ELEKTRİK TESİSLERİNDE GÜVENLİK ÖDEV (Yararlanabileceğiniz Kaynaklar:
Schneider Electric /Calculation of short circuits current—İsmail Kaşıkçı)

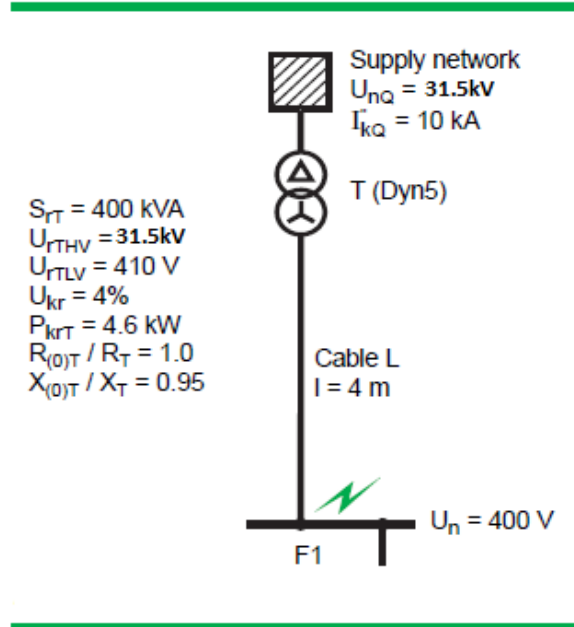## P1)

Problem 1. A transformer supplied by a network

A 20 kV network supplies a transformer T connected to a set of busbars by a cable L (see **Fig. 30**).

It is necessary to calculate, in compliance with IEC 60909, the initial short-circuit current I''_k and the peak short-circuit current i_p during a three-phase, then a phase-to-earth fault at point F1.

The following information is available:

■ The impedance of the connection between the supply and transformer T may be neglected
■ Cable L is made up of two parallel cables with three conductors each, where:

l = 4 m; 3 x 185 mm² Al
$Z_L = (0.208 + j0.068)$ Ω/km
$R_{(0)L} = 4.23 R_L$; $X_{(0)L} = 1.21 X_L$

■ The short-circuit at point F1 is assumed to be far from any generator

$S_{rT} = 400$ kVA
$U_{rTHV} = 31.5$kV
$U_{rTLV} = 410$ V
$U_{kr} = 4\%$
$P_{krT} = 4.6$ kW
$R_{(0)T} / R_T = 1.0$
$X_{(0)T} / X_T = 0.95$

Supply network
$U_{nQ} = 31.5$kV
$I''_{kQ} = 10$ kA

T (Dyn5)

Cable L
l = 4 m

$U_n = 400$ V

F1

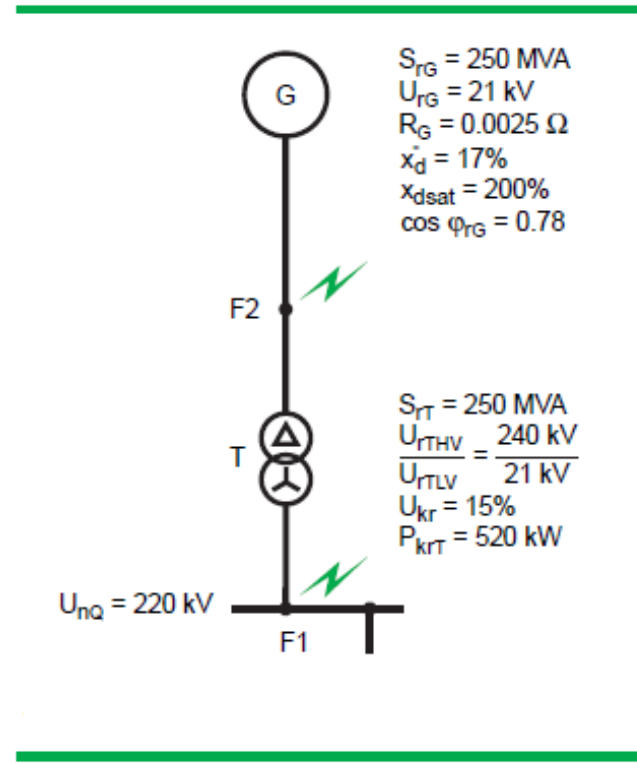## P2)

Problem 2. A power station unit

A power station unit S comprises a generator G and a transformer T with an on-load tap-changer (see **Fig. 31**).

It is necessary to calculate, in compliance with IEC 60909, the initial short-circuit current I''_k as well as the peak i_p and steady-state I_{kmax} short-circuit currents and the breaking short-circuit current I_b during a three-phase fault:
■ Outside the power station unit on the busbars at point F1
■ Inside the power station unit at point F2

The following information is available:
■ The impedance of the connection between generator G and transformer T may be neglected
■ The voltage factor c is assumed to be 1.1
■ The minimum dead time t_{min} for calculation of I_b is 0.1 s
■ Generator G is a cylindrical rotor generator (smooth poles)
■ All loads connected to the busbars are passive

$S_{rG} = 250$ MVA
$U_{rG} = 21$ kV
$R_G = 0.0025$ Ω
$x''_d = 17\%$
$x_{dsat} = 200\%$
$\cos \varphi_{rG} = 0.78$

G

F2

T

$S_{rT} = 250$ MVA
$\dfrac{U_{rTHV}}{U_{rTLV}} = \dfrac{240 \text{ kV}}{21 \text{ kV}}$
$U_{kr} = 15\%$
$P_{krT} = 520$ kW

$U_{nQ} = 220$ kV

F1

P3)

The single-pole short circuit current is to be calculated at the end of the line, considering the zero-sequence resistances. The data are given in Figure

350 MVA

20/0,4 KV
630 kVA
6 %

1,15 %

250 A
NYY-J 4 × 120 mm^2

L=640m

80 A
NYY-J 4 × 25 mm^2

L=800m
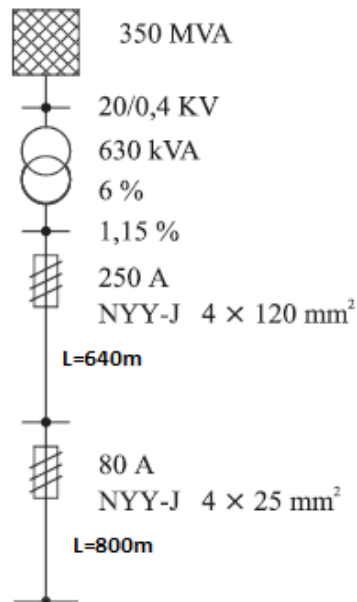
P4) In the electrical installation of a building the following data are known (Figure   ). Calculate all required short circuit currents and check the cut-off conditions.

230/400 V, 50 Hz

$I''_{KQ} = 250$ A

NH00
80A

NYM - J
5 × 16 mm^2

$l_1 = 15$ m

kWh

D02/63A

63 A

B16A

$l_2 = 30$ m
NYM - J
3 × 2,5 mm^2

C16A

$l_3 = 45$ m
NYM - J
3 × 2,5 mm^2