What an impressive Crowd

- Distinguished people that perform short circuit studies.
- That pay high liability insurance rates.
- That design critical standby systems.
- We welcome your input to this meeting!
- I will ask the questions
- I might cut you off so we can eat

Tonight

- NEC 2005 & 2008 – Selective Coordination
- Why
- Politics
- Is there a need?
- What will it cost?
- Potential solutions
- Can ATSs with a 30 cycle short circuit rating help?

NEC 2008 -Selective Coordination

- NEC(2008) 700.27 Coordination: requires “Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.”

- NEC(2008) 701.18 Coordination: requires “Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.”

- NEC(2008) 517.26 Application of other articles: requires “The essential electrical system shall meet the requirements of Article 700.”

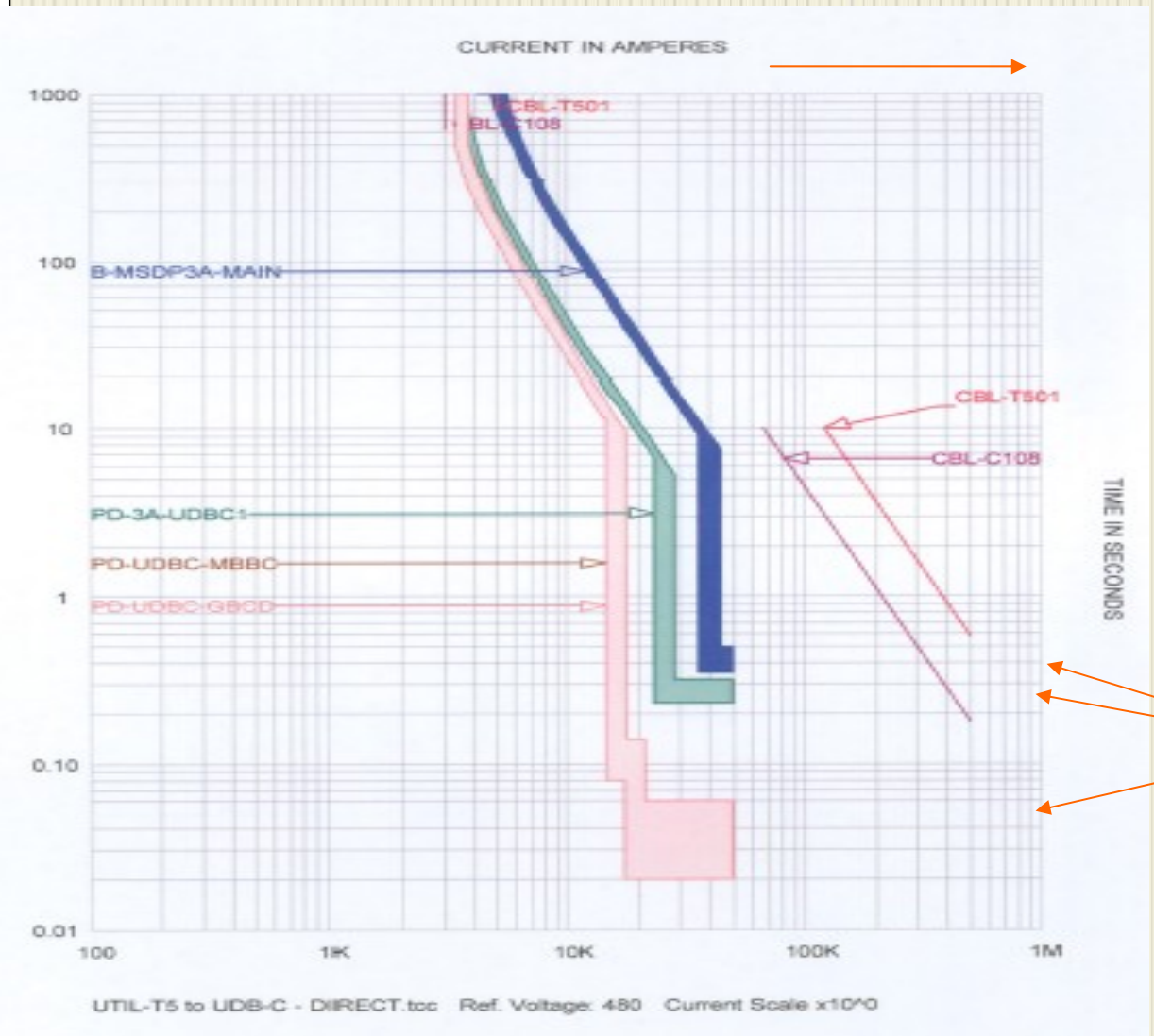
- NEC (2008) 708.54 Critical Operation Power Systems

The overcurrent protective devices may include the following:

- Molded Case Circuit Breakers
- Fused devices
- Insulated Case Circuit Breakers
- Air Power Circuit breakers

So what do you know about Selective Coordination?

Selective Coordination - Good

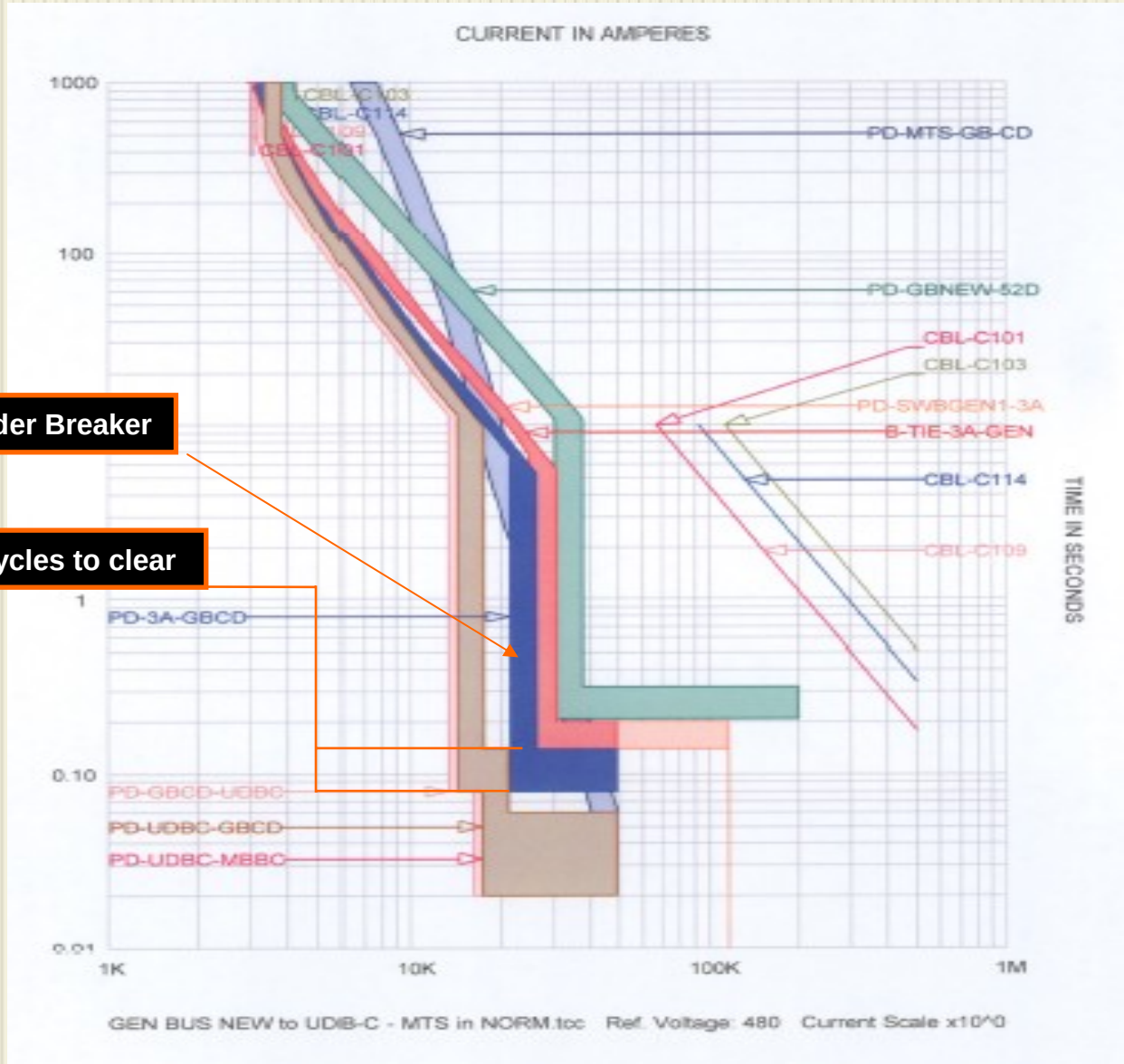


No overlapping fault current of individual devices.

This is coordinated properly.

In a perfect world this is great.

Selective Coordination - BAD



ATS Feeder Breaker

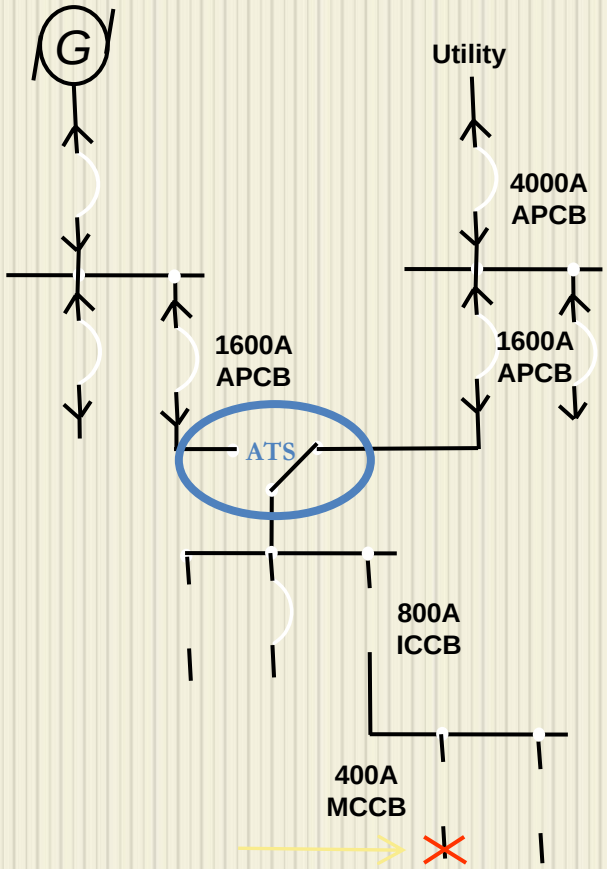
8 cycles to clear

In this case, since it takes 8 cycles for the upstream breaker to clear the fault, a 3 cycle rated transfer switch is inadequate.

NEC Article 100

- “Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings”

Selective Coordination



MCCB's (Molded Case Circuit Breaker) Instantaneous or Current Limiting Devices.

ICCB's (Insulated Case Circuit Breaker) are 30 cycle withstand or up to 4 Cycle Instantaneous.

APCB's (Air Power Circuit Breaker) are 30 cycle withstand devices.

An overcurrent event (overload, short circuit, or ground fault) here should trip the 400A MCCB

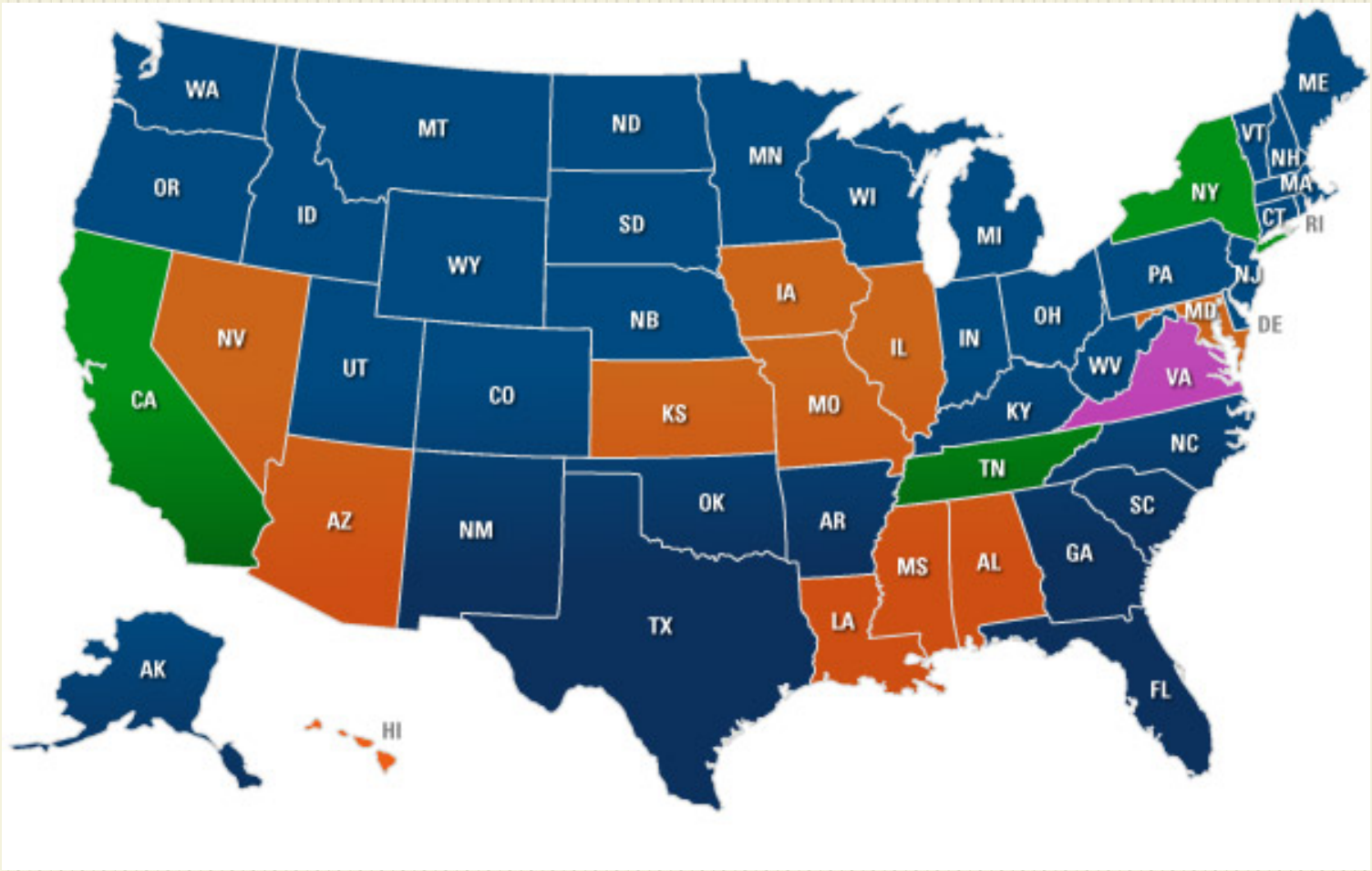
Code Rulings

- All kinds of panels and committees that are debating the value.

- The bottom line is that selection coordination is coming.

- We are not sure yet how it will all settle out?

2005 Code Adoption



What will California Do?

- California to adopt NEC 2005 on January 1, 2011.
- What will Jerry Brown want to do?
- Should we have the design consultant be responsible like Massachusetts?
- Do you have good lawyers?

Is there a need for selective coordination?

What are really the problems?

- Breakers are not set correctly in the field?
- Replacement breakers are not set correctly?
- Ground fault equipment not set correctly?
- 3 phase bolted faults are rare, more ground faults and arcing faults.
- Do you have an experience on significant selective coordination problems
- Russelectric has seen many, many events over 50 years!

So, is the issue Political?

- Is the solution dependent on which product are specified?
- Comments from the Breaker dudes
- Comments from the Fuse dudes

What is the cost?

- Do our clients care about cost?
- Do the clients want to pay your liability insurance?

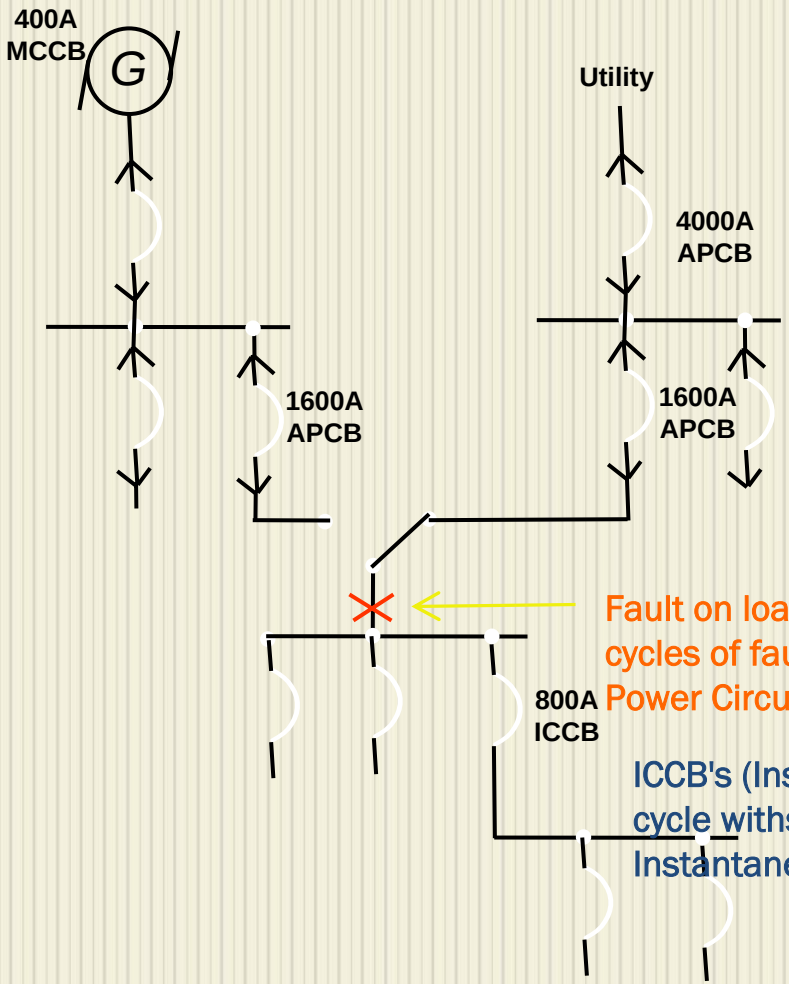
Many options for Selective Coordination

- Use larger frame breakers, electronic trip adjustments
- Consider the TCC curves from manufacturers that consider arc impedance
- Increase impedance of the cables
- Divide larger loads into smaller loads
- Mixing of overcurrent protective devices
- Change the type of breaker
- Consider Zone Selective Interlocking (ZSI)
- What is your favorite method?
- Or?

Why don’t we look at the heart of the emergency and standby system, the ATS

Did you know that our ATSs have not always been cooperative in the past!

Selective Coordination



APCB's (Air Power Circuit Breaker) are 30 cycle withstand devices.

Fault on load side of ATS could see up to 30 cycles of fault current depending on the Air Power Circuit Breaker settings that is feeding it.

ICCB's (Insulated Circuit Breaker) are 30 cycle withstand or up to 4 Cycle Instantaneous.

MCCB's (Molded Case Circuit Breaker) Instantaneous or Current Limiting Devices.

What if we build a 30 cycle switch

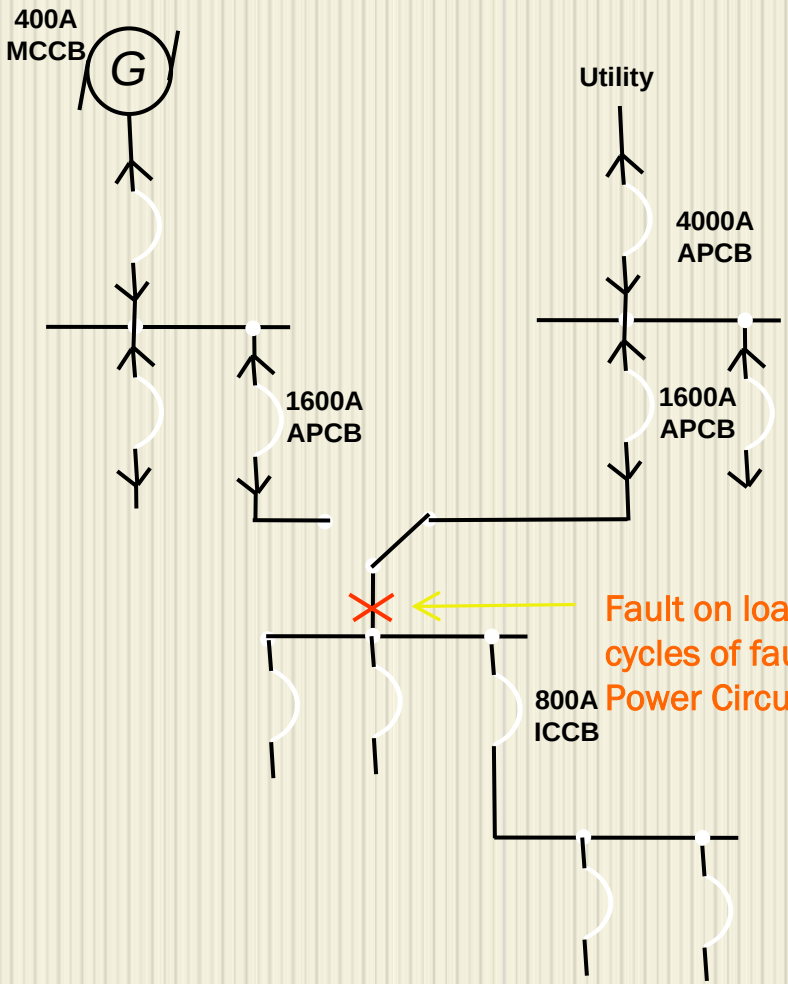
- That should not be very hard

The switch is the heart of the system

Now that we have a 30 cycle switch

- We can easily coordinate with downstream switches.

Selective Coordination



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UL 1008 makes us be the heart

- Closing and withstand testing
- Short time current test
- Overload test
- Endurance test
- Temperature test
- Dielectric voltage – withstand test

This is why you want ATSs to switch loads !!!!!

UL 1008 Short Circuit Test History

- Around 1989 UL introduced an optional 3 cycle test for any over-current protection device.

  ➢If a manufacturer didn't test to 3 cycles, they would be required provide a label that lists all breakers that the switch was "coordinated with".

  ➢This requirement did not take into consideration air power circuit breakers APCB's. Some of these breakers were 4-5 cycle devices (GE AKR and Westinghouse DS) Oops!

- January 9th, 2002 UL introduced an optional short time current rating test.

  ➢ They now have a 30 cycle withstand and a close test

Overcurrent Protective Devices

- Molded Case Circuit Breakers
- Fused devices
- Insulated Case Circuit Breakers
- Air Power Circuit breakers

We like Low Voltage Air Power Circuit Breakers

- Their instantaneous can be removed as with other types of breakers with electronic trip units.

Complete Coordination

A 30 cycle UL rated Transfer Switch truly gives you complete coordination with any over-current protective device.

Do you specify UL1558 switchgear for critical facilities?

- All we need to do in stall a 30 cycle switch and I think we have simplified selective coordination.
- The cost of the 30 cycle switch is about 10% higher than 3 cycle.

What is the Debate

- The Perfect World
  - ➢Increased installation costs.
  - ➢Difficulty of implementation and enforcement.
  - ➢Selective coordination does improve reliability.
- Equipment Standards
  - ➢The lack of official safety standards
  - ➢UL has no criteria for what constitutes selective coordination.
  - ➢Manufacturer can state what it construes to be selective coordination.
  - ➢A manufacturers battle.
- Breaker vs. Fuse
  - ➢The practical application and enforcement of the code.
  - ➢The breaker is usually on the losing side.
  - ➢Estimates of increased costs.
  - ➢Few people want fuses.
- Safety
  - ➢The time element introduces more energy into the system.
  - ➢Arc Flash!

Questions

- I have memory sticks with IEEE articles, IAEI articles, etc.
- I have also some hard copies of these articles
- I have some 3 cycle and 30 cycle hardware to review
- Let's eat