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Charley graduated from the University of South Dakota/Springfield in 1984 with an Associates degree in Automotive Technology and a Bachelors Degree in Automotive Science and Technology. He has spent 30 years in the automotive and heavy-duty truck industry working as a technician, trainer, warranty engineer, technical writer and service engineer. He has a wealth of electrical experience and uses it for solving modern day electrical problems fleets face on a daily basis. Charley is an ASE automotive master technician.

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Battery Review - Construction

- A battery is made of cells
- Each cell has:
  - positive plates
  - negative plates
  - electrolyte
  - separators
- A chemical reaction creates voltage!
Battery Review - Construction

- Connecting cells in series produces more voltage

- Basic design for a 12 volt lead acid battery

2.1 Volts X 6 = 12.60 Volts
Battery Review - Chemistry

- What happens when a battery is discharged?
- What happens when a battery is charged?
- Charging is reversing the chemical process that took place during the discharge by sending current through the battery in the reverse direction.
Battery Review – Determining State of Charge

- Measuring a battery open circuit voltage (OCV) is useful for estimating battery state of charge (SOC)

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<td>11.80</td>
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How Does Cold Effect the Battery?

- A battery is a chemical reaction
- Cold slows the rate of chemical reactions

**Batteries become “inactive” when they become cold!**
How Does Cold Impact Battery Starting?

- A cold battery has reduced performance
  - A fully charged, new battery at 0º F can lose up to 60% of its performance

- Engine starting requirements increase in cold weather:
  - Oil is thicker
  - Fuel is more difficult to vaporize

- If cranking requirements exceed the battery performance the vehicle will not start.
What can you do?

• Be sure vehicle has sufficient CCA
  • Check vehicle or engine manufacturers recommendations
• Make sure batteries and the cranking system are functionally tested using the correct procedures and proper equipment
• Use correct weight oil and proper fuel
How Does Cold Impact Battery Testing?

- A cold battery will not perform as well as a warm battery when tested
  - Account for temperature when testing
  - Determine temps using a temp sensor or by estimating by hand

- Failure to compensate for temperature typically leads to **failing a good** battery
What can you do?

- Determine battery temperature before testing and compensate
  - When manually load testing use temperature comp. chart
  - When using electronic testers provide accurate temp data
How Does Cold Impact Battery Charging?

• A cold battery will not charge as well as a warm battery
  • Charging times will increase
  • Charging rates will decrease, even if charging current is available

Why do batteries freeze?

• A fully charged battery won’t freeze until -70º F
• Badly discharged batteries can freeze at temps above 0º F

For in-vehicle pack charging high rate chargers, such as the PAC-100, are recommended

For out-of-vehicle charging separate channel chargers, such as the BUSPRO 660, are recommended
What can you do?

• Warm cold batteries before charging when possible
  • Bring vehicle/battery into a heated shop
• Use automatic chargers where possible and avoid attended manual charging
• Use remote sense and/or temperature compensated charging systems on vehicles

Remote Sense
Are There Any Benefits for Having a Cold Battery?

Yes!
Storing a battery in a cool/cold dry place is beneficial because:

• The self discharge rate is reduced
• The shelf life of the battery is increased

Avoid storing a battery in a warm/hot place because:

• The self discharge rate is increased
• The battery state of charge drops faster
• The battery shelf life is reduced
Questions & Answers
Thank you!