The transformation for the correction term $\Delta H = H - H_2$ for $1/\rho = 0$:

$$\Delta H = -\sqrt{p^2 - (p_x - a_c)^2 - (p_y - a_y)^2} + p - \frac{(p_x - a_x)^2}{2p} - \frac{(p_y - a_y)^2}{2p} \tag{47}$$

$$= p - p_z - \frac{(p_x - a_x)^2}{2p} - \frac{(p_y - a_y)^2}{2p}\,, \tag{48}$$

$$a_x = -\frac{B_z}{2} y\,, \tag{49}$$

$$a_y = \frac{B_z}{2} x\,, \tag{50}$$

is written as

$$x = x_0 + \Delta x\,, \tag{51}$$

$$y = y_0 + \Delta y\,, \tag{52}$$

$$p_x = p_{x0} + \frac{B_z}{2}\Delta y\,, \tag{53}$$

$$p_y = p_{y0} - \frac{B_z}{2}\Delta x\,, \tag{54}$$

where

$$\Delta x = \left(p_{x0} + \frac{B_z}{2} y_0\right) \sin w\ell - \left(p_{y0} - \frac{B_z}{2} x_0\right) (\cos w\ell - 1), \tag{55}$$

$$\Delta y = \left(p_{x0} + \frac{B_z}{2} y_0\right) (\cos w\ell - 1) + \left(p_{y0} - \frac{B_z}{2} x_0\right) \sin w\ell\,, \tag{56}$$

$$w = \frac{B_z(p - p_z)}{p p_z}\,. \tag{57}$$

The longitudinal coordinate is transformed as:

$$z = z_0 + \left(\frac{3}{2} - \frac{p}{p_z} - \frac{p_z^2}{2p^2} + \Delta v\right) \ell\,. \tag{58}$$