In this study the dynamic stability of viscoelastic functionally graded cylindrical shells (VEFGCSs) under an axial load with different initial conditions is investigated. Mathematical models are constructed for the problem of dynamic stability of the VEFGCSs, which is characterized simultaneously by taking into account both viscoelastic and FGM features. The basic equations of VEFGCSs are described by integro-differential equations using the linear viscoelasticity theory. An approach is developed to the determination of the critical times (CTs) for VEFGCSs with different initial conditions. Finally, the numerical analyzes are performed to demonstrate the influences of the initial conditions, the FGM profiles and the rheological parameter on the critical times for various geometric characteristics of the cylindrical shells.