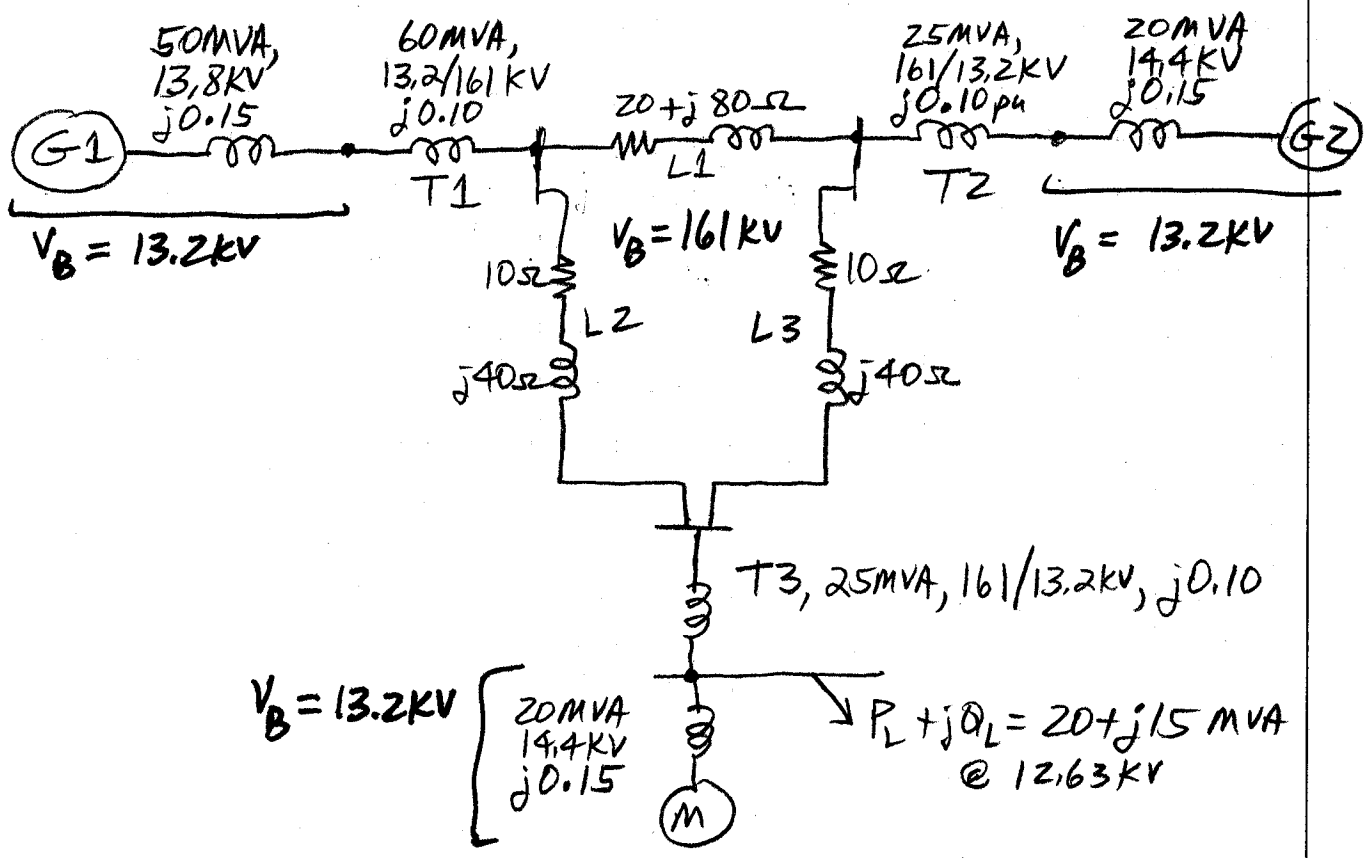
5.19 Use 161 KV base voltage in transmission lines (wasn't stated in problem), and 100 MVA



- Setting V_B = 161 KV in the transmission lines, the bases as you step across a transformer follow the line-to-line turns ratio
- Now, component by component

$$Z_{G1} = j0.15\left(\frac{100}{50}\right)\left(\frac{13.8}{13.2}\right)^2 = j0.328$$

$$Z_{T1} = j0.10\left(\frac{100}{60}\right)\left(\frac{13.2}{13.2}\right)^2 = j0.1667$$

For transmission lines, $Z_B = \frac{161^2}{100} = 259\Omega$

$$Z_{L1} = \frac{20+j80}{259} = 0.0772 + j0.309$$

$$Z_{L2} = Z_{L3} = \frac{10+j40}{259} = 0.0386 + j0.1544$$

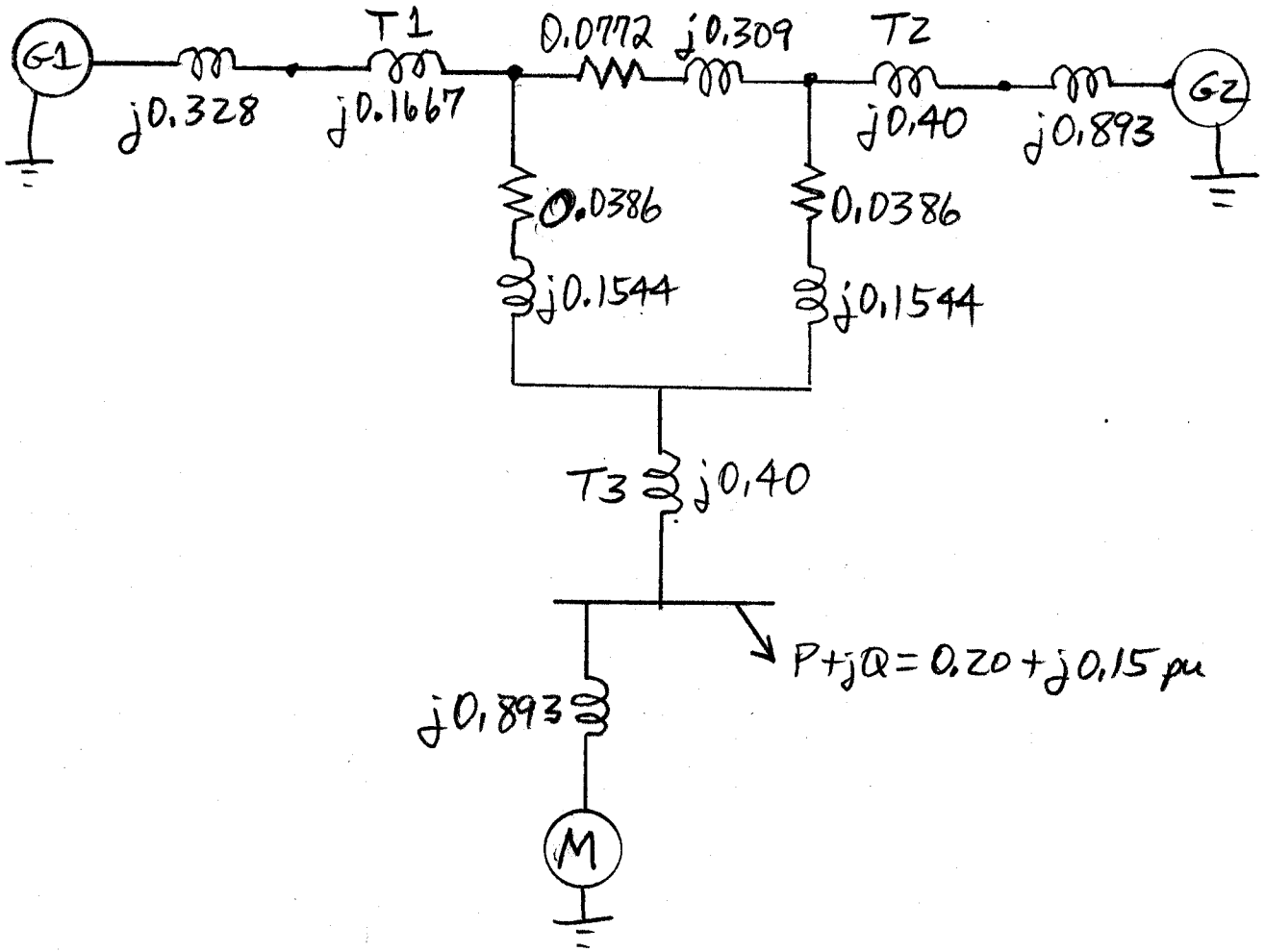
$$Z_{T2} = j0.10\left(\frac{100}{25}\right)\left(\frac{13.2}{13.2}\right)^2 = j0.40$$

$$Z_{G2} = j0.15\left(\frac{100}{20}\right)\left(\frac{14.4}{13.2}\right)^2 = j0.893$$

$$Z_{T3} = j0.10\left(\frac{100}{25}\right)\left(\frac{13.2}{13.2}\right)^2 = j0.40$$

$$Z_M = j0.15\left(\frac{100}{20}\right)\left(\frac{14.4}{13.2}\right)^2 = j0.893$$

For load, we assume constant power, so $P+jQ = 0.20+j0.15$



G1, G2, M are represented as voltage sources, Since the network is loaded with P+jQ, then we can set the V/δ at one gen, but the other gen & motor voltages must be solved by a loadflow program where gen & motor P, Q are known