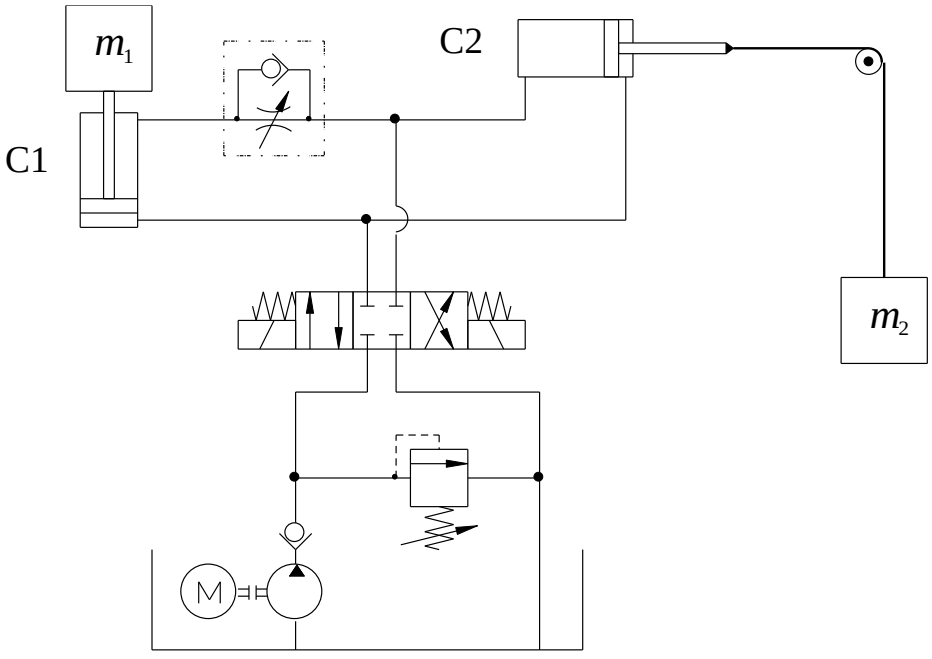
MEC-E5003 Fluid Power Basics
Calculation Exercises 4
Spring 2017

EXERCISE 9

The system in underlying figure is used to lift two masses. Find out the operation order of the cylinders and calculate the minimum setting pressure of pressure relief valve needed to ensure the operation. Also calculate the piston velocities for bot cylinders in lift phase(s).

Cylinder:
C1; piston diameter d_{c1} = 80 mm, piston rod diameter d_{cr1} = 50 mm, m_1 = 5000 kg.
C2; piston diameter d_{c2} = 63 mm, piston rod diameter d_{cr2} = 45 mm, m_2 = 3000 kg.
Cylinders are assumed to be leakage free and frictionless, the strokes are of equal length.
Pump: $V_{g,p}$ = 75 cm^3/r, $\eta_{v,p}$ = 0.9, $\eta_{hm,p}$ = 0.95. Speed of electric motor driving pump n_p = 1500 r/min.
Pressure losses of directional control valve can be omitted.
Throttle diameter of throttle check valve d_t = 3 mm.
C_q = 0.7, ρ = 860 kg/m^3.



EXERCISE 10

System in underlying figure is used to operate three chain conveyors, each equipped with individual hydraulic drive motor. Load torques of the motors are T_1 = 1500 Nm, T_2 = 700 Nm and T_3 = 300 Nm. Displacements of the motors are $V_{g,\mathrm{m1}}$ = 1000 cm^3/r, $V_{g,\mathrm{m2}}$ = 1000 cm^3/r and $V_{g,\mathrm{m3}}$ = 500 cm^3/r. Efficiencies of all the motors η_v = 0.90 ja η_hm = 0.85, the leakages of motors 1 and 3 are totally internal and of motor 2 totally external.

System pump produces constant flow of 8 l/min. The controllable throttle is circular in cross-section and has a diameter of d_t = 0.5 mm. C_q = 0.7 and ρ = 860 kg/m^3.

Calculate the minimum setting pressure of pressure relief valve needed to ensure the operation of the system at the announced loads. In addition, calculate the rotational speed of the motors.