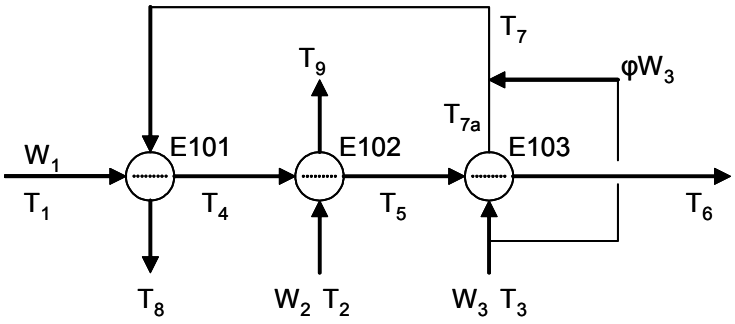
Problem Set 7: alternative HX network base case

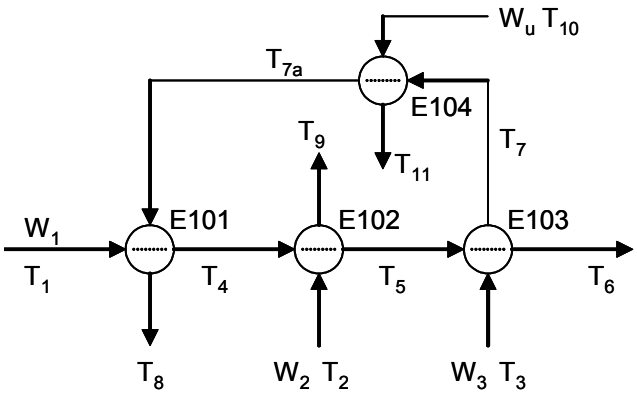
For this problem set, work with one or two names will be accepted.

Consider alternative heat exchanger networks:

bypass



trim HX



For each of these networks,
(1) assemble the nonlinear equations that describe their steady-state behavior
(2) classify the variables – there will now be 3 CV and 3 MV
(3) determine the unknown reference values for the following specifications

all heat capacities 2500 J kg^{-1} K^{-1}
all heat transfer coefficients 250 W m^{-2} K^{-1}
(inputs) W_{1r}: 8.2 kg s^{-1} T_{1r}:250°C
T_{2r}:136°C
T_{3r}:100°C
T_{10}: 180°C (we will presume that T_{10} is not disturbed from this value)
(outputs) T_{6r}: 129.3°C
T_{8r}: 223.4°C
T_{9r}: 168.8°C

Step (3) constitutes your design, in which the result will be heat exchanger sizes and the bypass fraction to achieve the specified outputs, for the specified inputs. Are these enough specifications to determine a unique design? Recall that the original network used three exchangers of area 117 m^2; any or all of these may change for the new designs. Furthermore, the manipulated variables may assume new reference values.

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