EET 150: Quiz 4, Unit 6 & 7, and Labs 6 & 7

Name: _____

3-Phase Calcs and Current Transformers

1) You measure 30A going to a 3-Phase Motor running on 480V. How much power are you paying for to run this motor?

30A is the Line Current and 480V is the Line Voltage; you pay for Apparent Power

a) If the Motor is rated at 24 HP, What is the Power Factor?

pf=PT/PA and PT can be found from HP

b) How much energy is simply being moved between the Motor and source, doing no real work?

Reactive Power (PQ) is energy that moves back and forth between Capacitors and Inductors.

c) If I removed that circulating energy, what would the current to the motor be?

As you reduce PQ, PA approaches PT. PT will never drop below the HP level.

d) What size Capacitor would it take to accomplish this?

See the Midterm Study Guide

e) How much current would be flowing to the PFC Capacitor?

PQ is not actually eliminated, it is merely diverted away from the source to the PFC Caps so it does not have to come from the power company.

f) At 6 cents a KWH, how much money would I save in an 8 hour shift if I correct the Power factor?

How many VA will the motor draw without PFC and how much with PFC? If you pay $.06 per KVAHr, What would be the cost difference over 8 hours?

2) The current coming from a Transformer to a motor is measured using a round thing. The wires to the Transformer run through the round thing and the two X leads from the round thing connect to an ammeter. What is the round thing?

What device is used to lower a really high current to a lower level to make it easier to measure. It is a Special type of transformer.

a) If you remove the ammeter from the round thing without shorting the X leads, or turning the motor off, what can happen?

In any transformer if the current steps down the voltage will step-up, perhaps too high for the device to contain.

b) What is the normal output current from one of these round things? ***See Midterm Study Guide.***

c) The Round thing you are using has 500:5 printed on the side. If the ammeter connected to the X leads reads 4.5A, what is the motor current? ***See Midterm Study Guide***

d) If the transformer is supplying 480V to the motor using a Wye primary, Delta secondary configuration, and the primary current is 10A, what is the Primary Line Voltage?

From above you can determine the Secondary Current, note that the Line current is from above, the Current from each transformer secondary coil will NOT be the line current because the transformer secondary is in a Delta configuration. Use the coil current to determine the Turns ratio, and the turns ratio to determine the primary voltage. Note that the Primary is in a Wye Configuration so the Primary voltage you determine will be the Phase Voltage, not the Line Voltage.

e) What kind of transformer would lover this voltage to 120V for safer measurement?

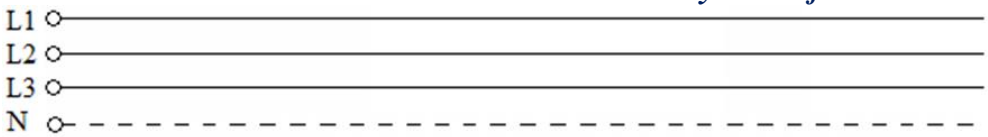
See Unit 4 Notes, Page 9

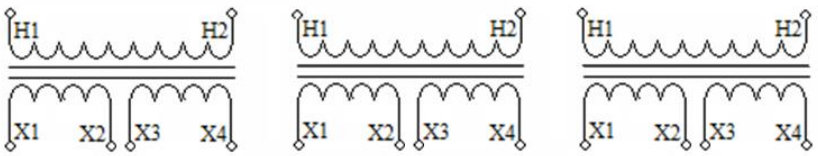
3) If a 3ϕ motor with a line-current 30A is connected in a Delta configuration, what is the current in each coil of the motor?

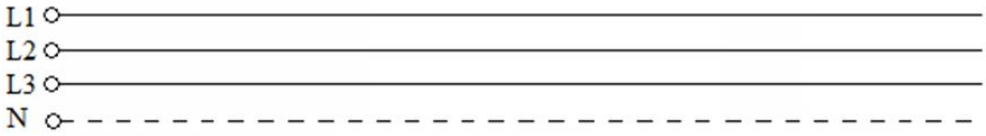
The Line Current is not the same as the Phase Current in a Delta

4) Connect the transformers below for Wye-Primary, to a 4-Wire-Delta Secondary, with Low voltage between phases L1 and L3. (Note fusing and do not reverse polarity *(H and X markings)*)

See Video in Weblocker Homework Folder. There is a Delta to 4-Wire Delta (4WΔ) video that will show how the 4WΔ should be connected. See the Midterm Study Guide for the Y connections.



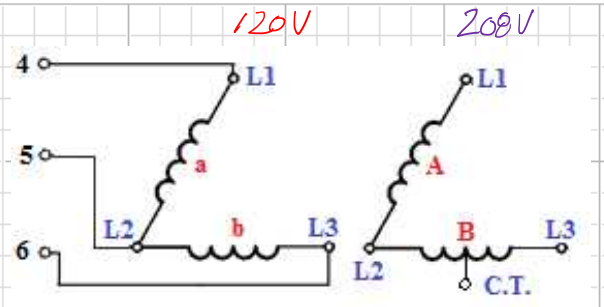




EET 150: Quiz 4, Unit 6 & 7, and Labs 6 & 7

Lab Portion: Build an Open Delta to an Open Delta Connection using transformers provided to you. Center-tap one of the secondaries for low-Voltage single-phase. Use the higher voltage coil as the secondary.

1) First Sketch the transformer connections including all transformer leads (even those not connected). Use the Low-Voltage side as the Primary.



Expect:

$V_{L1-CT} = 104 \cdot \sqrt{3} = 180V$

Record Actual Data Below

2) Estimate the maximum power this configuration could provide to a 3-phase load, recall that an Open-Delta connected transformers must be devalued.

On 208V = 1A on 120 side = 2A

$P_{120} = 2A \cdot 120V = 240VA$

$P_{208} = 208V \cdot 1A = 208VA$

Used as Isolation MUST USE Lower Rating. = 208VA

3) If one side of the Secondary were center-tapped for low voltage, calculate the voltage of the High Leg to Neutral.

$V_{L1-CT} = (V_{L3-CT}) \cdot \sqrt{3} = 104 \cdot \sqrt{3} = 180V$

Expected 180V, Measured 179V - Very Close

4) **Have the instructor sign-off on the circuit**_____

5) Build the circuit and collect the following data: ***Ask you Instructor for the Line Voltage-in to be used***

Measurement	Expected Value			Measured Value		
Line Voltages in	V_{L1-2} 120V	V_{L2-3} 120V	V_{3-1} 120V	V_{1-2}	V_{2-3}	V_{3-1}
Line Voltages out	V_{1-2} 208V	V_{2-3} 208V	V_{3-1} 208V	V_{1-2}	V_{2-3}	V_{3-1}
Single-Phase Voltage out	V_2 104V		V_3 104V	V_2		V_3
High-Leg Voltage	180V					

Instructor's signature:_____

Give actual Readings
Should see 4 Digits
Ex: 119.8V