You have a pure ensemble of systems of pairs of spin-1/2 particles, all in the same composite state. You split the ensemble up into three sub-ensembles, $A$, $B$, and $C$, and make the following measurements.

**Ensemble $A$:** You measure the total spin of the system and obtain $|S| = \sqrt{2}\hbar$ (spin-1) 60% of the time and $|S| = 0$ (spin-0) 40% of the time.

**Ensemble $B$:** You measure the $z$-component of the spin of particle 1 and obtain $S_z = \hbar/2$ (spin up) 100% of the time.

(1) Is this enough information to pinpoint the exact state of the pure ensemble? If so, what is the state that describes this ensemble? If not, is there a single measurement you could make on ensemble $C$ to clarify any remaining ambiguity in the state of the ensemble? Explain.