Q.)

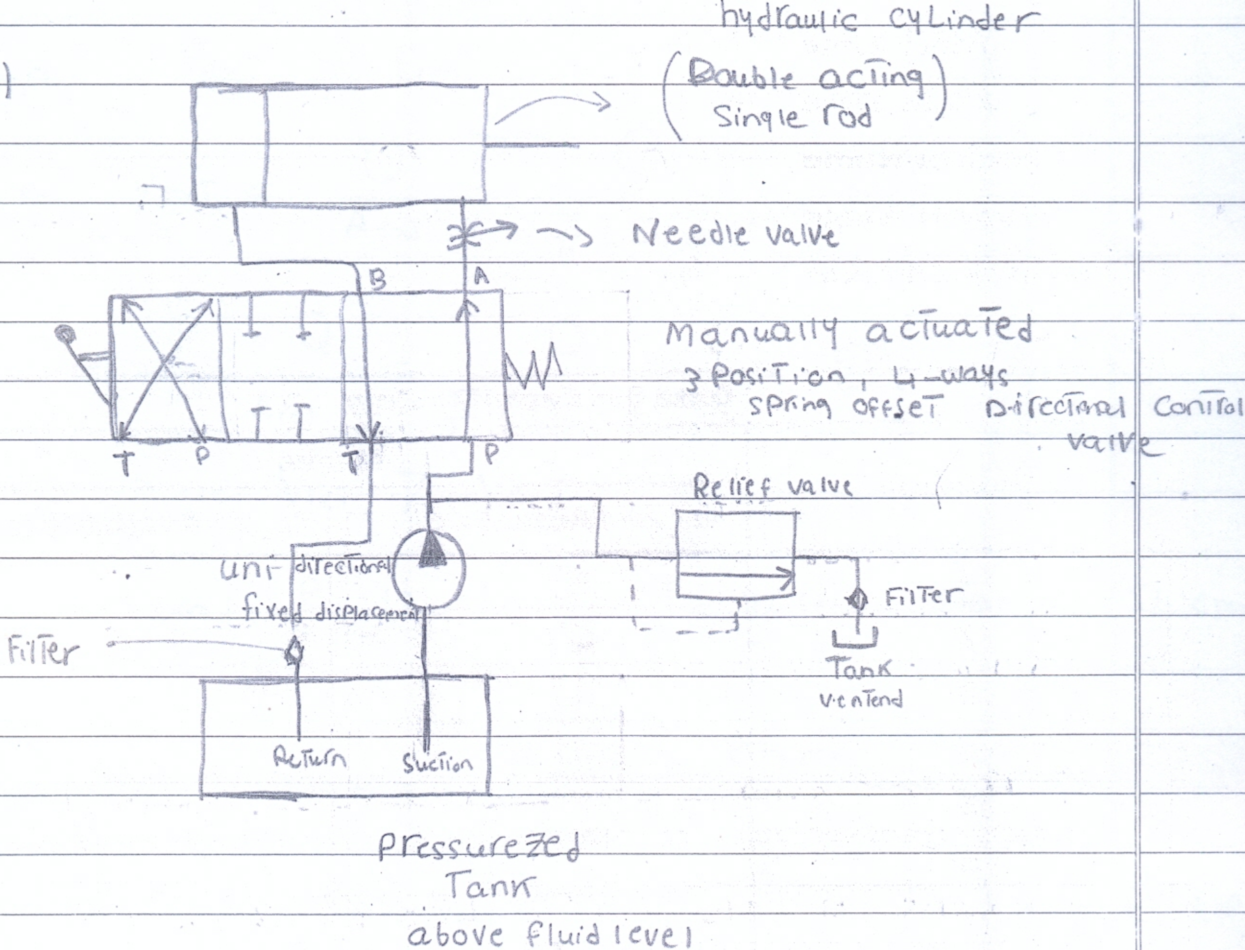
a)

1) The cylinder moving Down.

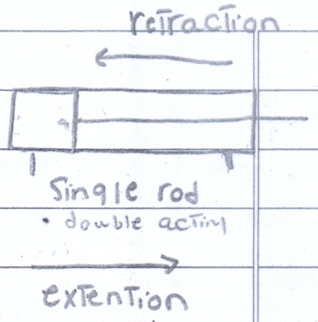
2) The valve moved UP in order To reverse The motion of load cylinder.

3) The Pressure on The outlet of The Pump will increase.

4)



b)



$\because F_{ext} = P\, A_{ext}$

$F_{ext} = P * \frac{\pi}{4} (D_{piston})^2 \rightarrow \boxed{1}$

$\because F_{ret} = P * A_{ret}$ $\quad A_{piston} > A_{piston} - A_{rod}$

$F_{ret} = P * \frac{\pi}{4} (D^2_{piston} - d^2_{rod}) \rightarrow \boxed{2}$

1 & 2 Then $F_{ext} > F_{ret}$

$\because V_{ext} = \frac{Q}{A_{ext}} = \frac{Q}{\frac{\pi}{4} (D_{piston})^2} \rightarrow \boxed{1}^*$

(Velocity)

$V_{ret} = \frac{Q}{A_{ret}} = \frac{Q}{\frac{\pi}{4} (D^2_{piston} - d^2_{rod})} \rightarrow \boxed{2}^*$

Then ①* & ②* $V_{ret} > V_{ext}$

---

c) $d = 15\ cm$, $P = 124\ bar$, $T = 10\ sec$, $stroke = 254\ cm$

Power = ??

Sol

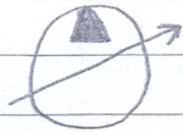
$\because Power_{mechanical} = \frac{Force * stroke}{Time} \rightarrow \boxed{1}$

$\because Force = Pressure * Area = (124 \times 10^5) * \frac{\pi}{4} (15 \times 10^{-2})^2$

$= 219126.0876\ N$

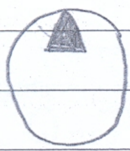
$\therefore Power = \frac{219126.0876 * (254 \times 10^{-2})}{10} = 55658.026$ watt

Q_2)

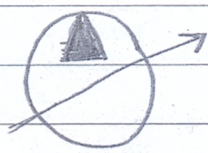
a)  (varriable displacement Pump) → بتعطى كميات متغيره بكل cycle

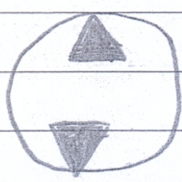
To increase The Pump flow rate in swash Plate Piston Pump

→ increase swash plate angle (θ_{stroke} = max) → $V_{D_{max}}$

 (Fixed displacement Pump) → بتعطى كميات ثابته بكل cycle (flow rate)

---

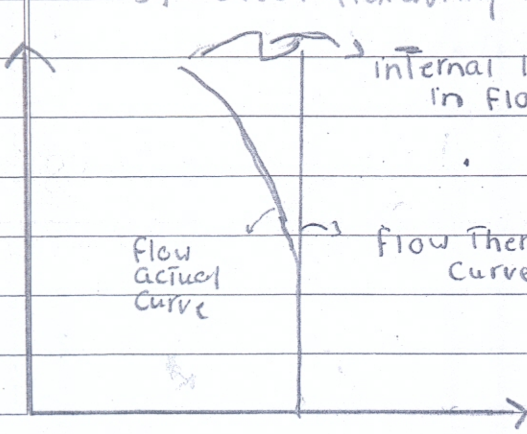
b) i) 

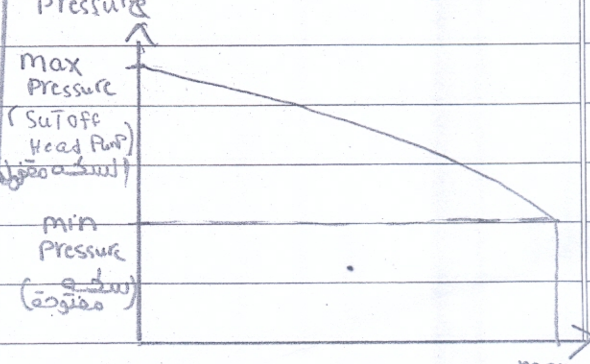
ii) 

---

c)

Positive Pump	Non Positive Pump
advantage → 1) high Pressure	← زي موتور المياه اللي في البيت
2) high Volumetric efficiency	1) Low Pressure
3) Small size	2) Transmission flow from one locTation To another
4) small change in efficiency	بتحول من تقليب الـ fluid الى المكان أي [illegible]
5) Great flexability of Performance	





d) Pressure = 70 bar $* 10^5$ Pa

Sol

$\because Q_{act})_{Pump} = Q_{act})_{motor}$

$\because Q_{Th})_{Pump} = V_D)_{Pump} * \frac{N}{60} = (82 * 10^{-6}) * \frac{500}{60} = 6.83 \times 10^{-4}$ m^3/sec

$\because \eta_{vol})_{Pump} = \frac{Q_{act}}{Q_{Th}}$ (0.82)

$\therefore Q_{act})_{Pump} = 5.6006 \times 10^{-4}$ m^3/sec $= (Q_{act})_{motor}$

$\eta_{vol})_{motor} = \frac{Q_{Th}}{Q_{act}} \longrightarrow$

$Q_{Th})_{motor} = 0.92 * (5.6006 \times 10^{-4}) = 5.152 \times 10^{-4}$ m^3/sec

$\therefore V_D)_{motor} = \frac{Q_{Th}}{rpm \cdot N/60} = \frac{5.152 * 10^{-4}}{(400/60)} =$ $\boxed{7.728 \times 10^{-5} \; m^3}$

$T_{Th})_{motor} = \frac{Pressure * Q_{Th}}{\omega} = \frac{70 \times 10^5 * (5.152 \times 10^{-4})}{2\pi \; 400/60}$

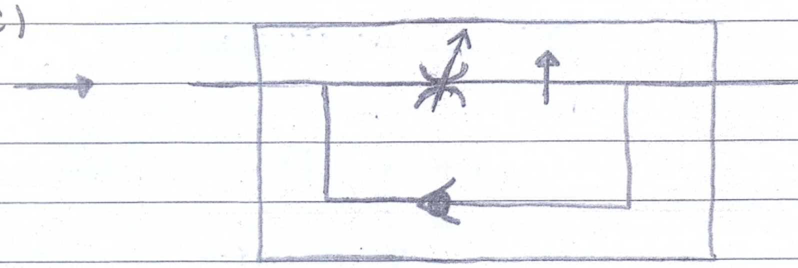
$= 86.096$ N.m

$\because \eta_m)_{motor} = \frac{T_{act} * \omega}{Pressure * Q_{Th}}$ (→ 0.9)

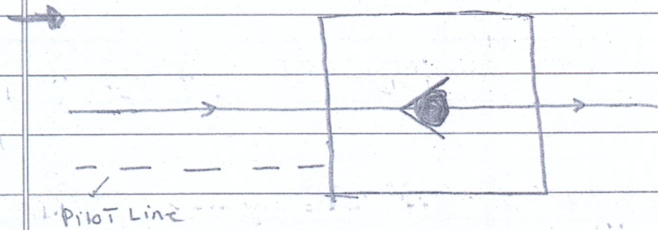
$\therefore T_{act} = 77.48$ N.m

Q3)

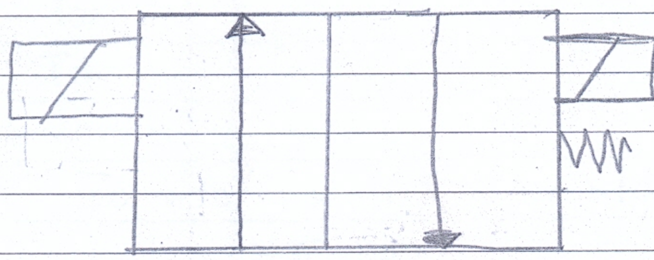
a)



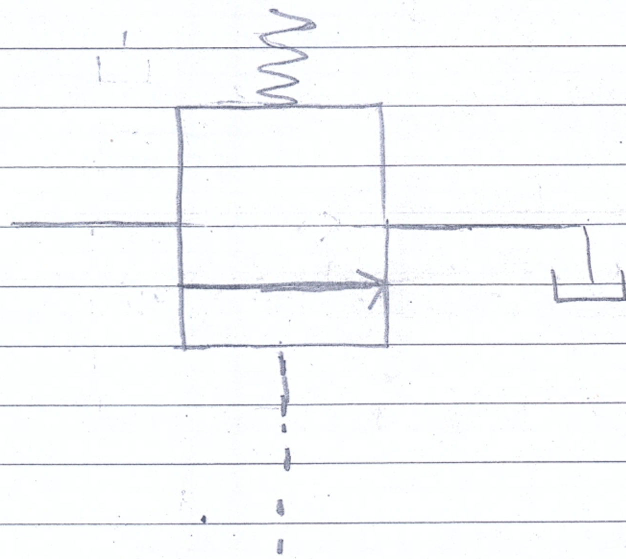
(FCV)
pressure compensated



Pilot check valve



DCV



unloading valve

b) $V_D = 164 \times 10^{-6}\ m^3$, $P = 70 \times 10^5\ Pa$

$N = 2000\ rpm$, $Q_{act} = 0.006\ m^3/sec$

$T_{act} = 170\ N.m$

find → η_{vol} , η_{mech} , $\eta_{overall}$, P_{act} ??

Sol

$\because Q_{Th} = V_D \times \frac{N}{60} = 164 \times 10^{-6} \times \frac{2000}{60} = 5.467 \times 10^{-3}\ m^3$

$\therefore \eta_{vol} = \frac{Q_{Th}}{Q_{act}} = \frac{5.467 \times 10^{-3}}{0.006} = 0.911 \times 100 = 91.11\ \%$

$\therefore \eta_{mech} = \frac{T_{act}}{T_{Th}} \longrightarrow$

$\therefore T_{Th} = \frac{70 \times 10^5 \times (5.467 \times 10^{-3})}{\frac{2\pi\ 2000}{60}} = 182.72\ N.m$

$\therefore \eta_{mech} = \frac{170}{182.72} \times 100 = 0.93 \times 100 = 93.03\ \%$

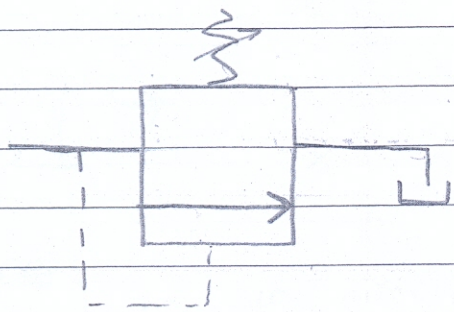
$\eta_{overall} = \eta_{mech} \cdot \eta_{vol} = 0.847 \times 100 = 84.72\ \%$

$Power_{actual} = T_{act} \times \omega = 170 \times \frac{2\pi \times 2000}{60} =$

$= 35604.716\ watt$

Q4)

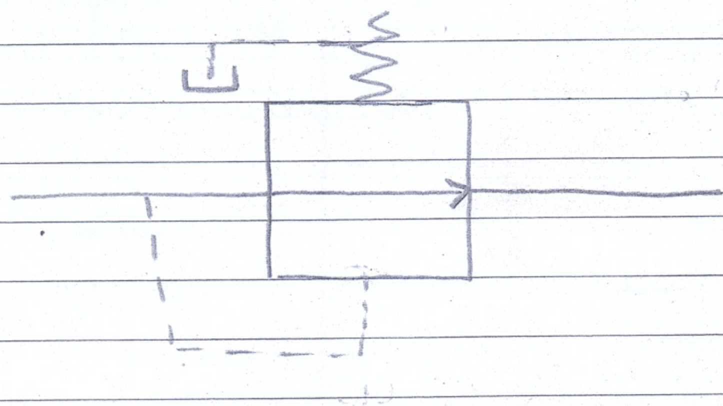
a)



Relief valve

يعمل على ارجاع الـ fluid إلى Tank
عندما يزيد الضغط في الـ system .
عن الضغط المضبوط به الـ Relief valve

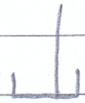
reducing valve



بتكون دائماً السكة مفتوحة ويعمل على تقليل الضغط في منطقة
معينة من الـ system ويعمل على ارجاع بعض الـ fluid إلى Tank
والجزء الآخر للـ system

أجزاء الـ circuit

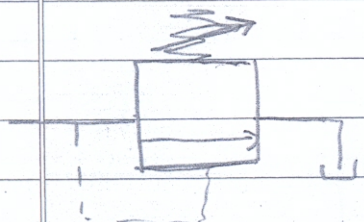
b)

i)  → ventend oil Tank below fluid level

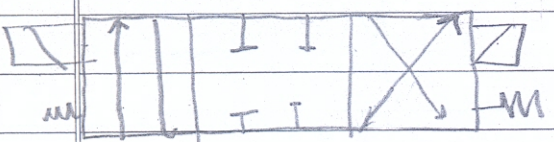
function
1) Storing oil
2) Cooling oil
3) Seperation of air from oil
4) Draing of impurities from bottom of Tank

→  → uni directional Fixed displacement

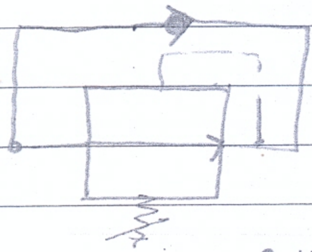
function → To force fluid Through the hydraulic circuit

→  → Relief valve

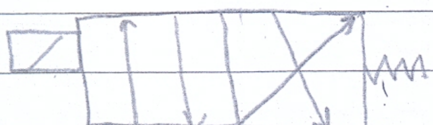
لما يزيد الضغط يرسل الـ fluid الى الـ Tank

→  Soleniod actuated 3 Position spring centered, 4 ways DCV

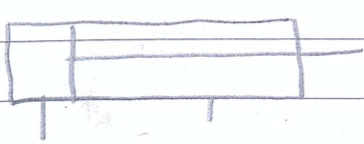
للتحكم في اتجاه الـ flow

→  Counter Balance valve

لحماية الـ vertical cylinder من الهبوط بسرعة بسبب الوزن والجاذبية

→  Soleniod actuated, 2 Position spring offset, 4 ways DCV

للتحكم في اتجاه الـ flow

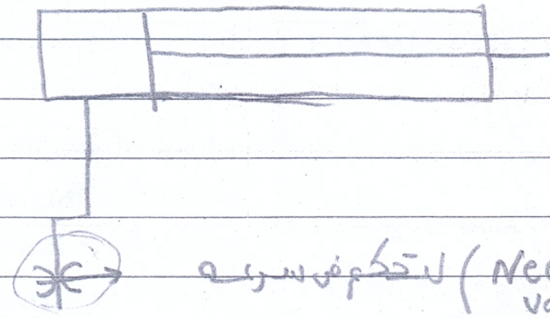
→  Double acting, single rod hydraulic cylinder

– في وضع الـ extension اتجاه الـ rod يروح لليمين وينزل الـ vertical cylinder الى اسفل

[illegible] retraction [illegible]

ii)

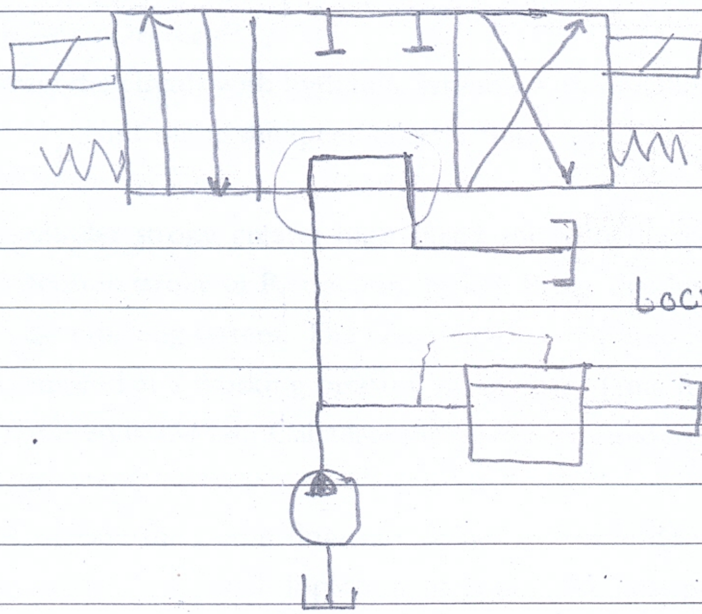
1)



نضع (Needle valve) لتحكم في سرعه

الـ flow عند extension

2)



نرجع إلى الـ Tank

في وضع الـ locked

3) نضع Filter قبل ما نرجع لكل Tank

عند return Line