Problem 6-21

transformer: 3ϕ, 500 KVA, 480 V_{LL}, leakage reactance $X_{L_{s1}} \approx$ impedance = 6%

Find L_{s1} ___

$$X_{L_{s1}} = 0.06 \frac{(\frac{480V}{\sqrt{3}})^2}{(\frac{500\ KVA}{3})} = 27.65\ m\Omega$$

$$L_{s1} = X_{L_{s1}}/\omega = \frac{27.65\ m\Omega}{377} = 73.34\ \mu h$$

Find L_{s2} ___

$$L_{s2} = 200ft \times 0.1 \frac{\mu h}{ft} = 20\ \mu h$$

find α _____

$$L_s = L_{s1} + L_{s2} = 93.34\ \mu H$$

$$V_d = 525V$$

$$V_{LL} = 460\ V$$

$$I_d = \frac{25kW}{525V} = 47.6A$$

$$V_d = 1.35\ V_{LL} \cos\alpha - \frac{3\omega L_s}{\pi} I_d$$

$$\therefore\ \alpha = 32^o$$

Using Eq. 6-67

$$u = \frac{2\omega L_s I_d}{\sqrt{2}\ V_{LL} \sin\alpha} = 971.8 \times 10^{-5}\ rad$$

$$\therefore\ t_{notch} = \frac{u}{\omega} \simeq 25.78\ \mu s$$

Using Eq. 6-68

$$\rho = \frac{L_{s1}}{L_{s1} + L_{s2}} = \frac{73.3}{73.3 + 20} = 0.786 = 78.6\%$$

Using Eq. 6-65

deep notch area $A_n = 2\omega(L_{s1} + L_{s2})I_d = 3.35$ V-rad = 8886V-μs

At the point of common coupling, the deep-notch area is

$$A_{n_{cc}} = \rho A_n \simeq 6980 \text{ V-}\mu\text{s}$$

Comparing the results with the limits given in Table 6-2, $\rho = 78.6\%$ exceeds the limits for all class of applications. However, the line-notch area of 6980 V-μs is within the limits for all class of applications.