



TPPL vs Lead calcium

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“All VRLA batteries are the same!”

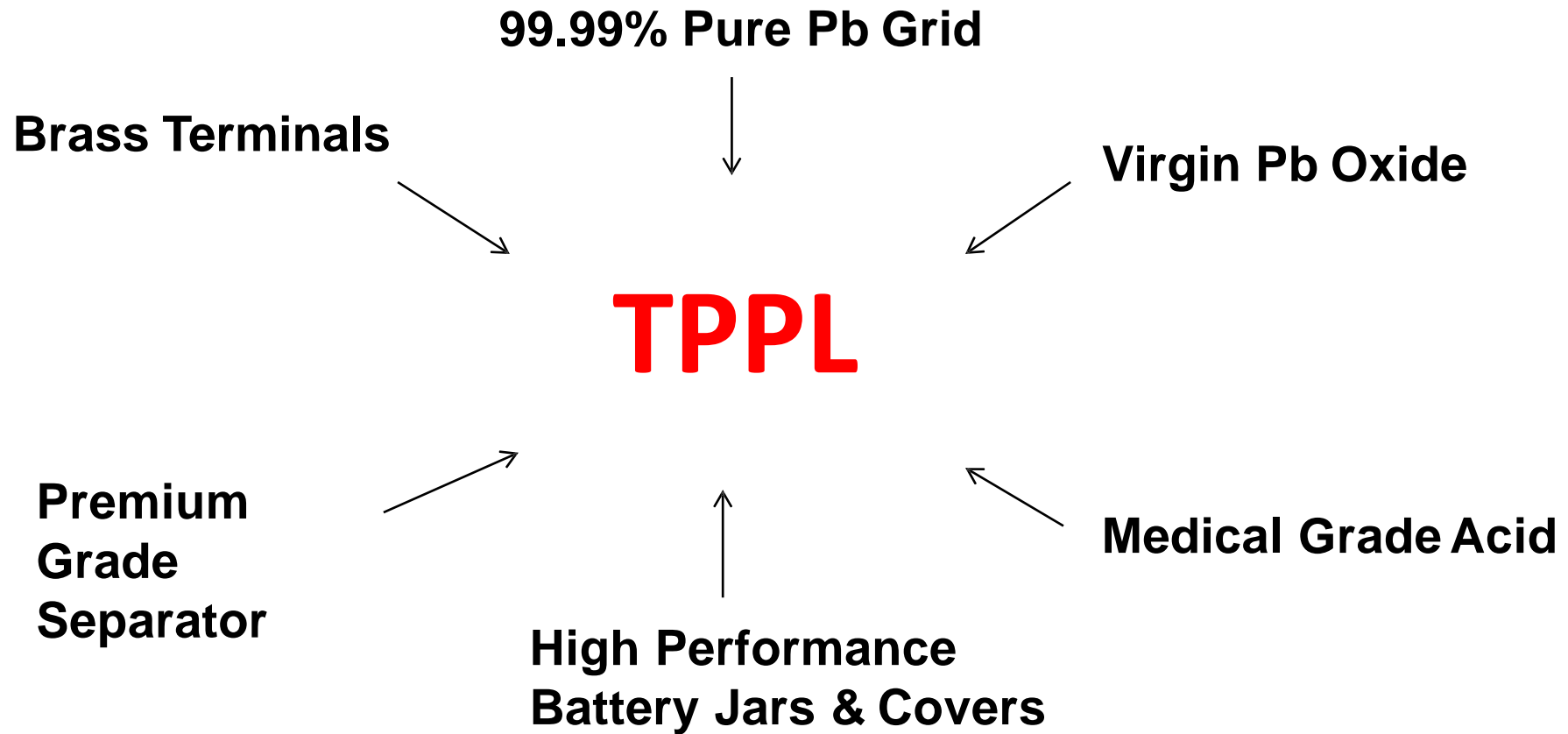
or are they?

Shifting market paradigm

Growing number of customers want...

- **More**
 - Service life
 - Shelf life
 - Recharge efficiency
 - Reliability
- **Less**
 - Volume
 - Weight
 - Maintenance
 - Cost over life (less TCO)

Thin Plate Pure Lead (TPPL) technology: High Purity Materials



Minimized Reactions = Maximized Life

Three decades plus of TPPL

Field proven



Cyclon Cells
(Cylindrical Plates)



DataSafe XE Batteries



Front access DataSafe XE Batteries



Front access SBS Batteries

TPPL technology – Benefits over PbCa

- The advantages of high purity materials & advanced manufacturing are:

- Low rate of self discharge

= Long Shelf Life

- Low float charge current

- Low rate of grid corrosion

- Low gassing rate

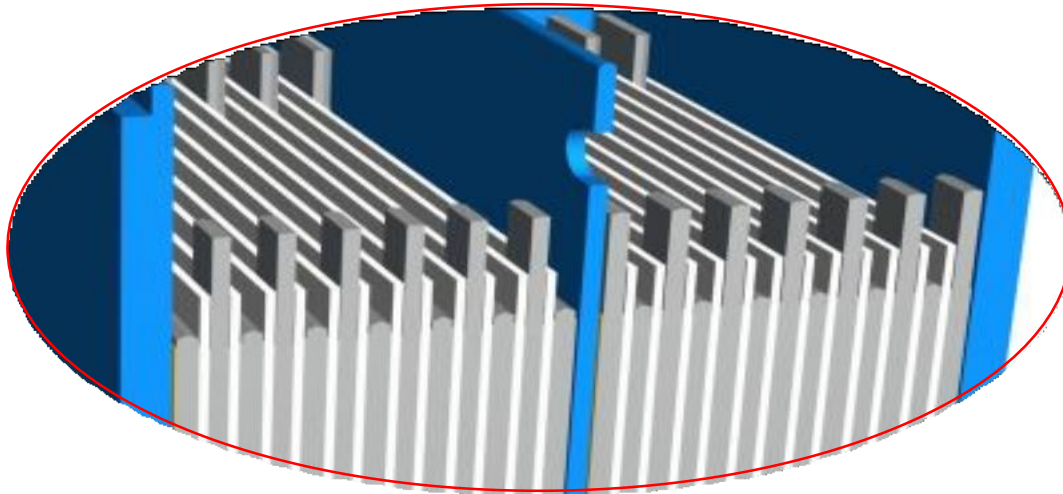
= Long Service Life

- Thinner positive grids

**= High Energy Density
High Performance**

Advantages of TPPL Technology

Standard AGM book-mold casting

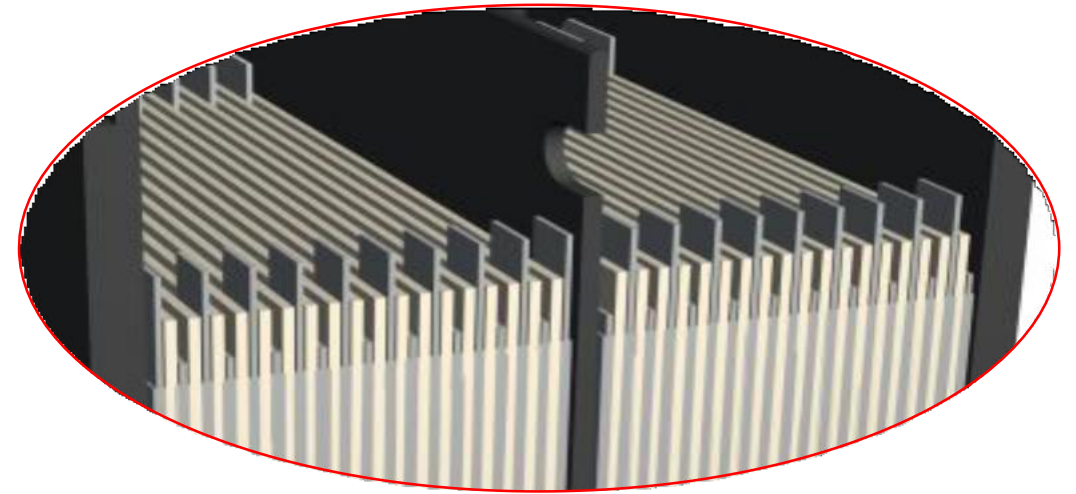


13 Plates per Section

0.5m²



TPPL



21 Plates per Section

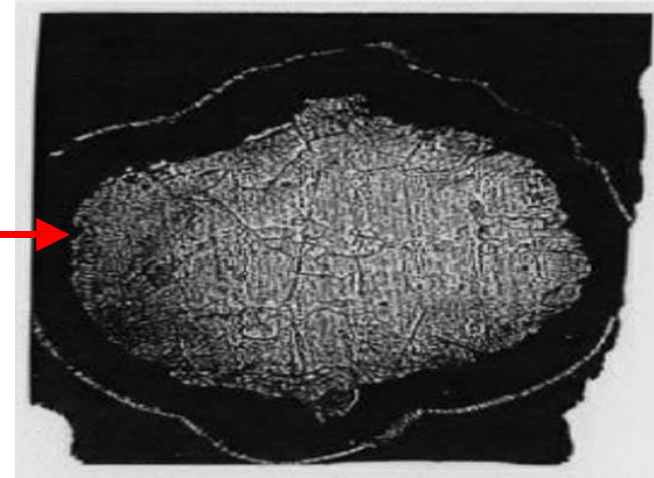
0.8m²



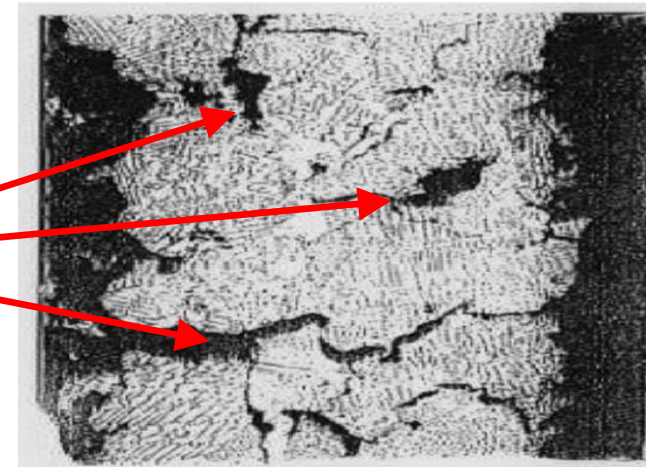
Grid corrosion comparison

Example after accelerated life test

TPPL cross section, very little corrosion or attack at grain boundary at float or elevated charge voltage



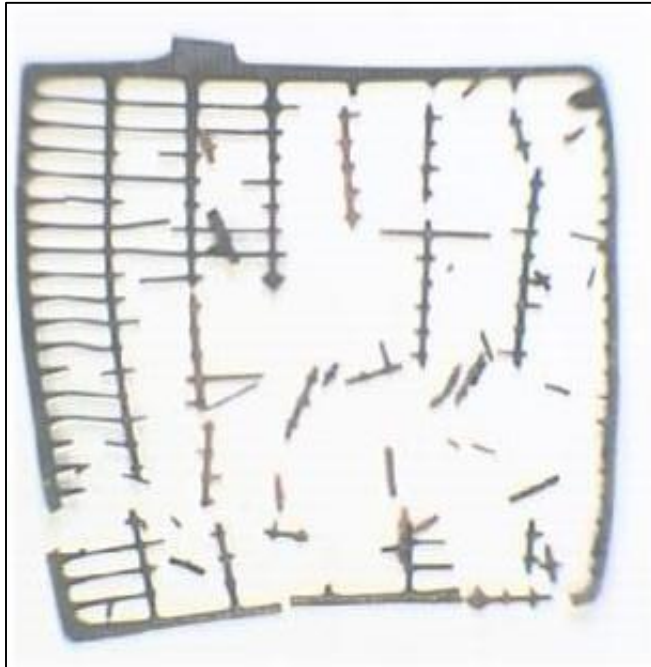
Lead-calcium alloy showing inter-granular corrosion leading to growth, loss of adhesion, loss of conductivity, happens during charging, faster at higher voltages



Grid corrosion differences

- Positive grid corrosion can't be avoided
- However, using Pure Lead grids, we can slow down this process

Standard book-mold casting



PbCa Cast Grid in 12 years

(Operated in float mode)

TPPL proprietary casting

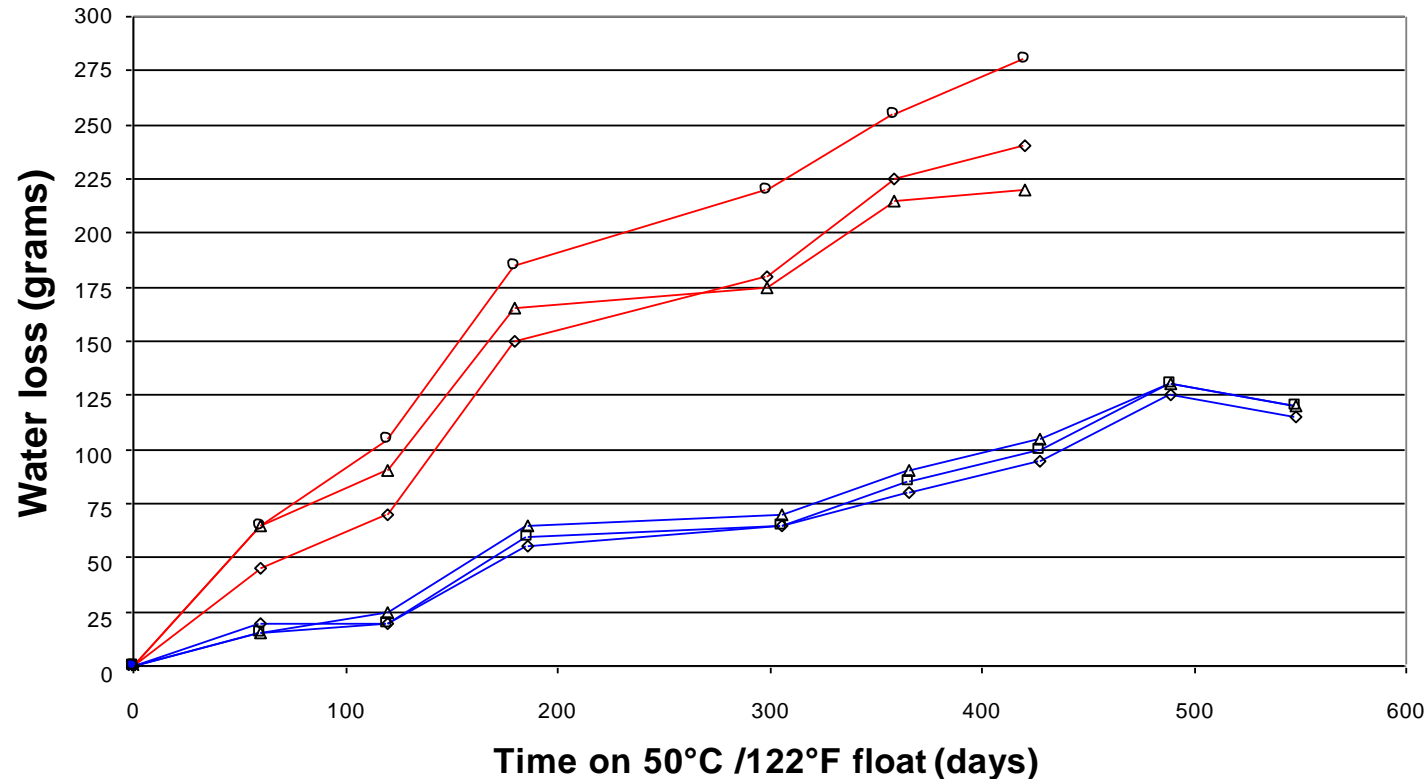


TPPL After 15 years

High H₂ & O₂ recombination efficiency

Lead Calcium (Pb-Ca) vs. Pure Lead (TPPL)

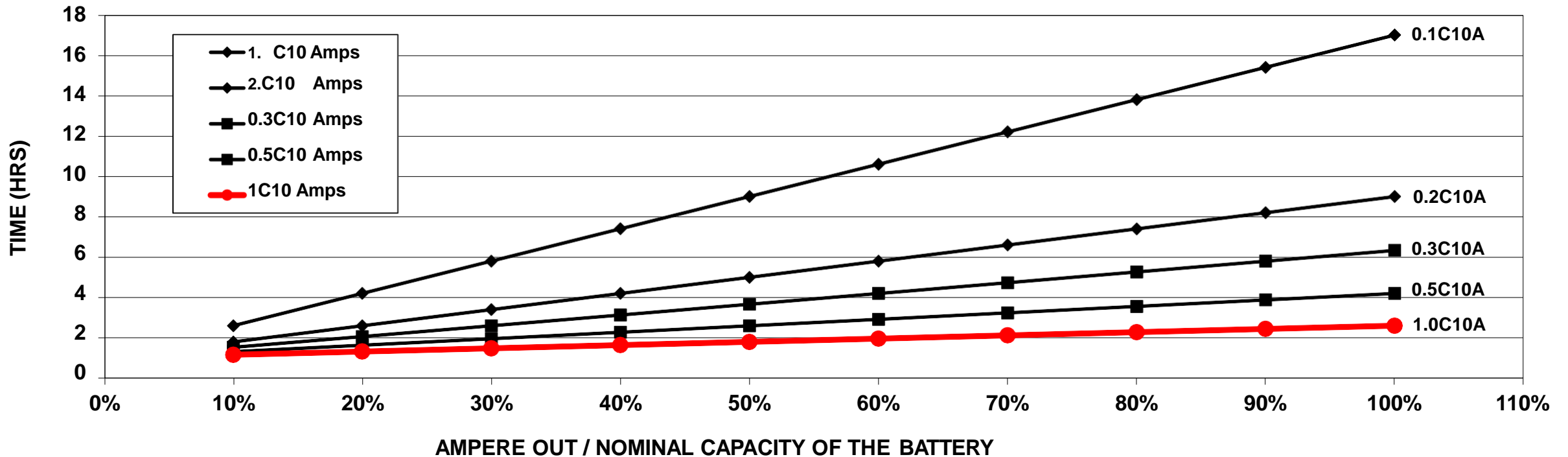
Water loss during accelerated float life test



- Low float current and high efficiency recombination means there is virtually no gas emission under normal operating conditions
- Greatly reduces chances of dryout & thermal runaway conditions

Faster Recharge

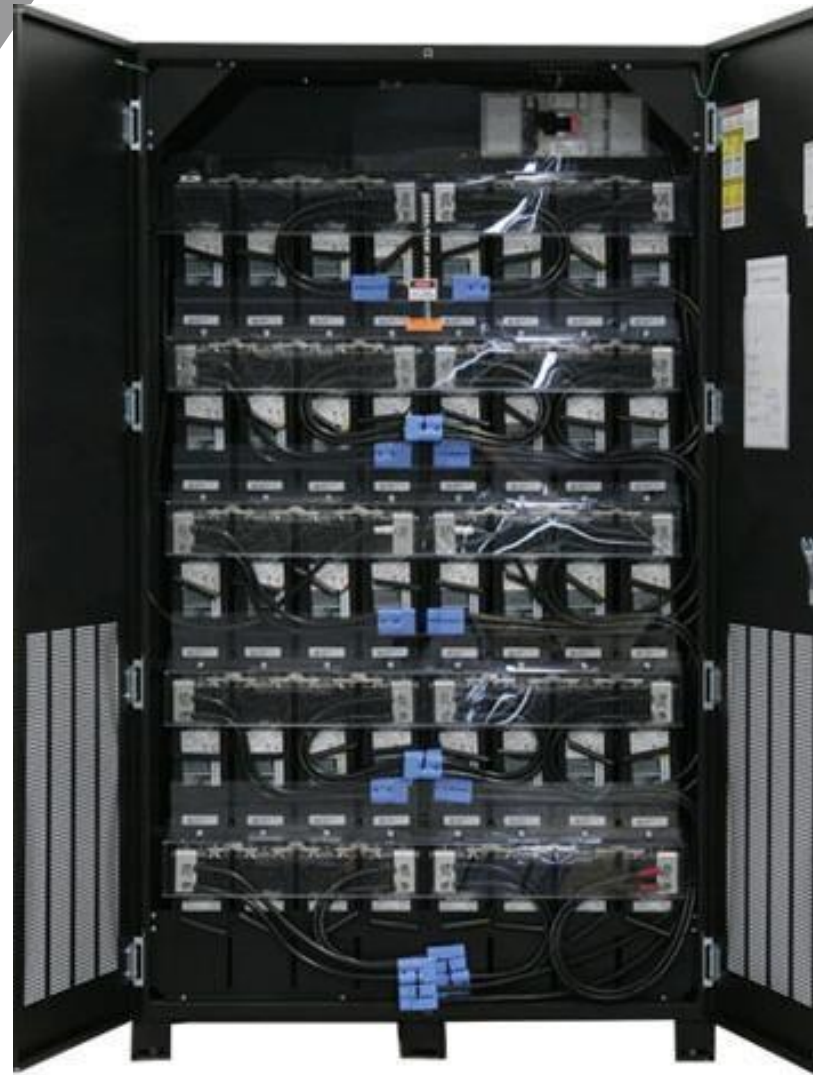
TIME TO FULL STATE OF CHARGE AS A FUNCTION OF
CURRENT LIMIT AND DEPTH OF DISCHARGE at 2.40Vpc



- Traditional Lead Calcium batteries are typically limited to $0.25C_{10}$ Amps charge current which prevents fast recharge. The higher recharge currents employed with **TPPL** makes faster recharge possible

VRLA Cabinets

Front and Top terminal
cabinets with integrated
breakers





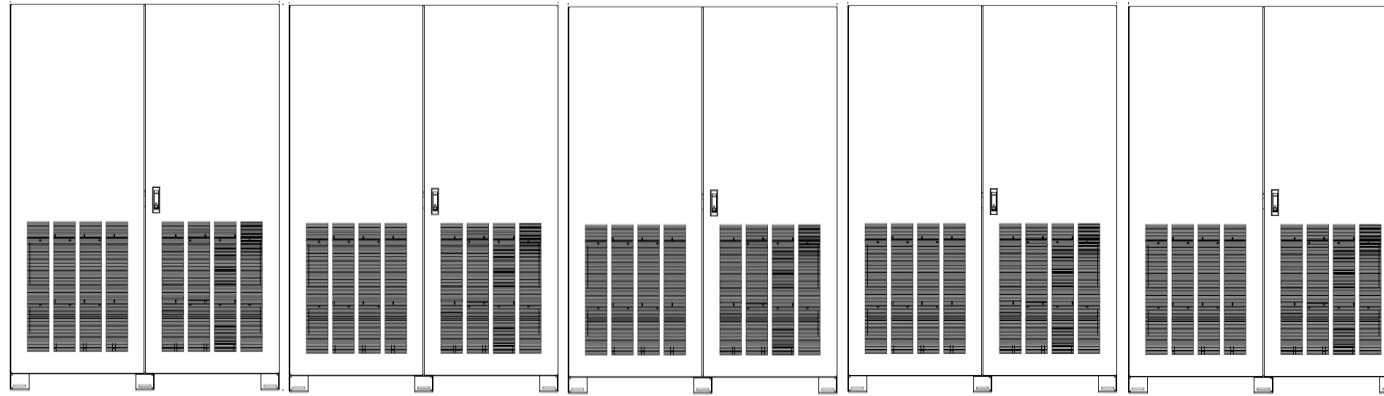
DataSafe XE

Thin Plate Pure Lead Batteries for UPS

Less Strings

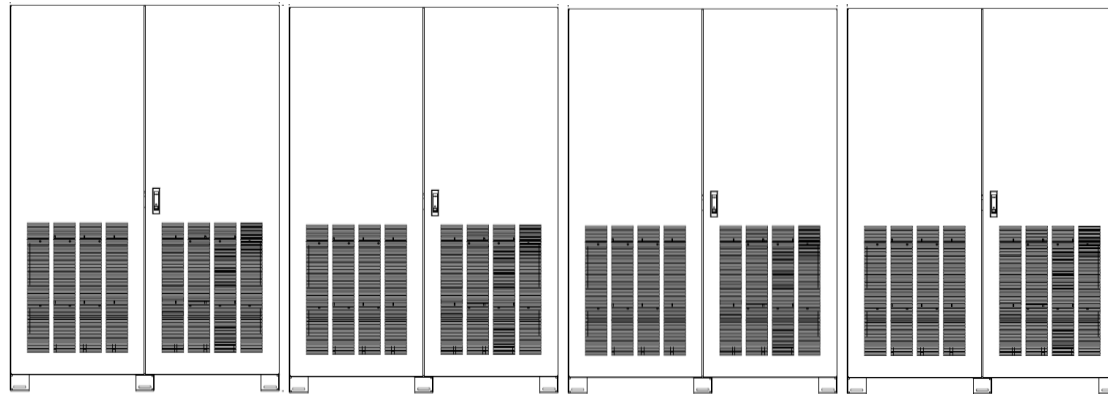
1000 kWb, 480vdc, HX vs. XE

**5 Cabinets
HX**



5 strings of 12HX540 (480vdc)
1000 kwb
BOL: 5:30
EOL: 2:30

**4 Cabinets
XE**

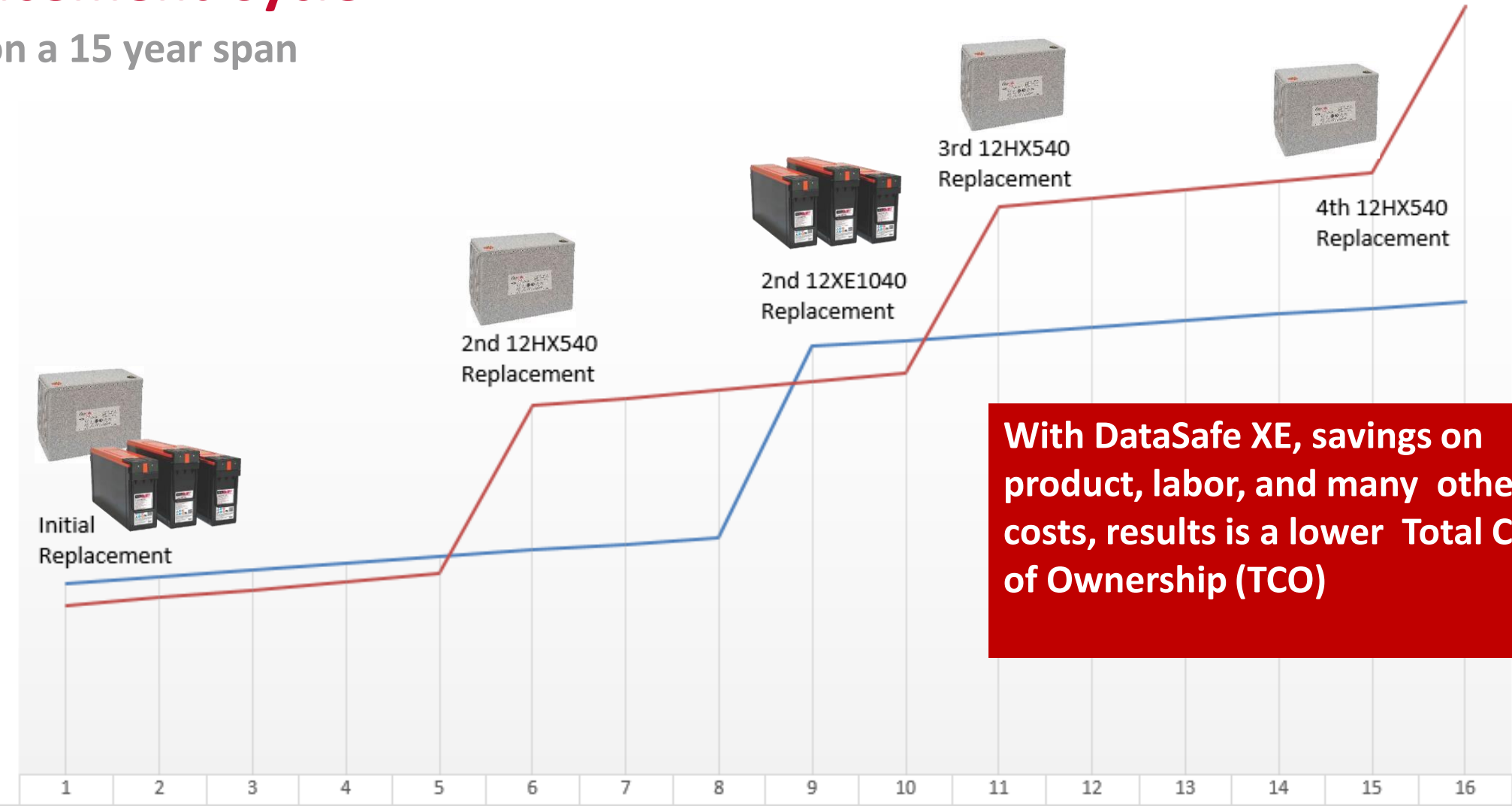


4 strings of 12XE1150 (480vdc)
1000 kwb
BOL: 4:30
EOL: 2:00

Replacement Cycle

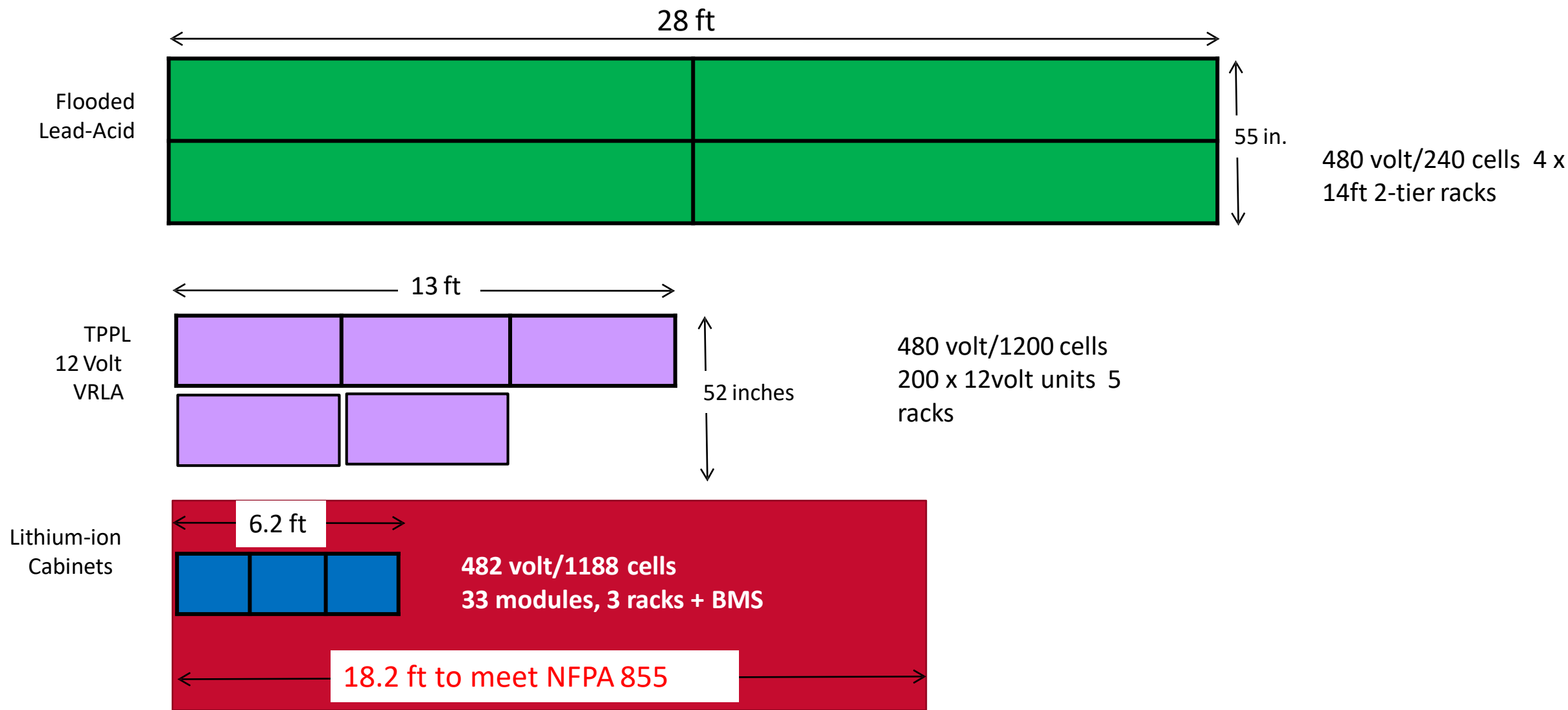
Based on a 15 year span

Cost



With DataSafe XE, savings on product, labor, and many other costs, results in a lower Total Cost of Ownership (TCO)

Footprint comparison- 750 KVA, 15min



Where is TPPL used?

Communications applications

Switchgear applications

Industrial UPS applications

Datacenter UPS applications

Plus many more...



Replacing existing VLA systems

Multi-String 3-Tier Rack VLA conversion to TPPL VRLA

- Huge space savings + Safer battery maintenance (no ladders necessary)
- Multiple String redundancy with a disconnect for each string



EnerSys Services Team

Turnkey, from Start to Finish

- Factory certified technicians nationwide
- Installation
- IEEE Preventative Maintenance
- Capacity Testing (Factory & Field)
 - Commissioning/Acceptance
 - Performance & Verification
- Battery Monitoring Systems
 - Installation
 - Removal
 - Preventative Maintenance
- Recycling



Summary

- Anywhere a conventional lead calcium AGM is used plus where customer is looking for:
 - Reliability
 - Longer float life than conventional AGM
 - Longer cycle life than conventional AGM
 - Wide operating temperature range
 - Long shelf life
 - Quick charge capability
 - High rate discharge capability in a smaller package
 - High rate discharge & excellent cycle life in the same battery



TPPL is FULLY proven in actual service conditions!



Thank You!

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