Advanced Diploma of Plant Engineering
(DPE)

Module 8 Thermodynamics, Compressor, Fans and Blowers

Instructions for using Thermoptim

V3

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DPE Module 8 Instruction
For using the software Thermoptim (DEMO)

1. Initial Setup

Video with instructions: https://www.youtube.com/watch?v=9otvizpKMVo

- Logon to Electromeet
- Open Thermoptim demo
  - The icon is located on the desktop

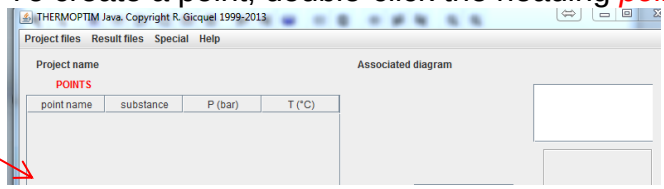
- Alternatively, you can download the software from Moodle.

(Values given below are defaults/examples, use values from Assignment, where given; NO SAVING SUPPORTED)

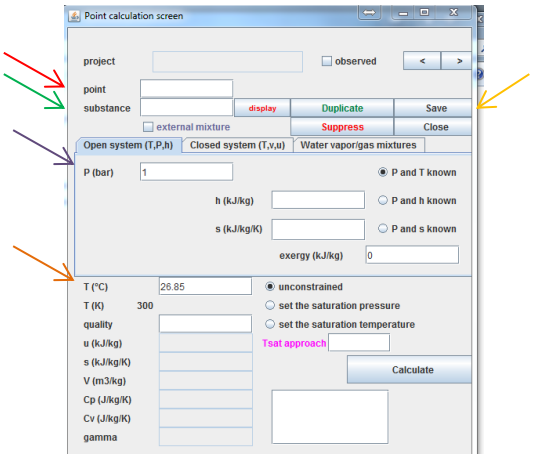
2. Compression

The refrigerator cycle is composed of four processes. We will start by modelling the first one: the compressor.

- Start by creating two points entitled "1" and "2"
  - To create a point, double-click the heading *point name*.



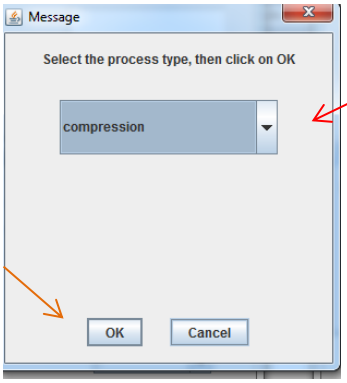
  - Enter the project name: A simple refrigerator cycle. (This is for the first time only
  - Enter the point name in this case 1.
  - Enter the point substance in the substance field. For this exercise, enter *R134a* and press ***enter***. **(The substance name R134a is cAsE seNsiTive)**
  - Enter the temperature (…) and pressure (…) (Values here are given in your module assignment, if not stipulated, use defaults)
  - Click Save.



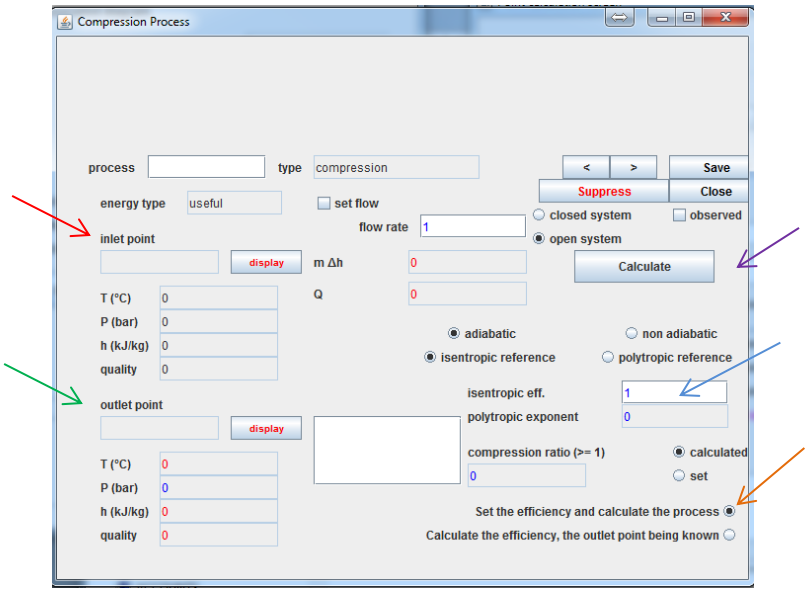
  - Repeat for point 2.

- Same temperature (…) and pressure (…)

- Create a process called “compressor”. Similarly to creating a point, to create this process, double-click the heading *process name*. A window appears.
  - Select compression and click OK.



  - Enter the process name. “compressor”
  - Double-click the heading *inlet point* and select point 1.
  - Double-click the heading *outlet point* and select point 2.
  - Enter polytropic efficiency (from Assignment) in *isentropic eff.*
  - Select *Set the efficiency and calculate the process.*
  - Click *Calculate*.
  - Record the outlet temperature and the polytropic exponent n. Then click Save.



- Insert the compressor diagram in the Diagram editor for Thermoptim.
  - Select the icon *compression*  on the tool bar. And click on the drawing field to add it.
  - Call it this component “compressor.”

- On the outlet port tab, enter the outlet point (2) and the substance *R134a*.
- Click Apply to confirm.

3. Condenser

The condenser is divided into two sub processes. We will call the first one desuperheating.

- Start by creating a point entitled "3a".
  - Follow the same steps as above. Enter the point name, substance and pressure. Click Save to confirm.
- Create a process called “desuperheating”. To create this process, double-click the heading *process name*. A window appears.
  - Select *exchange* and click OK.
  - Enter the process name “desuperheating”.
  - Double-click the heading *inlet point* and select point 2.
  - Double-click the heading *outlet point* and select point 3a.
  - Assuming that Δh is -19.23 kJ/kg. Enter this value (in *m Δh (W)* and select *Set m Δh and modify the outlet point.*
  - Click Calculate and Save.
  - Record this value.
- Insert the exchanger diagram in the Diagram editor for Thermoptim.
  - Select the icon *exchange* on the tool bar. And click on the drawing field to add it.
  - Call it this component “desuperheating.”
  - On the outlet tab, enter the outlet point name (3a) and the substance *R134a*.
  - Click Apply to confirm.

The second process is called condenser

- Start by creating a point entitled "3”.
  - Follow the same steps as above. Enter the point name, substance (press enter) and pressure. Assume the room temperature T(^{o}C) is 25^{o}C. Click Save to confirm.
- Create a process called “condenser”. To create this process, double-click the heading *process name*. A window appears.
  - Select *exchange* and click OK.
  - Enter the process name “condenser”.
  - Double-click the heading *inlet point* and select point 3a.
  - Double-click the heading *outlet point* and select point 3.
  - Click Calculate and Save.
- Insert the exchanger diagram in the Diagram editor for Thermoptim.
  - Select the icon *exchange* on the tool bar. And click on the drawing field to add it.

- Call it this component “condenser.”
- On the outlet tab, enter the outlet point (3) and the substance *R134a*.
- Click Apply to confirm.

4. Throttling

The next process is to reduce the temperature and pressure of the refrigerant using a throttle valve.

- Start by creating a point entitled "4”.
  - Follow the same steps as above. Enter the point name, substance (“*R134a”* press enter) and *pressure*. Assuming the outlet temperature is -10 ^{o}C. Click Save to confirm.
- Create a process called “throttling”.
- To create this process, double-click the heading *process name*. A window appears.
  - Select throttling and click OK.
  - Enter the process name “throttling”.
  - Double-click the heading *inlet point* and select point 3.
  - Double-click the heading *outlet point* and select point 4.
  - Click Calculate.
  - Record the outlet temperature and click Save.
- Insert the throttle diagram in the Diagram editor for Thermoptim.
  - Select the icon *throttling*  on the tool bar. And click on the drawing field to add it.
  - Call it this component “throttling.”
  - On the outlet tab, enter the outlet point (4) and the substance R134a.
  - Click Apply to confirm.

5. Refrigeration effect

A last process is required to complete the system.

- Create a process called “refrigeration effect”. To create this process, double-click the heading *process name*. A window appears.
  - Select exchange and click OK.
  - Enter the process name “refrigeration effect”.
  - Double-click the heading *inlet point* and select point 4.
  - Double-click the heading *outlet point* and select point 1.
  - Click Calculate and Save.
- Insert the exchanger diagram in the Diagram editor for Thermoptim.
  - Select the icon *exchange*  on the tool bar. And click on the drawing field to add it.
  - Call this component “*refrigeration effect*”
  - On the outlet tab, enter the outlet point (1) and the substance.
  - Click Apply to confirm.

6. Completing the diagram

- Start by connecting all components together.
  - Make sure that the inlet point is blue and the outlet point is green. If you need to flip a component, select it and press F1.
  - To draw a connect line, click on a green square and drag until you reach the blue square of the component you want to connect to.
- The *desuperheating* and *condenser* process exchange heat with the outside air.
  - To draw this, insert a utility icon  and call it ***outside air***.
  - Click Apply to confirm.
  - To connect the condenser and desuperheater to the outside air, click on the centre of an exchanger and drag the line to the centre of the utility. A blue line should appear. Repeat for the other exchanger.
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- The heat been exchanged at the cold chamber is represented by the process named *refrigeration effect*. To insert the cold chamber, insert a utility diagram call it ***cold chamber***. Then connect it to the refrigeration effect icon.
- If you change values, remember to click the “Recalculate” button.
- Double-check that the calculated values more-or-less reflect your initial parameters (Slight variations due to simulation variations)