We extend to open surfaces with simple singularities the theorem proposed by Xavier Jarque and Zbigniew Nitecki for Hamiltonian flows in the plane that are structurally stable among Hamiltonian flows. We describe the Hamiltonian dynamics on $\{x^2 + y^2 = z^2\}$ and $\{xy = 0\}$ by presenting characterization theorems for Hamiltonian stability and some natural consequences. The stability of planar Hamiltonian flows with an invariant line is also studied.