**Proof**- Let us assume 1$\phi$ transformer in which the total series imp. referred to primary is $Z_{1e}$, base current & voltage are $I_1$ & $V_1$ repectively.

$$\therefore (Z_1)_{base} = Z_{b1} = V_1/I_1 \quad \text{—— (1)}$$

$$(Z_1)_{pu} = \frac{Z_{1e}}{Z_{b1}} = \frac{Z_{e1} \cdot I_1}{V_1} \quad \text{—— (2)}$$

Also, total series imp. referred to secondary,

$$Z_{2e} = Z_{1e} \cdot (N_2/N_1)^2 \quad \text{—— (3)}$$

$$Z_{b2} = \frac{V_2}{I_2} \quad \text{—— (4)}$$

$$(Z_2)_{pu} = \frac{Z_{e2}}{V_2/I_2} = \frac{Z_{2e} \cdot I_2}{V_2} \quad \text{—— (5)}$$

$$\therefore I_2 = I_1 \cdot N_1/N_2$$

$$V_2 = \frac{N_2}{N_1} \cdot V_1$$

Hence, $(Z_2)_{pu} = Z_{1e}\left(\frac{N_2}{N_1}\right)^2 \cdot \frac{I_1 N_1}{N_2} \cdot \frac{N_1}{N_2 V_1}$

$$\boxed{(Z_2)_{pu} = \frac{Z_{1e} \cdot I_1}{V_1}}$$

$$\boxed{(Z_2)_{pu} = (Z_1)_{pu}}$$ proved

Numerical:-

Given that,

$(MVA)_b = 30\ MVA$

$V_b = 11\ kV$

$X = 20\% = 0.2$

$\therefore I_b = \frac{(MVA)_b}{V_b}$

$= \frac{30 \times 10^6}{11 \times 10^3}$

$= 2.73 \times 10^3$

$X_b = \frac{V_b}{I_b}$

$= \frac{11 \times 10^3}{2.73 \times 10^3}$

$= 4.033\ \Omega$

$X_{pu} = \frac{0.2}{4.033} = 0.0496 = 0.05\ pu$

for 50MVA, 10kV base we get,

$(X_{pu})_{new} = (X_{pu})_{old} \cdot \frac{(MVA)_{new}}{(MVA)_{old}} \cdot \frac{(kV)^2_{old}}{(kV)^2_{new}}$

$= (0.05) \cdot \left[\frac{30}{50}\right] \cdot \left[\frac{10}{11}\right]^2$

$= 0.025\ pu$