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6. Important rules for modeling a system with pneumatic components [1](#)

This section will detail the important rules that should be respected to model a system with **Pneumatic** library components correctly.

6.1. Causality in the Pneumatic library [1](#)

As previously stated, it is necessary to distinguish two types of component in the **Pneumatic** library.

- Capacitive components are volumes in which the temperature and the pressure are computed from the enthalpy and mass flow rates inputs at their ports.
- Resistive components are those in which the enthalpy and mass flow rates are evaluated from the temperature and pressure inputs at their ports.

This implies that a pneumatic model is always built in such a way that an extreme resistive element R is always connected to an extreme capacitive element C as shown in [Fig. 6.1](#).



Fig. 6.1 Connection rule [1](#)

For this reason, it is important for you to understand the inner structure of the submodels used (*R*, *C-R*, *C-R-C*, ...) to ensure correct connection.

6.2. Important rules [¶](#)

- The **Pneumatic** library deals with gases only.
- It is better if you build **the system slowly** and run a simulation after each portion of circuit is added. This normally leads to a better understanding of the system and the results. It is also less likely that the setting of parameters will be forgotten. The user will have to be very careful when running multi-gas simulations: the gas type indexes must be adjusted in the corresponding submodels.
- This version of the **Pneumatic** library includes more than 50 submodels. Full documentation of these submodels is available in HTML format or, more briefly, directly in **Simcenter Amesim**, in the description of each submodel.
- The **Pneumatic** library can be coupled with the **Thermal** and **Thermal-Hydraulic** libraries to study interactions between gases, liquids and solids as shown in the previous examples. In the **Pneumatic** library, thermal ports have been added to pneumatic components:

$$T = T_{oil} + T_{radialL} + T_{axialL}$$

Fig. 6.2 Coupling thermal and pneumatic components [¶](#)

- In some extreme cases, you will have to change the value of the tolerance used by the integration algorithm to control the accuracy of the solution. You can access this parameter in the **Run Parameters** dialog box in **Simulation** mode. Its default value (10^{-7}) is satisfactory for most situations.

Sometimes, calculations may be unusually slow with a large number of discontinuities being handled during the simulation. This may be due to integration “noise” where small variations of some state variables are being greatly amplified and the resulting variations create discontinuities.

A reduced tolerance will reduce the noise and may cure the problem. Notice that it is normally unsatisfactory to set values for the tolerance higher than 10^{-3} or lower than 10^{-12} .

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