Problem 6-22

Find the leakage impedance of the 480V, 40 kVA, 3-phase transformer --

$$x_{Ll} = 0.03 \times \frac{(\frac{480}{\sqrt{3}})^2}{(\frac{40 \times 10^3}{3})} = 0.1728\ \Omega$$

$$\therefore\ L_l = \frac{0.1728}{\omega} \simeq 458\ \mu H$$

From problem 6 - 21

$$L_{s2} = 20\ \mu H + 458\ \mu H = 478\ \mu H$$

and $L_s = L_{s1} + L_{s2} = 73.34 + 478 = 551.34\ \mu H$

From Eq. 6-55

$$525 = 1.35 \times 460 \times \cos\alpha - \frac{3 \times 377 \times 551.34 \times 10^{-6}}{\pi} \times 47.6$$

$$\therefore\ \alpha = 30.6^o$$

$$u = \frac{2\omega L_s I_d}{\sqrt{2}\ V_{LL} \sin\alpha} = 59.75 \times 10^{-3}\ \text{rad}$$ From Eq. 6-67

$$t_{notch} = \frac{u}{\omega} = 158.5\ \mu s$$

$$\rho = \frac{L_{s1}}{L_{s1} + L_{s2}} = \frac{73.34}{551.34} = 13.3\%$$

deep notch area $A_n = 2\omega(L_s)I_d$ From Eq. 6-65

$$= 19.79\ \text{V-rad} = 52{,}487\ \text{V-}\mu s$$

At the point of common coupling

$$A_{n_{cc}} = \rho A_n = 0.133 \times 52{,}487 \simeq 6980\ \text{V-}\mu s \text{ (same as in problem}$$

Comparing the results with the limits in Table 6-2, the factor ρ now (as compared to the system in Problem 6-21) is acceptable for dedicated and general systems. As before, the line-notch area is acceptable for all systems.