Determining Energy Loss in pneumatic machinery

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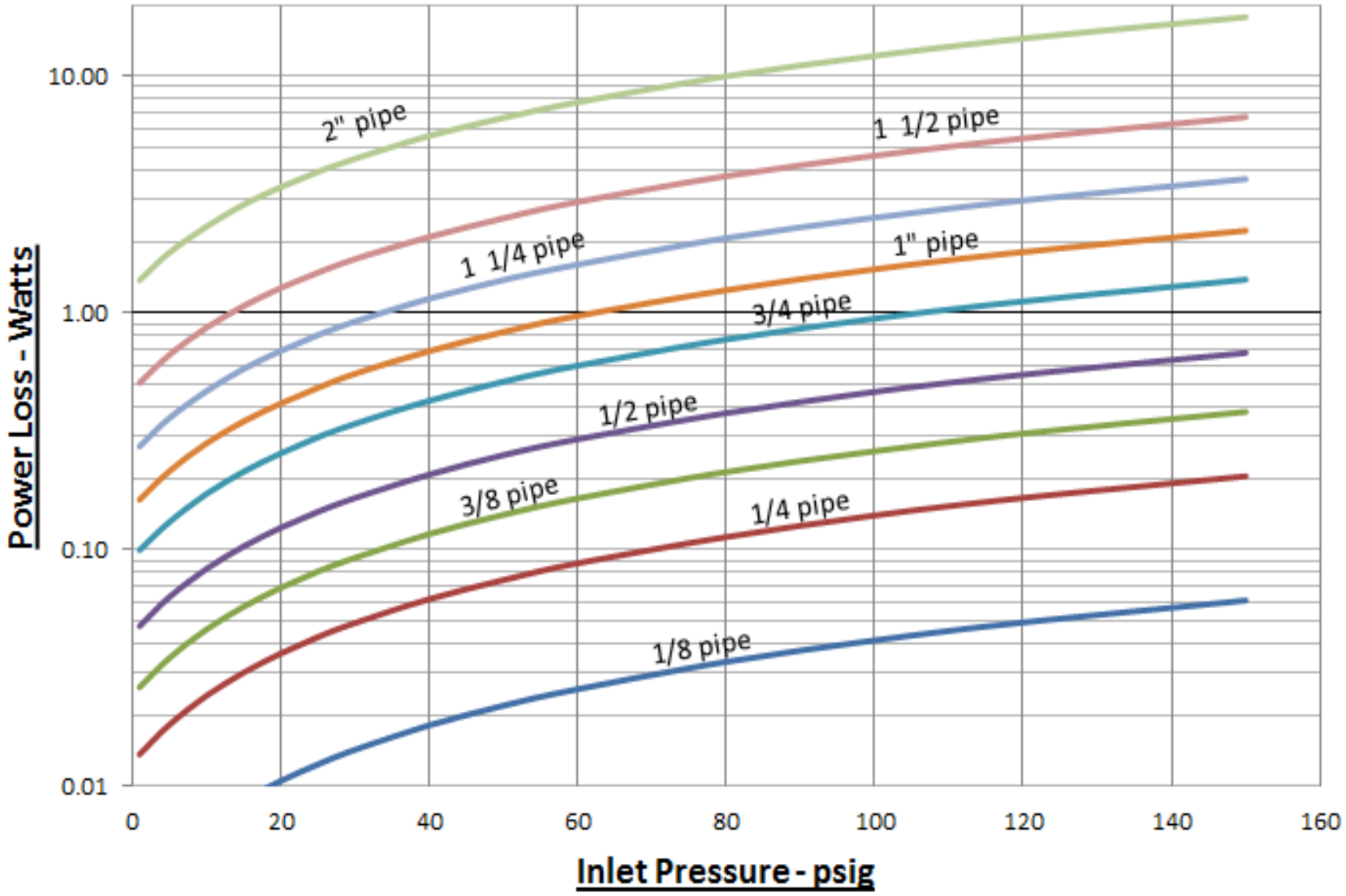
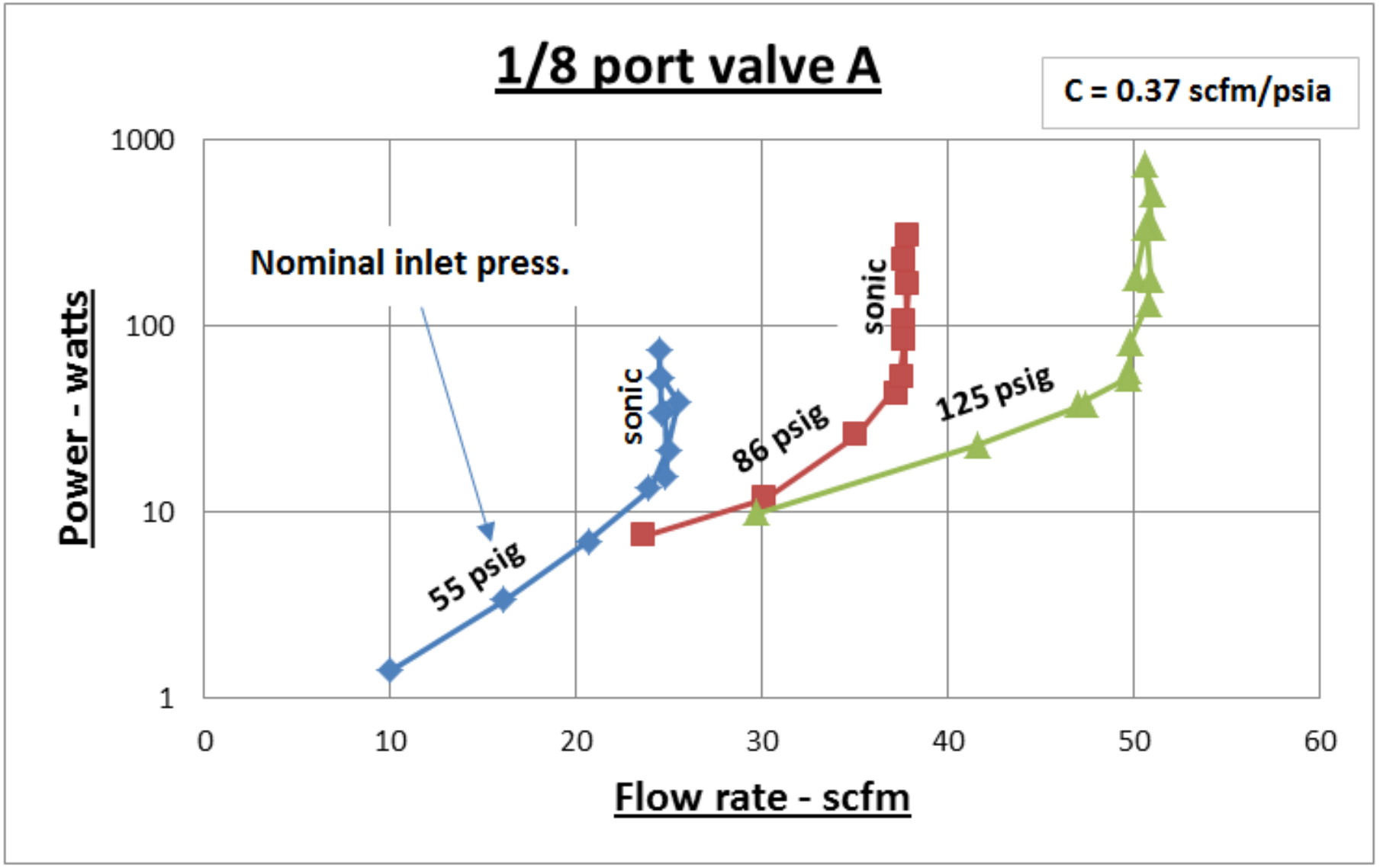
Last year - components

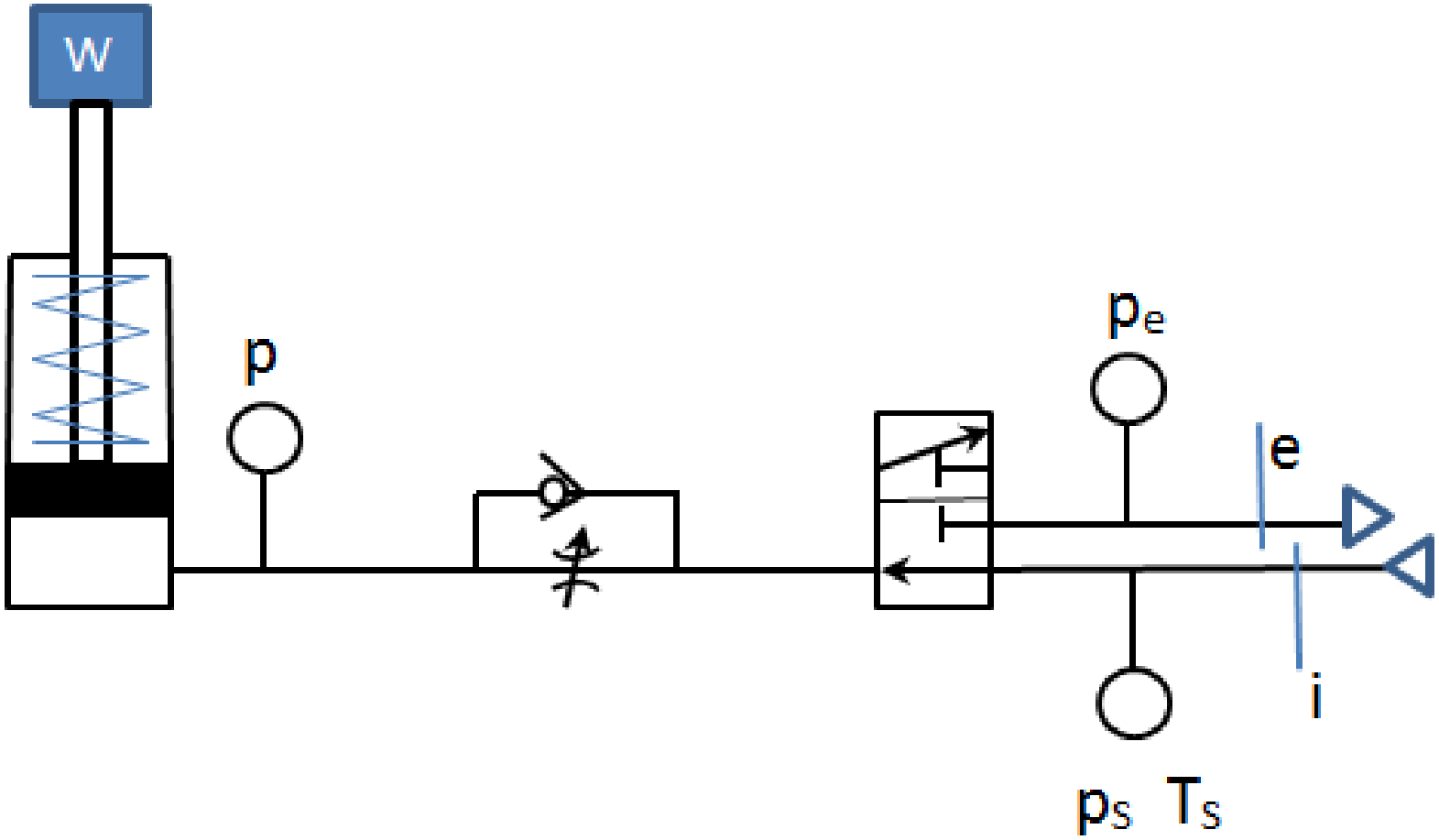
- Power loss in pneumatic piping
- Power loss through pneumatic valves

Power Loss in 100 ft. of Pipe at Max. Recomended Flow

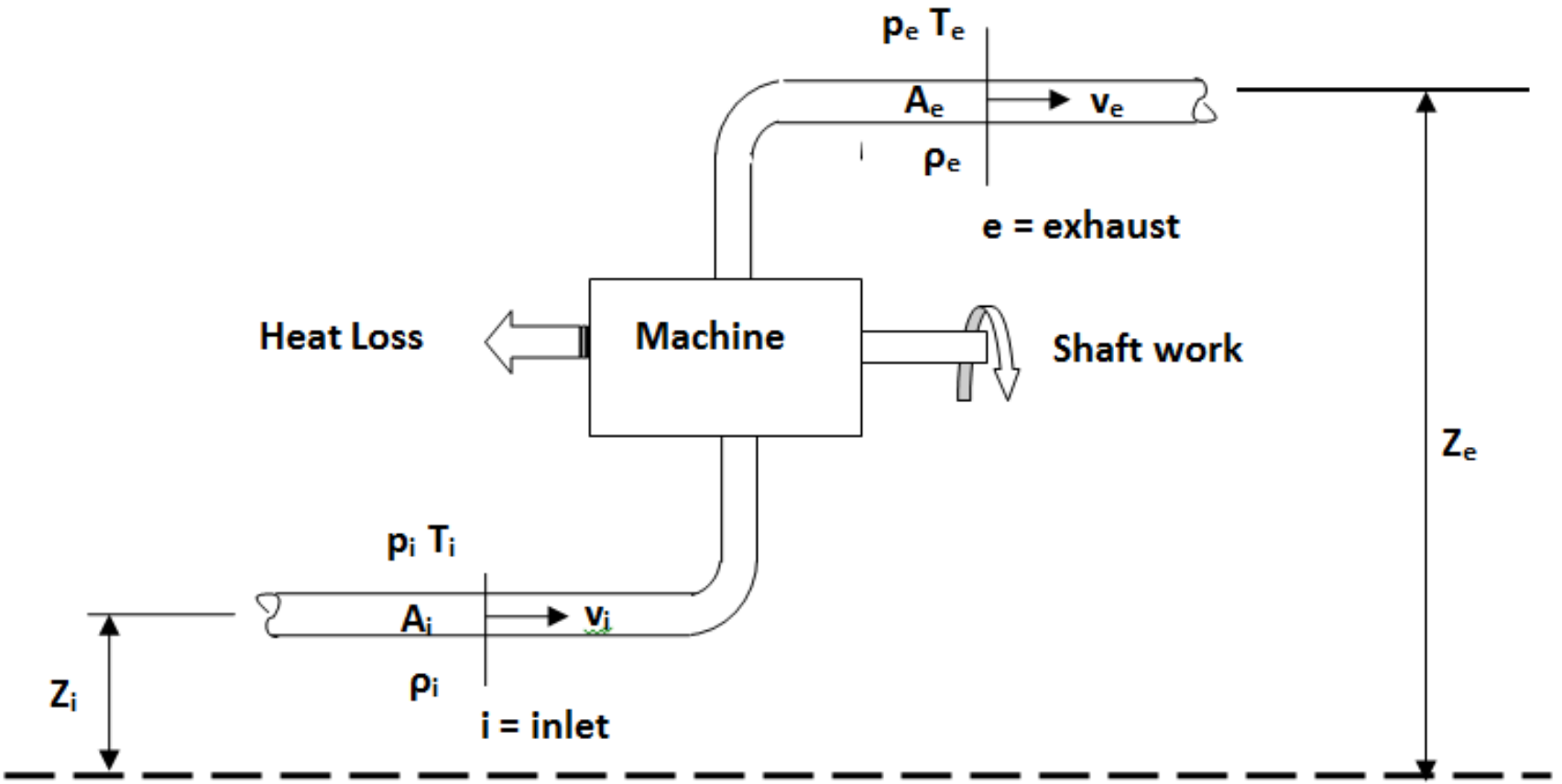



1/8 port valve A
C = 0.37 scfm/psia
Nominal inlet press.
sonic
sonic
55 psig
86 psig
125 psig
Power - watts
1000
100
10
1
0
10
20
30
40
50
60
Flow rate - scfm

Pneumatic Machine



Machine Schematic



Energy Balance

(KE +PE +IE + flow work)$_{in}$ – (KE +PE +IE + flow work)$_{out}$

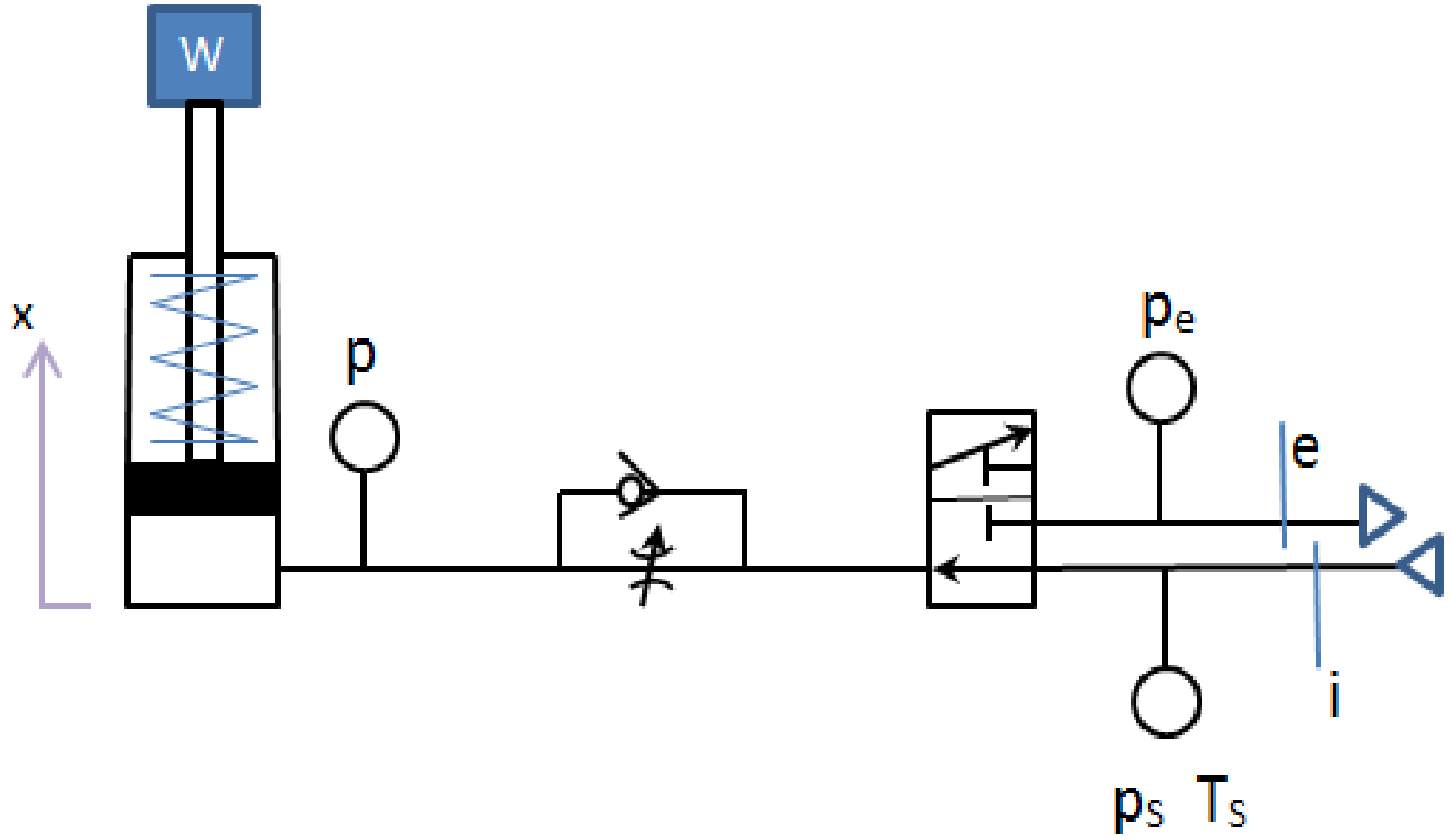
- Shaft work – Heat loss = 0

$$E_L(dm) = \left(\frac{v_i^2}{2} - \frac{v_e^2}{2}\right)(dm) + \left(\frac{p_i}{\rho_i} - \frac{p_e}{\rho_e}\right) - E_S(dm)$$

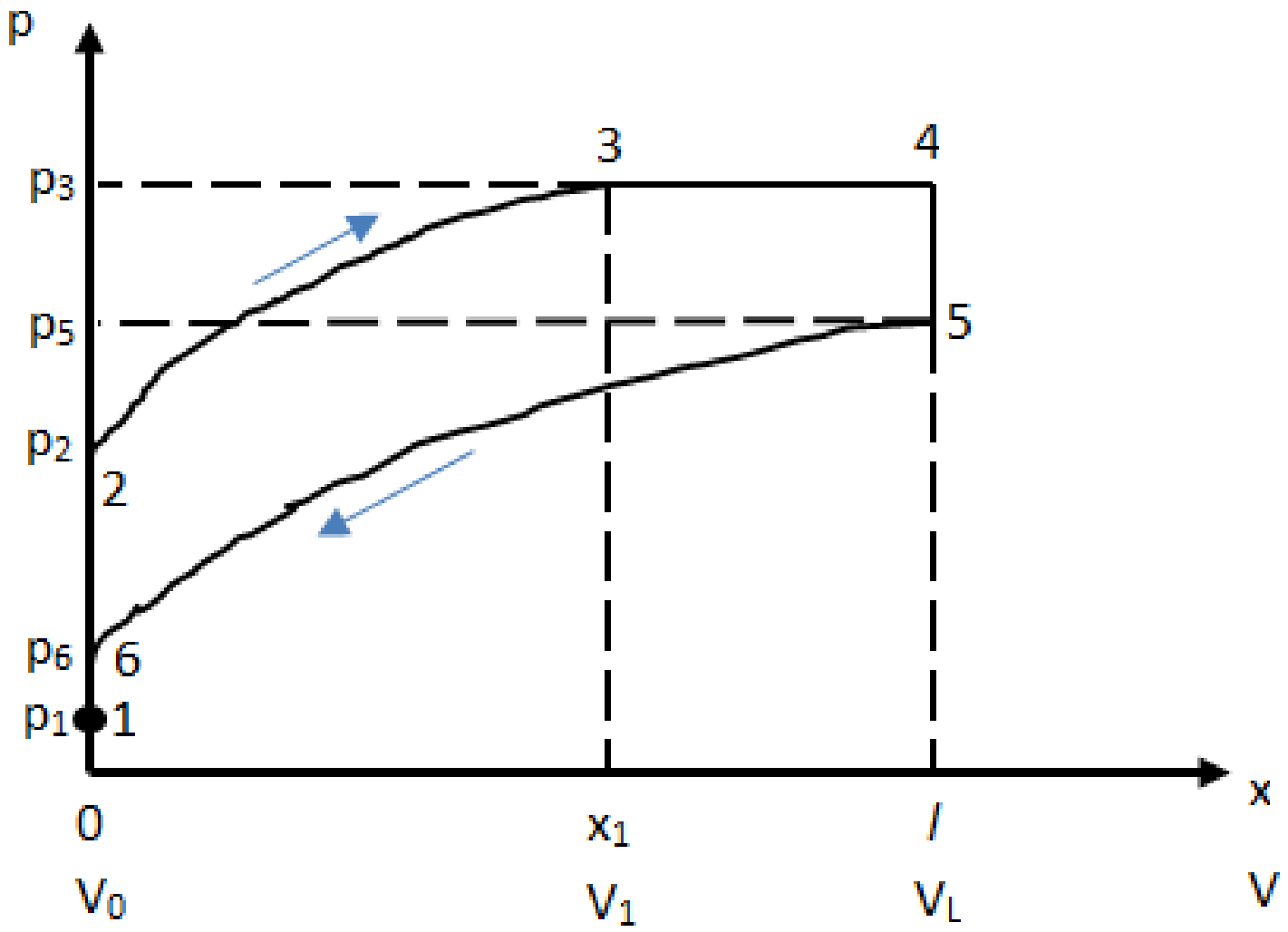
And the Power loss is:

$$P_L = E_L G \qquad \text{watts}$$

Pneumatic Machine



PV diagram



Conclusions

- Cost of power to perform a cycle determined.
- Mfg. cost vs. cycle rate can be determined.
- Is there an optimum rate?
- Analyze before building a machine.