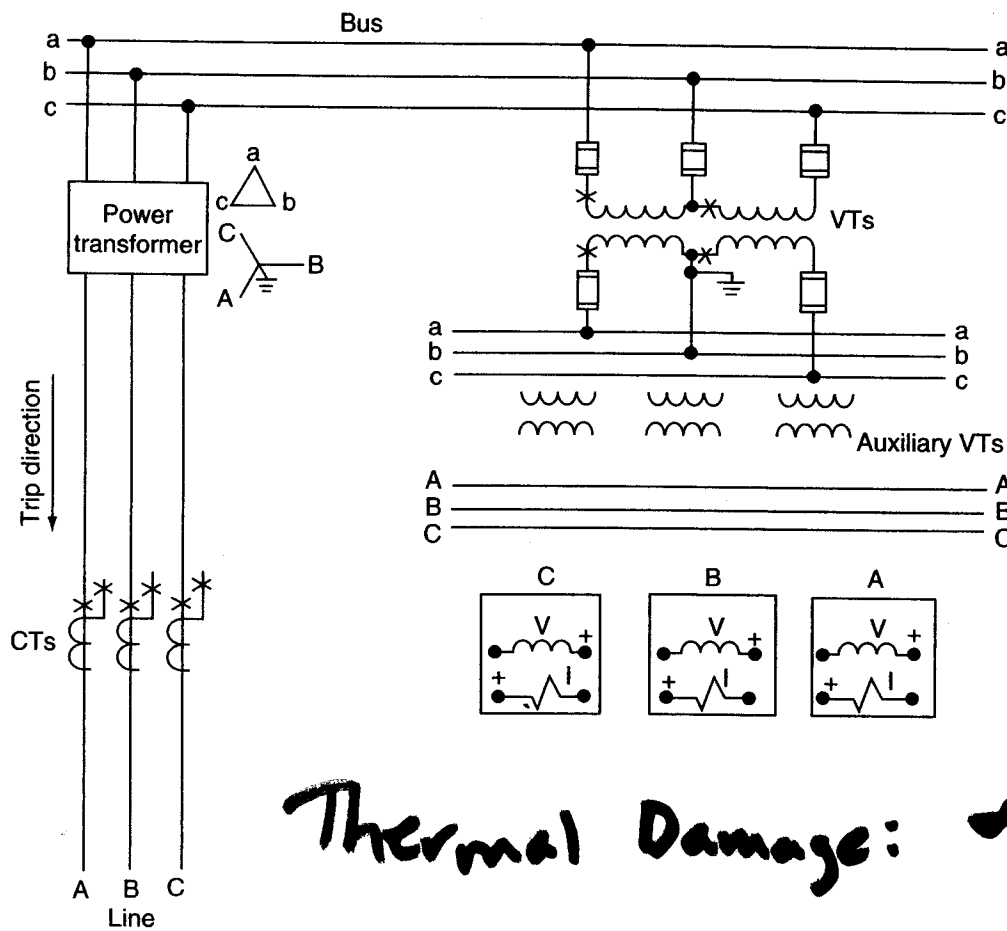


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Thermal Damage: i^2t

FIGURE P3.3

CHAPTER 4

4.1 The per-unit currents for a phase-*a*-to-ground fault are shown in the diagram of Figure P4.1. Assume that the system is reactive with all resistances neglected and that the generator(s) are operating at $j = 1.0$ per-unit voltage.

Draw the positive, negative, and zero sequence diagrams and describe the system that must exist to produce the current flow as shown.

4.2 For the system shown in Figure P4.2

- a. Determine the source and equivalent star reactances of the transformer on a 30 MVA base.
- b. Set up the positive, negative, and zero sequence networks. There are no fault sources in the 13.8 and 6.9 kV systems. Reduce these

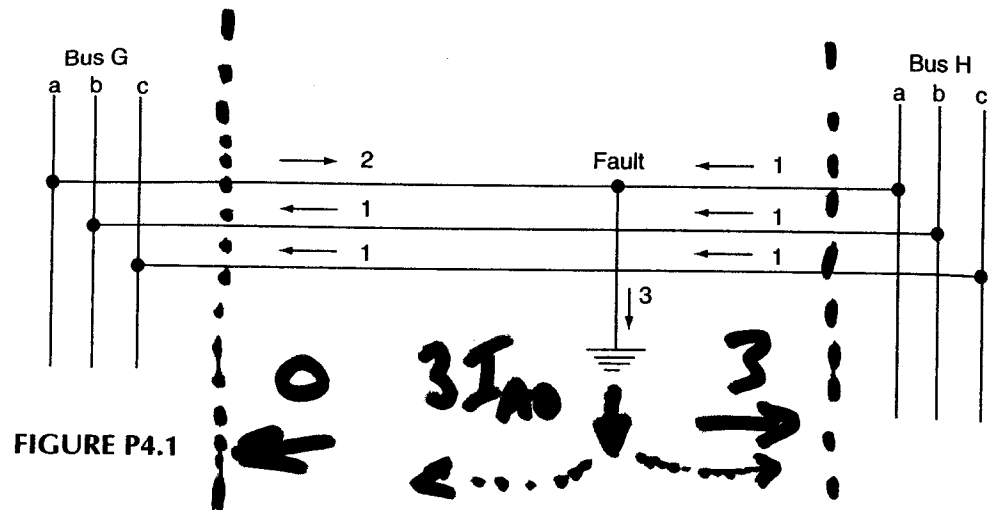
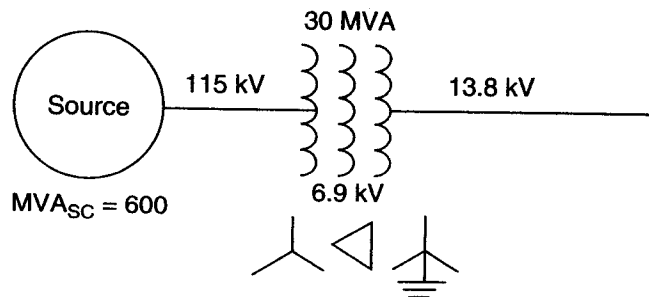


FIGURE P4.1

- networks to single-sequence reactances for faults on the 13.8 kV side.
- Calculate a three-phase fault at the 13.8 kV terminals of the transformer.
 - Calculate a single-phase-to-ground fault at the 13.8 kV transformer terminals.
 - For the fault of part d, determine the phase-to-neutral voltages at the fault.
 - For the fault of part d, determine the phase currents and the phase-to-neutral voltages on the 115 kV side.
 - For the fault of part d, determine the current flowing in the delta winding of the transformer in per unit and amperes.
 - Make an ampere-turn check for the fault currents flowing in the 115, 13.8, and 6.9 kV windings of the transformer.

4.3 For the system shown in Figure P4.3

- Determine the current flowing to the load. Assume that the generators of the equivalent source behind the 13.8 kV bus are operating at 1 per-unit voltage at 0° .

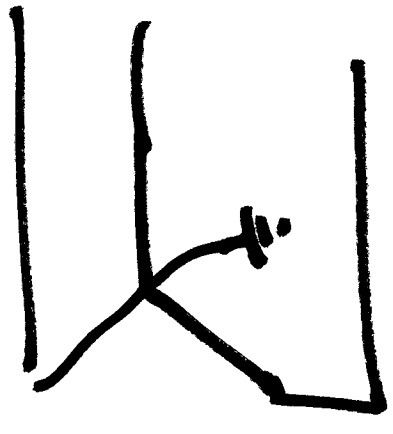
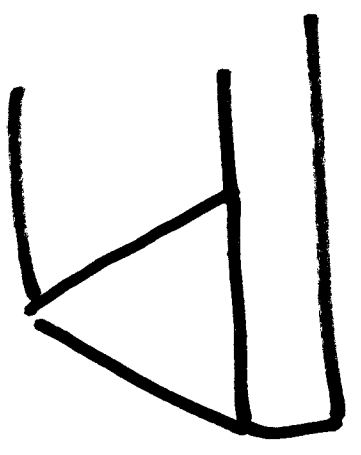
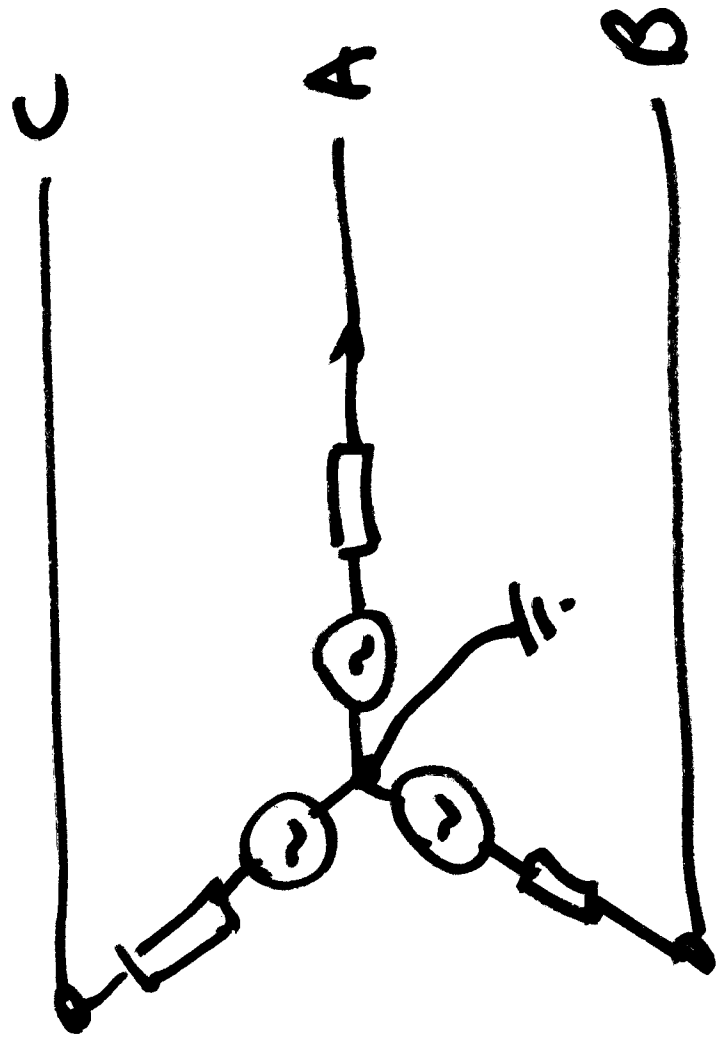
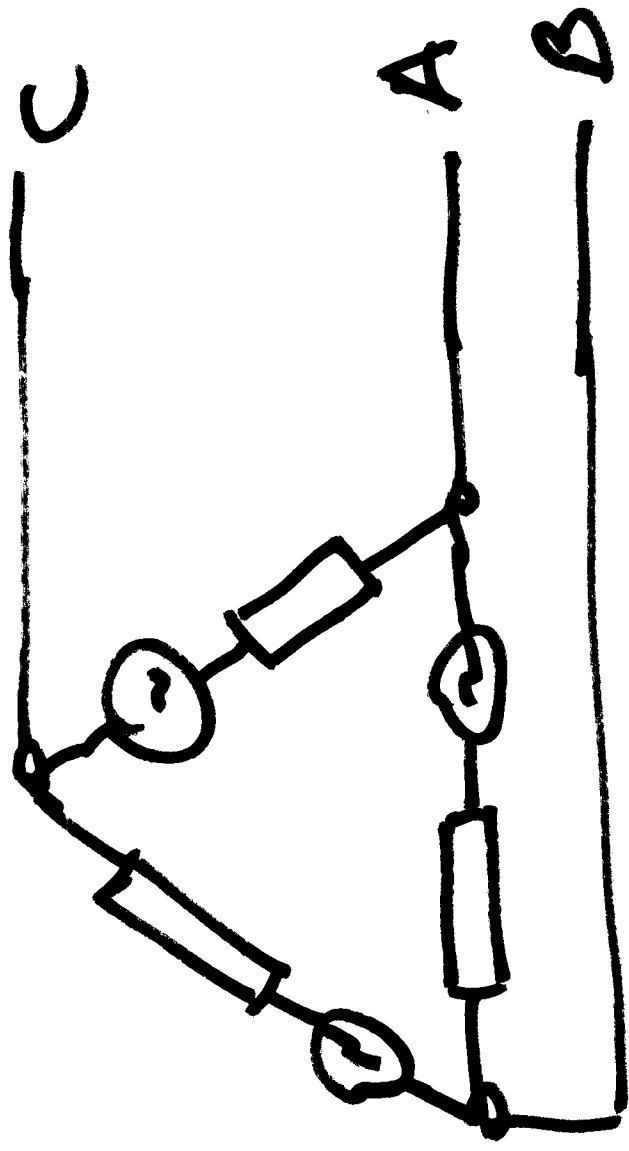


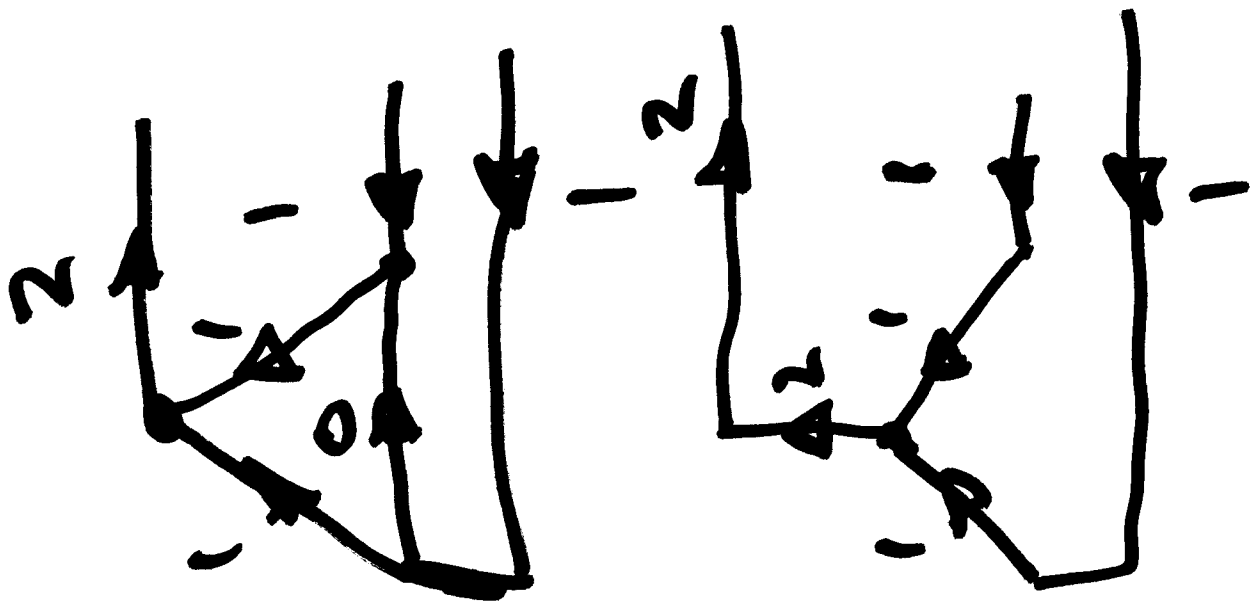
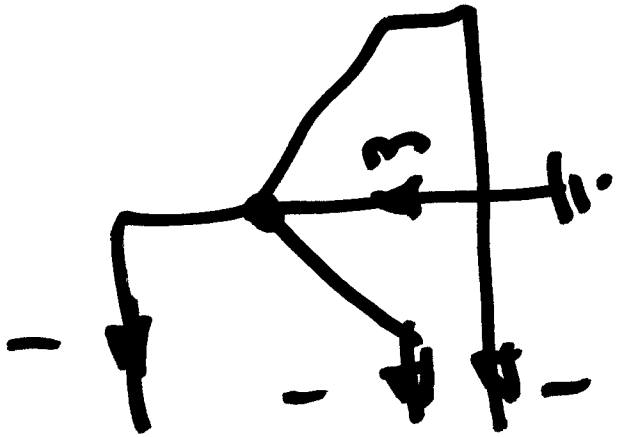
$$X_{115-13.8} = 10\% \text{ on } 30 \text{ MVA}$$

$$X_{115-6.9} = 22.5\% \text{ on } 15 \text{ MVA}$$

$$X_{13.8-6.9} = 11\% \text{ on } 10 \text{ MVA}$$

FIGURE P4.2





Per-Phase Analysis

\downarrow
VAN

ΦA-N

