LAB4: Computation of the EP3

Assessing the economic potential of level-3

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Lab

The economic potential of level-3 (EP_3) is defined as:

$$EP_3 = EP_2 - \dot{€}_{reactors\ \&\ compressors}$$

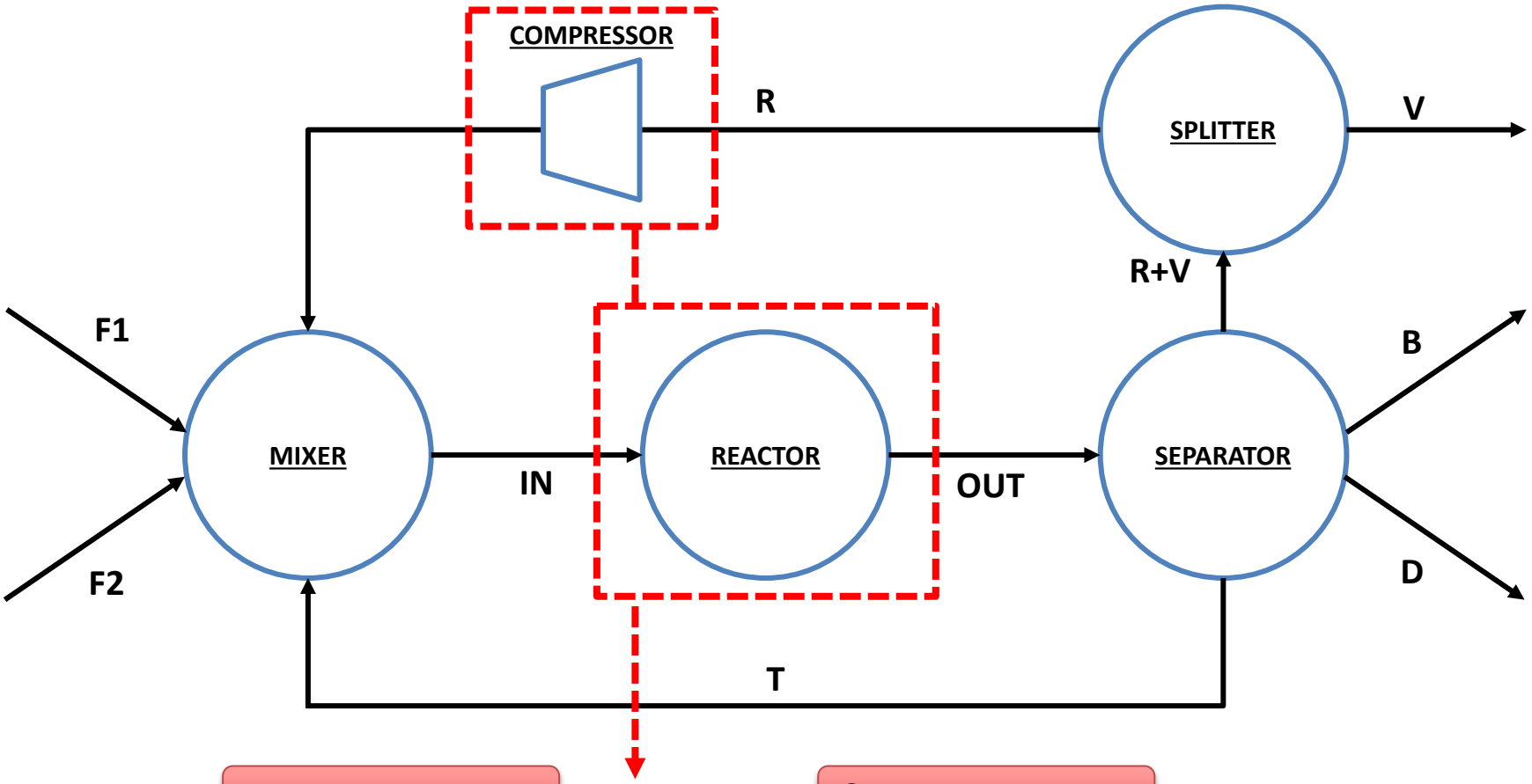
with EP_3 in [M€/y].

If the EP_3 is greater than zero, the process may be economically attractive; vice versa, the process is not economically interesting.

It is then necessary to find the reactor and compressor dimensions.

Remark: the cost of the pumps is negligible over that of compressors.

Reactor and compressor



Reactor

$$\dot{€}_{reactor}$$

Compressor

$$\dot{€}_{compressor}$$

The equipment costs must account for:

- Capital expenditure (CapEx);
- Operative expenditure (OpEx).

The **CapEx** term is the sum of the costs of the materials used to manufacture and install the equipment (*e.g.*, vessels and welds).

The **OpEx** term depends on the equipment's operating requirements, such as electricity consumption and other utilities (*e.g.*, steam and cooling water).

The suggested **depreciation period** for the reactor and the compressor is equal to **5 years**.

Cost of the reactor

The reactor does not require any catalyst: the CapEx term does not include the costs of the catalyst and its support.

The reactor is also **virtually isothermal** and **operated adiabatically**. Accordingly, it does not require a heat exchange system.

Therefore, the cost of the reactor will consist of investment costs only. The reactor is equivalent to an empty pressurized pipe: then, it will be assimilated into a **pressure tank** to calculate its investment costs.

Since it works at **high temperatures**, the reactor must be **insulated**. This leads to an increase in investment costs by 15%.

Cost of the compressor

CapEx:

⇒ **Guthrie's formula** for the installation of a centrifugal compressor.

OpEx:

⇒ **Electricity consumption** of the compressor.

Since both the investment and operating costs depend on the operating power, and this power depends on the recycled flowrate (**R**), such expenses related to the compressor are expected to show the same trend as that of the recycled flowrate.