

# Elektrische Aandrijvingen

WTB

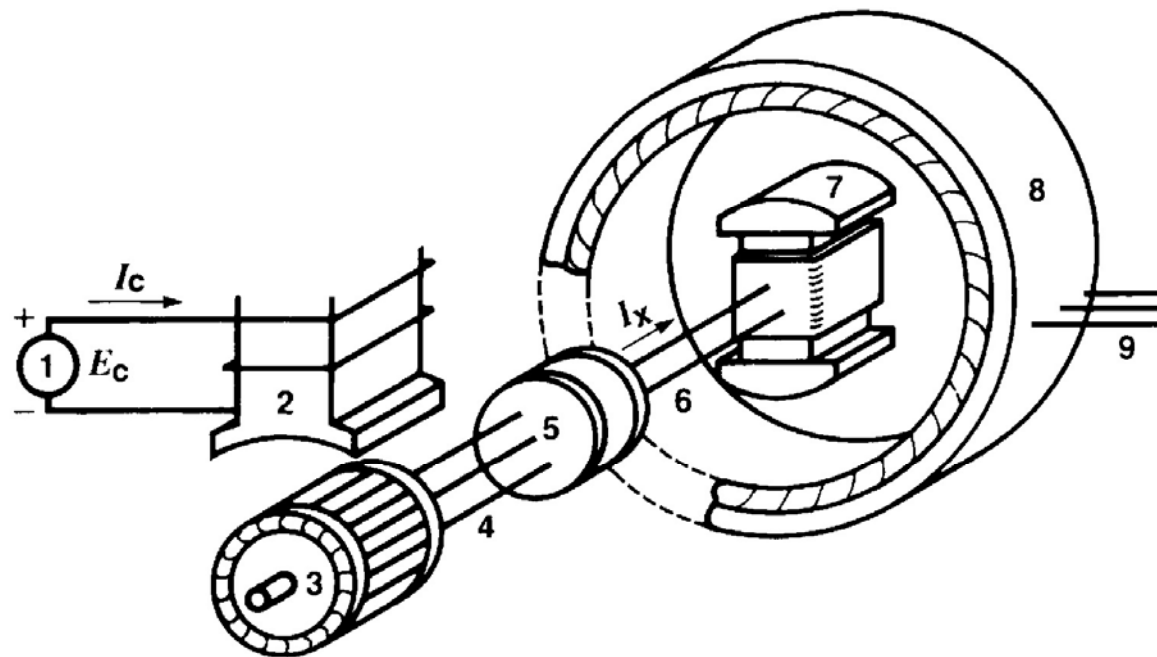
Lokatie/evenement

P.BAUER

March 5, 2009

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Figure 17.3 Diagram showing the main components of a brushless exciter for a synchronous motor. It is similar to that of a synchronous generator.



- 1 - dc control source
- 2 - stationary exciter poles
- 3 - alternator (3-phase exciter)
- 4 - 3-phase connection
- 5 - bridge rectifier
- 6 - dc line
- 7 - rotor of synchronous motor
- 8 - stator of synchronous motor
- 9 - 3-phase input to stator



Figure 17.7a Equivalent circuit of a synchronous motor, showing one phase.

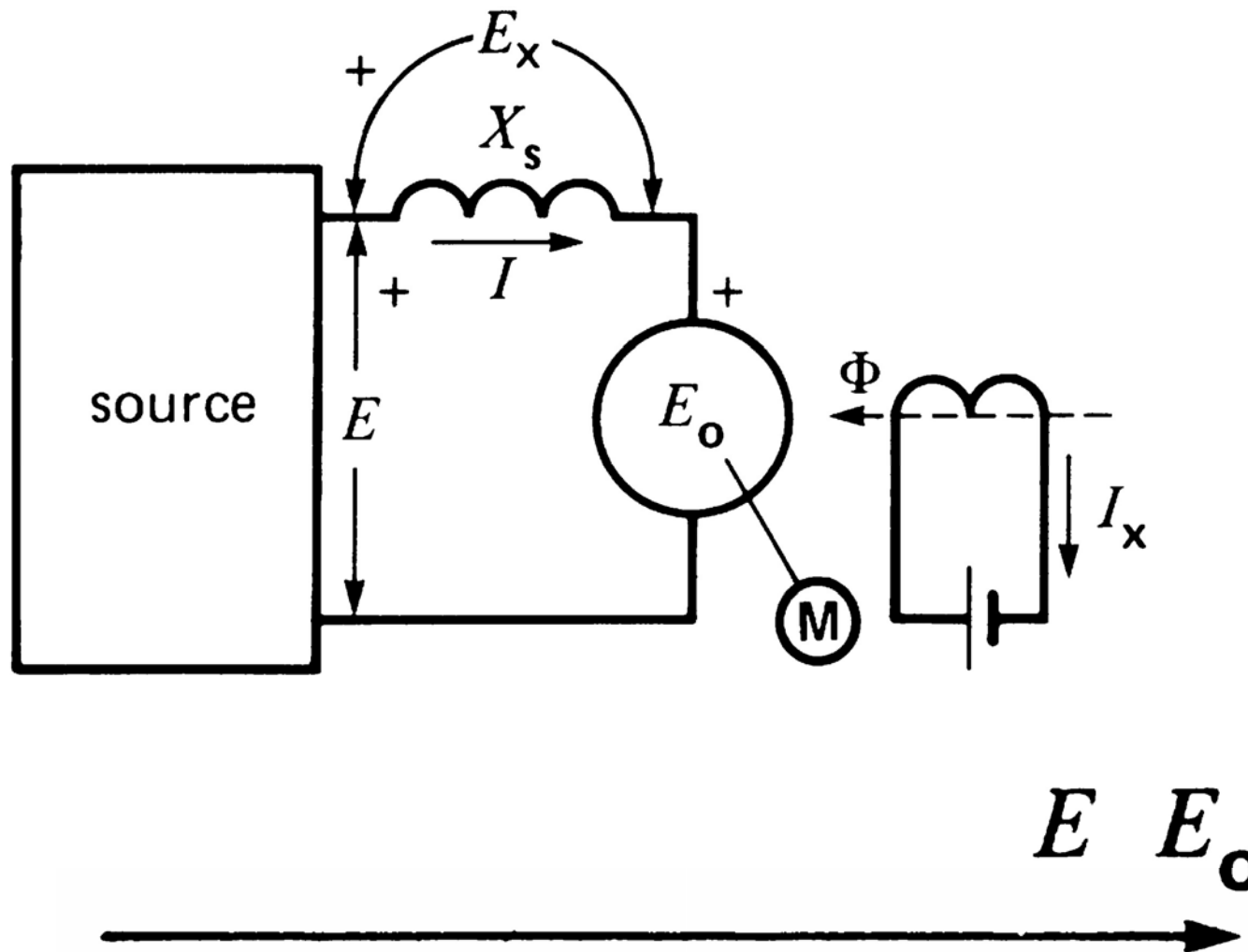


Figure 17.7a Equivalent circuit of a synchronous motor, showing one phase.

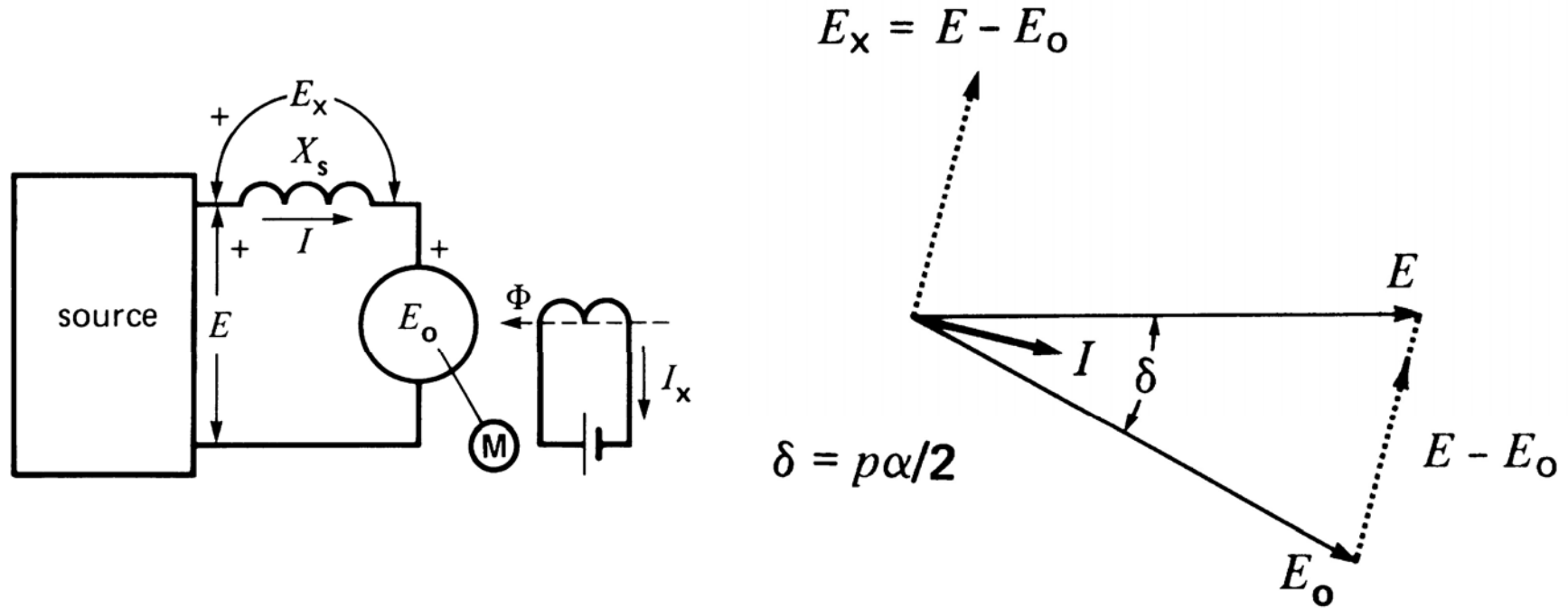


Figure 17.8a Equivalent circuit of a synchronous motor connected to a source  $E$ .

## Example 17.2

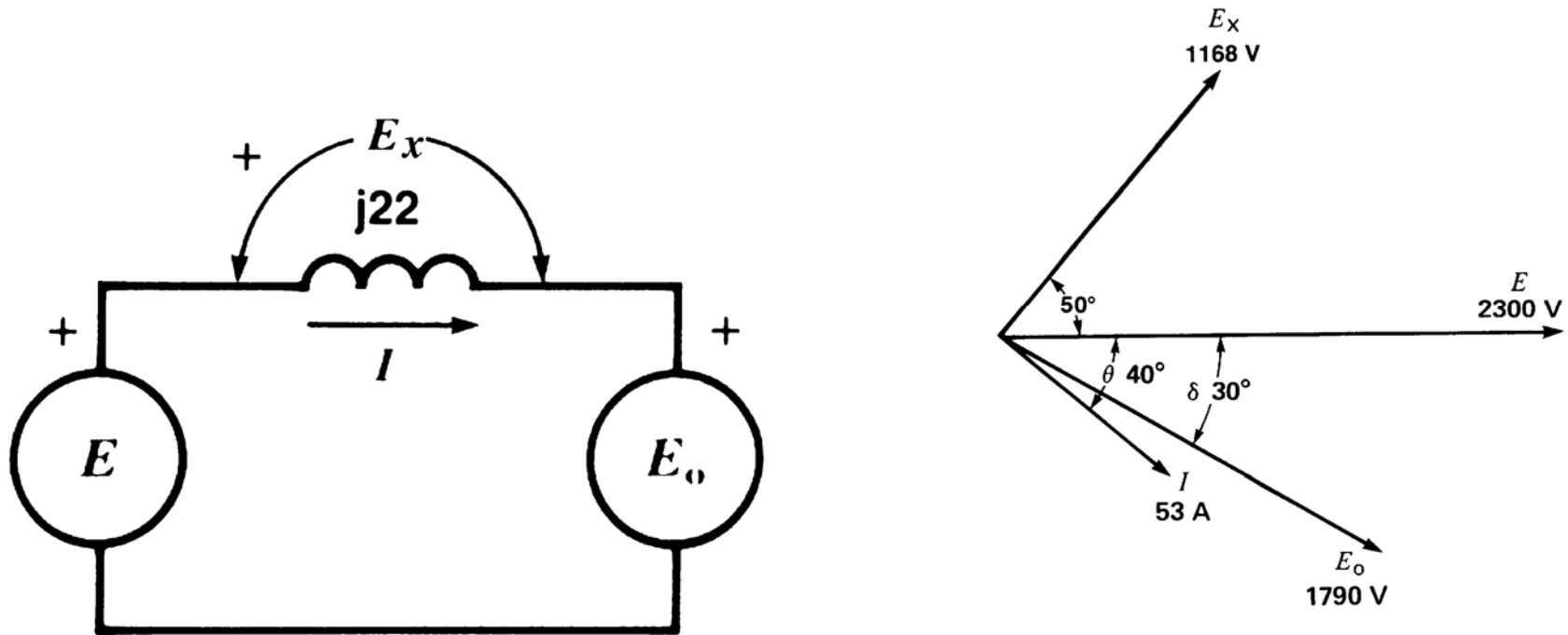


Figure 17.9 Power and torque per phase as a function of the torque angle  $\delta$ . Synchronous motor rated 150 kW (200 hp), 1200 r/min, 3-phase, 60 Hz. See Example 17-3.

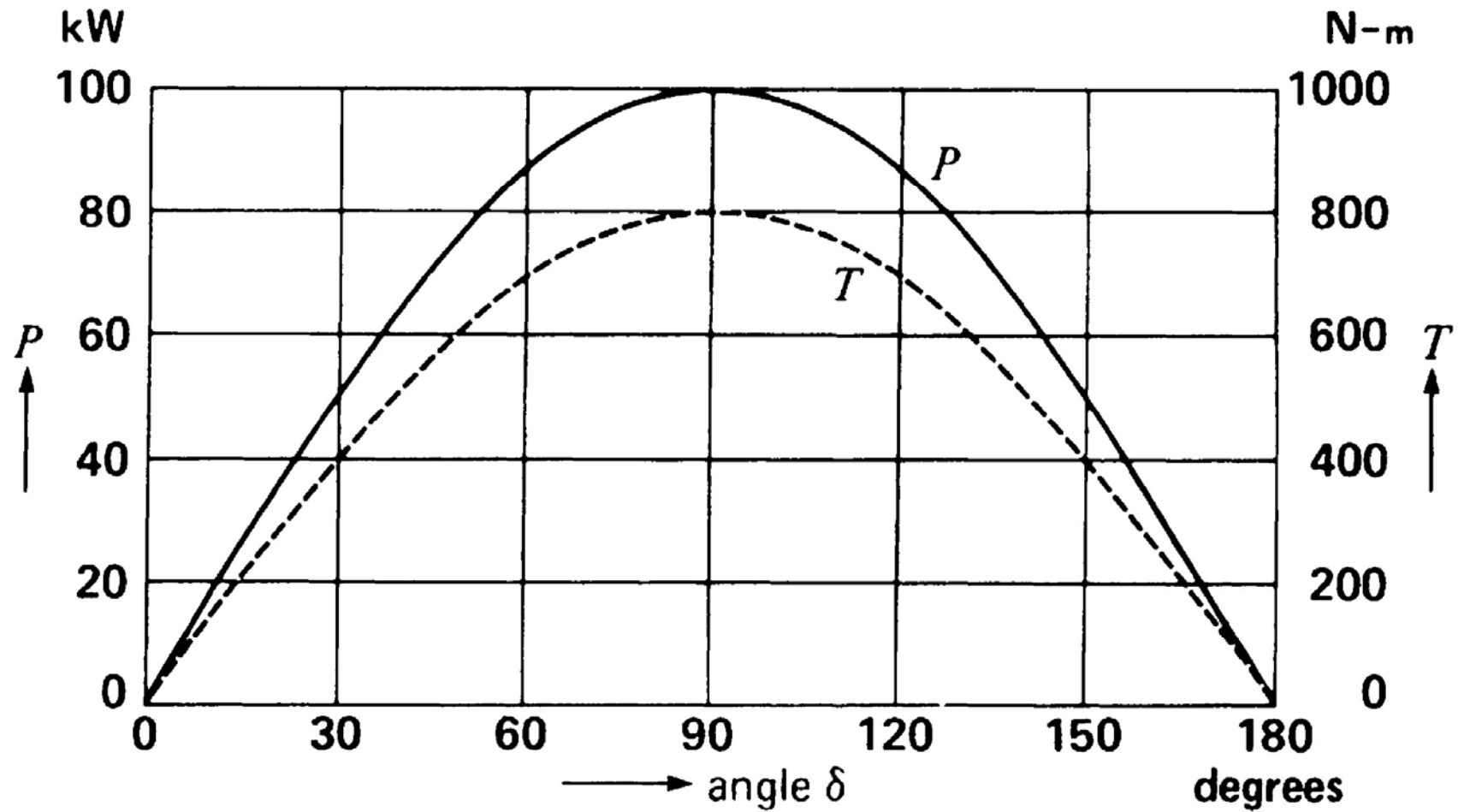


Figure 17.14 Unity power factor synchronous motor and phasor diagram at full-load.

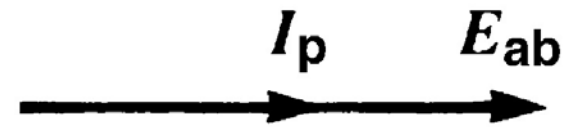
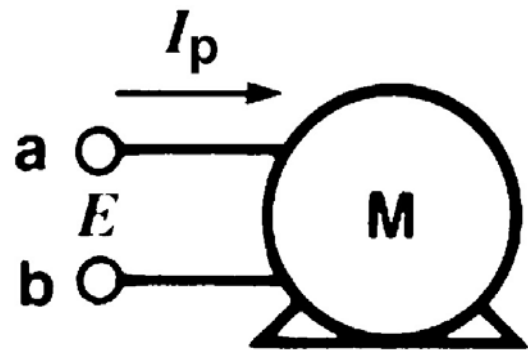




Figure 17.15 80 percent power factor synchronous motor and phasor diagram at full-load.

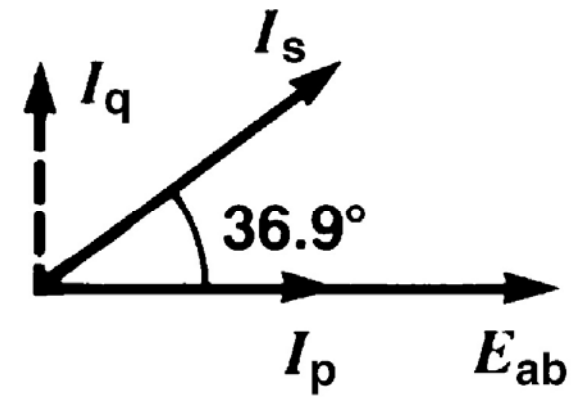
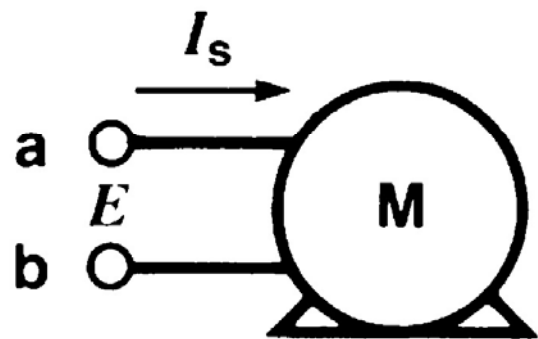


Figure 17.16 a. Synchronous motor operating at unity power factor with a mechanical load of 800 kW. Field excitation is 100 A. b. Phasor diagram shows current in phase with the voltage.

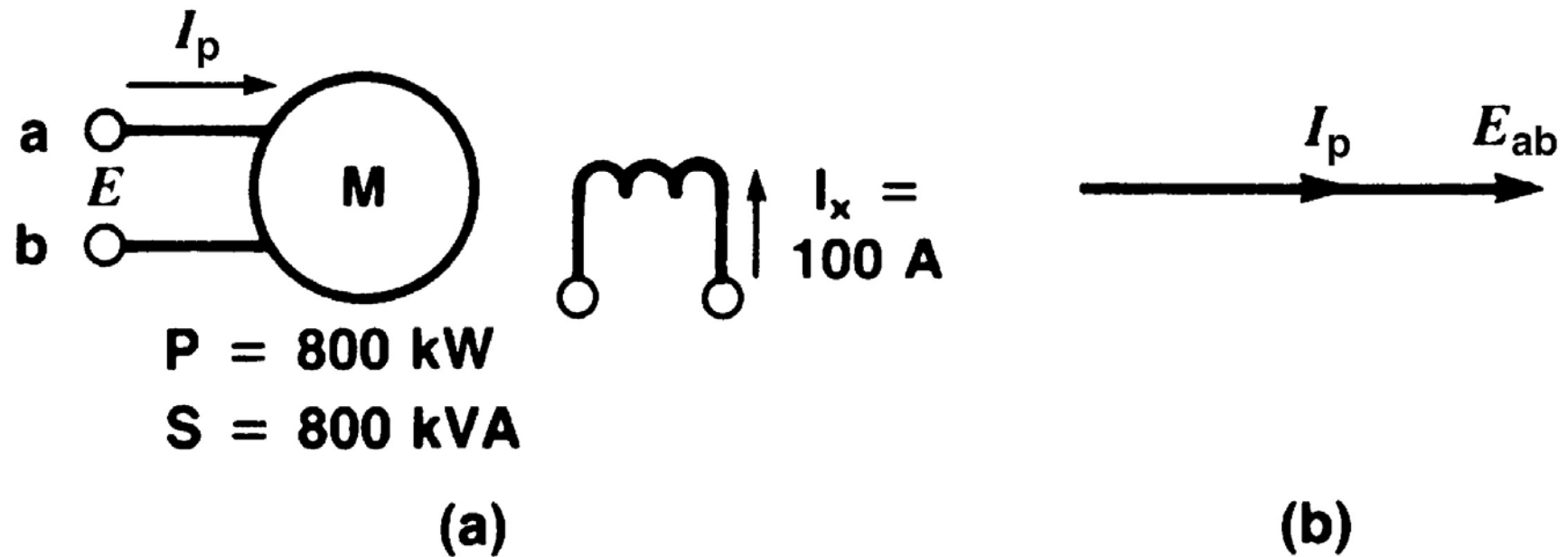


Figure 17.17 a. Field excitation reduced to 70 A but with same mechanical load. Motor absorbs reactive power from the line. b. Phasor diagram shows current lagging behind the voltage.

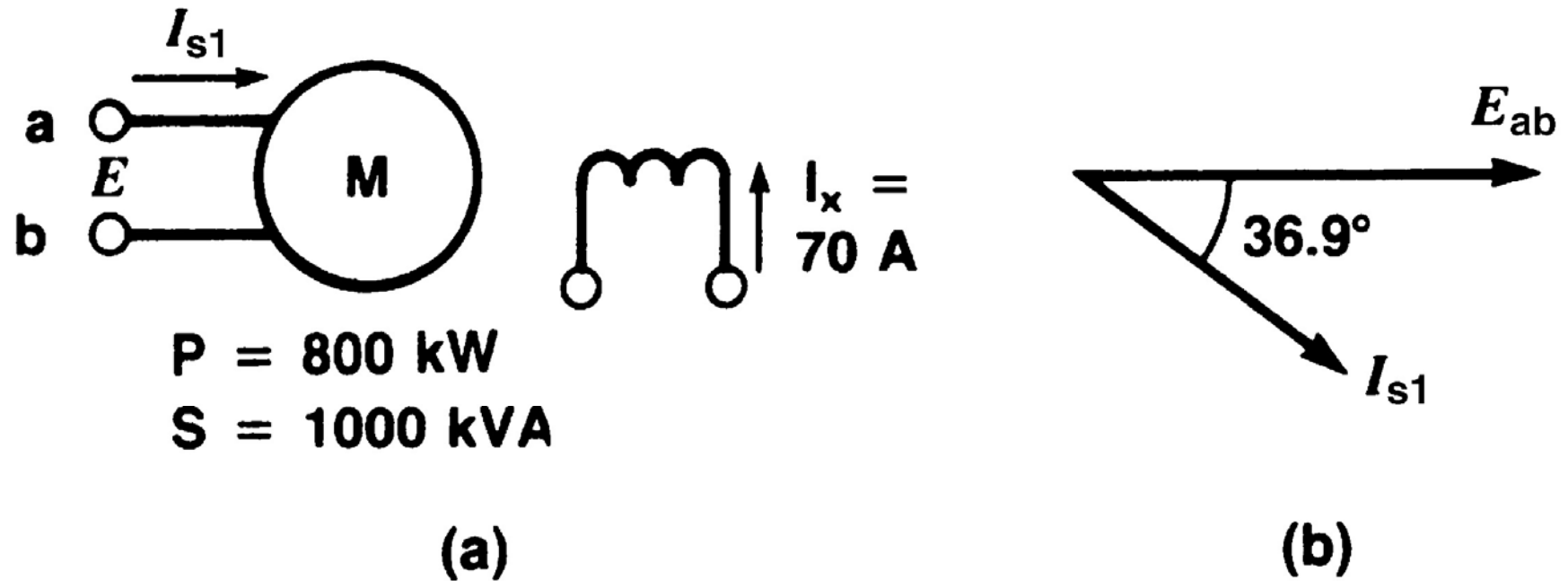


Figure 17.18 a. Field excitation raised to 200 A but with same mechanical load. Motor delivers reactive power to the line. b. Phasor diagram shows current leading the voltage.

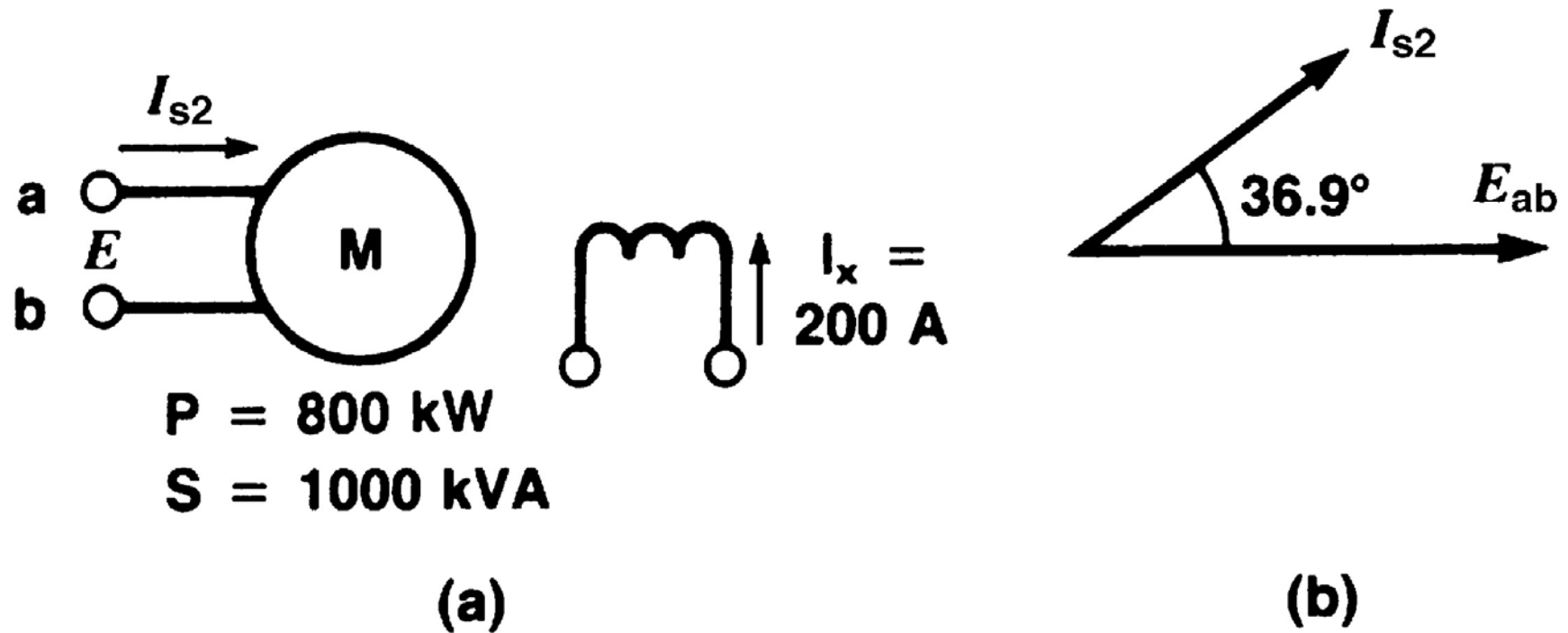


Figure 17.19 No-load and full-load V-curves of a 1000 hp synchronous motor.

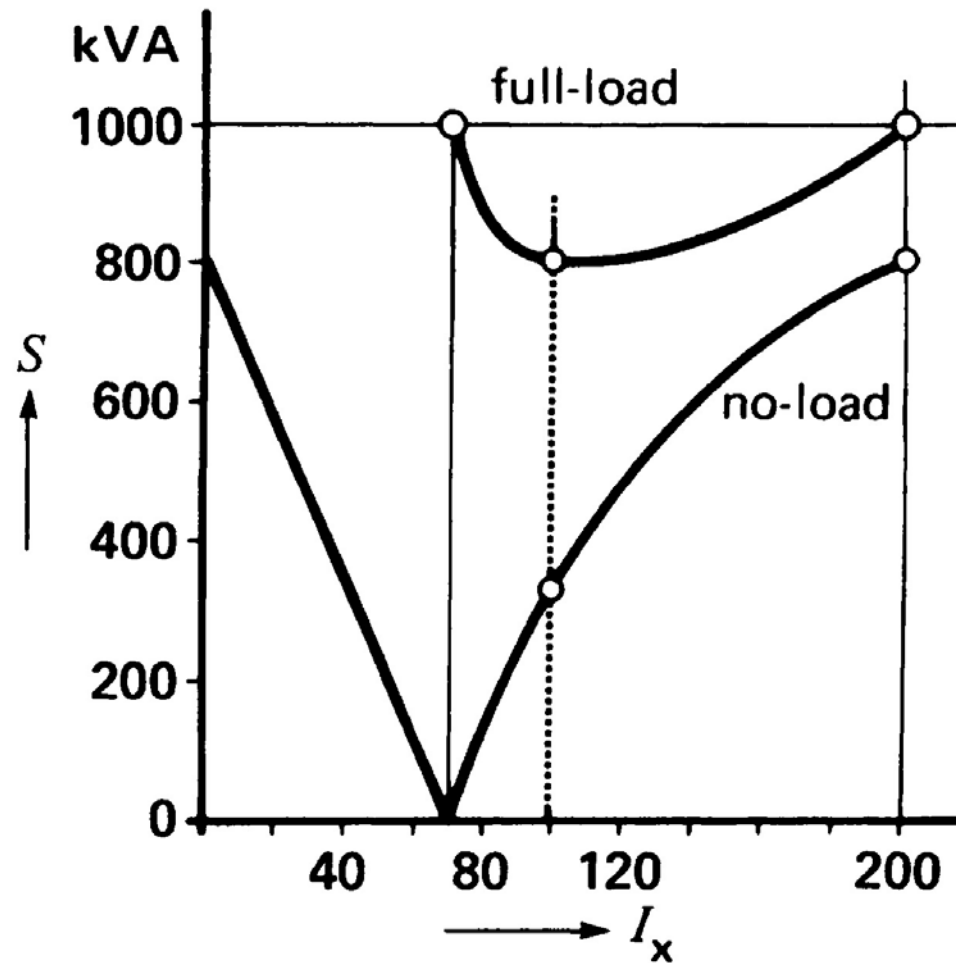


Figure 17.20 Circuit of a synchronous motor connected to a source  $E$ . Note the arbitrary (1) polarity marks and arbitrary direction of current flow. See Example 17-5.

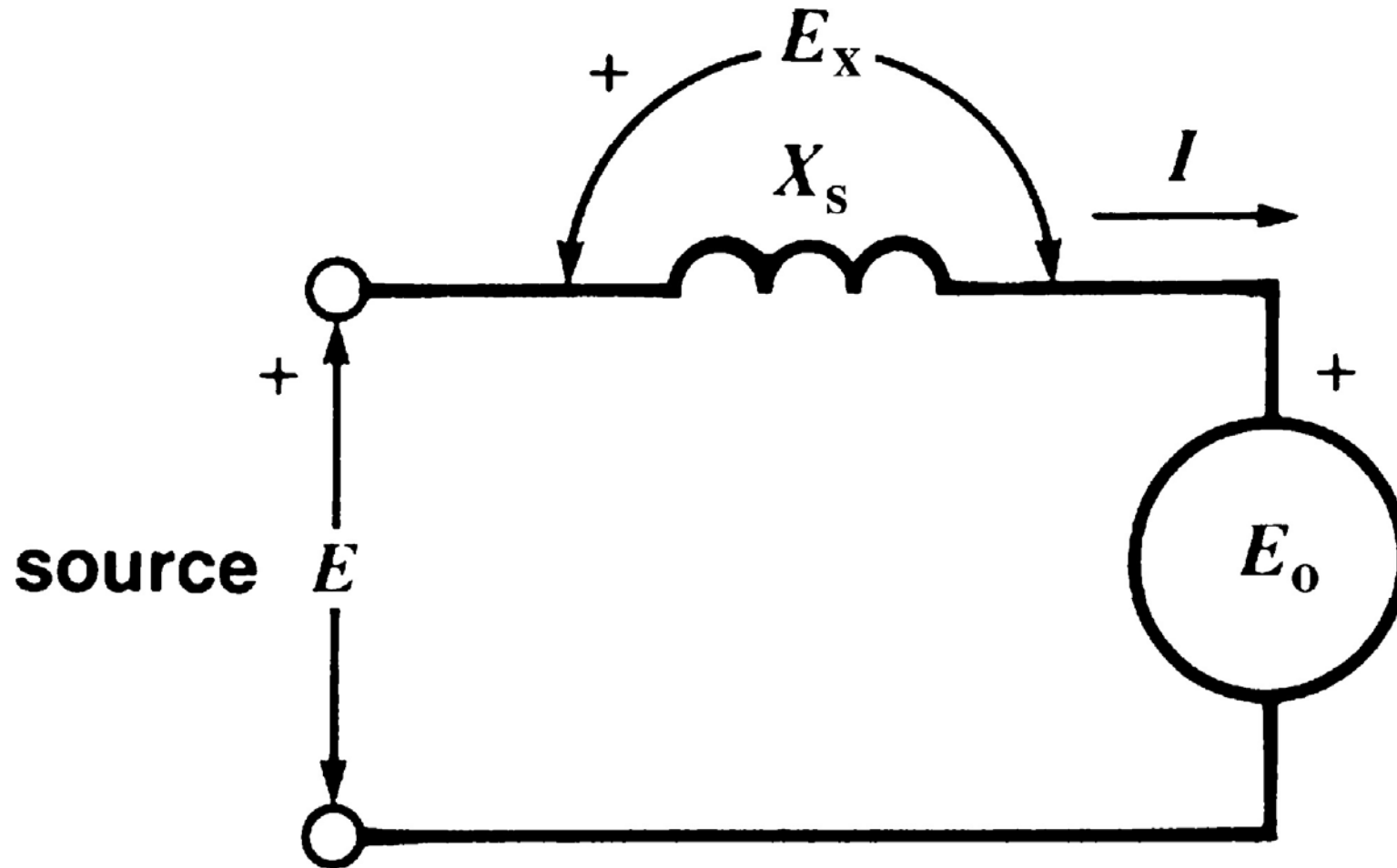


Figure 17.21 See Example 17-5.

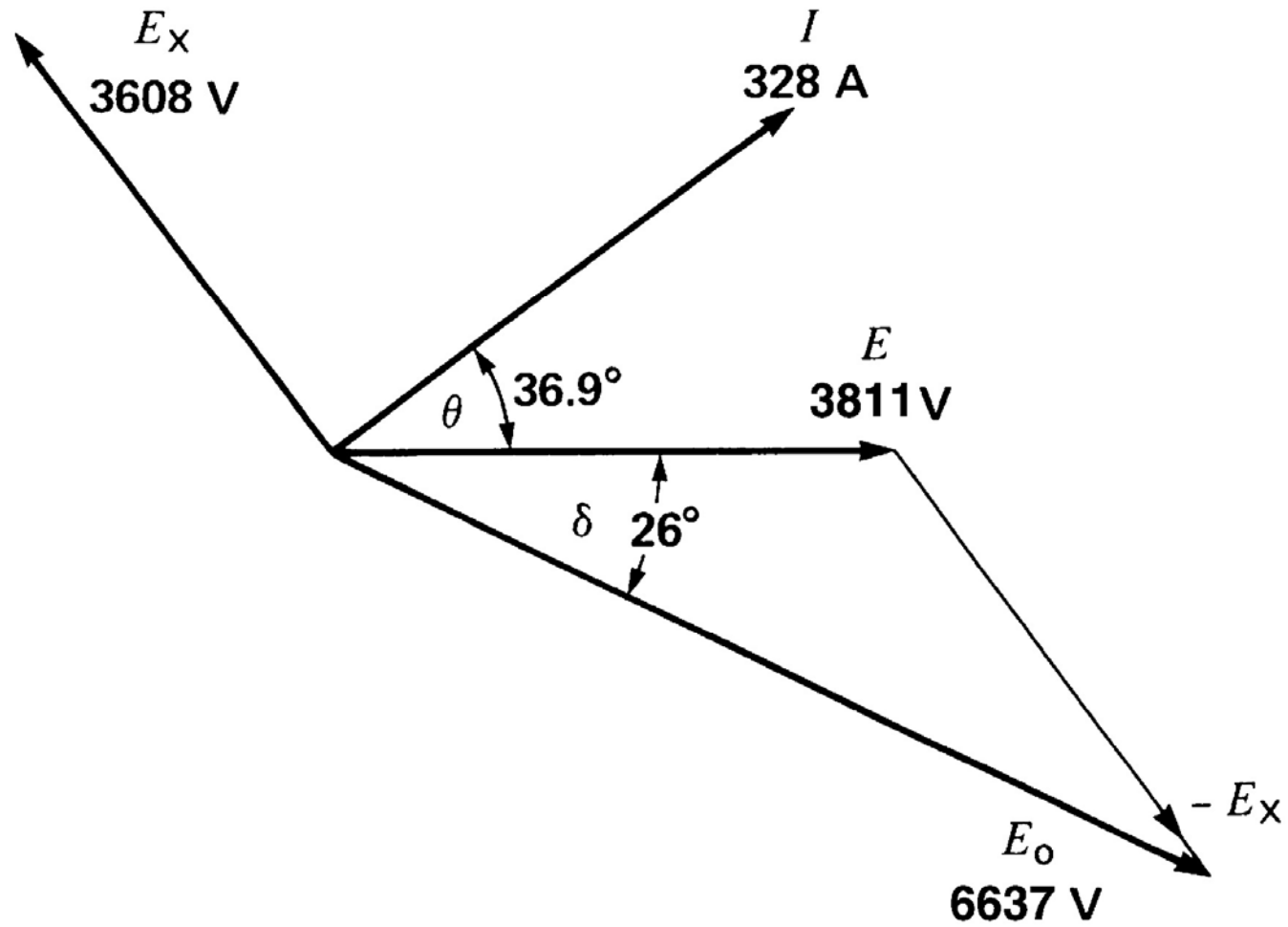


Figure 17.22a Motor turning at 600 r/min (Example 17-6).

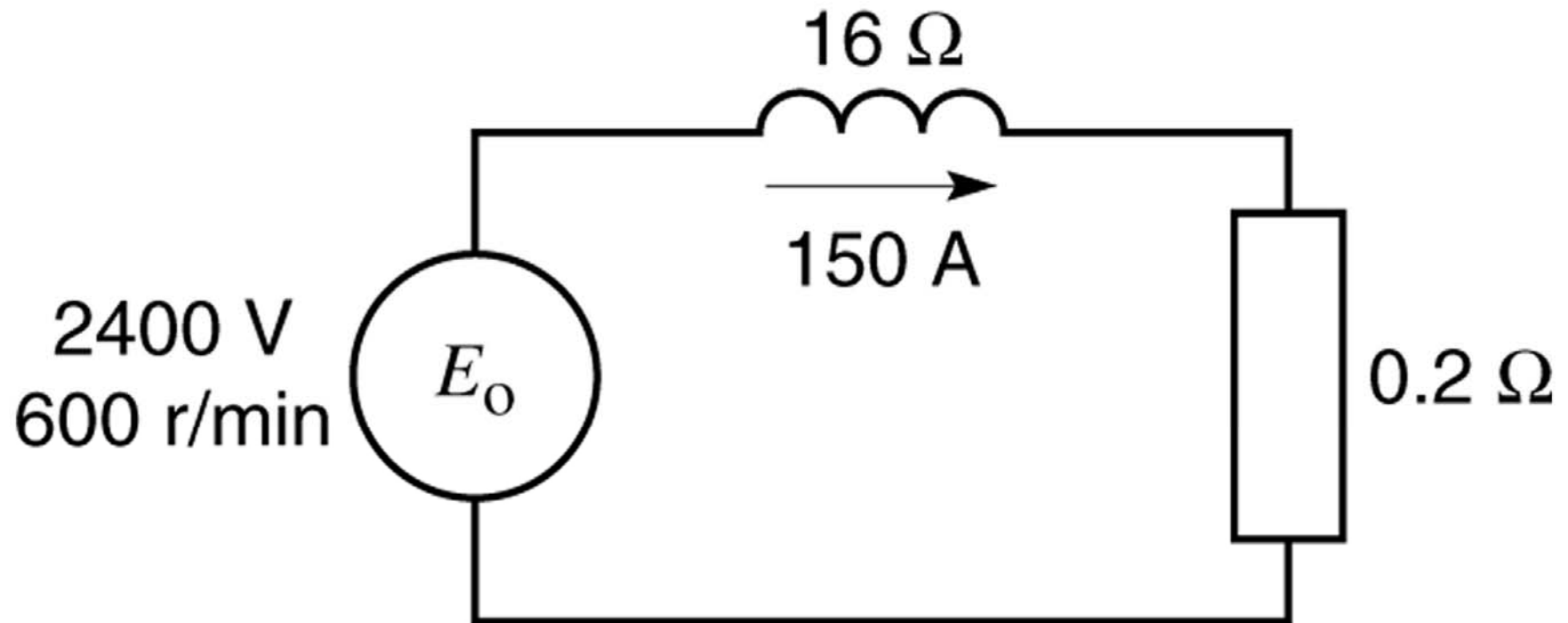




Figure 17.22b Motor turning at 150 r/min (Example 17-6).

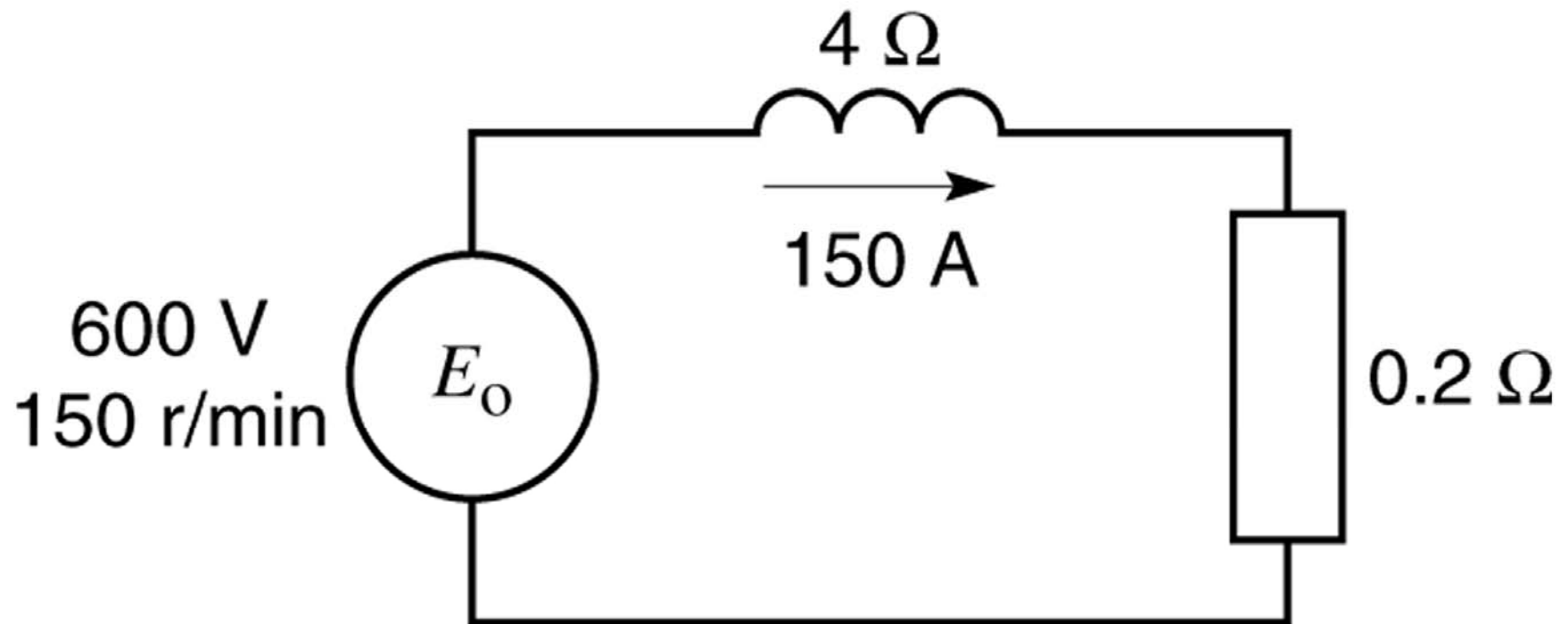


Figure 17.23 Comparison between the efficiency (a) and starting torque (b) of a squirrel-cage induction motor and a synchronous motor, both rated at 4000 hp, 1800 r/min, 6.9 kV, 60 Hz.

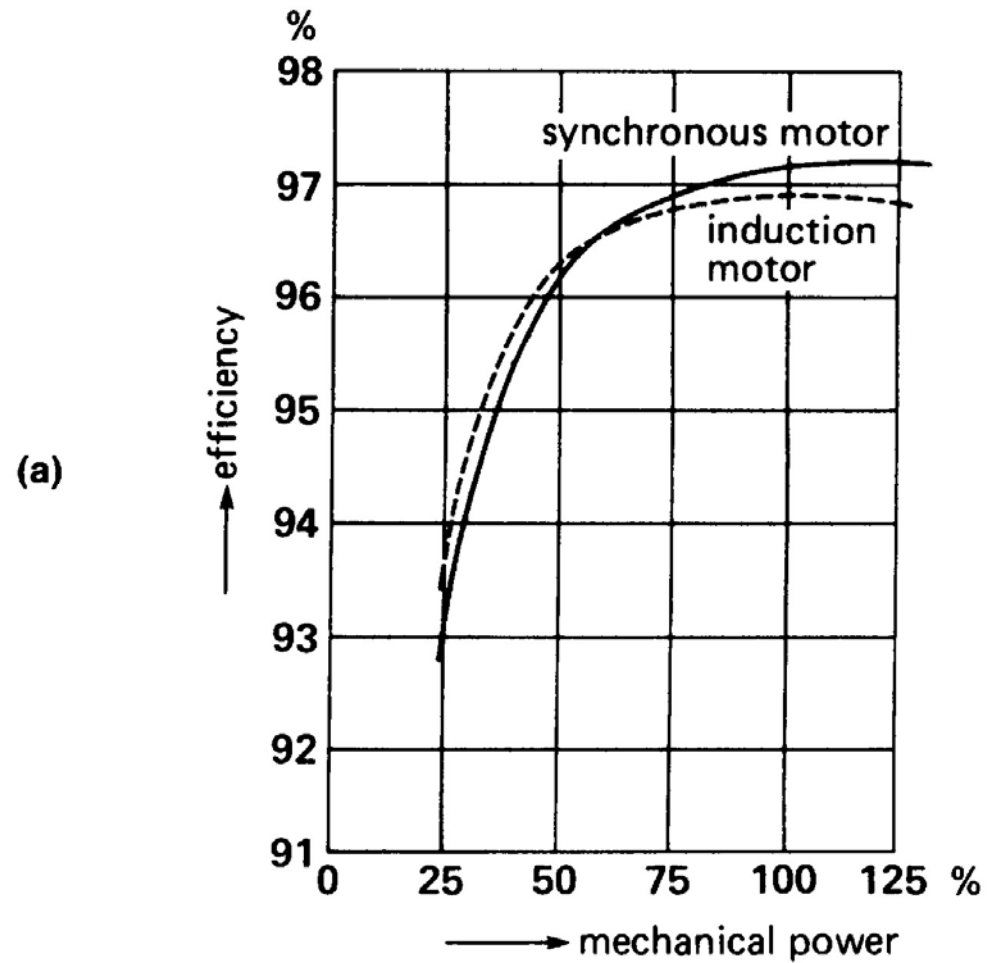


Figure 17.23 (continued) Comparison between the efficiency (a) and starting torque (b) of a squirrel-cage induction motor and a synchronous motor, both rated at 4000 hp, 1800 r/min, 6.9 kV, 60 Hz.

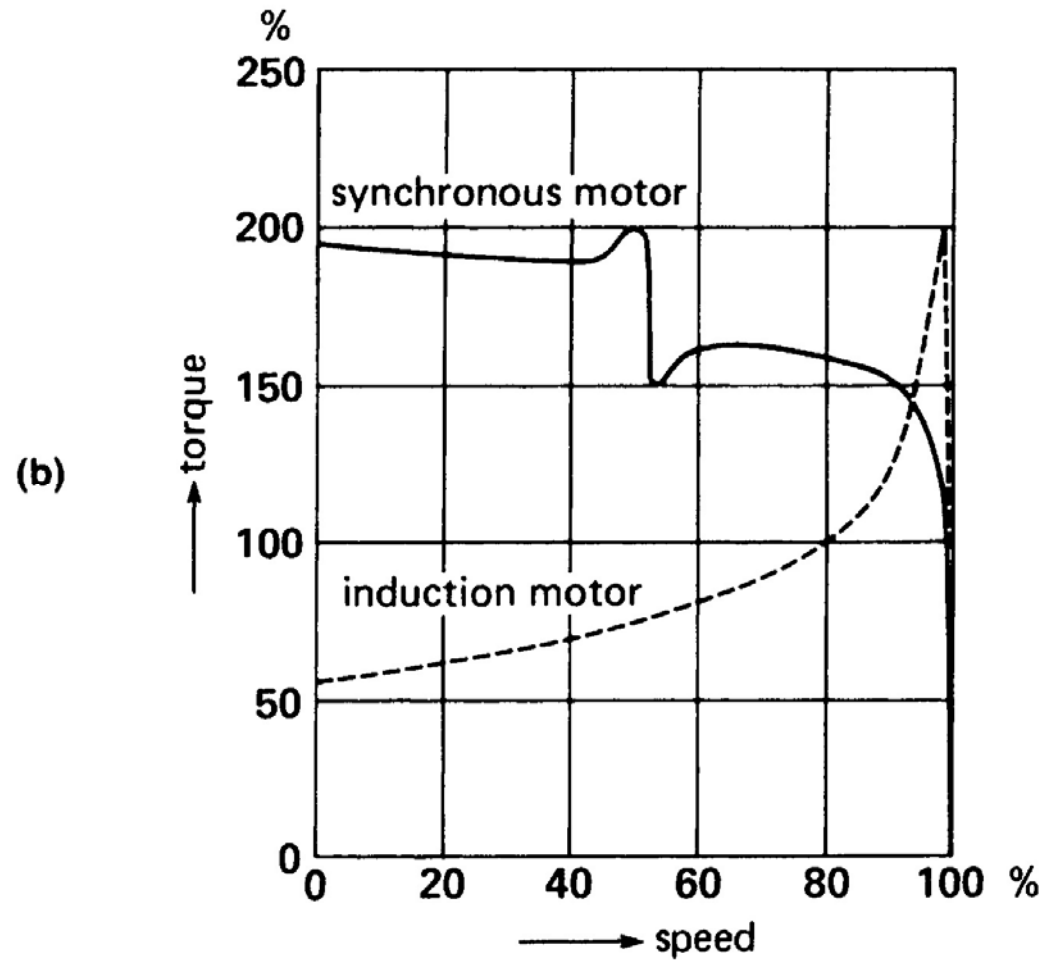


Figure 17.24a Three-phase, 16 kV, 900 r/min synchronous capacitor rated 2200 Mvar (supplying reactive power) to 1300 Mvar (absorbing reactive power). It is used to regulate the voltage of a 735 kV transmission line. Other characteristics: mass of rotor: 143 t; rotor diameter: 2670 mm; axial length of stator iron: 3200 mm; air gap length: 39.7 mm.

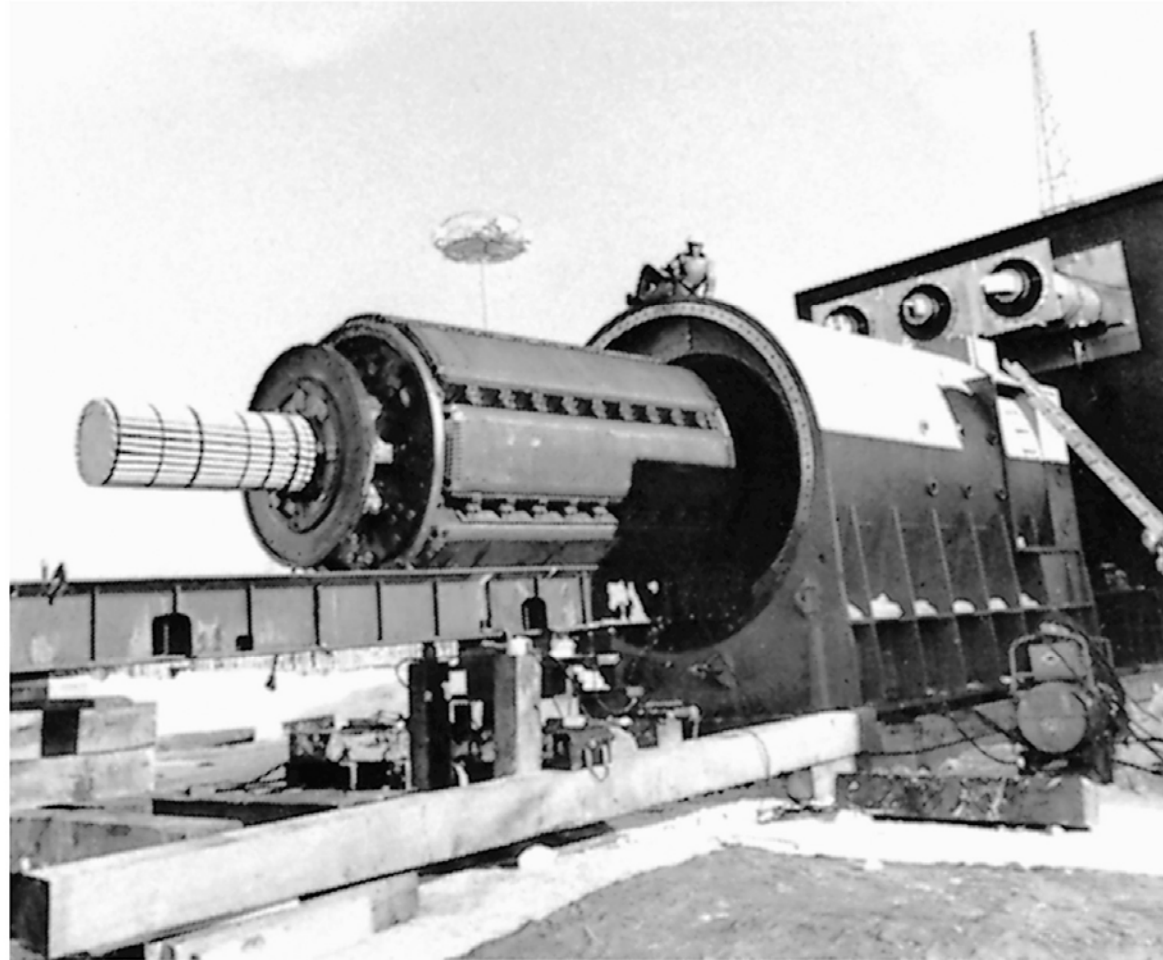
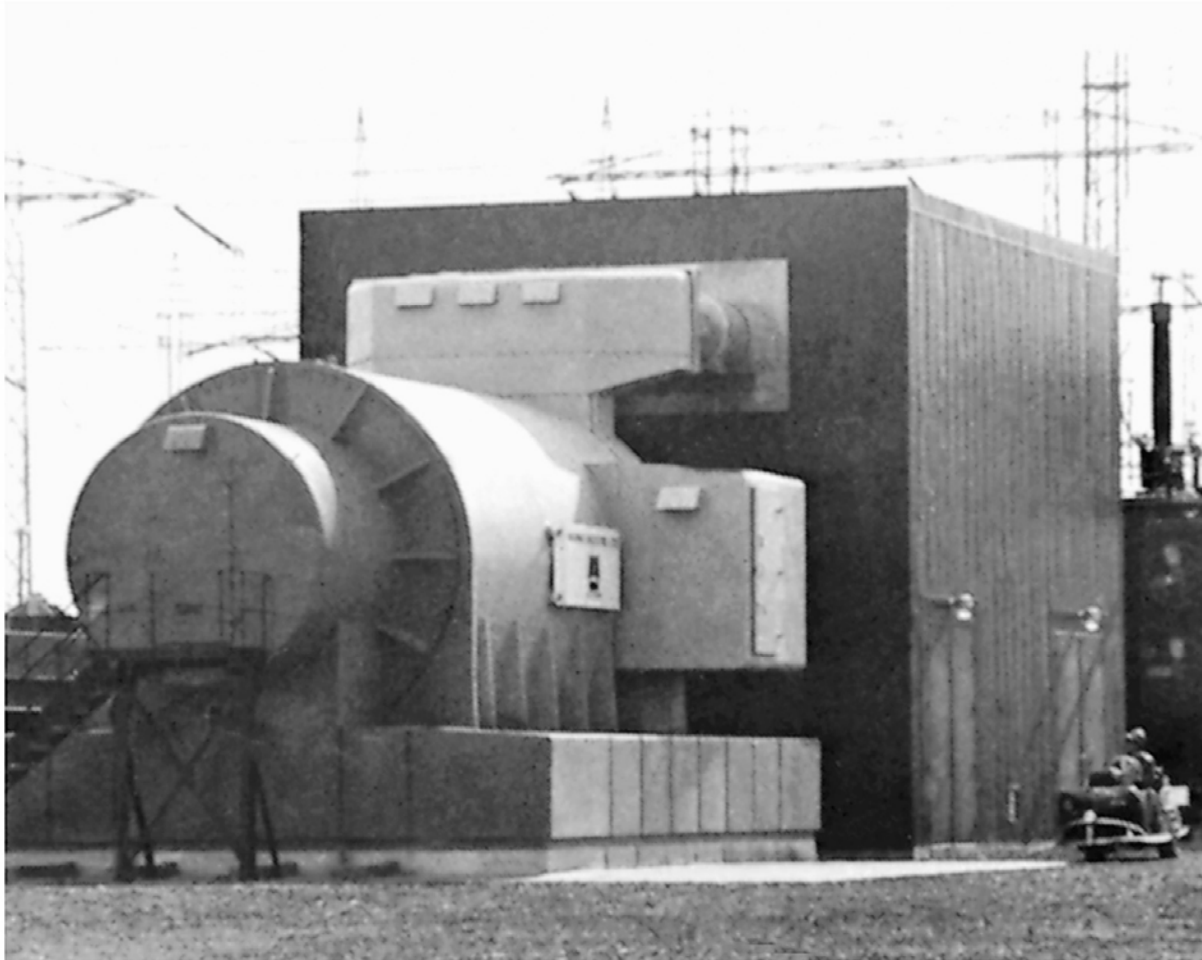


Figure 17.24b Synchronous capacitor enclosed in its steel housing containing hydrogen under pressure (300 kPa, or about 44 lbf/in<sup>2</sup>). (Courtesy of Hydro-Québec)



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Figure 17.25a Under-excited synchronous capacitor absorbs reactive power (Example 17-7).

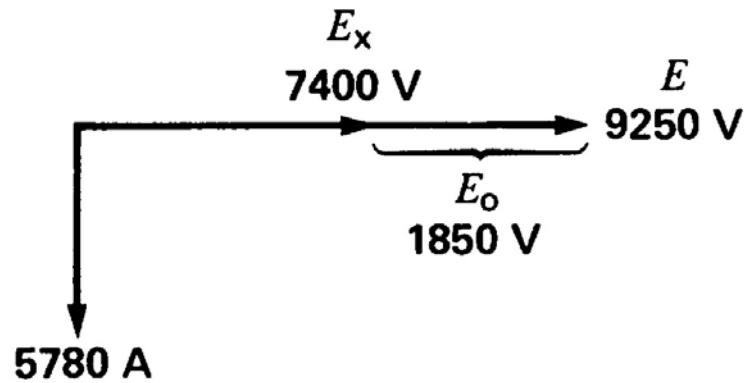
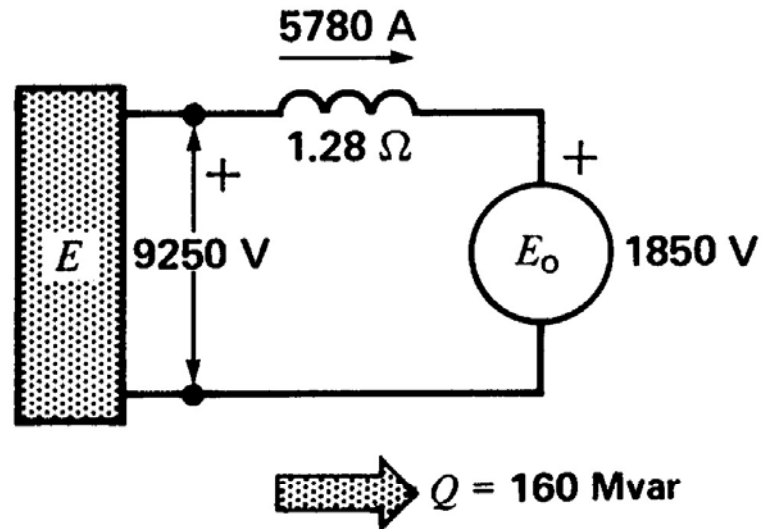


Figure 17.25b Over-excited synchronous capacitor delivers reactive power (Example 17-7).

