

Battery Test & Replace Summary of Results

1/16/2015

Project Scope

Intermec CK60
Intermec PB42
Intermec CN3
LXE MX7
Motorola WT4090

Presented By:

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Background:

Mobile printers and devices are in constant use in a Company’s operations. It is essential for these devices to be operating as efficiently as possible and for the batteries to be lasting full shift. Healthy batteries prevent work stoppages as well as costly power related device issues (i.e. service tickets, depot transaction costs, and “No Trouble Found” service returns)

Executive Summary:

GTS proposed that it conduct its Test & Replace™ program within all of a Company’s locations in order to identify, remove, and replace mobile device batteries that are no longer reliable. A pilot of the program was conducted within the Company’s location in Dallas, TX in order to more accurately gauge the scope of the program, and to collect data on the current state of mobile device batteries within the Company’s operations. **For the purposes of this pilot, no batteries were removed or replaced; only data was gathered.**

The goal of the pilot program is to increase visibility into the amount of batteries in operation and the condition of the batteries in use. The goal of the program is to remedy the following issues:

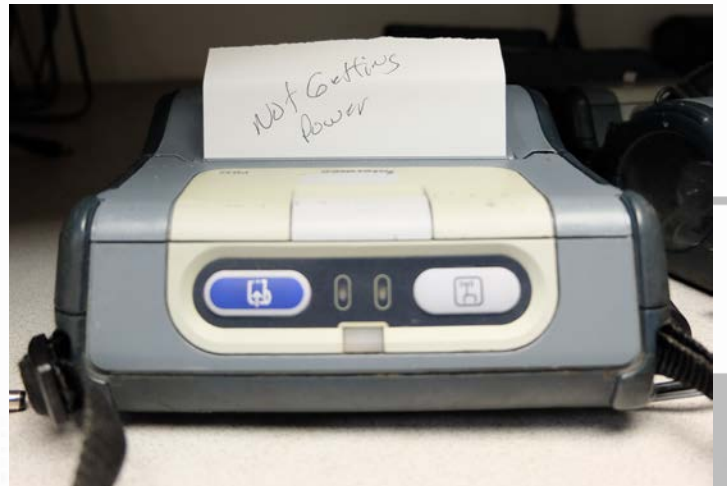
- Decreased worker productivity due to work stoppages to swap batteries
- Mobile device instability
- Skyrocketing service costs; particularly No Trouble Found “NTF” service returns
- Inefficient future purchasing due to limited inventory visibility

Testing Protocol:

For every battery tested, the following information was recorded.

- Total number of batteries in each location
- Manufacturer and model of each battery
- Battery date of manufacture
- State of Health (SoH) reading from GTS tester

“Not getting power” Note left on printer



Execution and Observations

The testing was conducted using RGIS technicians, and RGIS data collection equipment. In total 460 batteries were tested, and the testing took about 3 hours. Operations were not impeded in any way. It was clear that the batteries in these devices are used heavily and that there is not currently a battery management system in place. The fact that old batteries are not being removed was evident due to the wide range of manufacture dates of the batteries still in service. All of the drivers that we spoke with noted that dead batteries are a constant source of aggravation, and that they are rarely able to complete a route using a single battery.

Batteries were tested using both date of manufacture and the state of health reading from the GTS tester as pass/fail criteria. The pass/fail threshold from the tester was meant to equate to roughly 80% capacity. GTS recommends removing from service any battery that is below 80% capacity but this threshold can be adjusted based on input from the Company. Additionally GTS recommends, as an industry standard, that batteries be removed after 2 ½ years in service.

No batteries were removed from service. This pilot was conducted for the purpose of collecting data.

Summary of Results

CK60 Battery – Used in the CK60 device and PB42 printer

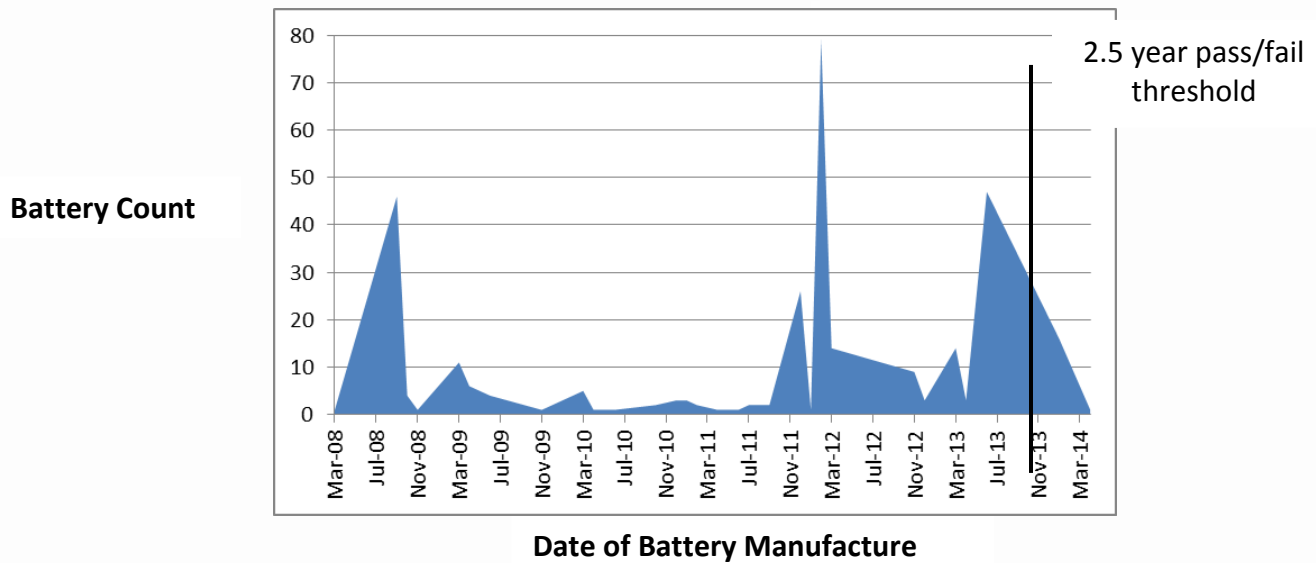
CK60	
Tested	435
Failed	368
Failure rate	85%
Average Date Code	Aug. 2011
Average State of Health	138

- 52 batteries were found in service with manufacture dates of 2008, over 6 years old.
- The average battery was manufactured in 2011, over 4 years old.
- All OEM CK60 batteries that were tested failed both on date code and SoH reading from the GTS tester.
- All passing batteries were after-market batteries that had been purchased within the last 12-18 months

- Two batteries still in use were physically damaged (shown below). Batteries with exposed cells can present a danger to the device user and should be disposed of immediately.



CK60 Battery Date Code Distribution Graph



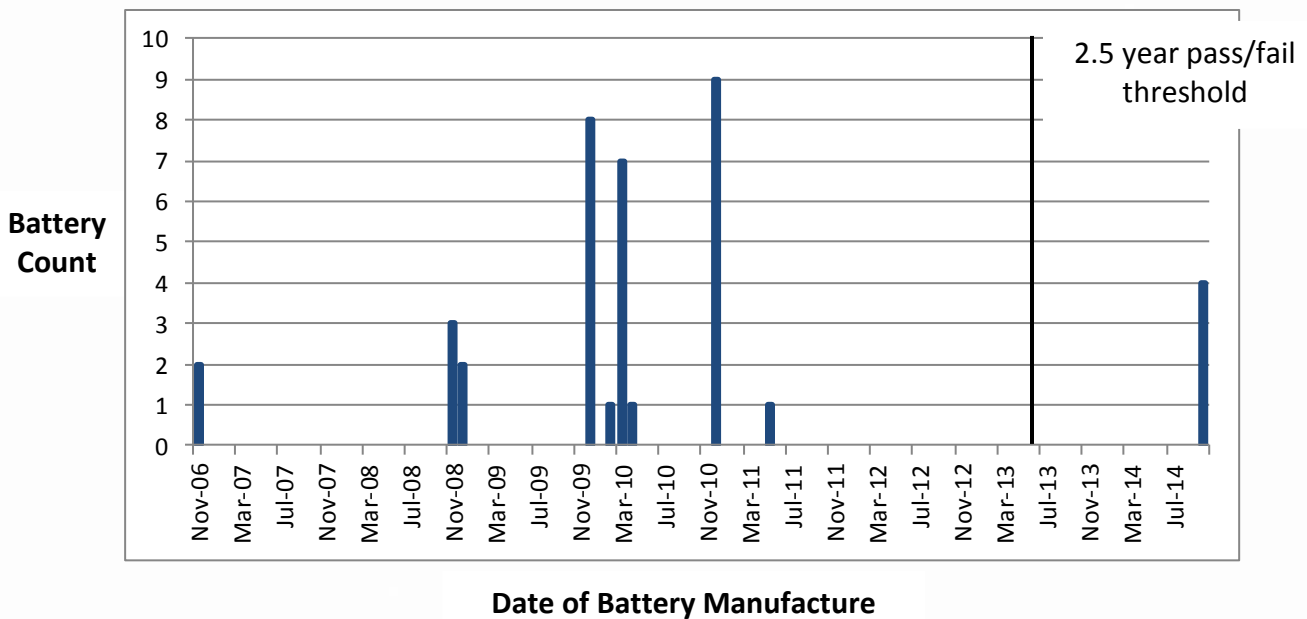
- The spikes on the graph above should correlate with battery purchases.
- The graph clearly shows that old batteries are not effectively being removed from service.
- Only 64 batteries passed based on the 2 ½ year pass/fail threshold.

CN3 Battery

- The oldest CN3 batteries found in service dated back to 2006, over 8 years old. These batteries should be removed from service and recycled.
- CN3 Battery power was a major source of complaint from drivers.
- Drivers noted that batteries frequently die, and when they do, delivery information must be recorded manually.
- There were only 4 new, after-market batteries. These were the only passing batteries.

CN3	
Tested	53
Failed	49
Failure rate	92%
Average Date Code	Jun-10

CN3 Battery Date Code Distribution Graph



- As the graph clearly shows, almost all of the CN3 batteries in use in this location have exceeded their useful life
- Based on the date code and SoH data, very few of these batteries are capable of lasting a full shift, and some may only power the device for a matter of 2-3 hours.

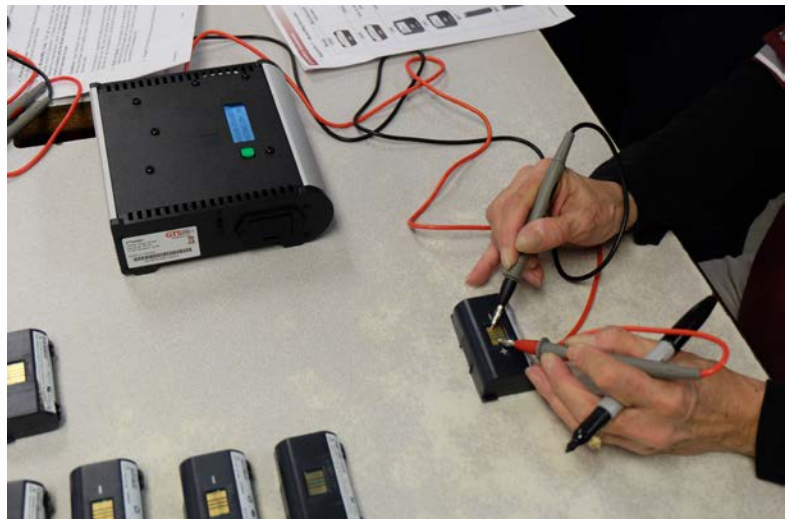
WT4090 Battery

- All WT4090 batteries were manufactured within the last 2 years and all passed the GTS testing.
- It was noted that these batteries were not a source of complaints, and there also were not many devices in use in the location.

WT4090	
Tested	12
Failed	0
Failure rate	0%
Average Date Code	Nov-13

MX7 Battery

- 14 MX7 batteries were tested.
- All serial codes were recorded, but date code is not printed on the battery label.
- Based on SoH readings from the GTS tester, about half of the batteries had reached the end of their useful life.
- These batteries were not a source of complaint, and it was noted that the batteries don't see particularly heavy usage.



Sample Test Requests

Store: 0000TX

RGIS
GTS-DEAN FOODS
Model/Mfg Combine Detail Report

Inv Date 01/16/15

4 of 6

Model/Mfg	Description	Status	Condition	Cycle Count	Date Code	Qty
10	Other Battery for CK60	PASS	1	26	1401	1
10	Other Battery for CK60	PASS	1	27	1303	1
10	Other Battery for CK60	PASS	1	27	1306	1
10	Other Battery for CK60	PASS	1	28	1211	1
10	Other Battery for CK60	PASS	1	28	1401	1
10	Other Battery for CK60	PASS	1	29	1306	1
10	Other Battery for CK60	PASS	1	31	1306	1
10	Other Battery for CK60	PASS	1	32	1303	1
10	Other Battery for CK60	PASS	1	32	1306	3
10	Other Battery for CK60	PASS	1	32	1401	1
10	Other Battery for CK60	PASS	1	33	1211	2
10	Other Battery for CK60	PASS	1	33	1306	1
10	Other Battery for CK60	PASS	1	34	1306	3
10	Other Battery for CK60	PASS	1	35	1211	1
10	Other Battery for CK60	PASS	1	35	1306	1
10	Other Battery for CK60	PASS	1	36	1306	2
10	Other Battery for CK60	PASS	1	36	1401	2
10	Other Battery for CK60	PASS	1	37	1211	1
10	Other Battery for CK60	PASS	1	38	1306	1
10	Other Battery for CK60	PASS	1	39	1212	1
10	Other Battery for CK60	PASS	1	39	1303	1
10	Other Battery for CK60	PASS	1	39	1304	1
10	Other Battery for CK60	PASS	1	39	1306	2
10	Other Battery for CK60	PASS	1	40	1303	1
10	Other Battery for CK60	REPLACE	1	8	1004	1
10	Other Battery for CK60	REPLACE	1	12	1202	1
10	Other Battery for CK60	REPLACE	1	20	1104	1
10	Other Battery for CK60	REPLACE	1	21	1202	1
10	Other Battery for CK60	REPLACE	1	24	1107	1
10	Other Battery for CK60	REPLACE	1	25	1202	2
10	Other Battery for CK60	REPLACE	1	26	1106	1
10	Other Battery for CK60	REPLACE	1	27	1202	2
10	Other Battery for CK60	REPLACE	1	28	1202	1
10	Other Battery for CK60	REPLACE	1	29	1107	1
10	Other Battery for CK60	REPLACE	1	29	1202	2
10	Other Battery for CK60	REPLACE	1	30	1202	1
10	Other Battery for CK60	REPLACE	1	31	1203	1
10	Other Battery for CK60	REPLACE	1	32	1202	3
10	Other Battery for CK60	REPLACE	1	33	1202	2
10	Other Battery for CK60	REPLACE	1	35	1202	2
10	Other Battery for CK60	REPLACE	1	36	1112	1
10	Other Battery for CK60	REPLACE	1	36	1202	1
10	Other Battery for CK60	REPLACE	1	37	1112	1
10	Other Battery for CK60	REPLACE	1	37	1202	1
10	Other Battery for CK60	REPLACE	1	38	1112	2
10	Other Battery for CK60	REPLACE	1	38	1202	1
10	Other Battery for CK60	REPLACE	1	39	1112	1

Recommendations

Based on the findings of this pilot, GTS believes that the Company can benefit greatly from a battery management system. From the data gathered, it is clear that there is not currently a system of removing old/ bad batteries from service, which in turn makes new battery purchases difficult to plan.

As described earlier in this report, these bad batteries are also major drains on productivity and an underlying cause of high device maintenance costs. It's also clear that at the site level, batteries are viewed as a consumable and sometimes an afterthought.

GTS believes that the Company would benefit immediately from using our high performance (upgrade to the OEM) batteries, coupled with one of our field service offerings.

Battery Purchases:

- GTS batteries are available for purchase through the Company's purchasing portal.
- GTS can supply a superior product for competitive prices and would like to be the preferred vendor for replacement batteries.

Test & Replace: (can be implemented immediately)

- Each battery is tested on site by a field technician
- Good batteries remain in service
- Bad batteries are replaced on the spot
- The Company is responsible for the cost of the new batteries and a service fee per site.
- The result is 100% guaranteed healthy batteries in every location, along with a complete inventory of battery counts and status to facilitate more efficient future purchases.
- Battery testing can be completed in all locations within one month

Power-as-a-Service: (can be implemented immediately)

- A Test & Replace program (as described above) is conducted annually in all the Company's locations.
- The Company is responsible for a small monthly per battery fee.
- For this per battery fee, GTS guarantees that every battery in operation is healthy.
- This program would be based on a 3 or a 5 year contract.