5. ANALISA PERHITUNGAN PENYULANG TANPA GROUND WIRE

5.1. Penyulang Dukun - GI Manyar

- 60 MVA
- $150/20\ kV$
- $MVA_{hubung\ singkat} = 3203$ MVA

$$Z_s = Z_{pu} = \frac{MVA_{base}}{MVA_{hs}} = \frac{60}{3203} = 0.01187 \text{ pu}$$

$X = 10\%$

$Z_t = 0.1$ pu

$$Z_{base} = \frac{(KVA_{base})^2}{MVA_{base}}$$

$$= \frac{20^2}{60}$$

$$= \frac{400}{60}$$

$$= 6.667\ \Omega$$

$$Z_{G(pu)} = \frac{Z_{G(sebenarnya)}}{Z_{base}}$$

$$= \frac{500}{400/60}$$

$$= 75 \text{ pu}$$

$3Z_G = 3 \times 75$ p.u

$= 225$ p.u

$Z_f = 35\ \Omega$

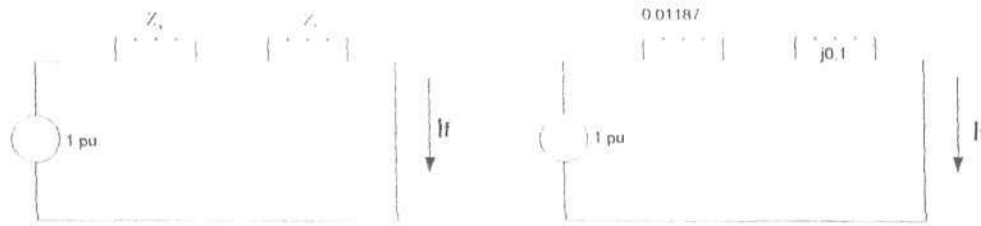
$$Z_{f(p.u)} = \frac{Z_{f(sebenar)}}{Z_{base}}$$

$$Z_{p.u} = \frac{35}{400/60}$$

$$= 5.25 \text{ p.u}$$

$$3Z_f = 15.75 \text{ p.u}$$

1) Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo



$$I_f = \frac{1}{Z_s + Z_t}$$

$$= \frac{1 \times 1.1}{0.0187 + 0.1}$$

$$= \frac{1.1}{0.1187}$$

$$= 9.2607 \text{ pu}$$

$$I_{base} = \frac{KVA_{base}}{\sqrt{3}.KV_{base}}$$

$$= \frac{60000}{\sqrt{3}.20}$$

$$= \frac{60000}{34.64101616}$$

$$I_{base} = 1732.05 \text{ A}$$

$I_{f(s)} = I_{f(pu)} \cdot I_{base}$

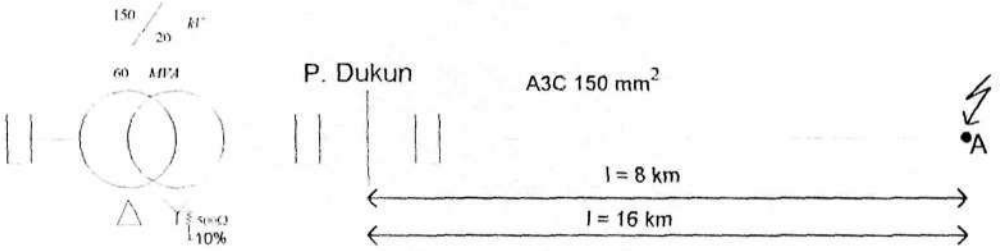
$= 9.26705 \times 1732.05$

$= 16051.0014$

≈ 16 kA

Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo adalah 16.0510 kA

2) Arus Hubung Singkat 3Ø Maksimum pada sisi Jaringan



$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\,(8km)} = 1.8848 + j0.8224\ \Omega$

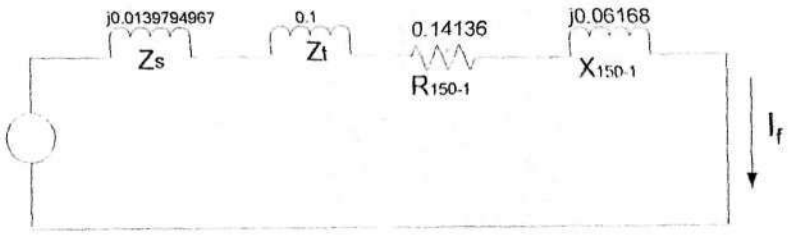
$Z_{150\,(16km)} = 3.7696 + j1.6448\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\,(pu)} = 0.14136 + j0.06168\ \Omega$ [l = 8 km]

$Z_{150\,(pu)} = 0.28272 + j0.12336\ \Omega$ [l = 16 km]

➢ Untuk l = 8 km



$$I_{f(pu)} = \frac{1}{Z_s + Z_t + Z_l}$$

$$I_{f(pu)} = \frac{1 \times 1.1}{j0.01187 + j0.1 + 0.14136 + j0.06168}$$

$$= 3.103573063 - j3.810307761$$

$$= \sqrt{3.103573063^2 + 3.810307761^2}$$

$$= 4.914327115 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 4.914327115 \times 1732.05$$

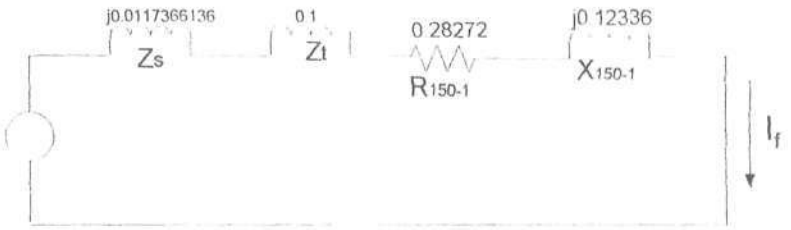
$$= 8511.860279 \text{ A}$$

$$= 8.5119 \text{ kA}$$

$$\approx 8 \text{ kA}$$

Arus hubung singkat 3Ø maksimum pada jaringan (l = 8 km) adalah 8.5119 kA

➢ Untuk l = 16 km



$$I_{f(pu)} = \frac{1}{Z_s + Z_t + Z_l}$$

$$I_{f(pu)} = \frac{1 \times 1.1}{j0.01187 + j0.1 + 0.28272 + j0.12336}$$

$$= 2.299152559 - j1.91295153$$

$$= \sqrt{2.299152559^2 + 1.91295153^2}$$

$$= 2.990900541 \text{ pu}$$

$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$

$= 2.990900541 \times 1732.05$

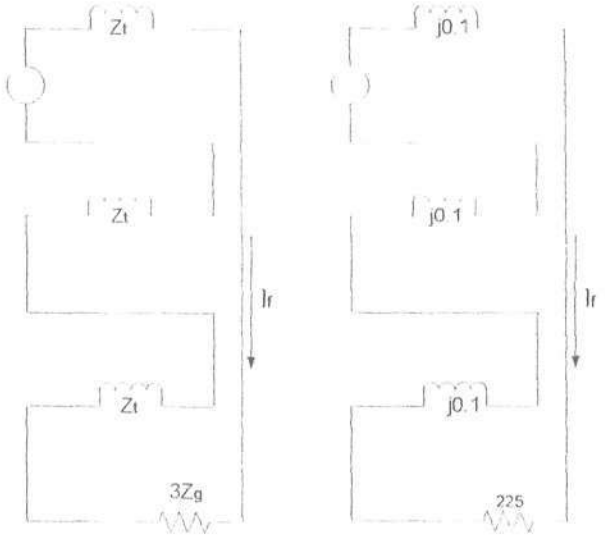
$= 5180.389282\ A$

$= 5.1804\ kA$

$\approx 5\ kA$

Arus hubung singkat 3Ø maksimum pada jaringan (l = 16 km) adalah 5.1804 kA

3) Arus Hubung Singkat 1Ø ke Tanah Maximum



$$I_{f(pu)}'' = \frac{1 \times 1.1}{225 + j0.3}$$

$$= \frac{1.1}{225 + j0.3} \times \frac{225 - j0.3}{225 - j0.3}$$

$$= \frac{247.5 - j0.33}{50625 + j0.09}$$

$$= \frac{247.5 - j0.33}{50625.09}$$

$$= 0.00489 - j0.0000065$$

$$= \sqrt{(0.00489^2 + 0.0000065^2)}$$

$$= 0.00489\ pu.$$

$I_{f(pu)}' = 3 \times I_{f(pu)}''$

$= 3 \times 0.00489$

$= 0.01467$ pu

$I_f = I_{f(pu)}' \cdot I_{base}$

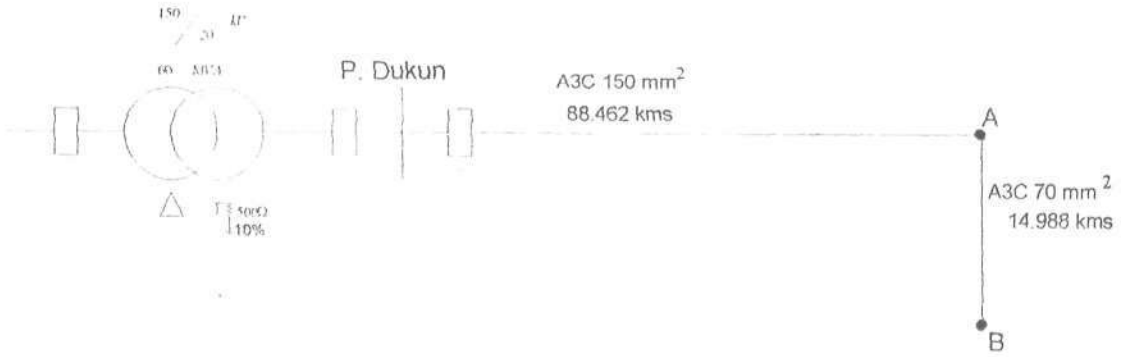
$= 0.01467 \times 1732.05$

$= 25.409$ A

$I_{f(Max)} = 25$ A

Arus Hubung Singkat 1Ø ke Tanah Maximum adalah 25.409 A

4) Arus Hubung Singkat 1Ø ke Tanah (Minimum) di titik B:



$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\text{-}0} = 0.3836 + j1.1427\ \Omega/km$ [tanpa Ground Wire]

$Z_{70} = 0.5049 + j0.0754\ \Omega/km$

$Z_{70\text{-}0} = 0.6529 + j1.1848\ \Omega/km$ [tanpa Ground Wire]

$Z_{150\text{-}1(88.462)} = 20.8416472 + j9.0938936\ \Omega$

$Z_{150\text{-}0(88.462)} = 33.9340232 + j101.0855274\ \Omega$

$Z_{70\text{-}1(14.988)} = 7.5674412 + j1.1300952\ \Omega$

$Z_{70\text{-}0(14.988)} = 9.7856652 + j17.7577824\ \Omega$

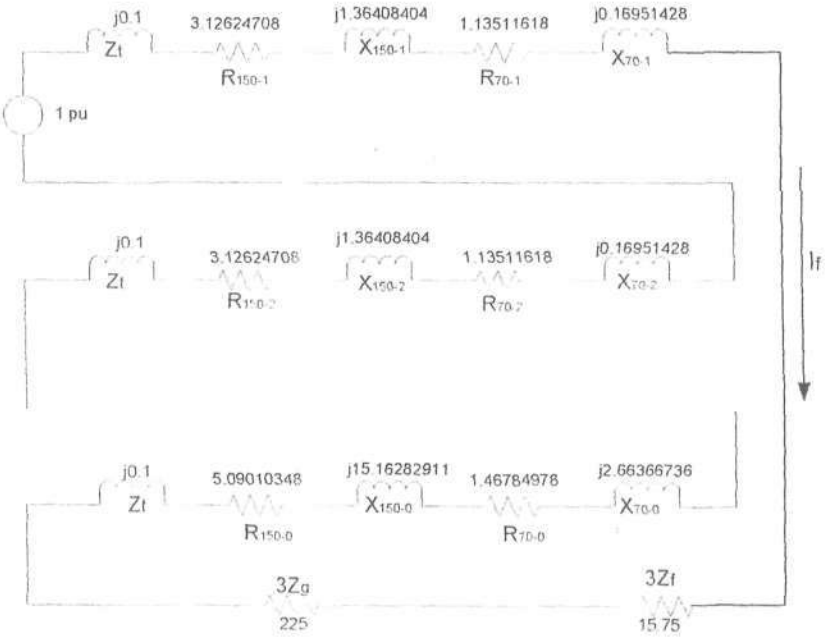
$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\text{-}1(p.u)} = 3.12624708 + j1.36408404$ pu

$Z_{150\text{-}0(p.u)} = 5.09010348 + j15.16282911$ pu

$Z_{70\text{-}1(p.u)} = 1.13511618 + j0.16951428$ pu

$Z_{70\text{-}0(p.u)} = 1.46784978 + j2.66366736$ pu



$$I_{f(pu)} = \frac{1}{R + jX}$$

$$= \frac{1}{255.8306798 + j21.19369311}$$

$$= \frac{1}{255.8306798 + j21.19369311} \times \frac{255.8306798 - j21.19369311}{255.8306798 - j21.19369311}$$

$$= 0.003882192212 - j0.0003216111156$$

$$= \sqrt{(0.00388192212^2 + 0.0003216111156^2)}$$

$$= 0.003895221824 \text{ pu}$$

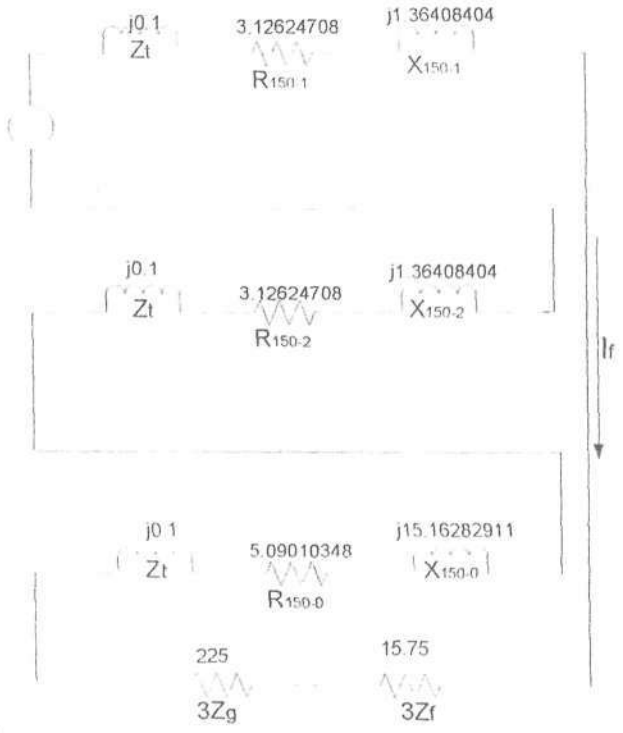
$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$

$= 0.003895221824 \times 1732.05$

$= 6.74671896$ A

Arus hubung singkat 1Ø ke tanah minimum di titik B adalah : 6.7467 A

5) Arus Hubung Singkat 1Ø ke Tanah di titik A (Minimum) :



$$I_{f(pu)} = \frac{1}{R + jX}$$

$$= \frac{1}{252.0925976 + j18.19099719}$$

$$= \frac{1}{252.0925976 + j18.19099719} \times \frac{252.0925976 - j18.19099719}{252.0925976 - j18.19099719}$$

$$= 0.003946248004 - 0.0002847611827$$

$$= \sqrt{(0.003946248004^2 + 0.0002847611827^2)}$$

$$= 0.003956508845 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 0.003956508845 \times 1732.05$$

$$= 6.852871145 \text{ A}$$

Arus hubung singkat 1Ø ke tanah minimum di titik A adalah : 6.8529 A

5.2. Penyulang Prambangan - GI Segoromadu

- 60 MVA
- $150/20\ kV$
- $MVA_{hubung\ singkat} = 3455$ MVA

$$Z_s = Z_{pu} = \frac{MVA_{base}}{MVA_{hs}} = \frac{60}{3455} = 0.0117366136 \text{ pu}$$

$X = 10\%$

$Z_t = 0.1$ pu

$$Z_{base} = \frac{(KVA_{base})^2}{MVA_{base}}$$

$$= \frac{20^2}{60}$$

$$= \frac{400}{60}$$

$$= 6.6667\ \Omega$$

$$Z_{G(pu)} = \frac{Z_{G(sebenarnya)}}{Z_{base}}$$

$$= \frac{500}{400/60}$$

$$= \frac{30000}{400}$$

$$= 75 \text{ pu}$$

$3Z_G = 225$ p.u

$Z_f = 35\ \Omega$

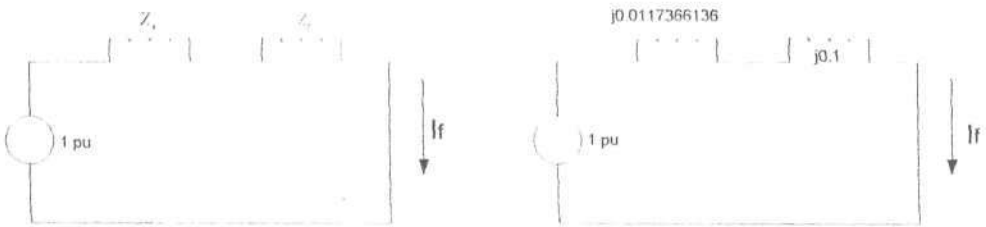
$$Z_{f(p.u)} = \frac{Z_{f(sebenar)}}{Z_{base}}$$

$$Z_{p.u} = \frac{35}{400 / 60}$$

$$= 5.25 \text{ p.u}$$

$$3Z_f = 15.75 \text{ p.u}$$

1) Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo



$$I_f = \frac{1}{Z_s + Z_t}$$

$$= \frac{1 \times 1.1}{0.017366136 + 0.1}$$

$$= \frac{1.1}{0.117366136}$$

$$= 9.372379781 \text{ pu}$$

$$I_{base} = \frac{KVA_{base}}{\sqrt{3}.KV_{base}}$$

$$= \frac{60000}{\sqrt{3}.20}$$

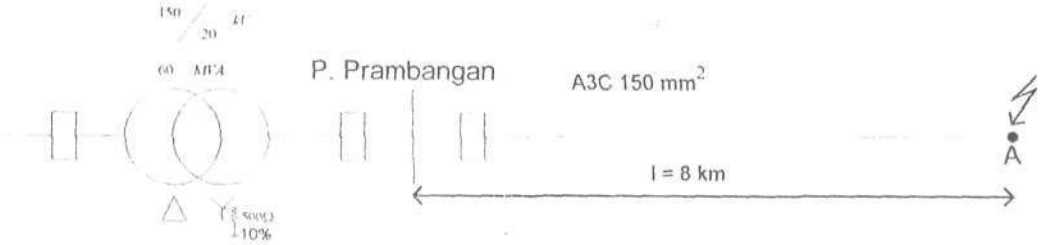
$$= \frac{60000}{34.64101616}$$

$$I_{base} = 1732.05 \text{ A}$$

$$I_{f(s)} = I_{f(pu)} \cdot I_{base}$$
$$= 9.372379781 \times 1732.05$$
$$= 16233.4304 \text{ A}$$
$$\approx 16 \text{ kA}$$

Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo adalah 16.2334 kA

2) Arus Hubung Singkat 3Ø Maksimum pada sisi Jaringan

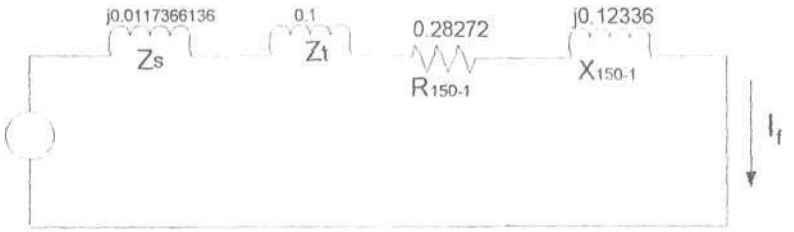


$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\,(8km)} = 1.8848 + j0.8224\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\,(pu)} = 0.28272 + j0.12336\ \Omega$



$$I_{f(pu)} = \frac{1}{Z_s + Z_t + Z_1}$$

$$I_{f(pu)} = \frac{1 \times 1.1}{j0.0117366136 + j0.1 + 0.28272 + j0.12336}$$

$$= 2.300219399 - j1.91275393$$

$$= \sqrt{2.300219399^2 + 1.91275393^2}$$

$$= 2.991594371 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 2.991594371 \times 1732.05$$

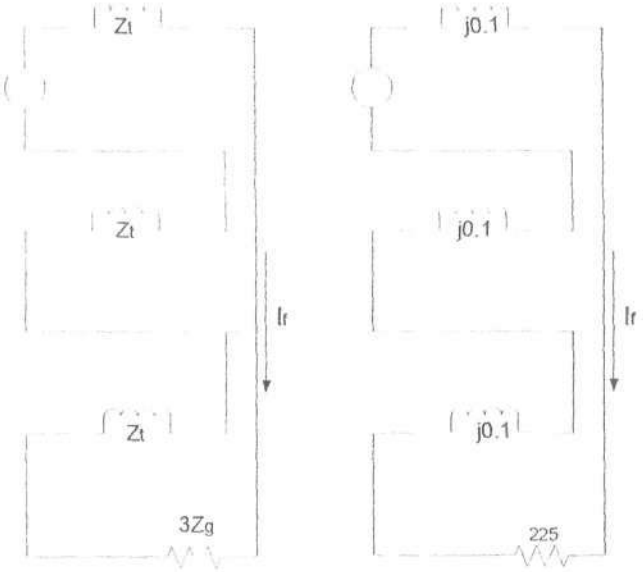
$$= 5181.59103\text{A}$$

$$= 5.1816 \text{ kA}$$

$$\approx 5 \text{ kA}$$

Arus hubung singkat 3Ø pada jaringan (l = 8 km) : 5.1816 kA

3) Arus Hubung Singkat 1Ø ke Tanah Maximum



$$I_{f(pu)}'' = \frac{1 \times 1.1}{225 + j0.3}$$

$$= \frac{1.1}{225 + j0.3} \times \frac{225 - j0.3}{225 - j0.3}$$

$$= \frac{247.5 - j0.33}{50625 + 0.09}$$

$$= \frac{247.5 - j0.33}{50625.09}$$

$$= 0.00489 - j0.0000065$$

$$= \sqrt{(0.00489^2 + 0.0000065^2)}$$

$$= 0.00489 \text{ pu.}$$

$$I_{f(pu)}' = 3 \times I_{f(pu)}''$$

$$= 3 \times 0.00489$$

$$= 0.01467 \text{ pu}$$

$$I_f = I_{f(pu)}' \cdot I_{base}$$

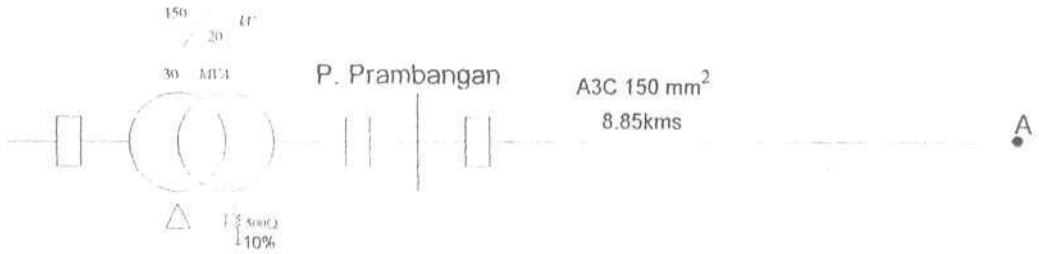
$$= 0.01467 \times 1732.05$$

$$= 25.409 \text{ A}$$

$$I_{f(Max)} = 25 \text{ A}$$

Arus Hubung Singkat 1Ø ke Tanah Maximum adalah 25.409 A

4) Arus Hubung Singkat 1Ø ke Tanah di titik A (Minimum) :



$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\text{-}0} = 0.3836 + j1.1427\ \Omega/km$ [tanpa Ground Wire]

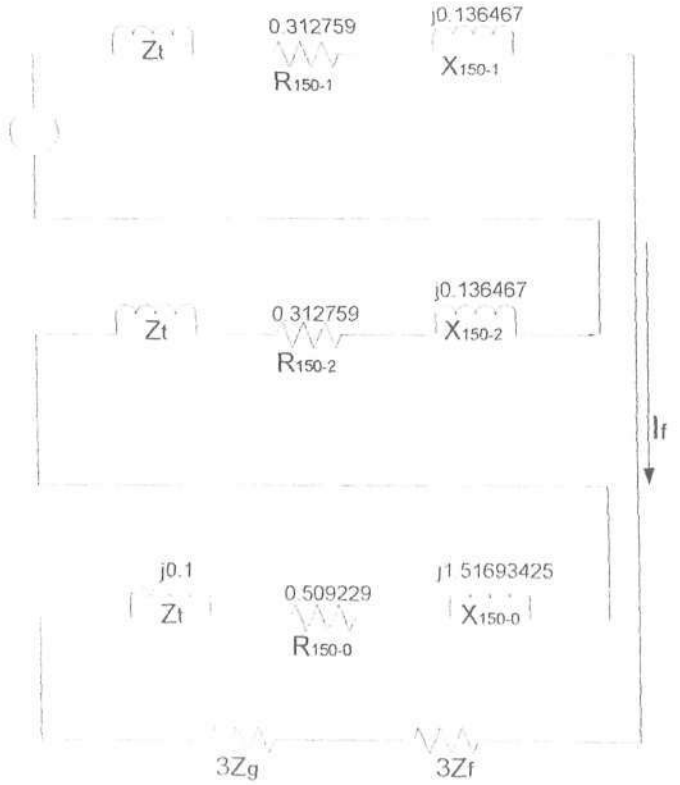
$Z_{150\text{-}1(8.85)} = 2.08506 + j0.90978\ \Omega$

$Z_{150\text{-}0(8.85)} = 3.39486 + j10.112895\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\text{-}1(p.u)} = 0.312759 + j0.136467$ pu

$Z_{150\text{-}0(p.u)} = 0.509229 + j1.51693425$ pu



$$I_{f(pu)} = \frac{1}{R + jX}$$

$$= \frac{1}{241.884747 + j2.08986825}$$

$$= \frac{1}{241.884747 + j2.08986825} \times \frac{241.884747 - j2.08986825}{241.884747 - j2.08986825}$$

$$= 0.004133891738 - j0.00003571655178$$

$$= \sqrt{(0.004133891738^2 - j0.00003571655178^2)}$$

$$= 0.004149292483 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 0.004149292483 \times 1732.05$$

$$= 7.186782045 \text{ A}$$

Arus hubung singkat 1Ø ke tanah minimum di titik A adalah : 7.1868 A

5.3. Penyulang Sidayu - GI Petrokimia

- 30 MVA
- $150/20\,kV$
- $MVA_{hubung\ singkat} = 2146$ MVA

$$Z_s = Z_{pu} = \frac{MVA_{base}}{MVA_{hs}} = \frac{50}{2146} = 0.01398 \text{ pu}$$

$X = 10\%$

$Z_1 = 0.1$ pu

$$Z_{base} = \frac{(KV_{base})^2}{MVA_{base}}$$

$$= \frac{20^2}{30}$$

$$= \frac{400}{30} \text{ pu}$$

$$= 13.3333\ \Omega$$

$$Z_{G(pu)} = \frac{Z_{G(sebenarnya)}}{Z_{base}}$$

$$= \frac{500}{400/30}$$

$$= \frac{15000}{400}$$

$$= 37.5 \text{ pu}$$

$3Z_G = 112.5$ p.u

$Z_f = 35\ \Omega$

$$Z_{f(p.u)} = \frac{Z_{f(sebenar)}}{Z_{base}}$$

$$Z_{f(p.u)} = \frac{35}{400/30}$$

$$= 2.625 \text{ p.u}$$

$$3Z_{f(p.u)} = 7.875 \text{ p.u}$$

1) Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo

$$I_f = \frac{1}{Z_s + Z_t}$$

$$= \frac{1 \times 1.1}{0.01398 + 0.1}$$

$$= \frac{1.1}{0.11398}$$

$$= 9.6508 \text{ pu}$$

$$I_{base} = \frac{KVA_{base}}{\sqrt{3}.KV_{base}}$$

$$= \frac{30000}{\sqrt{3}.20}$$

$$= \frac{30000}{34.64101616}$$

$$I_{base} = 866.025 \text{ A}$$

$$I_{f(s)} = I_{f(pu)} \cdot I_{base}$$

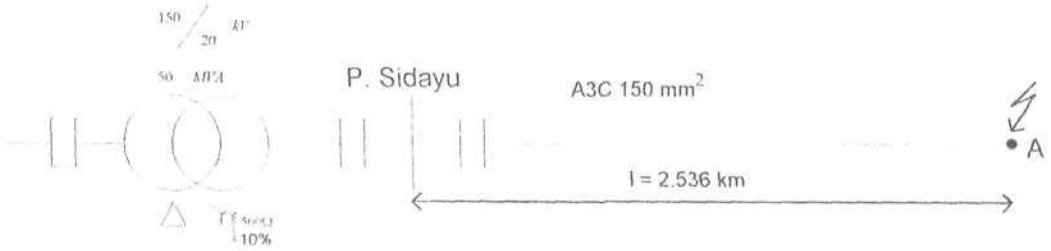
$$= 9.6508 \times 866.025$$

$$= 8357.8341 \text{ A}$$

$$\approx \underline{\underline{8 \text{ kA}}}$$

Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo adalah 8.3578 kA

2) Arus Hubung Singkat 3Ø Maksimum pada sisi Jaringan



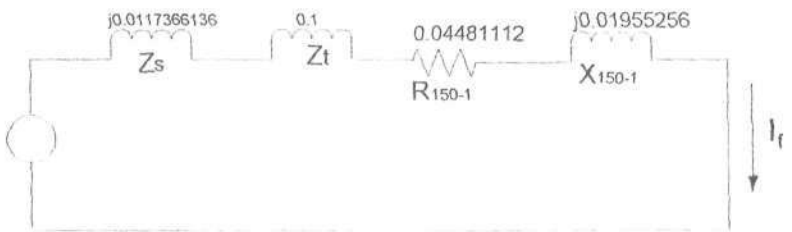
$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\text{-}1(2.536)} = 0.5974816 + j0.2607008\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\text{-}1(p.u)} = 0.04481112 + j0.01955256$ pu

➢ Untuk l = 2.536 km



$$I_{f(pu)} = \frac{1}{Z_s + Z_t + Z_l}$$

$$I_{f(pu)} = \frac{1 \times 1.1}{j0.01398 + j0.1 + 0.04481112 + j0.01955256}$$

$$= 2.484615105 - j7.403899202$$

$$= \sqrt{2.484615105^2 + 7.403899202^2}$$

$$= 7.809675769 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 7.809675769 \times 866.025$$

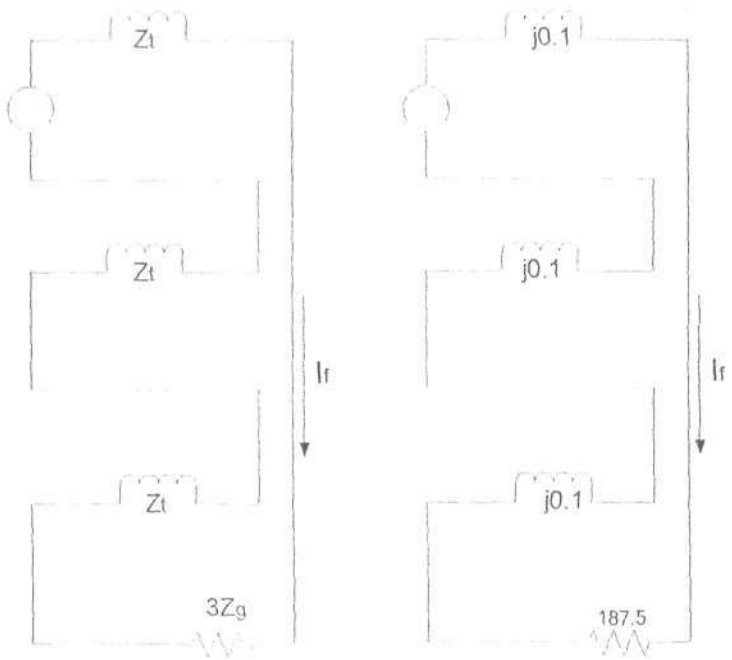
$$= 6763.374458 \text{ A}$$

$$= 6.7634 \text{ kA}$$

$$\approx 8 \text{ kA}$$

Arus hubung singkat 3Ø maksimum pada jaringan (l = 2.536 km) adalah 6.7634 kA

3) Arus Hubung Singkat 1Ø ke Tanah Maximum



$$I_{f(pu)}'' = \frac{1 \times 1,1}{112.5 + j0.3}$$

$$= \frac{1.1}{112.5 + j0.3} \times \frac{112.5 - j0.3}{112.5 - j0.3}$$

$$= 0,00978 - j0.0000261$$

$$= \sqrt{(0,00978^{\,2} + j0.0000261^{2})}$$

$$= 0.00978 \text{ pu}$$

$$I_{f(pu)}' = 3 \times I_{f(pu)}''$$

$$= 3 \times 0.00978 \text{ pu}$$

$$= 0.02934 \text{ pu}$$

$$I_f = I_{f(pu)}' \cdot I_{base}$$

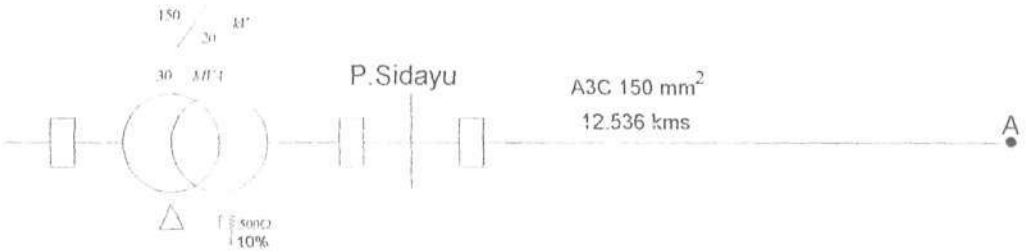
$$= 0.02934 \times 866.025$$

$$= 25.4092 \text{ A}$$

$$I_{f(Max)} = 25 \text{ A}$$

Arus Hubung Singkat 1Ø ke Tanah Maximum adalah 25.409 A

4) Arus Hubung Singkat 1Ø ke Tanah di titik A (Minimum) :



$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\text{-}0} = 0.3836 + j1.1427\ \Omega/km$ [tanpa Ground Wire]

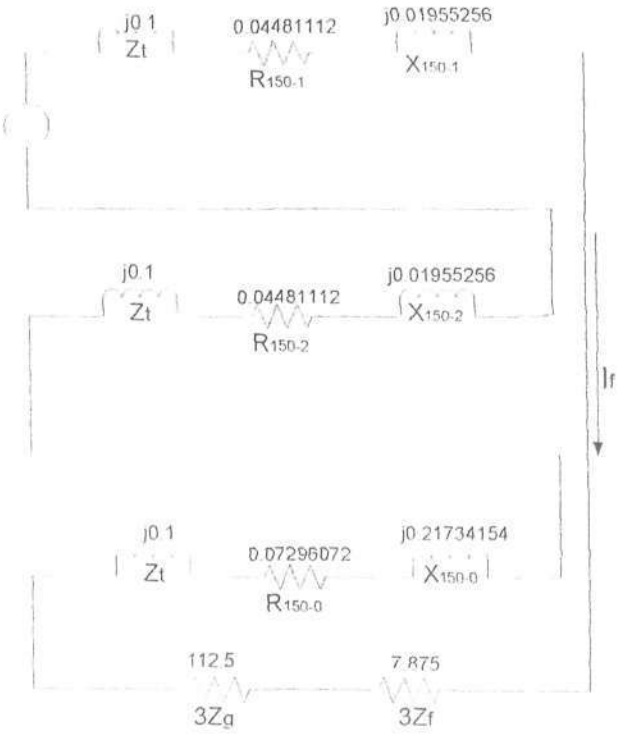
$Z_{150\text{-}1(2.536)} = 0.5974816 + j0.2607008\ \Omega$

$Z_{150\text{-}0(2.536)} = 0.9728096 + j2.8978872\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\text{-}1(p.u)} = 0.04481112 + j0.01955256$ pu

$Z_{150\text{-}0(p.u)} = 0.07296072 + j0.21734154$ pu



$$I_{f(pu)} = \frac{1}{R + jX}$$

$$= \frac{1}{195.5375831 + j0.55644666}$$

$$= \frac{1}{120.5375831 + j0.55644666} \times \frac{120.5375831 - j0.55644666}{120.5375831 - j0.55644666}$$

$$= 0.008295990875 - j0.0000328974031$$

$$= \sqrt{(0.008295990875^{\ 2} + j0.0000328974031^2)}$$

$$= 0.008296056101 \text{ pu}$$

$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$

$= 0.008296056101 \times 866.025$

$= \underline{\underline{7.184591985 \text{ A}}}$

Arus hubung singkat 1Ø ke tanah minimum di titik A adalah : 7.1846 A

5.4. Penyulang Sukorejo - GI Alta Prima

- 60 MVA
- $150/20\ kV$
- $MVA_{hubung\ singkat} = 3455$ MVA

$$Z_s = Z_{pu} = \frac{MVA_{base}}{MVA_{hs}} = \frac{60}{3455} = 0.0117366136 \text{ pu}$$

$X = 10\%$

$Z_t = 0.1$ pu

$$Z_{base} = \frac{(KVA_{base})^2}{MVA_{base}}$$

$$= \frac{20^2}{60}$$

$$= \frac{400}{60}$$

$$= 6.6667\ \Omega$$

$$Z_{G(pu)} = \frac{Z_{G(sebenarnya)}}{Z_{base}}$$

$$= \frac{500}{400/60}$$

$$= \frac{30000}{400}$$

$$= 75 \text{ pu}$$

$$3Z_G = 3 \times 75 \text{ pu}$$

$$= 225 \text{ pu}$$

$Z_f = 35\ \Omega$

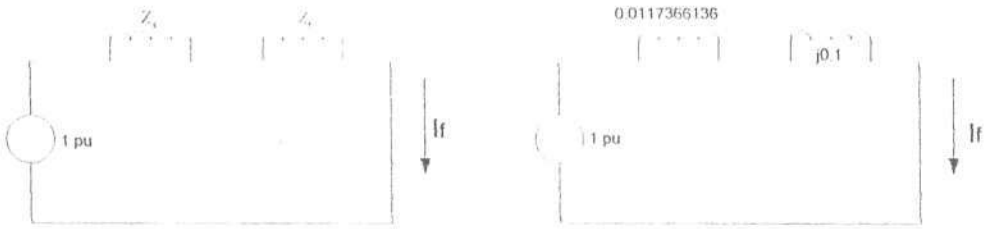
$$Z_{f(p.u)} = \frac{Z_{f(sebenar)}}{Z_{base}}$$

$$Z_{p.u} = \frac{35}{400/60}$$

$$= 5.25 \text{ pu}$$

$$3Z_f = 15.75 \text{ pu}$$

1) Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo



$$I_f = \frac{1}{Z_s + Z_t}$$

$$= \frac{1 \times 1.1}{0.017366136 + 0.1}$$

$$= \frac{1.1}{0.117366136}$$

$$= 9.372379781 \text{ pu}$$

$$I_{base} = \frac{KVA_{base}}{\sqrt{3}.KV_{base}}$$

$$= \frac{60000}{\sqrt{3}.20}$$

$$I_{base} = 1732.05 \text{ A}$$

$I_{f(s)} = I_{f(pu)} \cdot I_{base}$

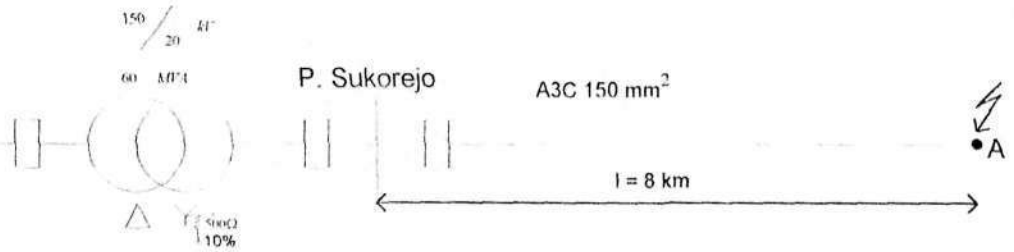
$= 9.372379781 \times 1732.05$

$= 16233.4304$ A

$\approx \underline{\underline{16\ kA}}$

Arus Hubung Singkat 3Ø Maksimum di Sisi Sekunder Trafo adalah 16.2334 kA

2) Arus Hubung Singkat 3Ø Maksimum pada sisi Jaringan

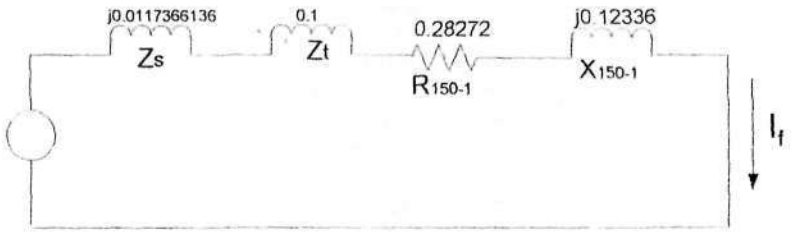


$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\,(8km)} = 1.8848 + j0.8224\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\,(pu)} = 0.28272 + j0.12336\ \Omega$



$$I_{f(pu)} = \frac{1}{Z_s + Z_t + Z_1}$$

$$I_{f(pu)} = \frac{1 \times 1.1}{j0.0117366136 + j0.1 + 0.28272 + j0.12336}$$

$= 2.300219399 - j1.91275393$

$$= \sqrt{2.300219399^2 + 1.91275393^2}$$

$$= 2.991594371 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 2.991594371 \text{ x } 1732.05$$

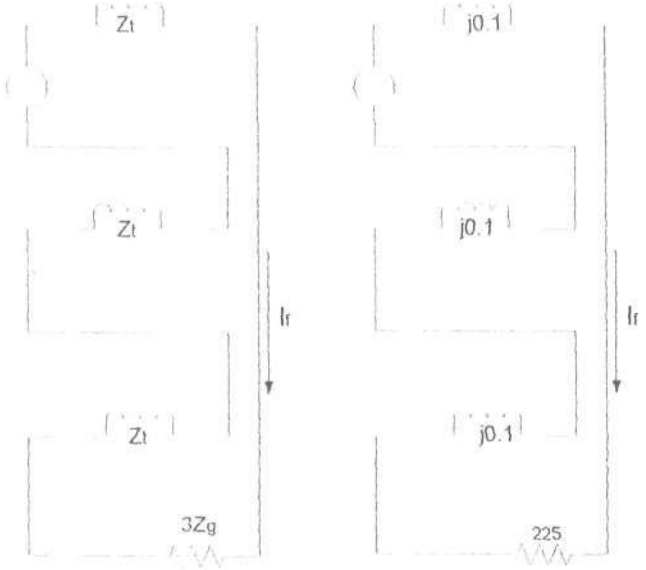
$$= 5181.59103$$

$$= 5.1816 \text{ kA}$$

$$\approx 5 \text{ kA}$$

Arus hubung singkat 3Ø pada jaringan (l = 8 km) : 5.1816 kA

3) Arus Hubung Singkat 1Ø ke Tanah Maximum



$$I_{f(pu)}'' = \frac{1 \times 1.1}{225 + j0.3}$$

$$= \frac{1.1}{225 + j0.3} \times \frac{225 - j0.3}{225 - j0.3}$$

$$= \frac{247.5 - j0.33}{50625 + 0.09}$$

$$= \frac{247.5 - j0.33}{50625.09}$$

$$= 0.00489 - j0.0000065$$

$$= \sqrt{(0.00489^2 + 0.0000065^2)}$$

$$= 0.00489 \text{ pu.}$$

$$I_{f(pu)}' = 3 \times I_{f(pu)}''$$

$$= 3 \times 0.00489$$

$$= 0.01467 \text{ pu}$$

$$I_f = I_{f(pu)}' \cdot I_{base}$$

$$= 0.01467 \times 1732.05$$

$$= 25.409 \text{ A}$$

$$I_{f(Max)} = 25 \text{ A}$$

Arus Hubung Singkat 1Ø ke Tanah Maximum adalah 25.409 A

4) Arus Hubung Singkat 1Ø ke Tanah di titik A (Minimum) :

$Z_{150} = 0.2356 + j0.1028\ \Omega/km$

$Z_{150\text{-}0} = 0.3836 + j1.1427\ \Omega/km$ [tanpa Ground Wire]

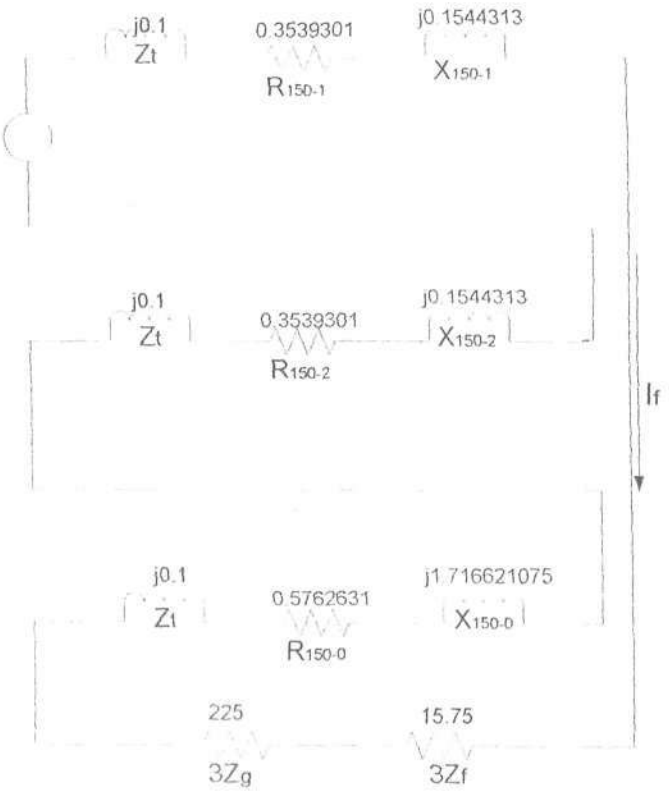
$Z_{150\text{-}1(9.865)} = 2.359534 + j1.029542\ \Omega$

$Z_{150\text{-}0(9.865)} = 3.841754 + j11.4441405\ \Omega$

$$Z_{(pu)} = \frac{Z_{sebenarnya}}{Z_{base}}$$

$Z_{150\text{-}1(p.u)} = 0.3539301 + j0.1544313$ pu

$Z_{150\text{-}0(p.u)} = 0.5762631 + j1.716621075$ pu



$$I_{f(pu)} = \frac{1}{R + jX}$$

$$= \frac{1}{242.0341233 + j2.35483675}$$

$$= \frac{1}{242.0341233 + j2.35483675} \times \frac{242.0341233 - j2.35483675}{242.0341233 - j2.35483675}$$

$$= 0.004131257754 - j0.00004019448766$$

$$= \sqrt{(0.004131257754^2 + 0.00004019448766^2)}$$

$$= 0.004131453283 \text{ pu}$$

$$I_{f(sebenar)} = I_{f(pu)} \cdot I_{base}$$

$$= 0.004131453283 \times 1732.05$$

$$= \underline{7.155883658 \text{ A}}$$

Arus hubung singkat 1Ø ke tanah minimum di titik A adalah : 7.1559 A

5.5. Setting DGR Sesuai Hasil Perhitungnan Penyulang

$I_{setting} = 10\% \times I_{maksimum}$

$= 10\% \times 25\ A$

$= 2.5$

$I_{setting} = 2\ A$

Tabel 5.1. Setting DGR Sesuai Hasil Perhitungnan Penyulang

Nama GI/Penyulang	$I_{setting}$ (A)	Arus Hubung Singkat 1Ø ke Tanah Maks (A)
Segoromadu		
P. Prambangan	2	25
Petrokimia		
Sedayu	2	25
Manyar		
P. Dukun	2	25
Alta Prima		
P. Sukorejo	2	25

Arus *setting* untuk DGR pada masing-masing penyulang adalah sama yaitu 10% dari arus ganguan 1Ø maksimum ke tanah, yang besarnya pada masing-masing penyulang adalah sama yaitu 25 A

5.6. Perbandingan Hasil Perhitungan Hubung Singkat 3Ø Maksimum dengan *Lightning Arrester*

Tabel 5.2. Perbandingan Hasil Perhitungan Hubung Singkat 3Ø Maksimum dengan *Lightning Arrester*

No	GI/Penyulang	Hasil Perhitungan Hubung Singkat 3Ø Maks (kA)	Lightning Arrester (kA)	Hasil Perhitungan Hubung Singkat 1Ø Maks(kA)		Lightning Arrester (kA)	
				l=8km	l=16km	l=8km	l=16km
	Segoromadu						
1	Prambangan	16.2334	20	5.1816	-	10	-
	Petrokimia						
2	Sedayu	8.3578	10	6.7634	-	10	-
	Manyar						
3	Dukun	16.0510	20	8.5119	5.1804	10	10
	Alta Prima						
4	Sukorejo	16.2334	20	5.1816	-	10	-

LA yang berada pada sisi sekunder trafo lebih besar daripada LA yang ada di jaringan. LA yang berada semakin jauh dari bus semakin kecil.