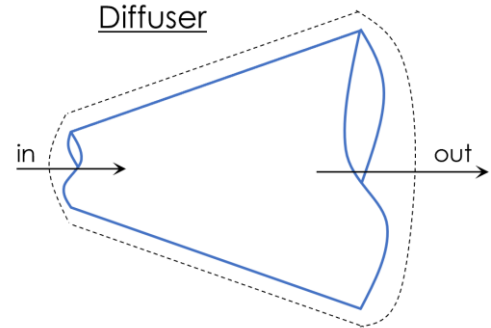# THERMODYNAMICS: MOLLIER DIAGRAMS

Mollier Diagrams:

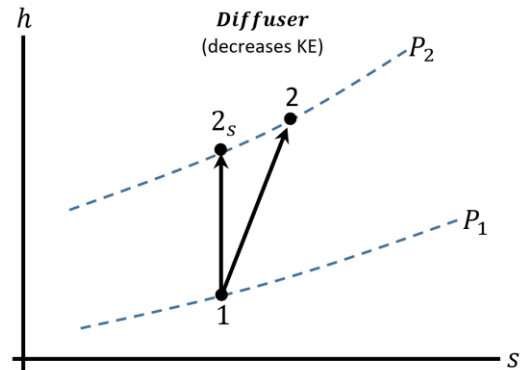### Nozzle

Diffuser
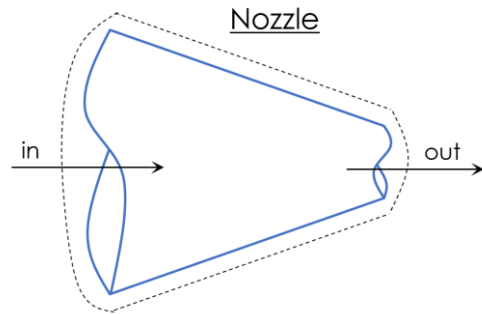
Assumptions:
- Steady flow
- Single stream
- Adiabatic $(\Delta Q = 0)$
- No work $(W=0)$
- Open system
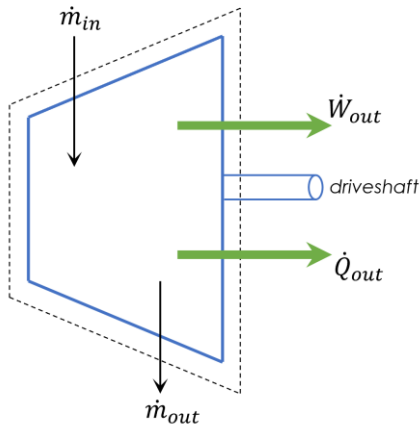- Control volume
- $\Delta PE = 0$ (but $\Delta KE \neq 0$)

Nozzle (increases KE)
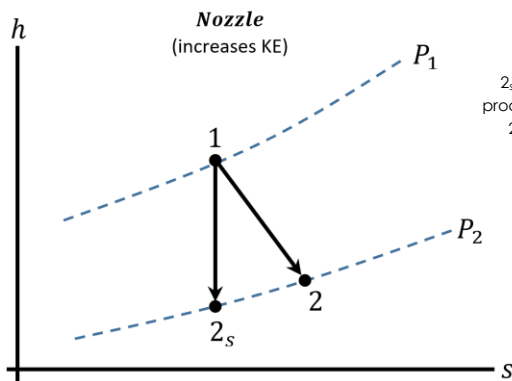
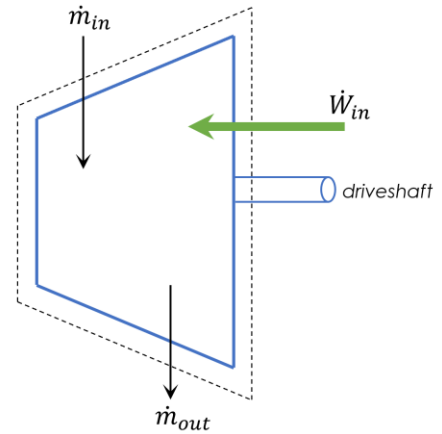2_s represents a reversible process (Carnot/ideal), while 2 represents an actual process.

Diffuser (decreases KE)

Where the energy balance equation reduces to:

$$h_{in} - h_{exit} = \frac{1}{2}(V_{exit}^2 - V_{in}^2)$$

Turbines

$\dot{m}_{in}$
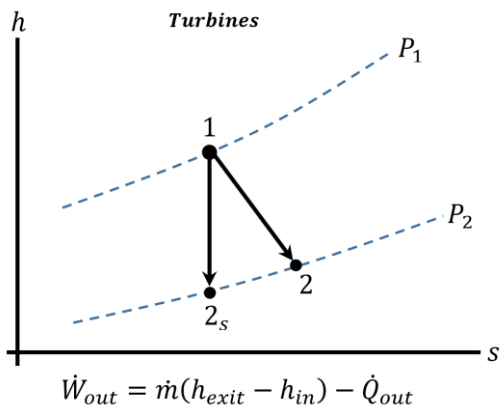
$\dot{W}_{out}$

driveshaft

$\dot{Q}_{out}$

$\dot{m}_{out}$

Compressor/Pump

$\dot{m}_{in}$

$\dot{W}_{in}$

driveshaft

$\dot{m}_{out}$
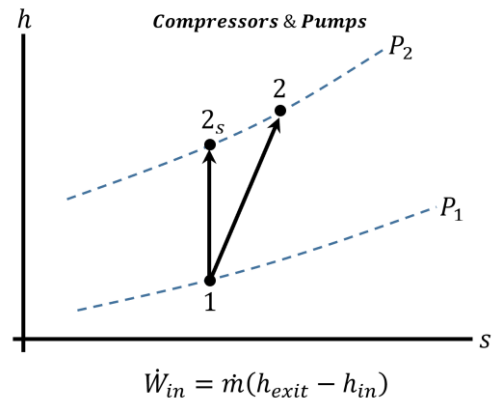
Assumptions:
- Steady state $(\dot{m}_{in} = \dot{m}_{out})$
- Open system
- Control volume
- $\Delta PE = \Delta KE = 0$

Turbines

h

P_1

1

P_2

2

2_s

s

$$\dot{W}_{out} = \dot{m}(h_{exit} - h_{in}) - \dot{Q}_{out}$$

Isentropic efficiency: $\eta_T = \dfrac{h_1 - h_2}{h_1 - h_{2s}}$

Compressors & **Pumps**

h

P_2

2

2_s

P_1

1

s

$$\dot{W}_{in} = \dot{m}(h_{exit} - h_{in})$$

Isentropic efficiency: $\eta_C = \dfrac{h_{2s} - h_1}{h_2 - h_1}$