As a second and very important power-quality element for stand-alone applications, the ability to provide and to absorb reactive power should be mentioned. Typical loads requesting reactive power are electric motors. Under these load conditions, the load current is no longer in phase with the voltage as shown in Figure 19.46.

Proper handling of reactive power is only possible with appropriate topologies as have been described and presented in Figures 19.36 and 19.37. In some inverter designs, handling of reactive power is limited depending on the load type. In this case, the acceptable power factor, which corresponds with the cosine of the phase-angle difference between voltage and current, is defined and the maximum power of the inverter is given in kilovolt amperes (kVA) instead of kilowatts (kW). The energy of the reactive power, which is to be absorbed and afterwards re-injected into the load, is normally stored in capacitors of appropriate size.

If all the elements in the inverter allow for reverse power flow, a bi-directional inverter is obtained, which can be used to charge the battery, when surplus power at the AC side is available. The combination of a Cuk converter shown in Figure 19.38 with a H-type bridge given in Figure 19.22 allows for such a concept.

Finally, stand-alone inverters should also be able to blow fuses in cases in which a short current occurs in loads. This requirement is perfectly fulfilled with only a few inverters. The reason can be seen in the high current needed to blow fuses. Depending on the reaction time, this current can be as high as five times the nominal one as shown in Figure 19.47.

Some inverters produce this high current by reducing the AC output voltage significantly. The resulting flicker observed for loads not to be separated by the fuse in question may be accepted in most cases.

Since the output voltage of grid-connected inverters has to correspond with the grid's voltage, the quality of the current that is to be injected into the grid becomes important. Under ideal circumstances, this current should be in phase with the grid's voltage (power factor = 1). The deviation from this power factor becomes therefore important for the description of the power quality. All modern transistor-based inverters have a power factor near unity at nominal load, with a tendency towards smaller values under part load (Figure 19.48).

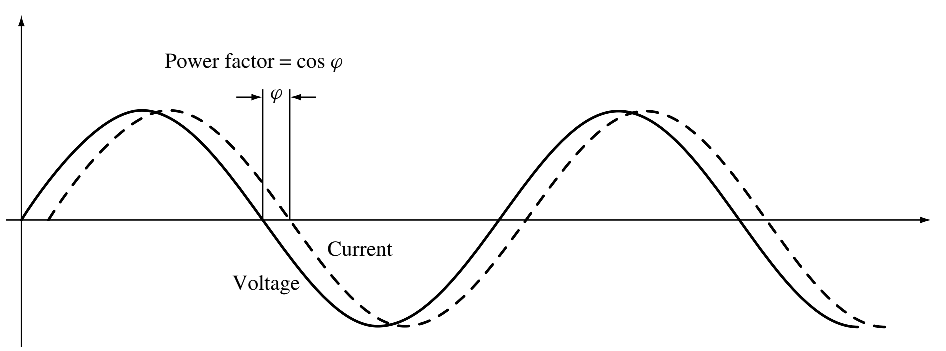

Figure 19.46 Power factors $\neq 1$ produced by reactive (inductive or capacitive) loads