

# Ask The GSS Expert



How does the Pressure Potential and the coordinate system effect the pressure in FloEFD?

**F**or several application areas, it is crucial to consider the hydrostatic height, for example for the design of pumps or fans. For models of high geodetic head and/or for fluids with high density, the gravitational head is significant. It is important to understand how FloEFD works to avoid any mistakes.

Setting up a FloEFD project user may ask himself the following questions:

- Do I need to correct the environment pressure (to take into account the piezo pressure) for FloEFD models of a high geodetic head, if there are openings at different heights?
- Does FloEFD take into account gravitational head correctly?
- How do you define the pressure at these openings?
- My pressures are too low or too high in the equipment. Is it normal?

FloEFD takes into account the gravitational head when the "gravity" option is enabled. When the "Pressure potential" check box is selected, the specified static pressure is assumed to be piezometric pressure (Figure 1). The "Refer to the origin" option allows the definition of a user defined coordinate system for the reference point of pressure. If this box is unchecked, the global coordinate system is considered.

The hydrostatic pressure is defined as:

$$p(h) = \rho \cdot g \cdot h + p_0$$

The pressure at the origin of the Global Coordinate System (ambient pressure) is defined on the General Settings dialog box. FloEFD automatically adds the  $\rho \cdot g \cdot h$  term to any Environment Pressure boundary condition.

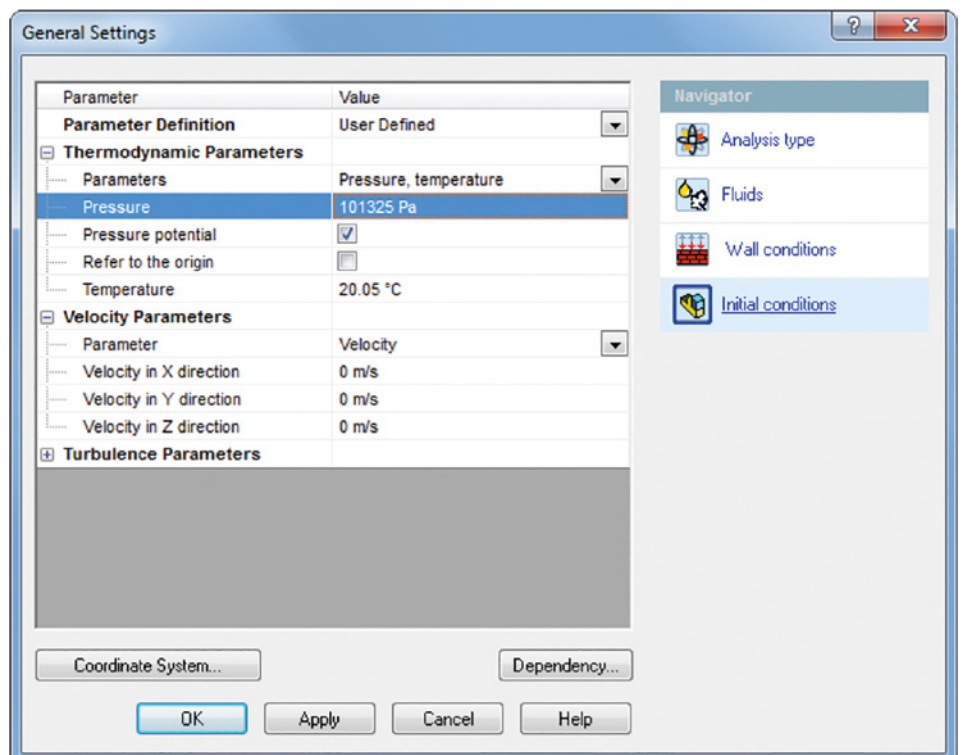


Figure 1. General, ambient settings

For example, a building with a height of 50 m and openings at a height of 10 m each. A boundary condition "ambient pressure" is specified for each opening with the value of the ambient pressure, for example 101325 Pa. The hydrostatic pressure must not be added manually, as this would wrongly increase the resulting pressure (Figure 2).

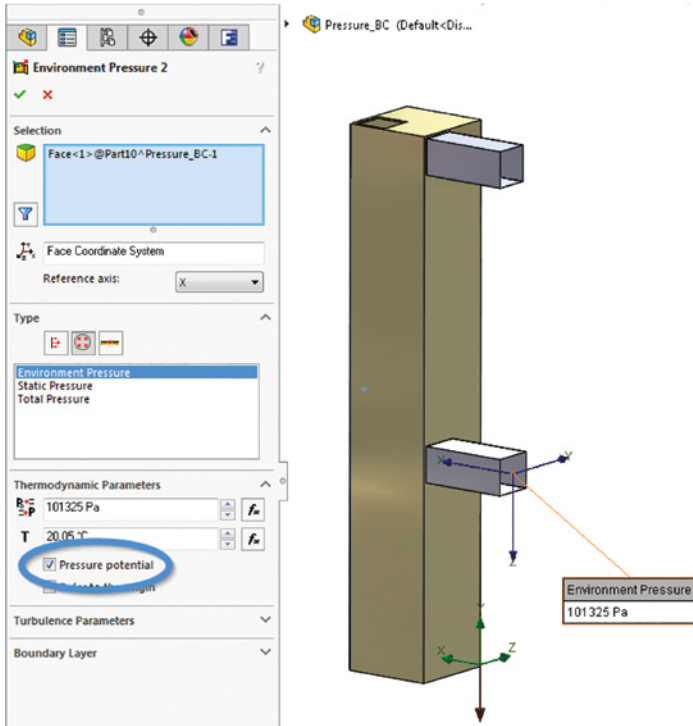


Figure 2. Pressure potential checkbox at pressure boundary condition

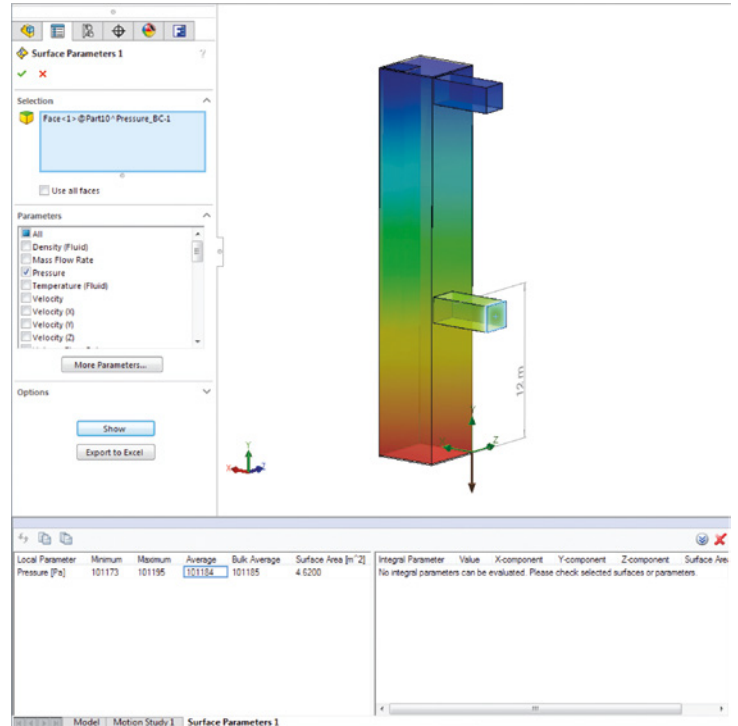


Figure 3. Pressure gradient for reference coordinate system at the bottom

A surface Goal "Total Pressure" on each of these openings' surface will show a value of  $p=101325 \text{ Pa} \pm \rho \cdot g \cdot h$  (This is to check and verify the validity of the data). The + or - sign determines the direction depending on the location of the Global Coordinate System.

The Surface parameter refers to the Total pressure. Notice, for the example shown in Figure 3, that the average value of total pressure is the reference pressure of 101325 Pa minus the  $\rho \cdot g \cdot h$  term's value.

With an increasing height from the coordinate system, the resulting pressure decreases compared to the reference pressure (Figure 3).

With a decreasing height from the coordinate system, the resulting pressure increases compared to the reference pressure (Figure 4).

On the results side (Figure 5), due to the location of Global Coordinate System, the pressure field is changing. This difference in the pressure field can be important in some cases where your results directly depend on the pressure value.

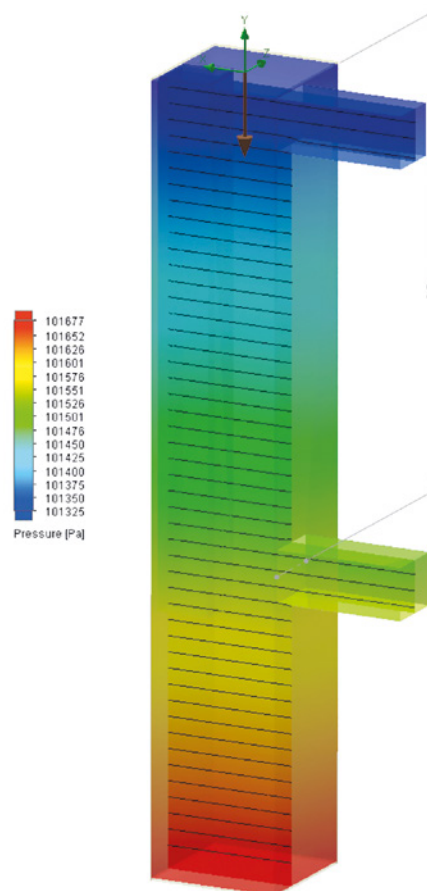


Figure 4. Pressure gradient for reference coordinate system at the top

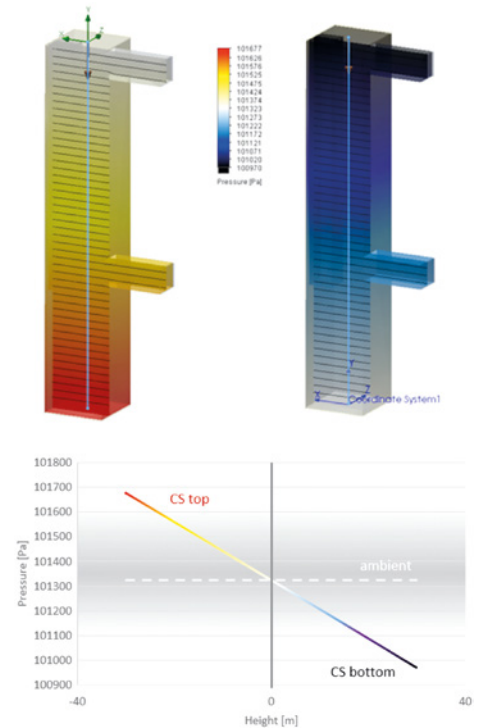


Figure 5. Result for reference Coordinate system at the top (left) and bottom (right)

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