

Elektrische Aandrijvingen

WTB

Lokatie/evenement

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FIGURE 14-5 Typical torque-speed curves of NEMA Design B, C, and D motors. Each curve corresponds to the minimum NEMA values of locked-rotor torque, pull-up torque, and breakdown torque of a 3-phase, 1800 r/min, 10 hp, 60 Hz, squirrel-cage induction motor. The cross section of the respective rotors indicates the type of rotor bars used.

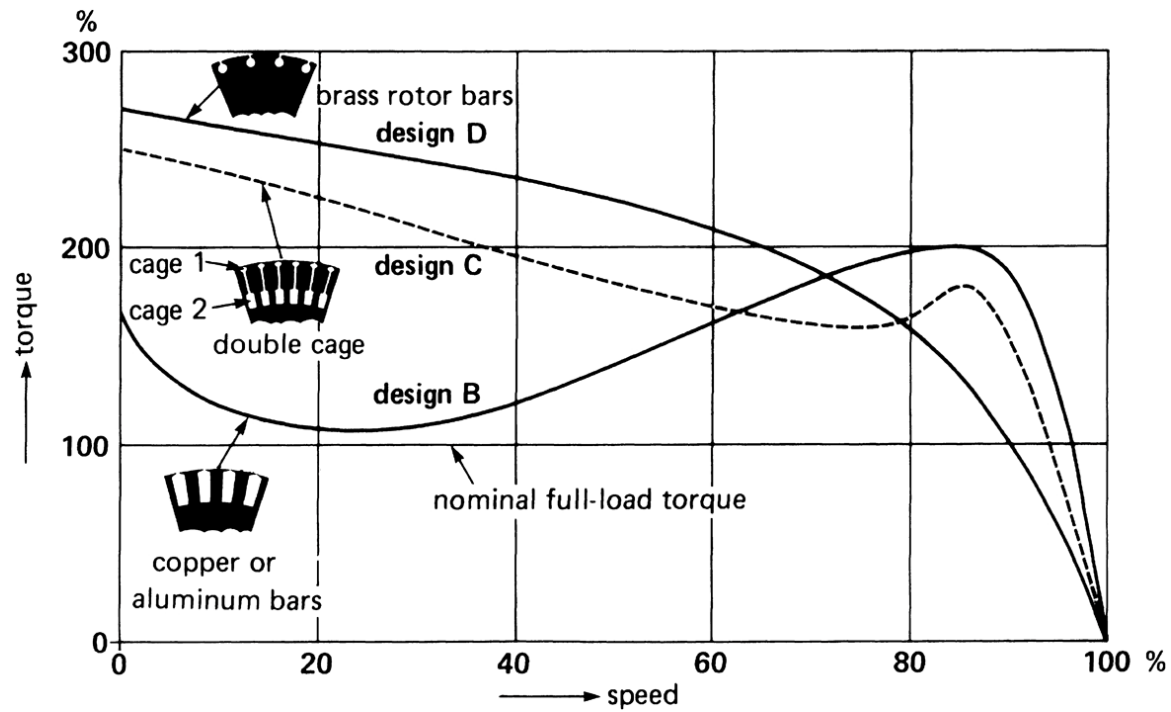


FIGURE 14-6 Gear motor rated at 2.25 kW, 1740 r/min, 60 Hz. The output torque and speed are respectively 172 N·m and 125 r/min. (Courtesy of Reliance Electric)

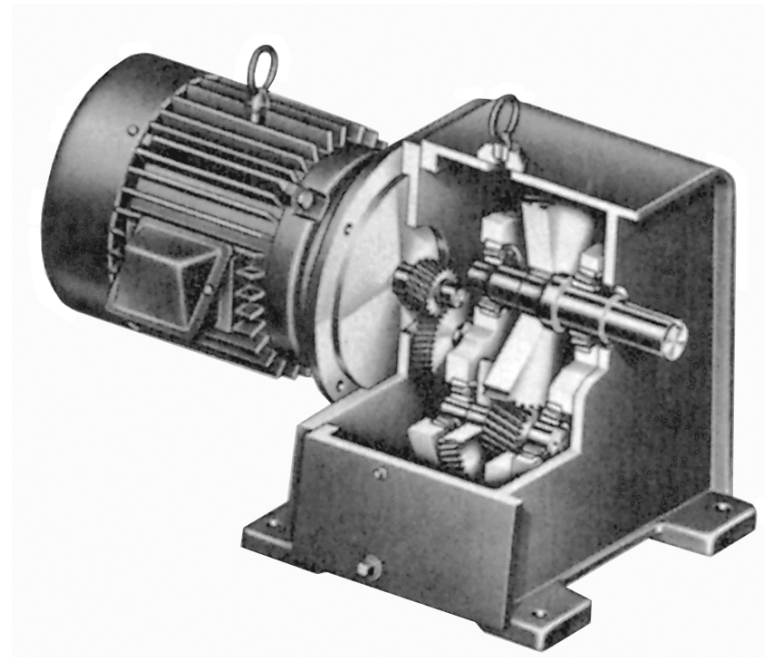
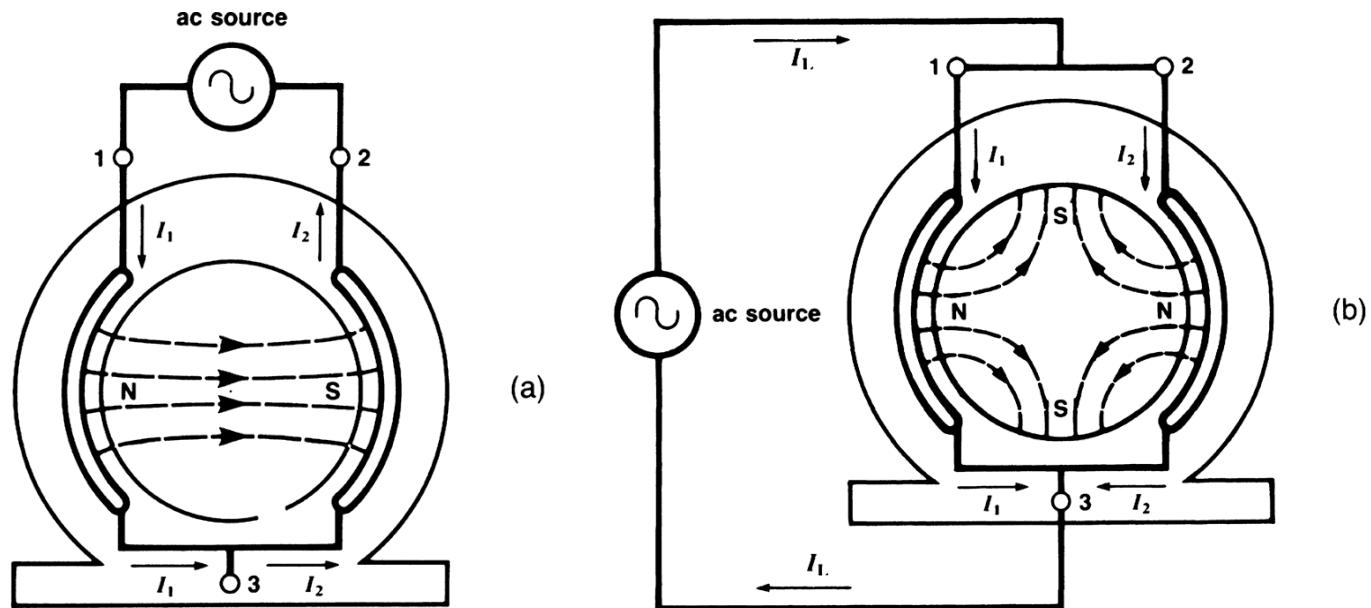
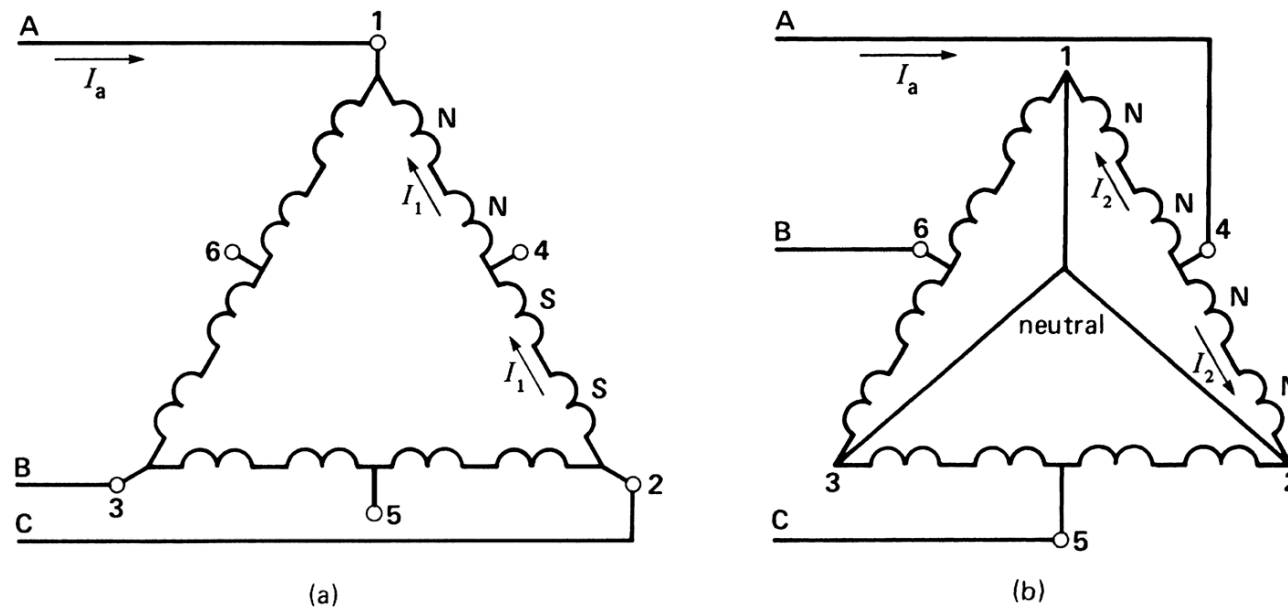


FIGURE 14-7 a. Two short-pitch coils connected in series produce a two-pole motor. b. When the coils are connected in parallel, a 4-pole motor is produced. Two of the poles are consequent poles.



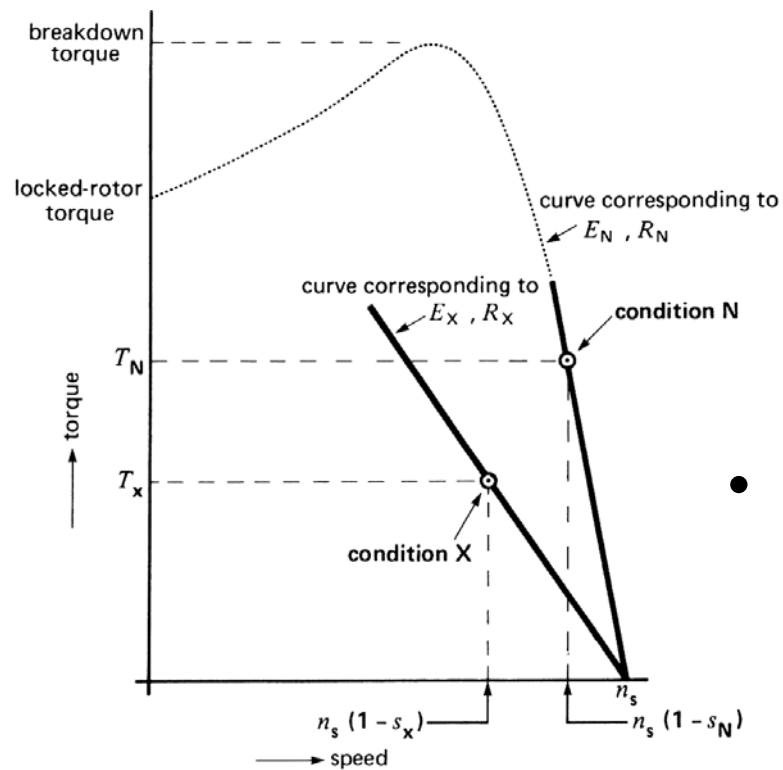
4-8 pole connection

FIGURE 14-8 a. High-speed connection of a 3-phase stator, yielding 4 poles. b. Low-speed connection of same motor yielding 8 poles.



Characteristics under various load

FIGURE 14-9 The torque-speed curve is essentially a straight line between the no-load and rated torque operating points.



- $s = k T R / E^2$

- $S_X = S_N [T_X/T_N] [R_X/R_N] [E_n/E_X]^2$

Example 14.1

- 3 phase, 208 V IM with synchr. speed 1200 r/min runs at 1140 r/min, connected to a 215 V line and driving a constant load. Calculate the speed if voltage increases to 240 V

- $s_x = s_n [T_x/T_n] [R_x/R_n] [E_n/E_x]^2$

- Slip at 215 V is $s = (n_s - n) / n_s = 0,05$

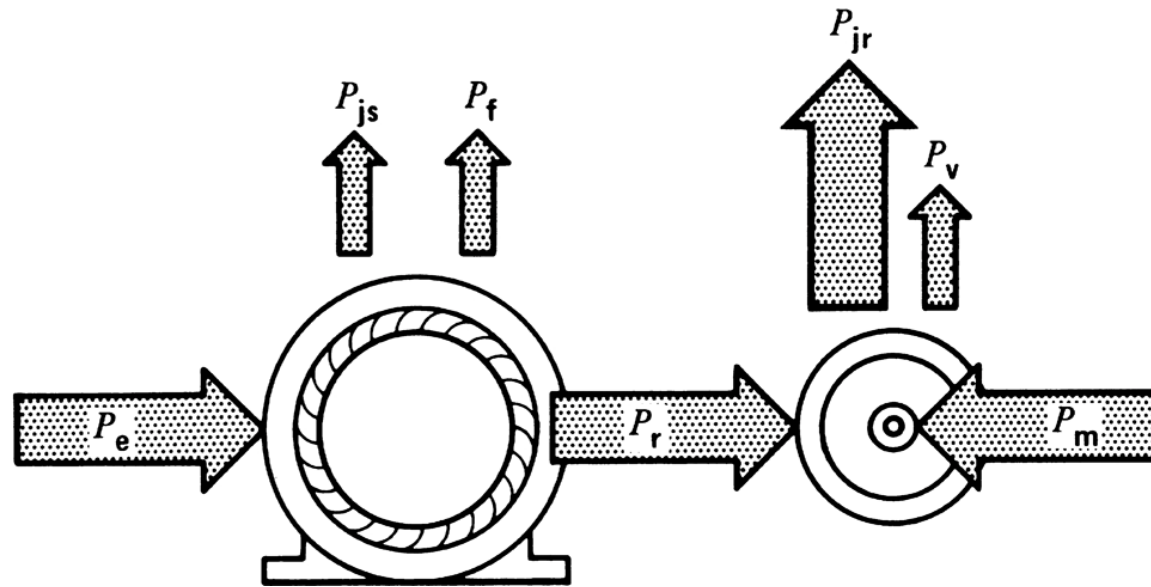
- $s_x = s_n [E_x/E_n]^2 = 0,04$

- Slip speed $0,04 \cdot 1200 = 48$ r/min

- new speed $1200 - 48 = 1152$ r/min

Starting and plugging an IM

FIGURE 14-10 When a 3-phase induction motor is plugged, the rotor PR losses are very high.



IM operating as a generator

FIGURE 14-13 Gasoline engine driving an asynchronous generator connected to a 3-phase line. Note that P and Q flow in opposite directions.

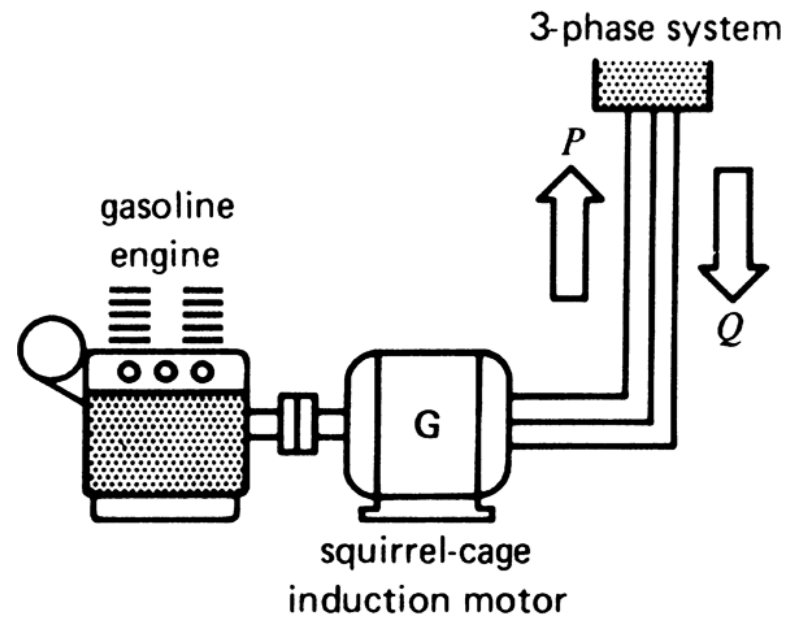


FIGURE 14-14 Capacitors can provide the reactive power for any asynchronous generator. This eliminates the need for a 3-phase external source.

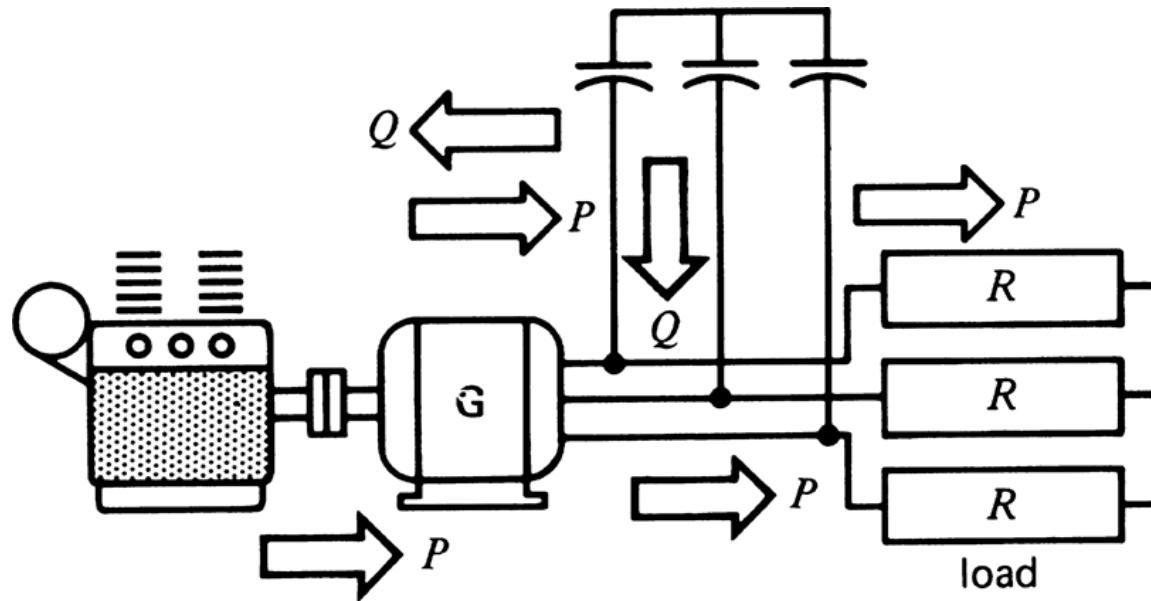
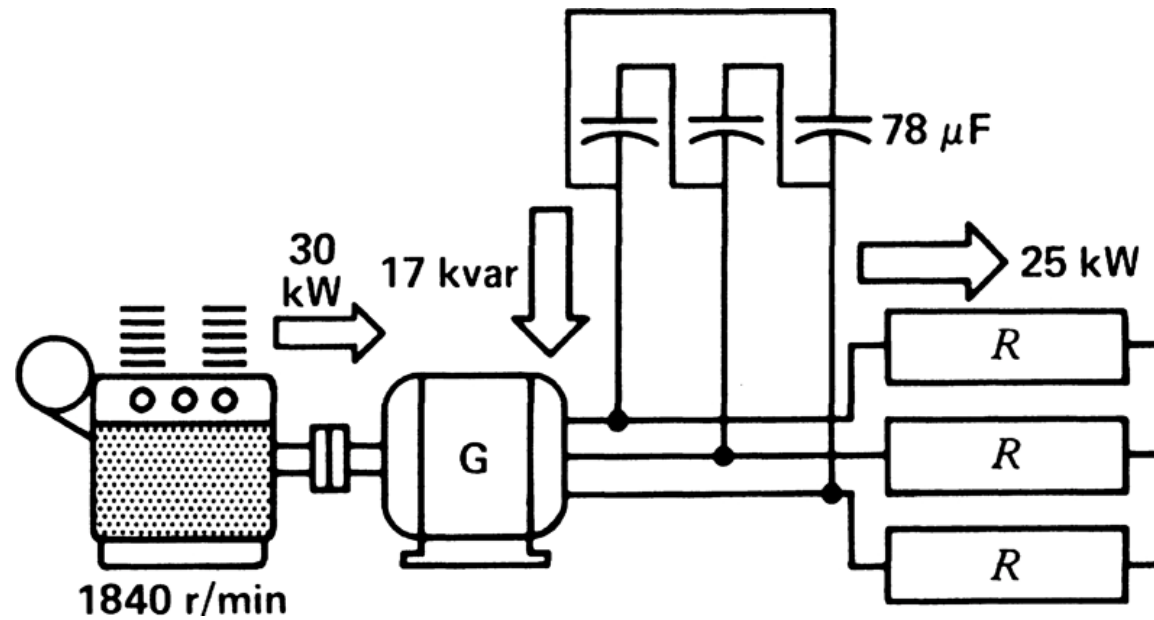


FIGURE 14-15 See Example 14-6.



Complete torque speed characteristic

FIGURE 14-16 Complete torque-speed curve of a 3-phase induction machine.

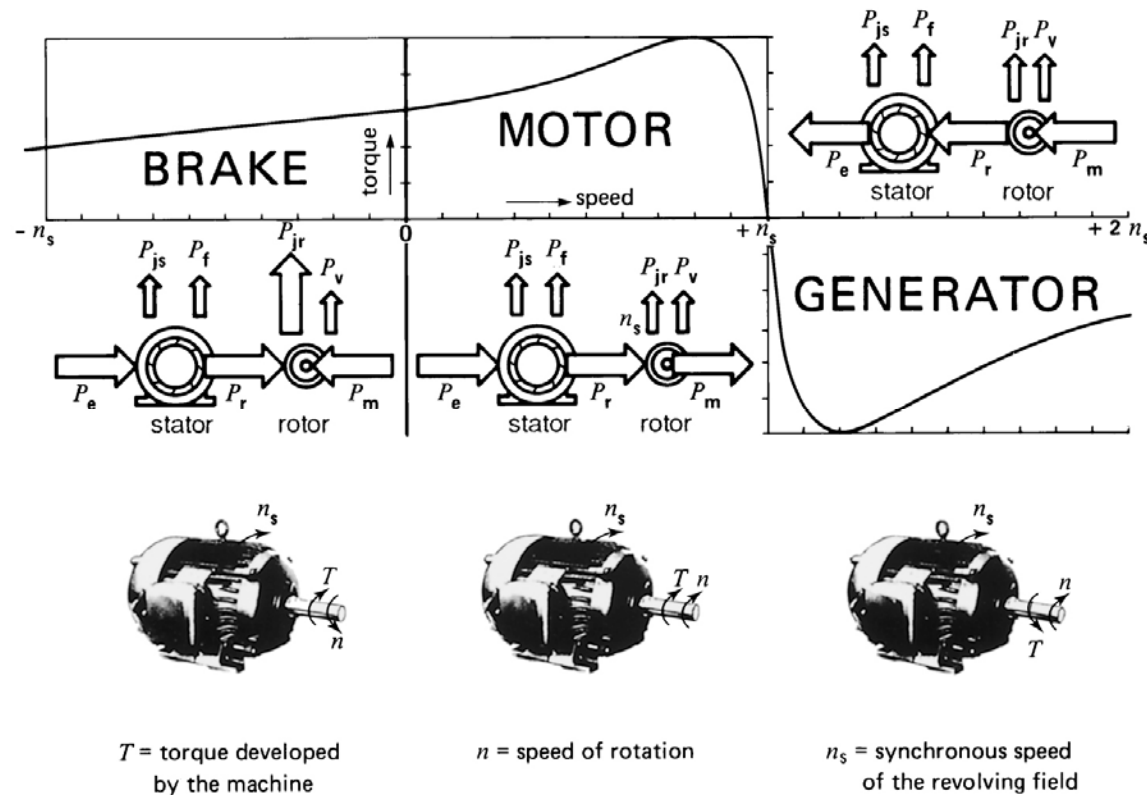


FIGURE 14-18 Wound-rotor motor used as a frequency converter.

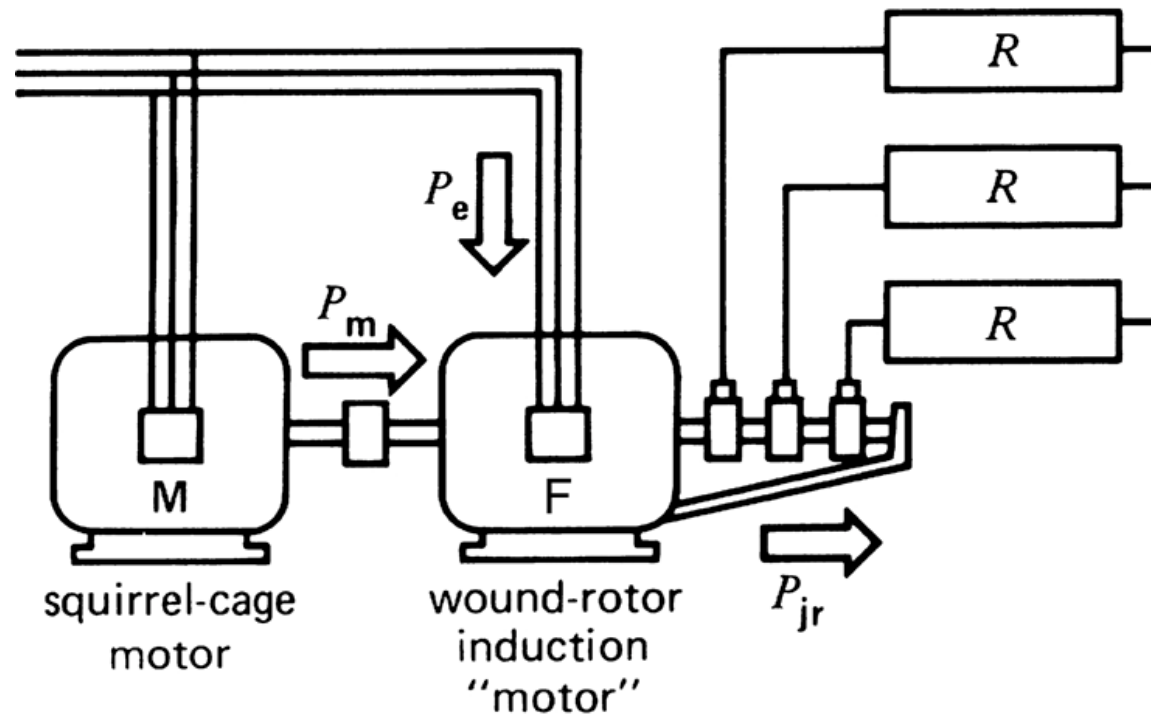


FIGURE 14-19 Power flow in a frequency converter when the output frequency is greater than the line frequency.

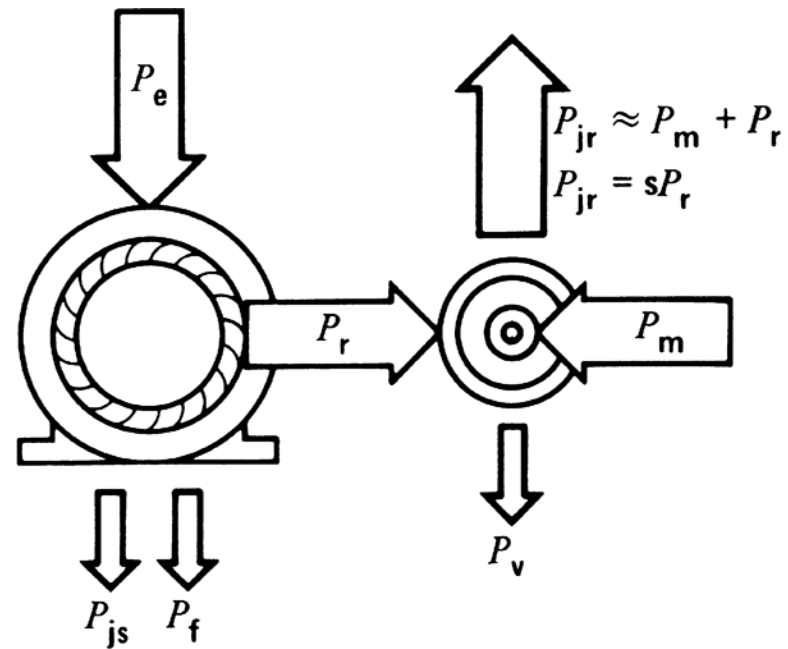


FIGURE 14-20 See Example 14-8.

