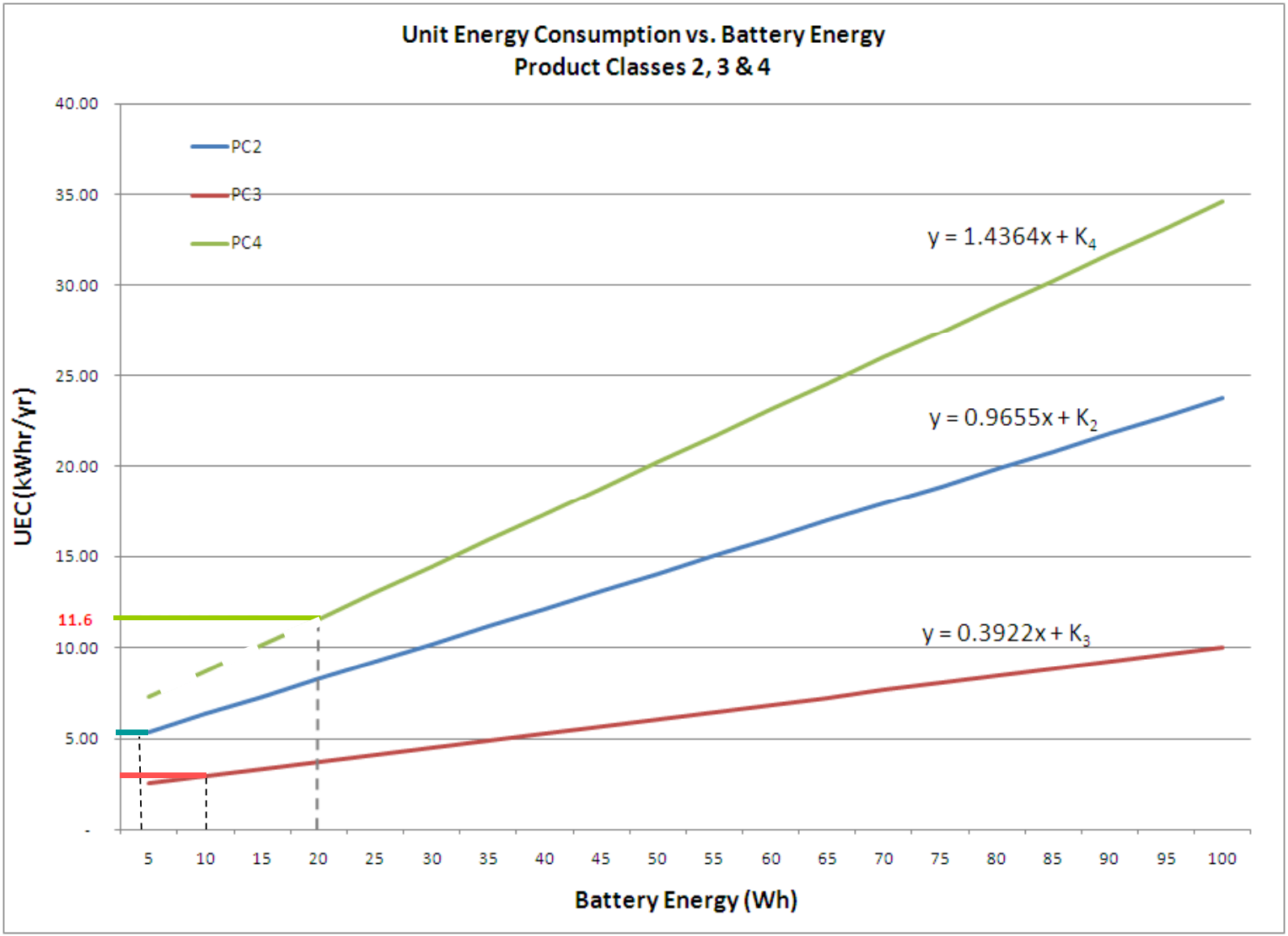
Scaling

- Scaling proposed at public meeting improves the applicability of CSL over a wide range of power levels
  - Appropriate for Eb levels higher the rep. unit
    - High correlation of data to regression
  - Inappropriate for lower levels
    - Effect of fixed losses dominate at lower levels
    - Evidenced by lower correlation
- Propose “break” at rep. unit for lower Eb’s

Original Regression Analysis



Proposed – “break” at representative unit



LCC – benefit overstatement
Usage and life in PC 3&4

- Usage in PC 3&4 – power tools not accurate
  - Pro - is: 2.70 should: 1.43
    - Why: 2 charges/ workday, 10 charges/7 days= 1.43
  - DIY detachable - is: 0.64 should: 0.29
    - Why: 2 charges/week, 2charges/7days = 0.29
- Life – some lifespans are overstated
  - Wearout based on usage – at old usages, life is curtailed
  - Market life at “normal” usage is no more than 5 years

LCC – benefit overstatement
Usage profiles in PC 2

- Usage of MADB appliances in PC2 is dramatically distorted by inclusion of consumer electronics in PC
  - Currently 0.55 charges/day
- Most MADB appliances see only a few charges a month (0.1 charges/day at the most)
- Many electronics in the product class are charged several times a week
- Consider segregating MADB’s from non-MADB’s for this PC

LCC – cost understatement

Cost of conversion to CSL 2 – Lithium

- Holding Safety and utility constant
  - Charging Safety –
    - analysis may not have considered uniform safety across all CSL 2 products and associated costs
    - UL 2575 should correct this in time
      - Drives redundant, cell-by-cell monitoring and control
    - Energy savings should not be an incentive to lower safety
  - Utility
    - Same performance: use of power cells rather than energy cells -
      - Eb lower for power cells – more cells for same capacity
    - Same Cycle life – requires discharge control
      - Analysis does not consider cost impact of discharge control

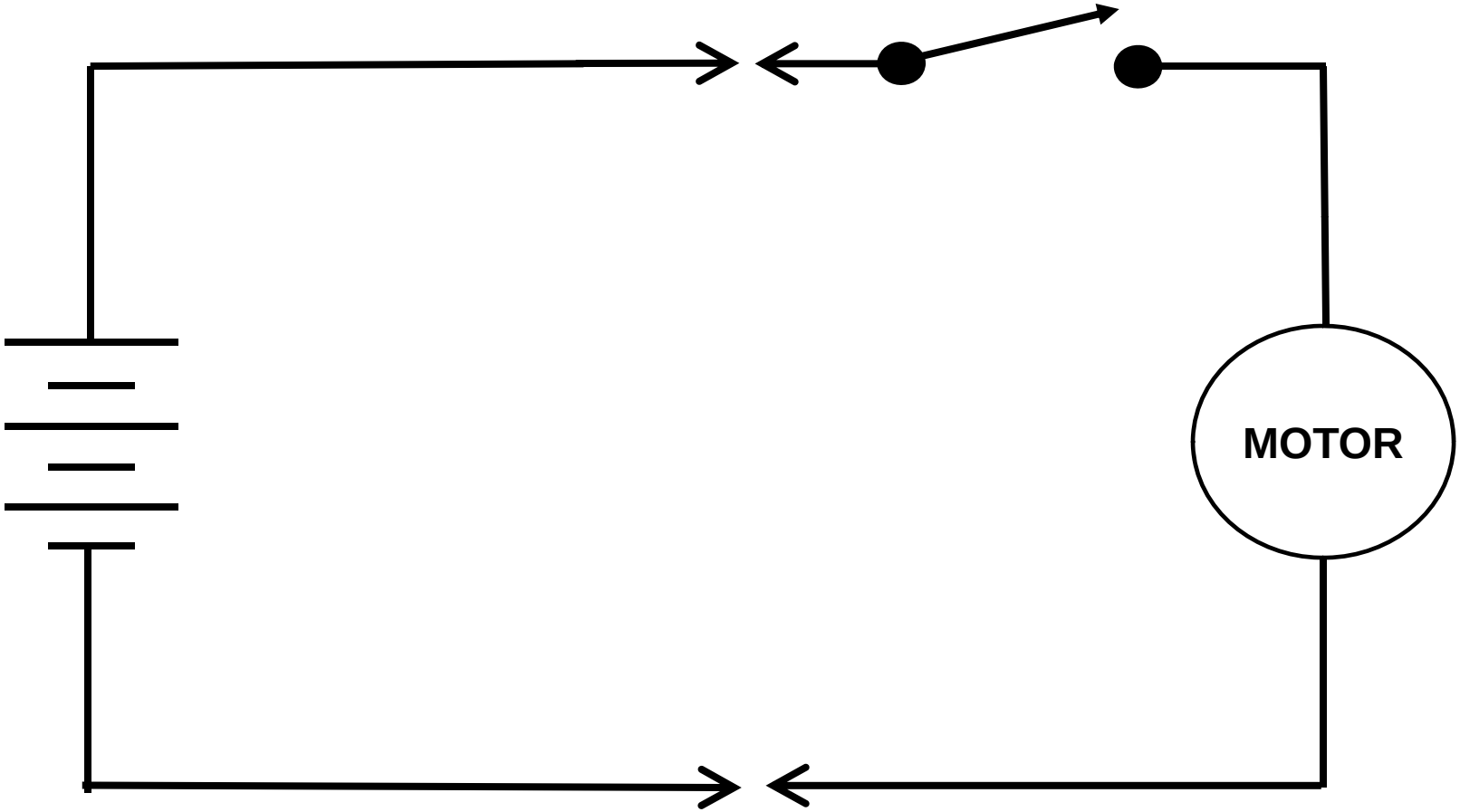
Safety - Charge control

- Specified in UL2575
  - While standard is not design proscriptive, state of the art usually requires:
    - Independent, redundant control
    - Cell-by-cell monitoring
- Some manufacturers follow this already
  - Unclear if cost analysis was sensitive to these differences between products

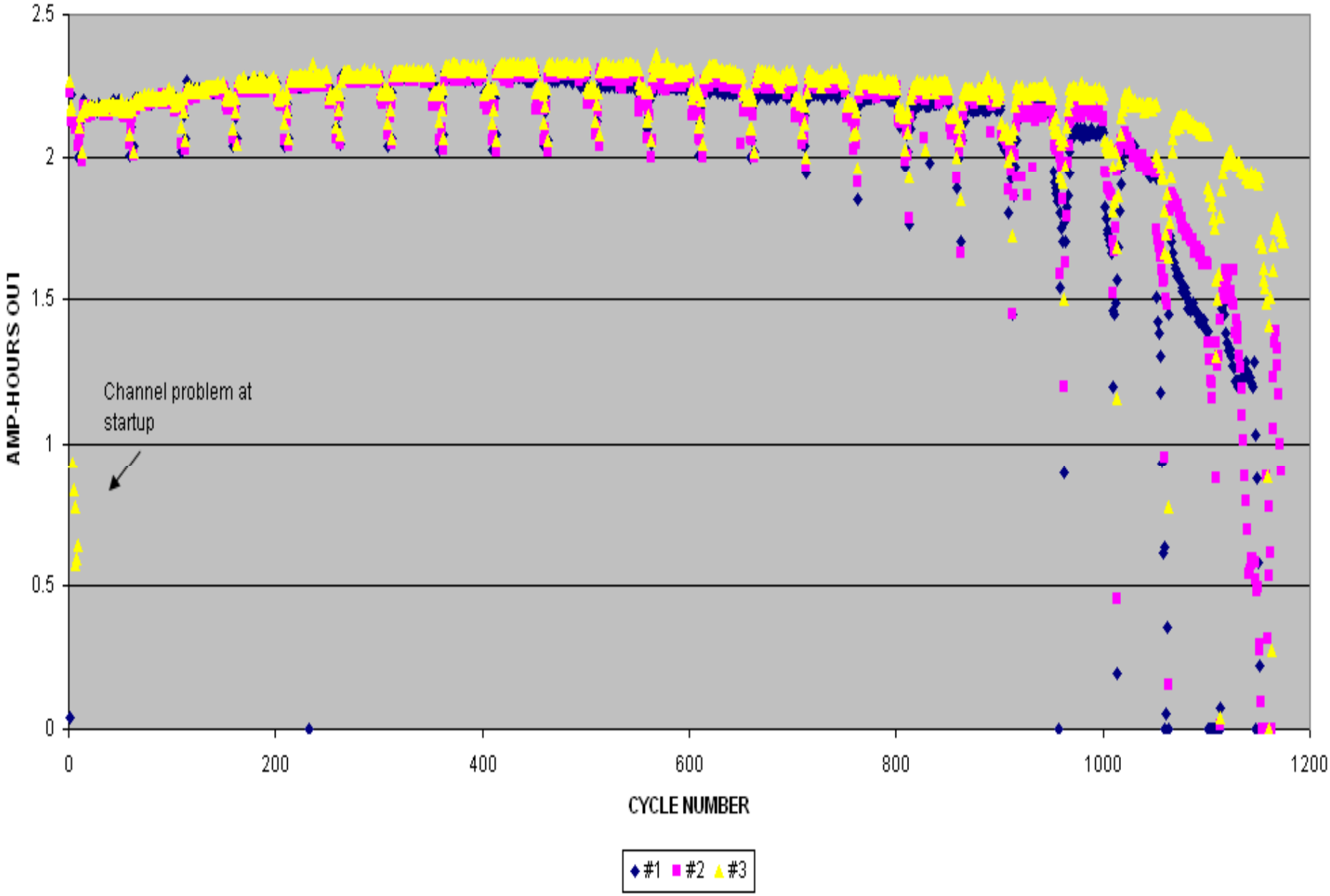
Utility - Cycle Life

- Pro tool users expect long cycle life
- Typically 800 – 1000 cycles from NiCd
- Li-ion without discharge control: 250
- Equivalent cycle life can be achieved with discharge control
  - Requires circuitry on load side
  - Not included in analysis as focus was on charging

Typical Ni-Cd System
No discharge control

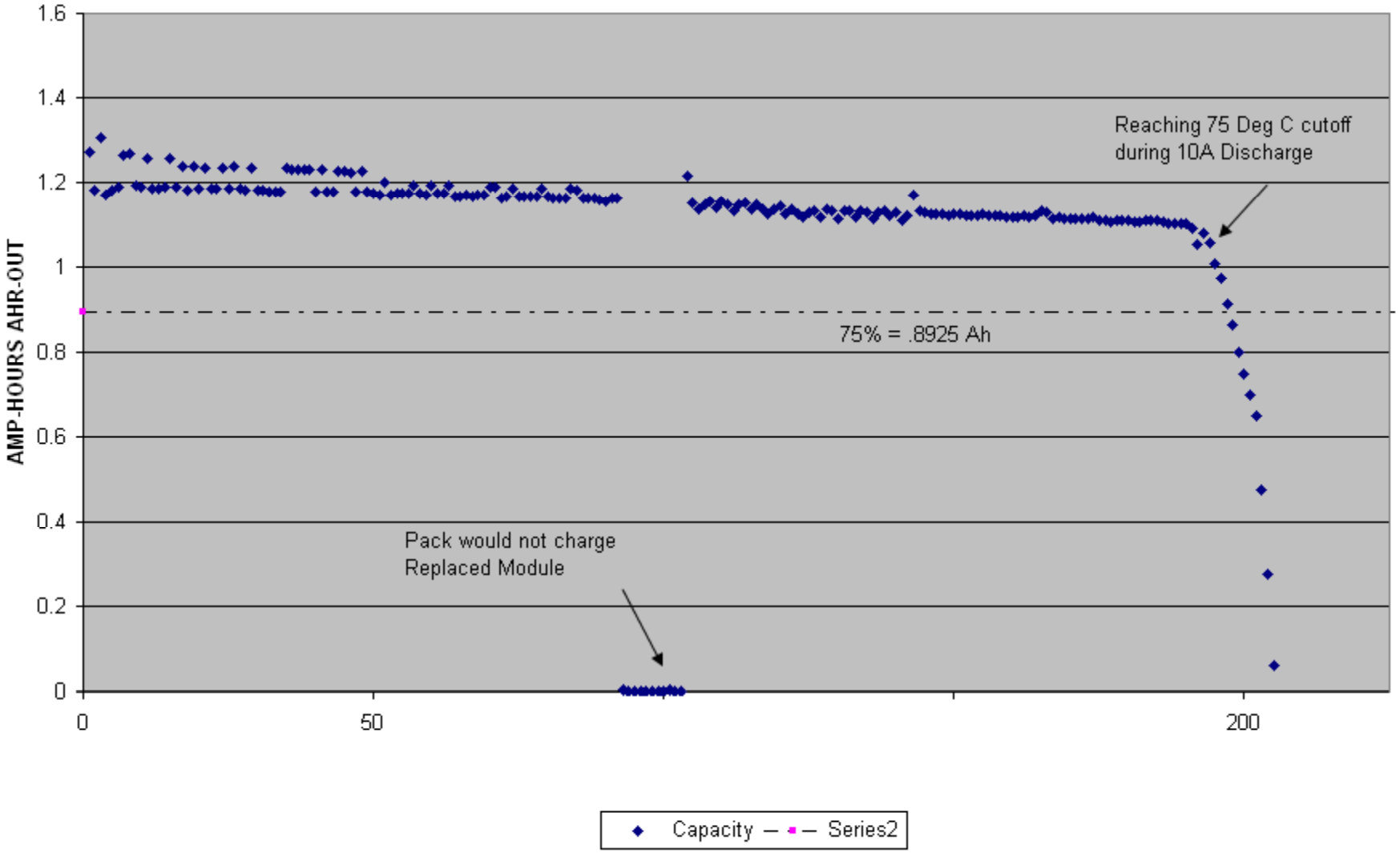


10A Cycle Life test 18V NiCd with 6V cut-off

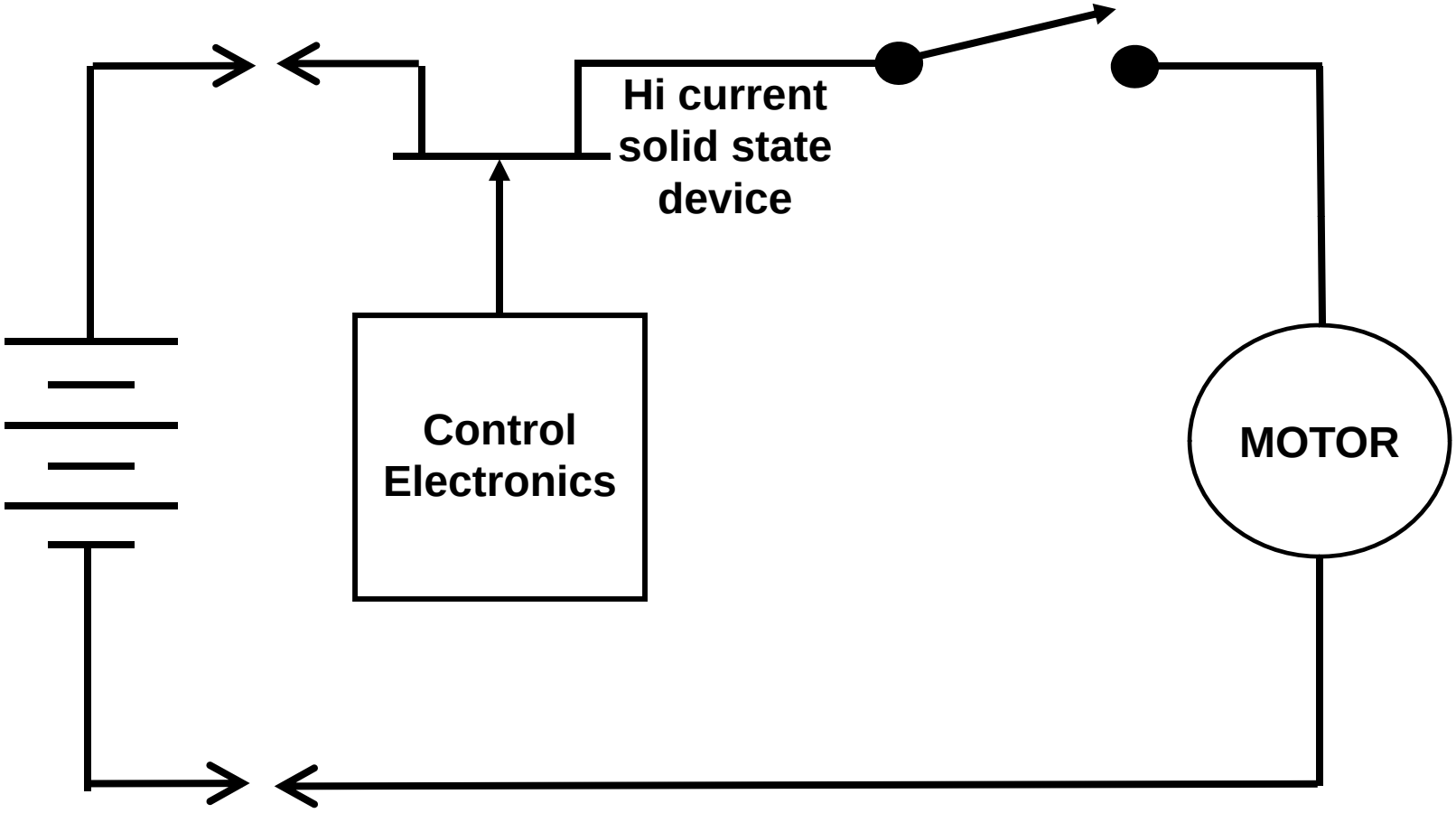


18V 1.5Ahr Pack

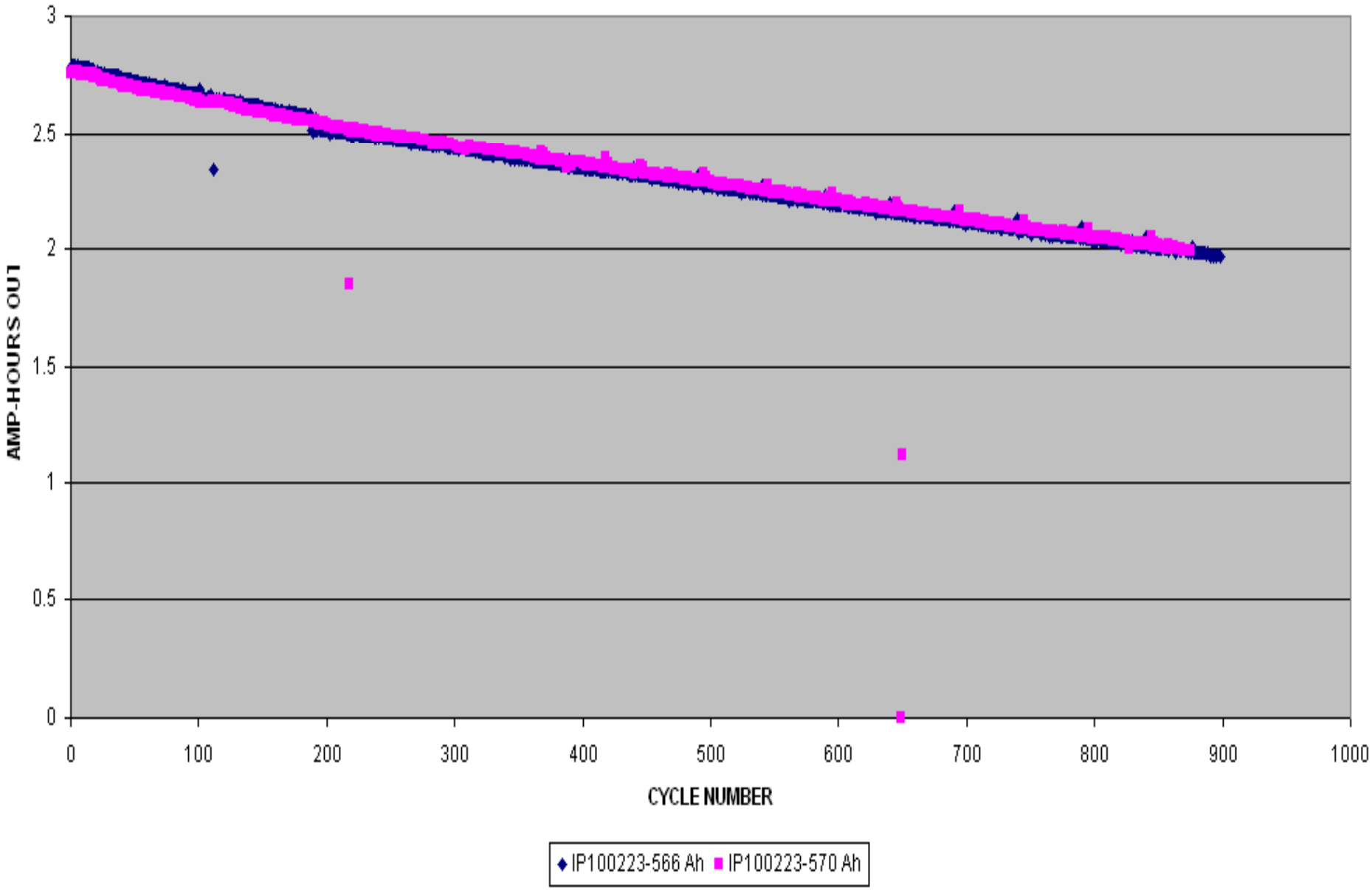
10A life with 5V cutoff



Li-ion System
Electronic Discharge control turns off at low cell voltage – extends life



10A Cycle Life – 18V Li-ion with tool cut-off



Multi-voltage Chargers

- Common in power tools
- Supported in TP
- How to handle in Standard ?
  - Especially when voltage range crosses PC boundaries
- We made suggestions in supplemental comments
  - Scaling helps