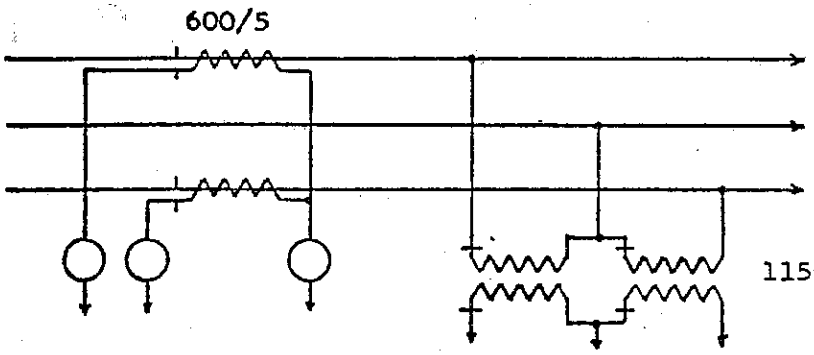
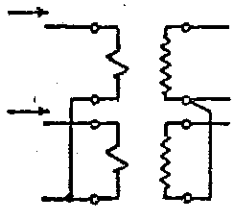
Calculating Meter Multipliers

1. Three wire - three phase using two element wattmeter with two C.T.'s and two P.T.'s



Assume: 11.55KV at 300 Amps., unity power factor

C.T.'s = 600/5 or 120/1, P.T.'s = 100/1



Pri. Watts = 11547 x 300 x 1.732

= 6,000,000 watts or 6,000 KW

Sec. Watts = 115.47 x 2.5 x 1.732

= 500 watts or 0.5 KW

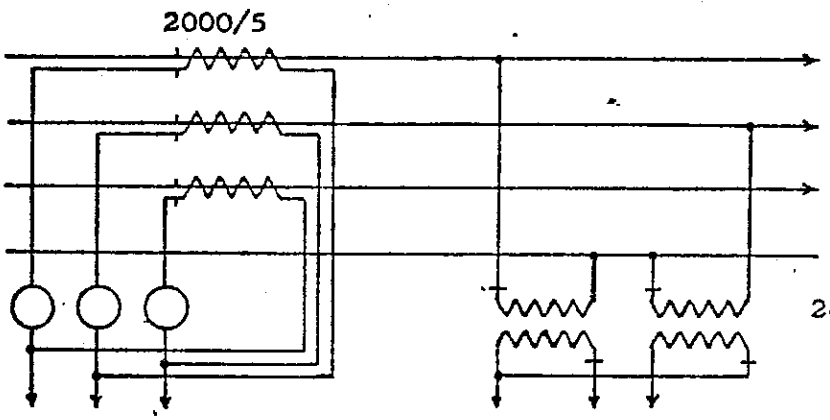
Meter must be multiplied by $\frac{\text{Primary watts}}{\text{Secondary watts}}$ to convert meter watts to primary watts

Therefore multiplier = $\frac{6,000,000}{500}$ = 12,000

This is identical to the product of C.T. ratio x P.T. ratio (120 x 100) or 12,000

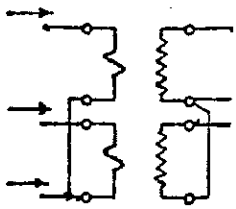
Three wire - two element metering: Multiplier = C.T. x P.T.

2. Four wire - three phase metering using two element wattmeter three C.T.'s and two P.T.'s connected phase to neutral (present 4 KV metering)



Assume: 2.4KV Ø to Neutral, 1000 Amps, unity P.F.

C.T.'s = 2000/5 or 400/1, P.T.'s = 20/1



Pri. Watts = 3 x $2400V_{Ø-N}$ x 1000A

= 7,200,000 watts or 7,200 KW

Sec. Watts = 4.33 x 120 x 1.732

= 900 watts or 0.9 KW

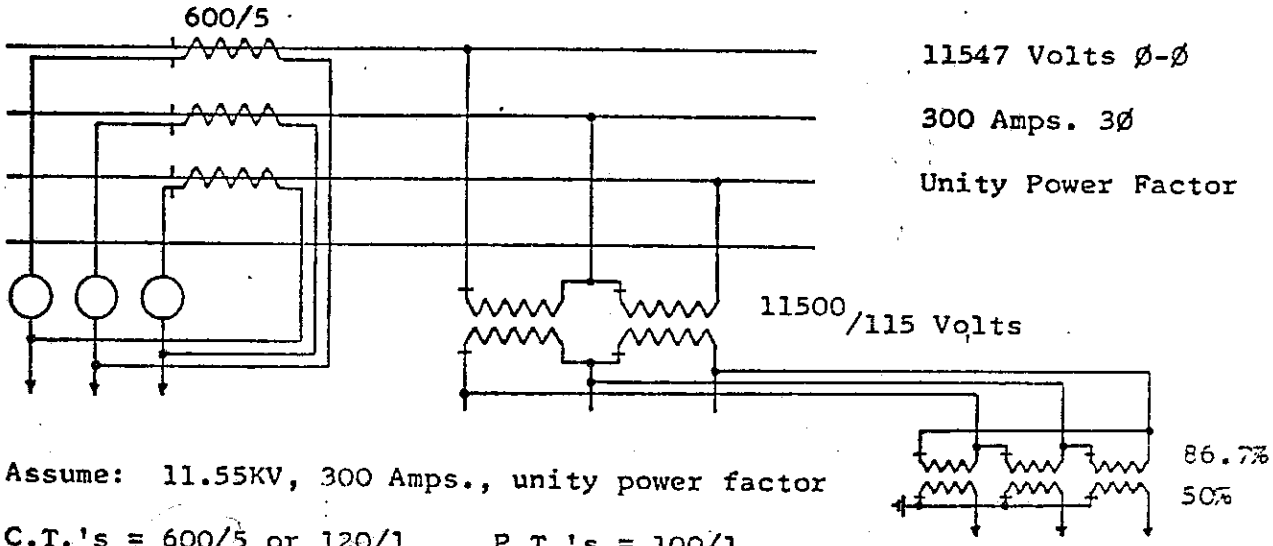
Meter must be multiplied by $\frac{\text{Primary watts}}{\text{Secondary watts}}$ to convert meter watts to primary watts.

Therefore multiplier = $\frac{7,200,000}{900}$ = 8,000

This is identical to the product of C.T. ratio x P.T. ratio (400 x 20) or 8,000

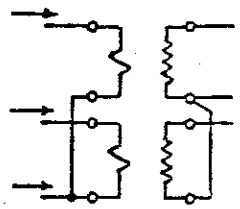
Four wire - two element metering using three C.T.'s connected delta and two P.T.'s connected phase to neutral: Multiplier = C.T. x P.T.

3. Four wire - three phase metering using two element wattmeter, three C.T.'s, two P.T.'s connected phase to phase and three auxiliary secondary phase shifting transformers. (present 12KV or 16KV metering)



Assume: 11.55KV, 300 Amps., unity power factor

C.T.'s = 600/5 or 120/1, P.T.'s = 100/1



Pri. Watts = 11547 x 300 x 1.732

= 6,000,000 watts or 6,000 KW

Sec. Watts = 115.47 x 4.33 x 1.732

= 866 watts or 0.866 KW

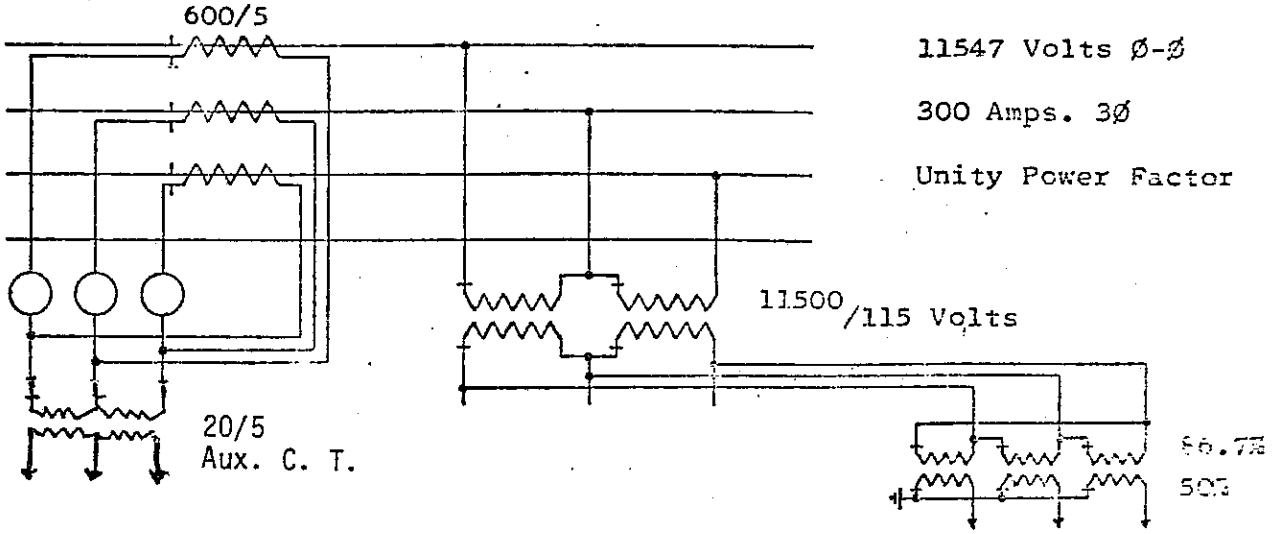
Meter must be multiplied by $\frac{\text{Primary watts}}{\text{Secondary watts}}$ to convert meter watts to primary watts

Therefore multiplier = $\frac{6,000,000}{866}$ = 6928

In This case the multiplier is not the product of C.T. ratio x P.T. ratio (120 x 100 = 12,000 ≠ 6928)

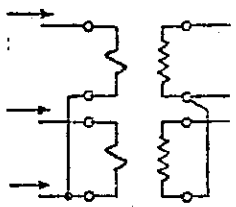
Four wire - two element metering using three C.T.'s connected delta, two P.T.'s connected phase to phase and three auxiliary phase shifting transformers: Multiplier = $\frac{\text{C.T. x P.T.}}{1.732}$

4. Four wire - three phase metering using two element wattmeter, three C. T.'s, two P. T.'s connected phase to phase and three auxiliary secondary phase shifting transformers plus two 20/5 auxiliary C. T.'s for station with capacity in excess of 50 mva.



Assume: 11.55 kV, 300 Amps., unity power factor

C. T.'s = 600/5 or 120/1, P. T.'s = 100/1



Pri. Watts = 11547 x 300 x 1.732

= 6,000,000 watts or 6,000 kw

Sec. Watts = 115.47 x 1.0825 x 1.732

= 216.5 watts

Meter must be multiplied by $\frac{\text{Primary watts}}{\text{Secondary watts}}$ to convert meter watts to primary watts

Therefore multiplier = $\frac{6,000,000}{216.5}$ = 27714

In this case the multiplier is not the product of C. T. ratio x P. T. ratio x Aux. C. T. Ratio (1L0 x 100 x 4 = 48000 ≠ 27,714)

DO NOT CONSIDER DELTA IN THE RATIO

Four wire - two element metering using three C. T.'s connected delta, two P. T.'s connected phase to phase and three auxiliary phase shifting transformers and two auxiliary C. T.'s: Multiplier = $\frac{\text{C. T.} \times \text{P. T.} \times \text{Aux. C. T.}}{1.732}$