

For this problem set, each student should submit individual work.

50,000 lb_m h⁻¹ of a refinery alkane stream that can be represented as hexadecane is to be cooled from 455 to 290°F. Rather than pay for cooling utilities, you decide to recover this energy into other streams that need to be heated. You find that fuel oil of “relative density” 0.95 is available at 305°F and 70,000 lb_m h⁻¹, and a large supply of tridecane is available at 210°F, although this must not be heated above 300°F. Perform preliminary sizing of suitable heat exchange equipment.

Your response should

- be worked in SI units
- include a flow diagram sketch with stream flows and temperatures shown
- include a table of physical properties and other design information that you used
- document and justify the simplifying assumptions you made
- list the process variables and classify each as “controlled”, “manipulated”, “disturbance”, or, if necessary, “intermediate”. (Intermediate is a category that arises in more complex processes – an intermediate variable depends on inputs, and either affects outputs or is itself an uncontrolled output.)
- assert a design case (what we have been calling “steady-state reference values) that gives you room to maneuver the manipulated variables and “optimizes” heat exchanger surface.

Don’t overdo it.

This is *preliminary* design. Don’t bog yourself down in detailed calculations for heat transfer coefficients, physical properties, and any details of heat exchanger design. Neither, of course, should you use bone-headed estimates of these quantities. Use good sense and the reference material you’ve been accumulating over the past few years to come up with the data you need. (But be suspicious of Equation 27-11 in Perry’s 7th...) Furthermore, “optimizing” the use of surface area simply means not to turn in the first result you calculate – work a bit with your independent variables to point toward a decent design.