abstract We investigate the conditions for the existence of an expanding virial shock in the gas falling within a spherical dark-matter halo. The shock relies on pressure support by the shock-heated gas behind it. When the radiative cooling is efficient compared to the infall rate the post-shock gas becomes unstable; it collapses inwards and cannot support the shock. We find for a monoatomic gas that the shock is stable when the post-shock pressure and density obey $\gamma_{\text{eff}} \equiv (\frac{d \ln P}{dt})/(\frac{d \ln \rho}{dt}) > 10/7$. When expressed in terms of the pre-shock gas properties at radius $r$ it reads $\rho r \Lambda(T)/u^3 < 0.0126$, where $\rho$ is the gas density, $u$ is the infall velocity and $\Lambda(T)$ is the cooling function, with the post-shock temperature $T \propto u^2$. This result is confirmed by hydrodynamical simulations, using an accurate spheri-symmetric Lagrangian code. When the stability analysis is applied in cosmology, we find that a virial shock does not develop in most haloes that form before $z \sim 2$, and it never forms in haloes less massive than a few $10^{11} M_\odot$. In such haloes, the infalling gas is not heated to the virial temperature until it hits the disc, thus avoiding the cooling-dominated quasi-static contraction phase. The direct collapse of the cold gas into the disc should have nontrivial effects on the star-formation rate and on outflows. The soft X-ray produced by the shock-heated gas in the disc is expected to ionize the dense disc environment, and the subsequent recombination would result in a high flux of $L_\alpha$ emission. This may explain both the puzzling low flux of soft X-ray background and the $L_\alpha$ emitters observed at high redshift.