

# Switching Resonance & Winding Failures



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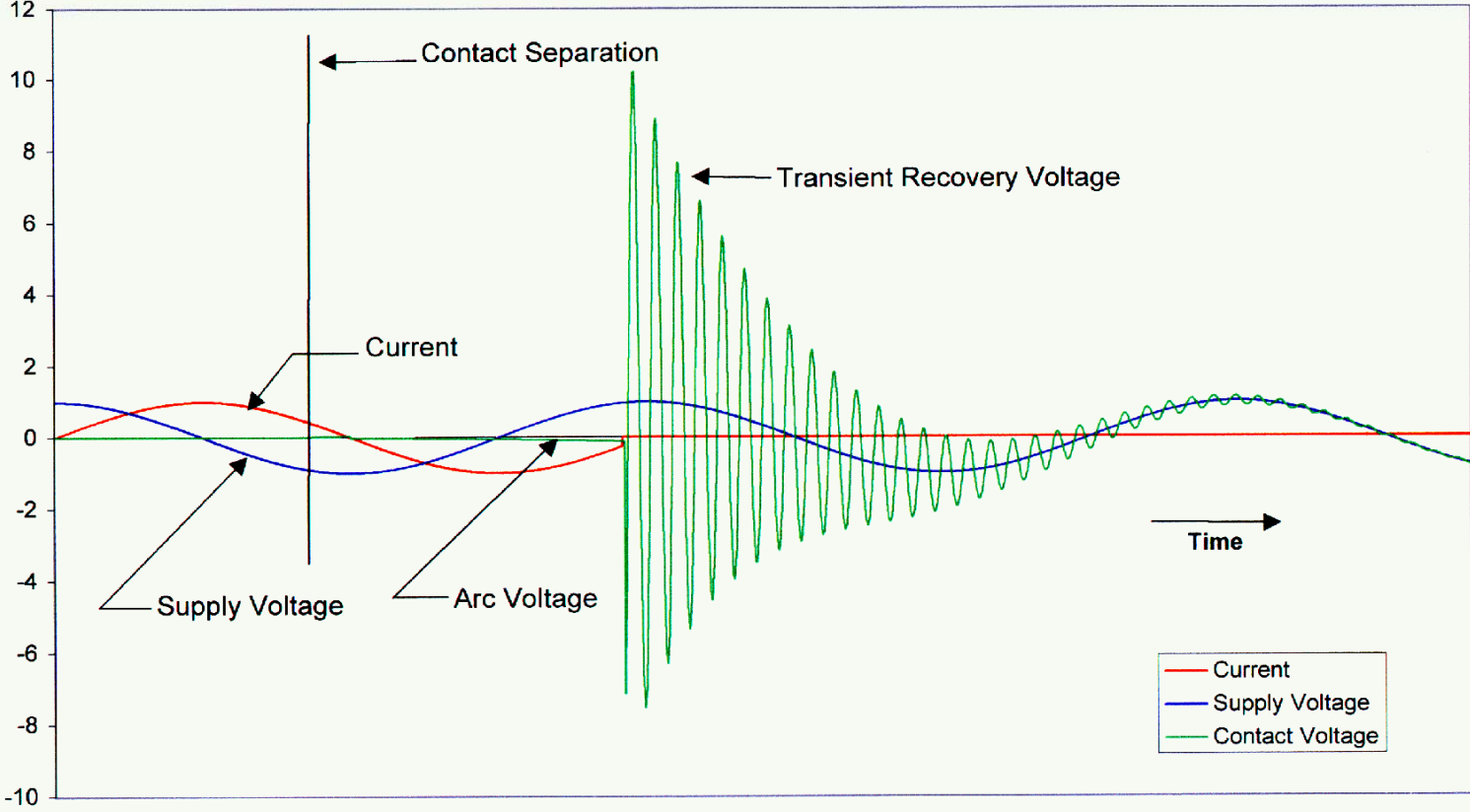
# Switching Resonance

- Associated with Interrupting Characteristics of Vacuum Circuit Breakers
- Effected by:
  - Distance Between Circuit Breaker & Transformer
  - Type of Load Being Switched
  - Switching Characteristics of the Circuit Breaker
  - Current Chopping

# Current Chopping

- Occurs during the interruption of currents at a point other than the zero crossing point
- More prevalent with Vacuum Breakers than Air Breakers, due to the nature of the device
- Can introduce High Frequency Oscillatory Voltage Transients on Transformer or Generator Windings

### Chopped Current Circuit Breaker Interrupting Process



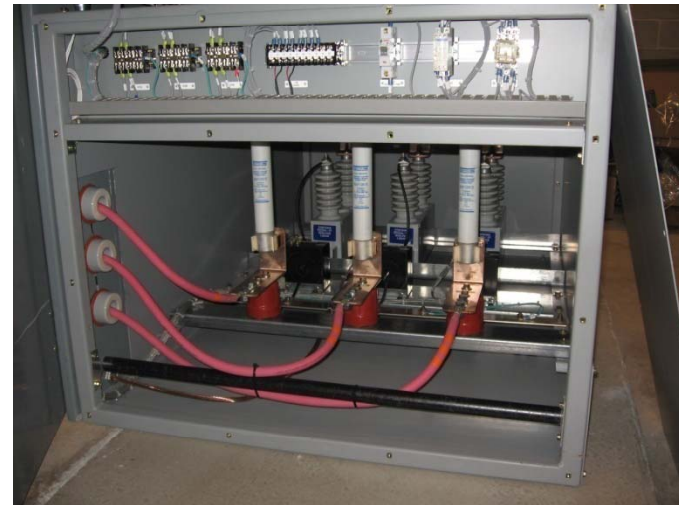
# Transients

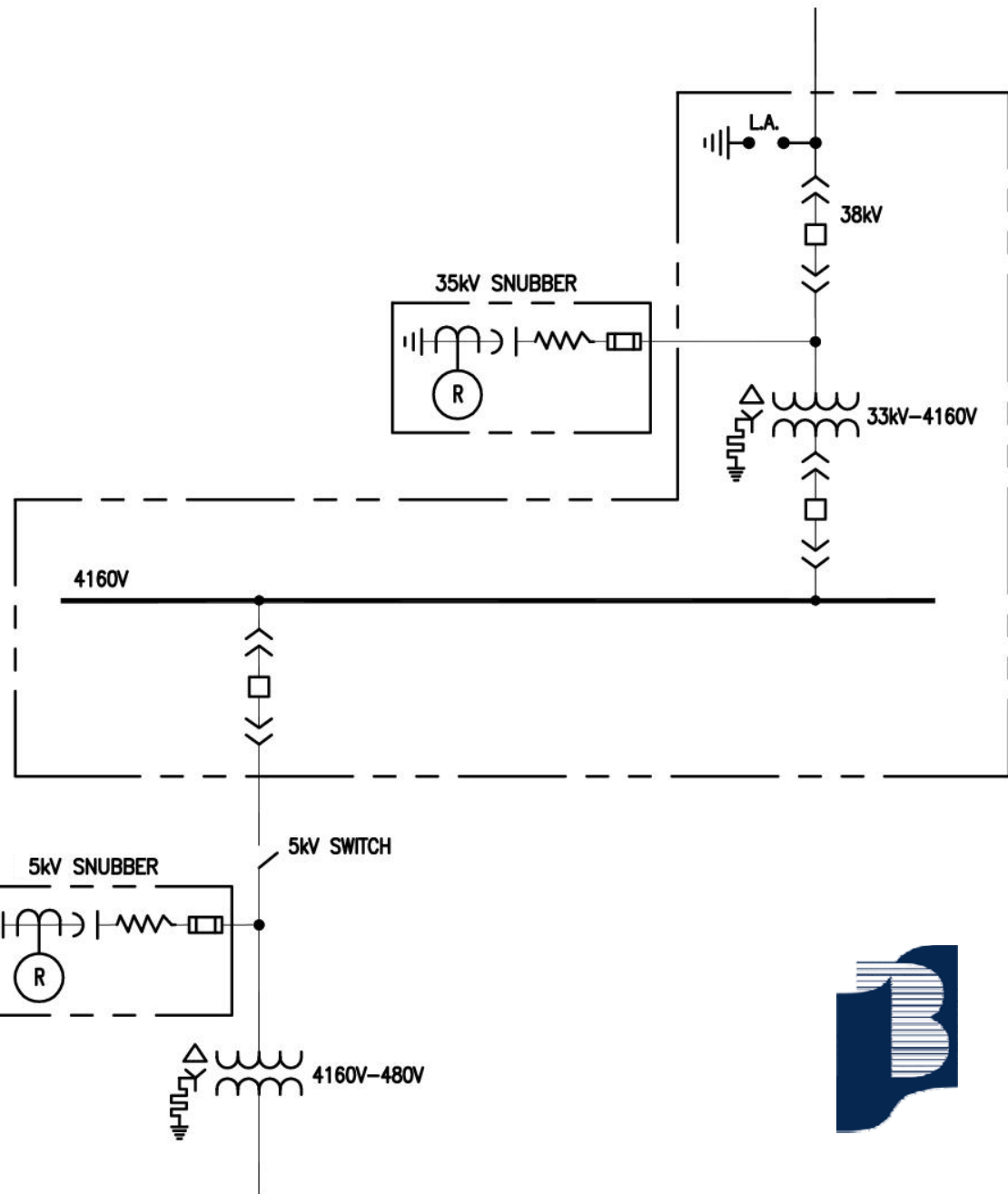
- If transient is at or near the natural frequency then high internal voltages may develop
- Transients are NOT overvoltage condition
- Standard TVSS/MOV design offers little protection from them
- Discovered During Commissioning/ Maintenance



# Transients

- Recommend installation of an RC Snubber System to present a low impedance path to ground for this energy





# Summary

- Switching Resonance is:
  - Frequency Related
  - Function of Circuit Breaker Characteristics & Transformer Properties
- Switching Resonance can be Difficult to Predict
- When Switching with Vacuum Breakers Snubbers are Recommended

# References

- David L. Swindler, PE  
IEEE Switchgear Committee  
ANSI C37 Committee
- IEEE Draft (PC57.142/D1.7)