A Current Story – When Primary Met Secondary

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Percentage-Restrained Differential

IOP = \left| I_1 + I_2 \right|

IRT = \frac{\left| I_1 \right| + \left| I_2 \right|}{k}
Internal Inspection Reveals Damage on H3 Bushing and Its CT Secondary Wiring
Pitting and Carbon Deposits From Arc
Junction Box J1 Scorched
Fault Root Cause
Why Did Bus Relay Operate for External Fault?
IB Phasors at Cycle 3, Current In = Current Out
IB Phasors at Cycle 4, Current In ≠ Current Out

10,500∠–98.1°
Bus Relay Operate and Restraint Quantities

Operate Current (pu of tap)

Restraint Current (pu of tap)
Top Gear Towing Challenge
Primary Currents Can Cause Thermal Damage

Current Input Ratings

- 15 A continuous
- 500 A for 1 second
- 625 A / 1,250 A for 1 cycle
Primary Voltages Can Cause Dielectric Failure

Current inputs rated to withstand 2,500 Vac
“Spark Gap Effect” Saves the Day

Ground Wire

80 kV
Recommendations

• Respect power system
• Request visual inspection during installation
• Analyze event reports, even if root cause is known
  ▪ Download all event types
  ▪ Implement automatic event retrieval system
  ▪ Synchronize all relays to GPS time source
• Primary system exposure can damage relays
  Inspect for damage, perform meter and dielectric tests

• Settings expertise alone is not enough
  Know equipment you are protecting
Questions?