Rated output power is 1280 kW. In order to find input current, efficiency is taken as 0.95 and power factor as 0.9.

1280/(0.9\*0.95)=1500kVA

1350V\*I\*(3^0.5)=1500kVA

I=641 Arms

Take 5A/mm^2

641A/5=128.2 mm^2

Pi\*r^2=128.2 mm^2

r=6.39mm

For 78 Hz skin dept is 7.38mm so single wire with 12.8 mm diameter can be used.

Pmech/2p=1280/6=213.33 kW/pole

Since we know the watts/pole value, we can chose Cmech value. According to the chart, the value should be between 250 and 300.

Pmech=Cmech\*D^2\*l\*n

n=f/p=78/3=26

1280=Cmech\*D^2\*l\*26

0.197>D^2\*l>0.164

After that motor aspect ratio should be determined.

X=l/D

X= pi\*(p^(1/3))/(2\*p)=pi\*(3^(1/3))/(2\*3)=0.755

Take D^2\*l=0.180 and l/D=0.755

0.180/0.755=D^3

D=0.62m, l=0.47m

Take D=0.6m l=0.5m and B=0.9T

Tp=pi\*D/6=pi\*0.1

Ф=l\*Tp\*B\*2/pi=l\*pi\*D/6\*0.9\*2/pi=90 mWeber

Return back to induced voltage.

E=4.44\*f\*kw\*N\* Ф

Vll=1350V

Vph=780V

780=4.44\*78\*0.95\*N\*0.090

N=26.34 turns

Number of turns must be an integer. Take N=24. Electrical loading should be calculated for this case.

A=53.721 kA/m

Fort his case, induced voltage shoud be adjusted again for N=24 by changing the dimensions.

780=4.44\*78\*24\* Ф

Ф=93.8mWeber

Keep the diameter same and increase the length to match required flux.

L=0.5m Ф=90 mWeber

L=0.52m Ф=0.93 mWeber

Analytical Results

L=0.52 m

D=0.6 m

A=51 kA/m

X=0.867

I=641A