BOUNDARY CONDITIONS

Mass flux and mechanical energy flux vanish at boundaries:

$$\rho w = \partial_z u = \partial_z v = 0 \text{ at } z = 0, 1,$$

Imposed heat flux is only flux of energy into system:

$$T = 1 \text{ at } z = 0,\ \partial_z T = \theta \text{ at } z = 1,$$

Magnetic boundary conditions:

$$B_x = B_y = 0 \text{ at } z = 0, 1$$

or

$$\partial_z B_x = \partial_z B_y = 0 \text{ at } z = 0, 1$$

or

$$\begin{aligned} &\partial_z B_x = f_1 B_x,\ \partial_z B_y = f_1 B_y \text{ at } z = 0 \\ &\partial_z B_x = 0,\ \partial_z \overline{B_y} = f_2 \text{ at } z = 0 \end{aligned}$$

In toroidal/poloidal form:

$$\begin{aligned} &T = P = 0 \\ &\overline{B_{x,y,z}} = 0 \end{aligned}$$

or

$$\begin{aligned} &\partial_z T = \partial_{zz} P = 0 \\ &\partial_z \overline{B_{x,y,z}} = 0 \end{aligned}$$

or

$$\begin{aligned} &(\partial_z + f_1)T = 0, \quad \partial_z(\partial_z - f_1)P = 0 \\ &\partial_z \overline{B_{x,y}} = f_1 \overline{B_{x,y}}, \quad \partial_z \overline{B_z} = 0,\ \text{at } z = 0, \end{aligned}$$

$$\begin{aligned} &\partial_z z P = 0, \quad \partial_z T = 0, \\ &\partial_z \overline{B_y} = f_2, \quad \partial \overline{B_{x,z}} = 0,\ \text{at } z = 1. \end{aligned}$$