DESIGN

The chopper has four thyristors that function both as main & commutation thyristors. Thyristor pairs S_1, S_2 & S_3, S_4 alternately conduct the load cct. The sequence of operation is as follows and some important waveforms are shown in Fig 4-7(b).

Design of alternators

High speed: Turbines } cylindrical
Low speed: engine driven, water wheel } & salient poles

Ratings & Dimensions

Power $S = 3 E_{ph} I_{ph}$

$= 3 \times (4.44 K_w f T_{ph} \phi_m) \times I_{ph}$ volt-amp

Specific magnetic loading, the average magnetic flux density over the wheel surface of the air-gap

$\bar{B} = 2p\phi_m / (\pi DL)$ wb/m² s.f.

Specific electric loading, the no. of rms amp. conductors/unit length of the gap surface circumference or the rms peripheral current density,

$a_c = 3 \times 2 T_{ph} I_{ph} / (\pi D)$ amp-cond/m

where $f = pn$; f=frequency, p= pole pairs

$S = 4.44 K_w pn (\pi DL \bar{B} / 2p) \frac{1}{2} \pi D a_c$

$S = 1.11 K_w \pi^2 \bar{B} a_c D^2 L n$ volt-amp

The output coefficient, with S in KVA is

$C = \frac{S}{D^2 L n} = 11 K_w \bar{B} a_c 10^{-3}$

If the speed $u = \pi D n$ ——— (17-4)

$S = 1.1 K_w \bar{B} . a_c . L (u^2/n) \times 10^{-3}$ KVA (rms)

Low speed machines.

$\bar{B} = 0.6$ wb/m², High values of $a_c = 45,000$ amp cond/m

$u = 30$ m/s, $K_w = 0.95$ & $L = 0.5$ m

the output obtained by Eqn. (17-5) is

$S \approx 80000/n$ KVA

Thus at 375 r/m, (16 poles for 50Hz), n = 6.25 r/s & an output of 14400 KVA could be obtained. The stator diameter would be about 4m. A 40 pole machine with n = 2.5 r/s would have a rating of 16MVA & a dia of 10m.

Specific loading

Typical conservative loadings for salient pole machines are given below.

D m	0.2	0.3	0.5	0.75	1.0	1.5	2.0	3.0
Li/D	0.7	0.65	0.6	0.5	0.42	0.33	0.3	0.3
$\bar{B}$ wb/m²	0.44	0.47	0.53	0.57	0.59	0.6	0.62	0.64