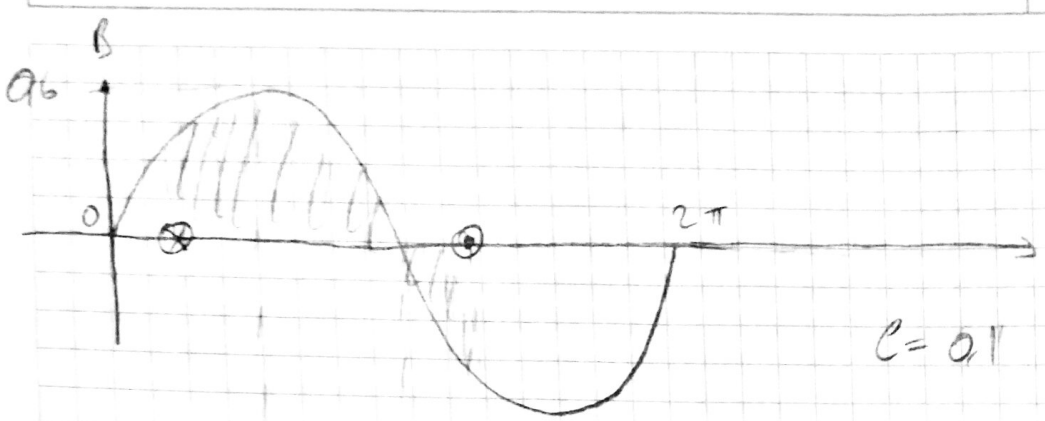
4,44 N Φ f



$l = 0,1$ $r = 17,5\,mm$

$B(\theta) = 0,6 \sin(\theta) \Rightarrow$

$10^{-6}\ \frac{mm^2}{m^2}$

$\Phi_L = 0,6 \cdot \cos\theta \cdot 2r \cdot l = 1,2\, r \cdot l \cdot \cos\theta$

$= 2,1\ mWb \cdot \cos\theta$

$V_{rms} = \frac{N}{\sqrt{2}} \frac{d\Phi_L}{dt} = \frac{N}{\sqrt{2}} \cdot 2,1 \cdot 10^{-3} \cdot w \sin(wt)$ $\quad f \to 25$

$= \frac{2\pi}{\sqrt{2}} \cdot N \cdot 2,1 \cdot 10^{-3} \cdot f = 24$

$\Rightarrow 4,44\ N \cdot 2,1 \cdot 10^{-3} \cdot 25 = 24$

$N = 103$ turns Φ

Air gap area $= \pi \cdot (20^2 - 17^2) \cdot 10^{-6}\ m^2 = 175\pi \cdot 10^{-6}\ m^2$

$= 175\pi\ mm^2$

With 0,7 FF $\Rightarrow$ Coil area $= 122,5\pi \cdot mm^2 \approx 385\ mm^2$

Coil area per phase $= \frac{385}{3} = 128\ mm^2$

$\Rightarrow$ Coil area per phase per coil $= \frac{128\ mm^2}{206} = 0,62\ mm^2$

Areapercoil = 0,62 mm² ⇒ Choose AWG 20 where:
ρ = 0,406 Areapercoil = 0,52
δ = 0,812

For the chosen coil

J = 4 A/mm² given

⇒ I = J · Areapercoil = 4 $\frac{A}{mm^2}$ · 0,62 mm² = 2,48A

length per turn = 2(rmean + 6) = 2(17,5·10⁻³ + 0,1) = 0,235m

Total length = 0,235 · 103 = 24,2 meters perphase

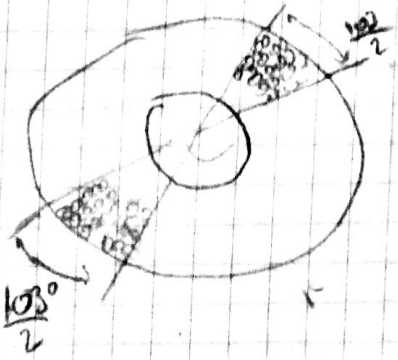
Coil Resistance = 33,31 $\frac{m\Omega}{m}$ · 24,2 ≈ 806 mΩ perphase

$P_{copper} = 2,48^2 \cdot 0,806 = 4,96W$ perphase

coil allowed → $\frac{4\,mm}{0,812} = 4,92$ ⇒ 5 coils can come on top of each other at most assuming such arrangement

coil → diameter

⇒ There will be around 20 coils grops on each side



20 · 0,812mm = 16,24 mm = arc length perside perphase
= 32,48 mm perphase

$\theta \cdot r = 32,48\,mm$ where $r = 20 - \frac{5}{2} \cdot 0,812 = 18$

⇒ θ = 1,8 rad = 103° degree per phase

Φ_{Lpeak}	N	AWG 20	I_{rms}	P_{copper}	Coil Spread Angle per phase	Sinmax
2,1 mWb	103 per phase	r = 0,406	2,48A per phase	4,96W per phase	103°	3·24·2,48 = 178,56 VA