The Impact of Overcurrent Protection Practices on System Reliability

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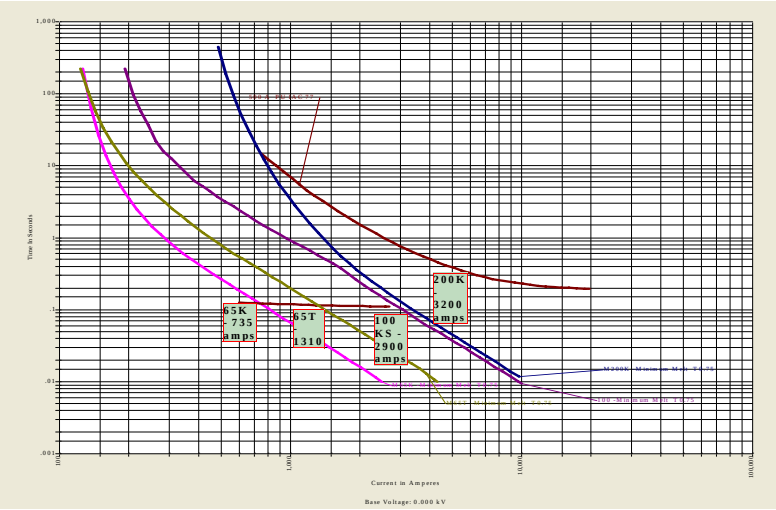
Topics

A. Fuse Save vs. Fuse Blow
B. Automation
C. Reclosers
D. Sequence Coordination
E. Single Phase Tripping
F. Lateral Fuse Philosophy
G. Distribution Transformer Fusing
H. Fault Impedance Pitfalls
I. Fault Recording Advantages
J. New Products
K. Challenges

2

A. Fuse Save vs. Fuse Blow

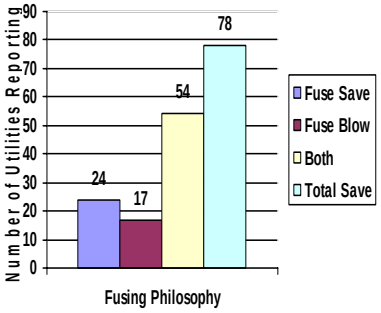


3

Survey Results

- **Fuse Blow** Philosophy **reduces MAIFI** but **increases SAIDI**
- **Fuse Save** doesn't work in high short circuit areas
- Most utilities use **both** philosophies

Industry Survey



4

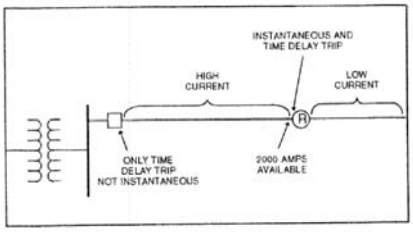
Limits of Coordination

Breaker/Recloser (total interrupt time in cycles)	65K Min Melt	200K Min Melt
2	1500	5962
3	1148	4700
4	1061	4334
6	813	3595

5

High/Low Scheme

- **Fuse Blow** near the substation
- **Fuse Save** where fault currents are low enough to allow proper coordination



6

Sectionalizers

- Reduce nuisance operations in high current areas
- Used where fuses are too fast
- No coordination curve
- Some fit into existing cutouts

7

B. Automation

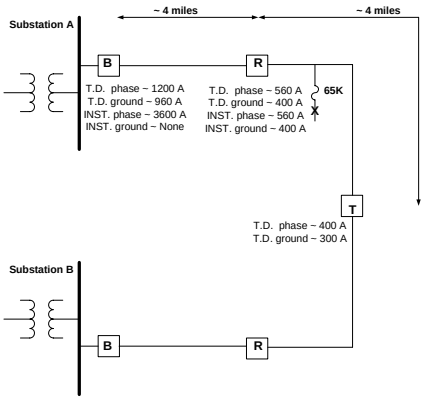
- New systems are flexible and reliable
- No limit to number of controls
- Logic is programmed in
- Scaleable

8

C. Reclosers

(feeder contribution)

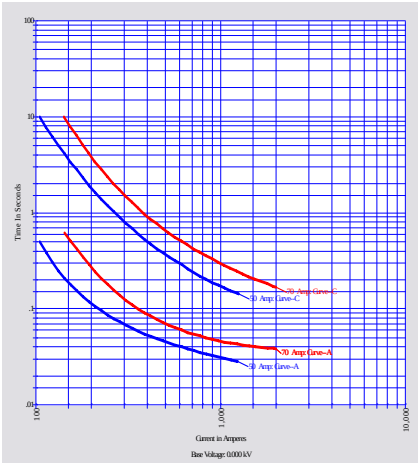
	SAIFI	SAIDI
Base Case (no line reclosers)	1.6	3.3
Add Midline Recloser	1.2	2.6
Add Loop Recloser	1.0	2.1
Allow Single Phase Switching	0.8	1.8



9

D. Sequence Coordination

- 2 reclosing devices in series
- Both reclosers see the fault
- Upstream device advances its control through its fast operation



10

E. Single Phase Tripping

- New reclosers allow single phase operation
- Single or three phase lockout
- Can reduce SAIFI and SAIDI at virtually no cost

11

F. Lateral Fuse Philosophies

- **Load** – tends to create nuisance operations. Difficult to “fuse save”.
- **One size** (e.g. 65K) – simple but generally limits coordination near the substation
- **Fuse High** – use slower fuse links (e.g. 100 or 200 ampere and slower types such as T and KS links

12

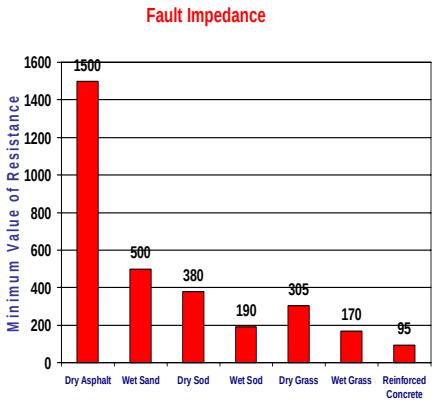
G. Distribution Transformer Fusing

- **ANSI Points** – usually result in numerous nuisance operations
- **>2 Times Load** – greatly reduces nuisance operations

13

H. Fault Impedance Pitfalls

- The **40 ohm** fault impedance is absolutely incorrect
- Results in improper coordination philosophies
- Detectable faults have **0 ohms** fault impedance

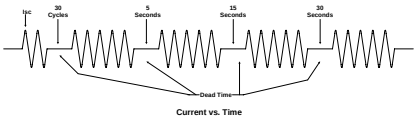


14

I. Fault Recording Advantages

- Can determine success of **instantaneous reclose**
- Can help assess value of **extra reclosures**
- Help in determining **fault location** and **fault impedance**

Breaker Reclosing Sequence



15

Reducing Substation Transformer Failures

- **Through faults** cause substation transformer failures
- **Recording** can help reduce number of reclosures
- **Pulsecoding** can reduce impact of reclosing

16

J. New Products

- TripSaver
- Sectionalizers
- Pulseclosing devices
- Electronic Reclosers
- Microprocessor based relays

17

K. Challenges

- **Reliability vs. Cost**
- **Arc Flash**
- **Distributed Generation**
- **Knowledgeable engineers**

18

Questions????

19