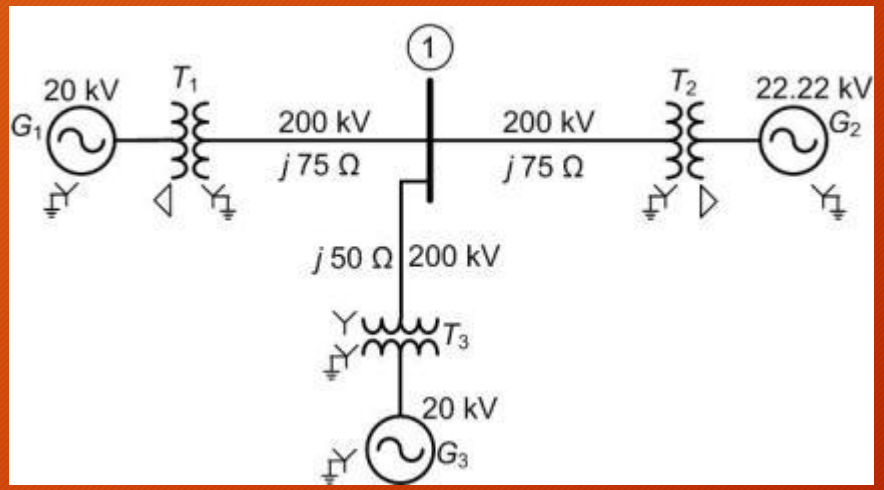

1
20 kV
G_1
T_1
200 kV
j 75 Ω
200 kV
j 75 Ω
T_2
22.22 kV
G_2
j 50 Ω
200 kV
T_3
20 kV
G_3

Power Systems

Real world context and experience

Greg Pink

2020-02-14

Introduction

Major components of many electrical systems

- Generators
- Transmission
- Transformers
- Protection
- Breakers
- Relays
- … and back to Transformers

Outline

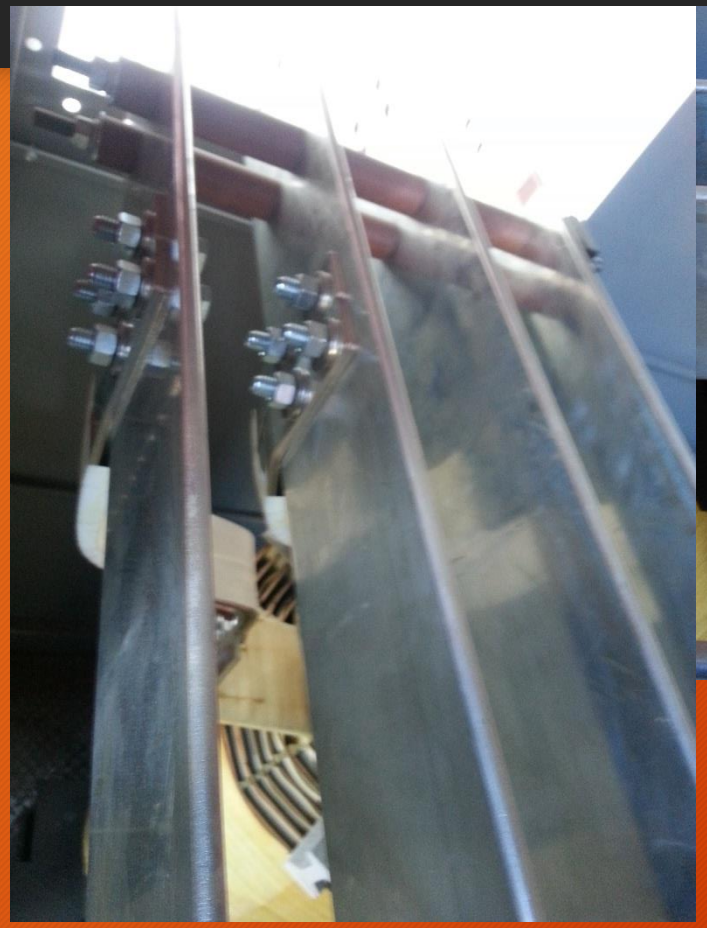
- Transformers
  - Inside of a transformer
  - Non-electrical components
  - Various types
    - Power
    - Current
    - Voltage
  - Safety

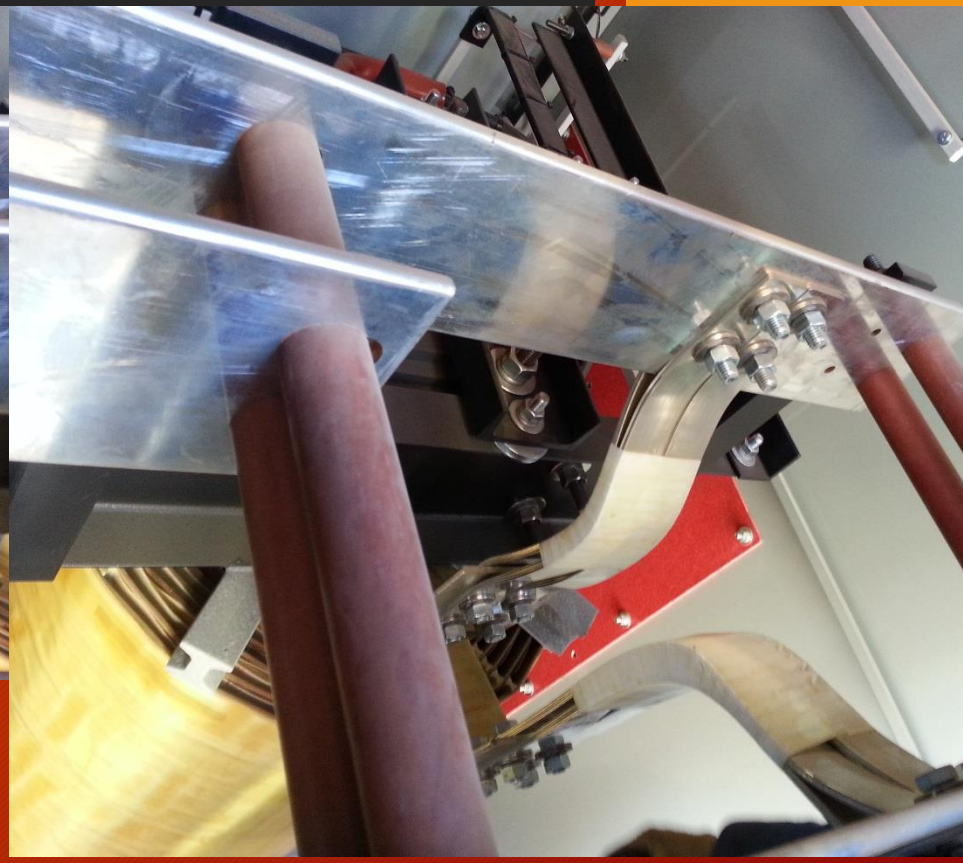
Inside a Transformer

Installation

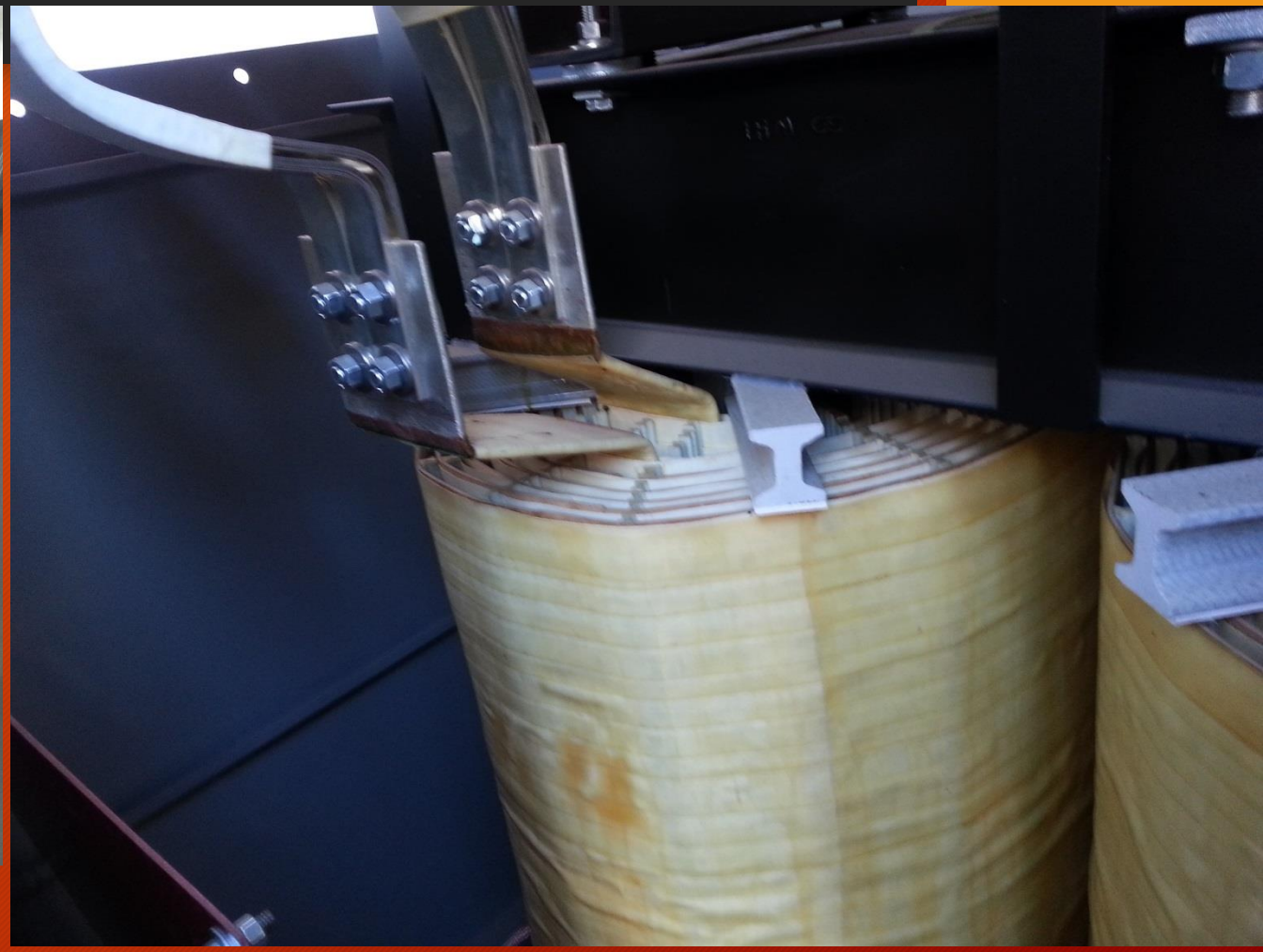
Core

What are these?





How about now?



… And this?

Hot Minute! Common Questions

- Noise
  - What causes noise?
- Temperature Rise?
  - Is it getting too hot in herre?
- Inverter Duty
  - What is this? Why?
- K-Rated Transformers?
  - Okay?

Non-electrical components

- Oil
  - Storage
  - Circulation
  - Heat dissipation
- Monitoring gauges
  - Temperature
  - Pressure
  - Hydrometers
- Emergency Systems
  - Sudden pressure

Oil and Air Circulation – Heat Dissipation

- Natural
- Forced
- Benefits?
- Disadvantages?
- Use in Canada?
- Use in Arizona?

Dissolved Gases in Transformer Oil

- Hydrogen
- Methane
- Ethane
- Ethylene
- **Acetylene**
- Carbon Monoxide
- Carbon Dioxide
- Oxygen/Nitrogen
- Propane/Butane/Butene

‘Types’ of Transformers

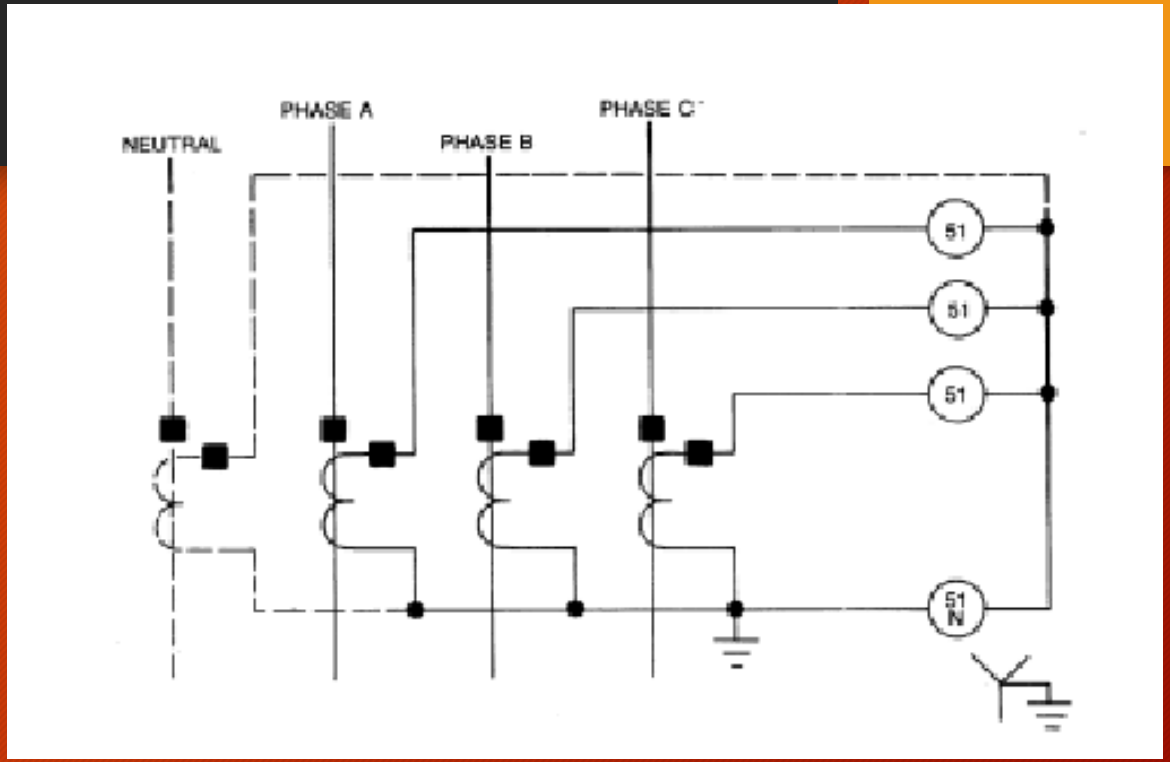
- Power
- Current
- Voltage

Power Transformers

- …

Current Transformers

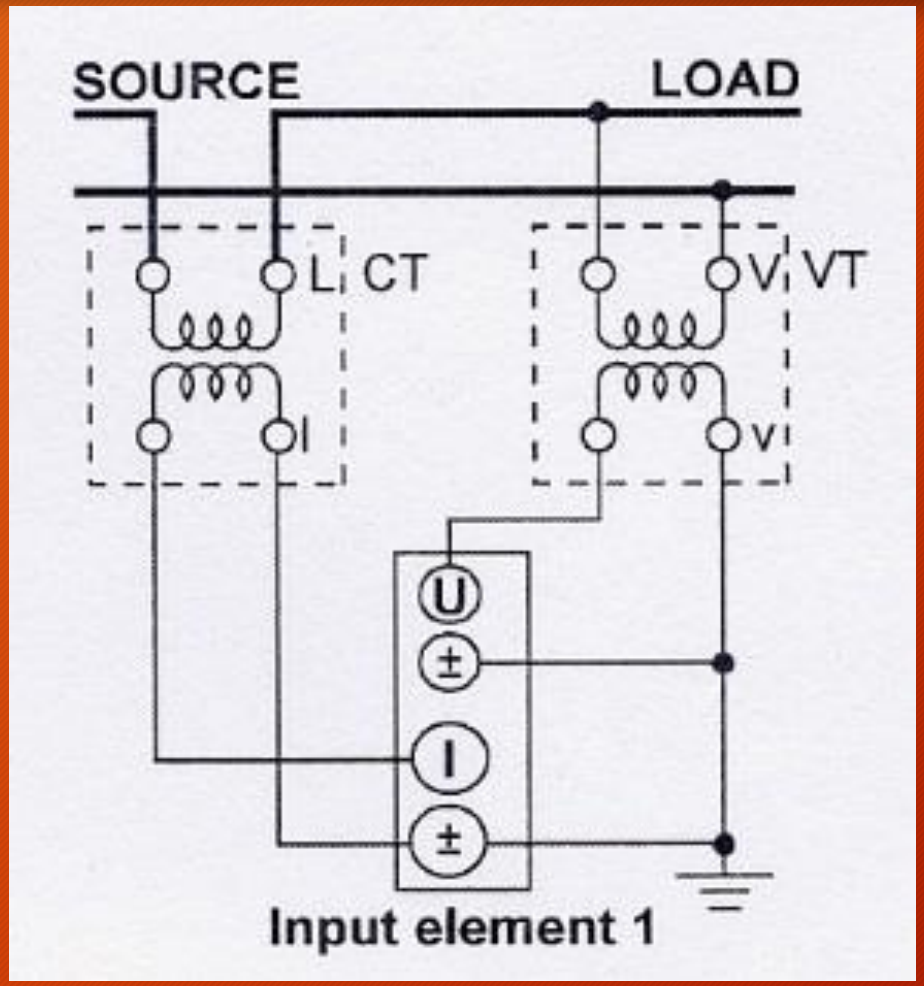
- Purpose?
- Where are they used?
- Differences to power transformers?
- How to read them?!?
  - Polarity – When does it matter?
  - Connections?
  - What are they protecting?
  - What protection do they help with?



Voltage Transformers

- Purpose?
- Where are they used?
- Differences to a power transformer?
- Special Cases?
  - Open Delta
  - Station Service

Quick Visual Comparison



Safety

- Testing Safety
  - What do you need to watch for?
- Isolation Safety
  - Voltage Transformer
  - Current Transformer
  - Power Transformer

Thank You

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