A$_1$A$_0$ ATP synthases are the major energy converters of archaea. They are composed of an A$_1$ region that synthesizes ATP and an integral part A$_0$ that conducts ions. The peripheral stalks of A-ATP synthases and V-ATPases have been proposed to provide transient elastic energy during the rotary catalytic cycle, with subunit E tethering the peripheral stalk to the A1-headpiece sector. We have solved the crystal structure of the entire subunit E (PhE) of the *Pyrococcus horikoshii* OT3 A-ATP synthase at 3.6 Å resolution. The structure reveals an extended S-shaped N-terminal α-helix with 112.29 Å in length, followed by a globular head group. The S-shaped feature, common in elastic connectors and spacers, would facilitate the storage of transient elastic energy during rotary motion in the enzyme. The structure has been superimposed into the asymmetric peripheral stalks of the three-dimensional reconstruction of the *Pyrococcus furiosus* enzyme, revealing that the S-shaped subunit PhE fits well into the bent peripheral stalk, whereas the previously solved E subunit structure (3.1 Å resolution) of *Thermus thermophilus* A-ATP synthase is well accommodated in the density of the straight stator domain. The two peripheral stalks in A-ATP synthases appear to be in different conformations in the intact enzyme density, supporting proposed models of conformational flexibility in the stator subunits.

References
