$$\frac{J_v}{a} \equiv -\frac{1}{\sqrt{2\epsilon}M_P}\frac{\Lambda^2 H^2}{M^4}\frac{1}{\mathcal{H}^2}\Bigg\{6\Delta^{-1}\Big[(\Delta\delta\sigma')^2 - \partial_i\partial_j\delta\sigma'\partial_i\partial_j\delta\sigma' + \Delta\delta\sigma\Delta\delta\sigma'' - \partial_i\partial_j\delta\sigma\partial_i\partial_j\delta\sigma''\Big]$$
$$-2\mathcal{D}_{ij}\Big[\partial_i\delta\sigma'\partial_j\delta\sigma' + \partial_i\partial_j\delta\sigma\Delta\delta\sigma - \partial_i\partial_k\delta\sigma\partial_j\partial_k\delta\sigma - \delta\sigma''\partial_i\partial_j\delta\sigma\Big]$$
$$-4\Big[\delta\sigma''\Delta\delta\sigma + 2\delta\sigma'\Delta\delta\sigma'\Big]\Bigg\} - \frac{12}{\sqrt{2\epsilon}M_P}\frac{\Lambda^2 H^2}{M^4}\partial_i\delta\sigma\left[-\frac{2}{\mathcal{H}}\partial_i\delta\sigma' + \partial_i\delta\sigma\right], \tag{4.2}$$