



FIGURE 11.29 Twin-screw compressor: (a) loading and unloading of screw compressor; (b) suction-compression-discharge processes. (Source: Dunham-Bush Compressors. Reprinted by permission.)

Single-Screw Compressor. The single-screw compressor was developed in the 1960s and has been used in refrigeration systems since the 1970s. The single-screw compressor has a single main rotor and two gate rotors, as shown in Fig. 11.30. As the main rotor rotates, one of the flutes opens to the suction port and is filled with suction vapor until its suction end meshes with the gate rotor. The discharge end of this flute is covered by the rotor casing. When the main rotor turns, the meshing of gate rotor A with the flute compresses the trapped gas and raises its pressure. When the discharge end of this flute opens to the discharge port, compression stops and the hot gas is discharged. In a single-screw compressor, compression occurs simultaneously in both the top and bottom of the main rotor.

Performance of Twin-Screw Compressor

In a typical twin-screw compressor using HCFC-22 as refrigerant with $V_i = 2.6$, η_v drops from 0.92 to 0.83 and η_{isen} decreases from 0.82 to 0.60 when the pressure ratio p_{dis}/p_{suc} increases from 3 to 8. A twin-screw compressor is more energy-efficient than a reciprocating or a scroll compressor of the same size, operating at the same conditions, and is less energy-efficient than a centrifugal compressor using a water-cooled condenser. Some recently developed screw compressors can even tolerate liquid slugging.