Sage Model Notes

Regenerator.scfn

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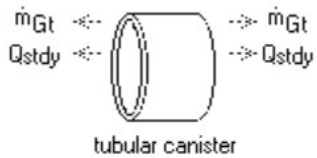
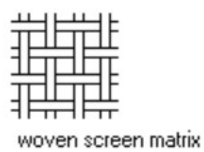
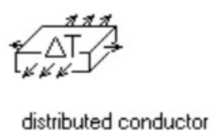
A regenerator is an important stirling-cycle machine element that alternately stores and releases heat to lower and raise the temperature of a gas flowing back and forth within. The root level model is simply a tubular canister representing the outer wall of a regenerator container:



The tubular canister is one of the options on the *Canisters* page of the component palette. The connector arrows have been moved up from lower-level components inside the canister:

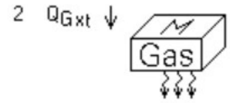




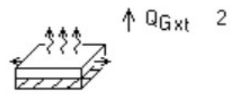
The woven screen matrix component is one of the options in the *Matrices* page of the component palette inside. The distributed conductor is one of the options on the *Heat Flows* page. It models thermal conduction down the canister wall via the Q_{stdy} heat flow arrows at the canister level.

Bar vs Distributed Conductor A bar conductor is another option in the *Heat Flows* page. It too models canister wall thermal conduction, but using a lumped parameter approach that captures the effects of thermal conductivity varying over the temperature range of the canister, often considerable in the case in a cryogenic regenerator, but does not permit branching heat flow. A distributed conductor resolves thermal conductivity on a spatial grid and does permit branching heat flow. With a distributed conductor there is some confusion over input `D`, which only has meaning if you are modeling branching heat flow. If, as in this model, you are just modeling axial thermal conduction in the canister wall you can leave `D` at its default value.

Inside the woven screen matrix are components representing the gas and solid parts of the regenerator:

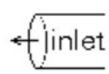


matrix gas

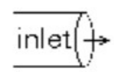


rigorous surface

The matrix gas component is the only option in the *Gas Domain* page of the component palette inside. There is a different type of matrix gas for each parent matrix type. The rigorous surface is one of the options on the *Matrix Solids* page. Inside the matrix gas component are positive and negative gas inlets that model the mass flow rate through the end boundaries of the regenerator gas.



negative gas inlet



positive gas inlet

These come from the *Charge/Inlets* page of the component palette and are the source of the $\dot{m}_{Gt}$ arrows at the ends of the canister in the root model.

Optional Within the rigorous surface, you could create negative and positive heat-flow ends for axial matrix conduction, then move the resulting Q_{stdy} connection arrows up to the root-component level for connection to temperature sources. This would make sense if the ends of your regenerator matrix were in good thermal contact with some sort of solid conduction paths. Otherwise gas heat transfer will couple internal matrix axial conduction to the enthalpy flow carried by the gas.

You can model thermal conduction between the matrix rigorous surface and the canister wall if you want. See the sample model for a porous-matrix heat exchanger for more details.

Tip Change the names of the components displayed in the edit form to correspond with their function, using the Specify|Component Name menu command when the component is highlighted. For example, you might want to change the generic name *tubular canister* to *regenerator*, or whatever. This will help you understand the purpose of your model components and is especially useful when there is more than one component present with the same generic name.