Here's how equation (D-2) (the momentum equation for lossless fluids) is linearized into equation (D-4):

$$\rho(\vec{u}_t + (\vec{u} \cdot \vec{\nabla})\vec{u} + \vec{\nabla} P) = 0 \tag{D-2}$$

$$\rho_0 \vec{u}_t + \vec{p} = 0 \tag{D-4}$$

Using the relations

$$\begin{aligned} \delta\rho &\equiv \rho - \rho_0 \\ p &\equiv P - p_0 \end{aligned}$$

We can write (D-2) as

$$\begin{gathered} (\delta\rho + \rho_0)(\vec{u}_t + (\vec{u} \cdot \vec{\nabla})\vec{u}) + \vec{\nabla}(p + p_0) = 0 \\ \delta\rho\vec{u}_t + \delta\rho(\vec{u} \cdot \vec{\nabla})\vec{u} + \rho_0\vec{u}_t + \rho_0(\vec{u} \cdot \vec{\nabla})\vec{u} + \vec{\nabla} p = 0 \end{gathered}$$

The first term is second order, the second term is third order, and the third term is second order. These can all be dropped, leaving you with equation (D-4).