2.-

NO 22

******Revision Problems******

Problem.01

A horizontal pipe of diameter 60 cm and length 6.0 Km connects two tanks. The water surface elevation of the upper tank is at level 150.00 m. The pipe friction factor is considered constant and equals 0.02. The velocity of flow in the pipe equals 1.50 m/sec. After 10 years of service, it was found that the flow reaching the lower tank is reduced by 20% due to leakage from a hole in the middle of the pipe. Find the leaking water-discharge through the hole and sketch the total energy line showing its slope.
Neglect minor losses.

Problem.02

Figure (66) shows five pipelines connecting 4 tanks. A pump is installed at the end of pipe (1). The water levels in the four tanks are also given in the figure. The flow in pipe (2) is towards the junction "J", while the flow in pipe (3) is towards tank (B). The following table gives other available data for the five pipelines.

Pipe	D (m)	L (m)	Q (m^3/sec)
1	1.00	6300	?
2	1.00	2100	1.20
3	0.60	1880	0.50
4	0.50	?	0.40
5	?	10500	?

Neglecting minor losses, and considering the friction factor for all pipes is constant and equals 0.02 (f = 0.02), determine:

a- The head given by the pump
b- The discharge in pipe (1)
c- The length of pipe (4)
d- The diameter of pipe (5)
e- Sketch the total energy line.

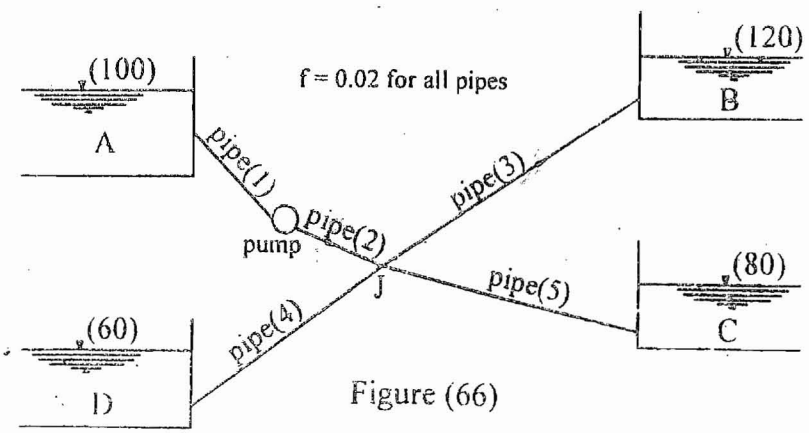
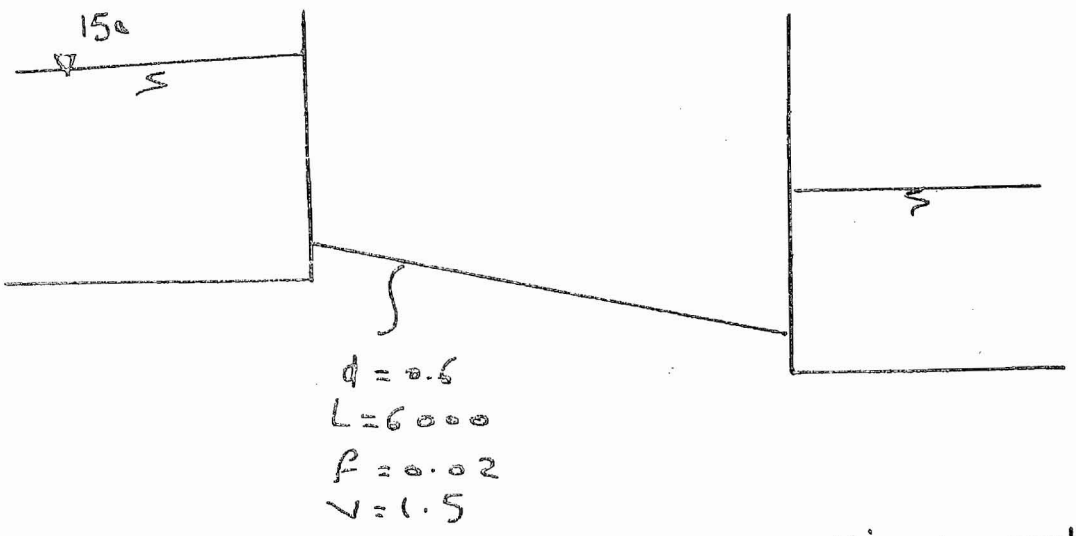


Figure (66)



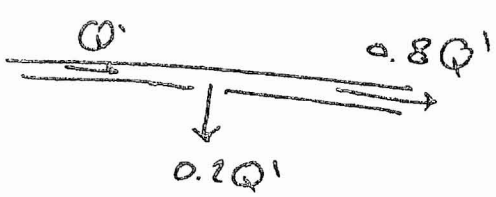
Minor neglected

- Solve Case (A) Get "Hst"

$$Q = VA = 1.5 * \pi/4 * 0.6^2 = 0.424\ m^3/s$$

$$H_{st} = \frac{8 f l Q^2}{\pi^2 d^5 g} = \frac{8 * 0.02 * 6000 * 0.424^2}{\pi^2 * 0.6^5 * g} = 22,94\ m$$

- CASE (B)



$$h_{st} = h_{f_1} + h_{f_2}$$

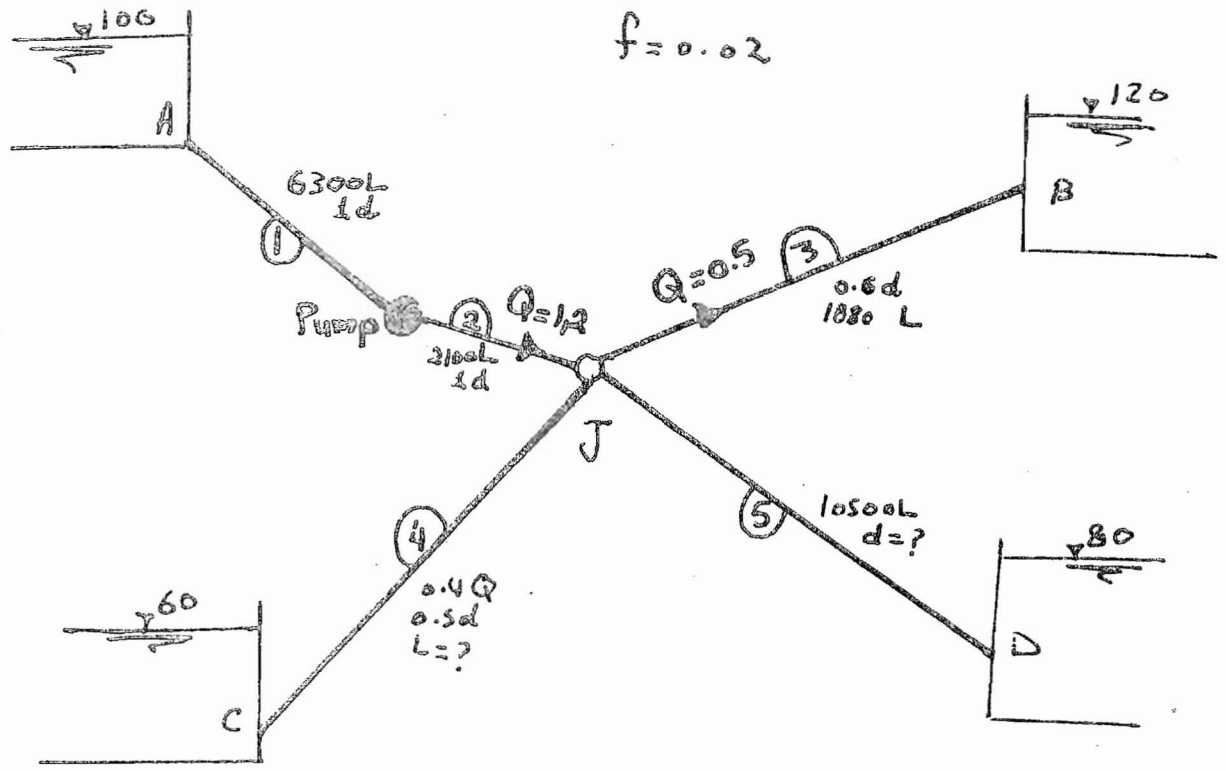
$$22,94 = \frac{8 * 0.02 * 3000 * Q'^2}{\pi^2 * 0.6^5 * g} + \frac{8 * 0.02 * 3000 * (0.8Q')^2}{\pi^2 * 0.6^5 * g}$$

$$22,94 = 63,75\ Q'^2 + 40,8\ Q'^2$$

$$\boxed{Q' = 0.468\ m^3/s}$$

Problem.02

Final-2001



Req :- 1- H_p 2- d_5 3- L_4
4- Q_5 5- T.E.L.

Pipe 3

$$h_{L_3} = \frac{8fLQ^2}{\pi^2 d^5 g} = \frac{8*0.02*1880*0.5^2}{\pi^2*0.6^5*g}$$

$$h_{L_3} = 10 \quad m$$

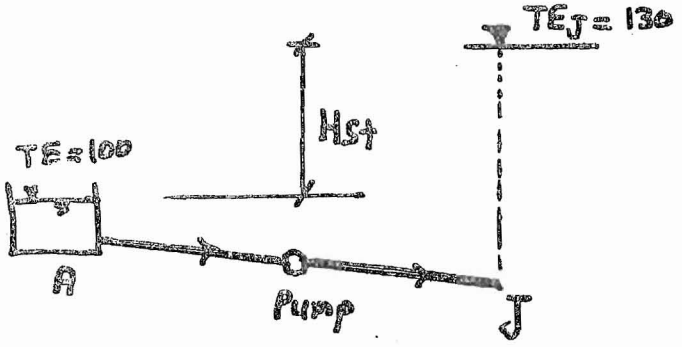
$$\therefore \nabla \; TE_J = 120 + 10m = 130m$$

• لاحظ ان منسوب J 130 أعلى من منسوب A 100 لذالك فاننا الـ Pump هنا تستخدم لرفع المياة to lift

$$H_p = h_{st} + h_L$$

- اتجاه التدفق من A → J

- المضخة تستخدم للرفع

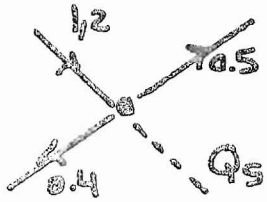


$\therefore H_p = H_{st} + h_{L_{A\to J}}$

$$= (130-100) + \frac{8 * 0.02 * 6300 * 1.2^2}{\pi^2 * 1^5 * g} + \frac{8 * 0.02 * 2100 * 1.2^2}{\pi^2 * 1^5 * g}$$

$$\therefore \boxed{H_p = 50 \text{ m}}$$

- **NODE J**



$$\therefore \boxed{Q_5 = 0.3 \text{ m}^3/\text{s}}$$

- **Pipe "5"**

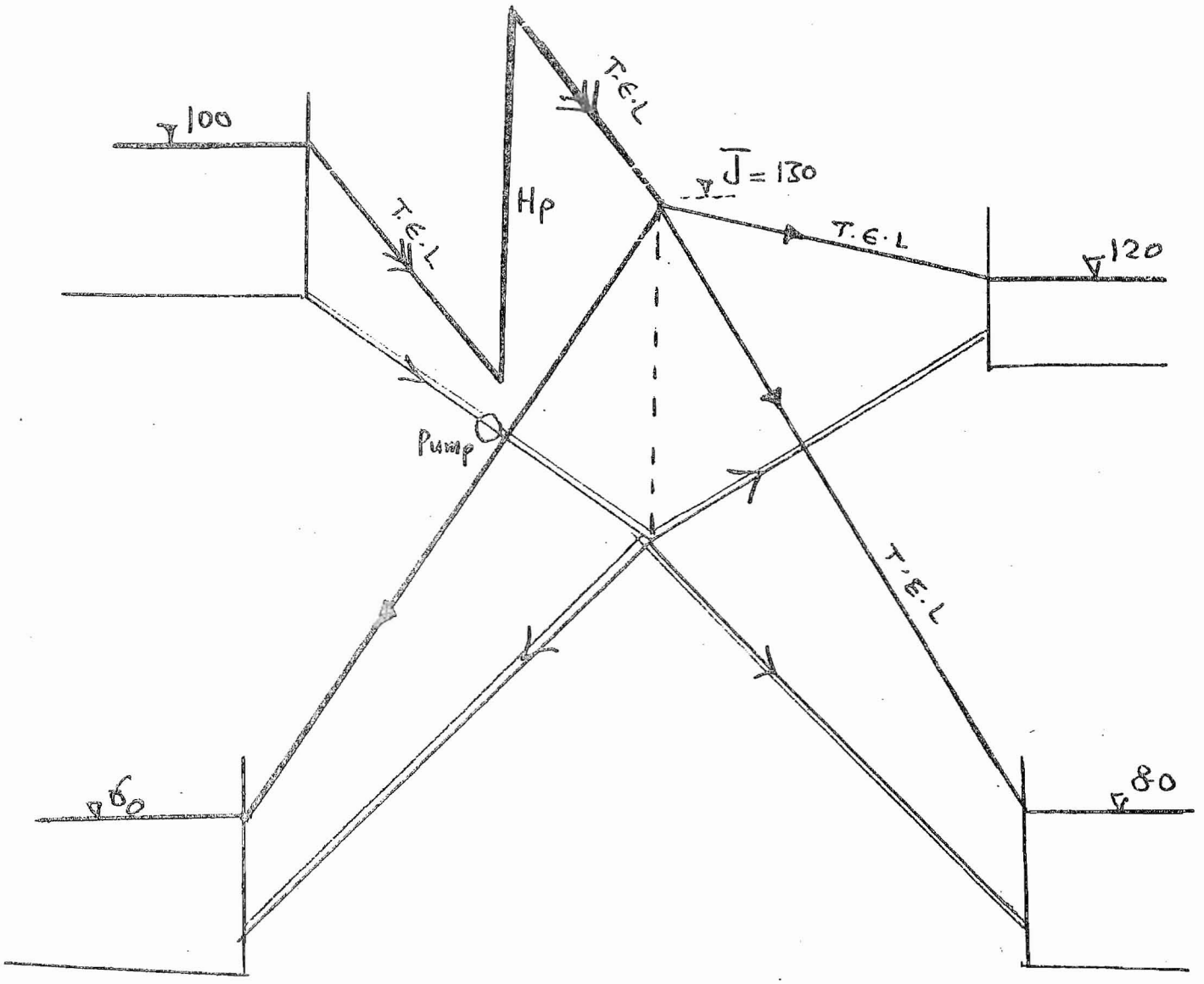
$$130 - 80 = \frac{8 * 0.02 * 10500 * 0.3^2}{\pi^2 * g * d^5}$$

$$\boxed{d_5 = 0.5 \text{m}}$$

- **Pipe "4"**

$$130 - 60 = \frac{8 * 0.02 * L * 0.4^2}{\pi^2 * g * 0.5^5}$$

$$\boxed{L = 8273 \text{ m}}$$


100
T.E.L
Hp
T.E.L
J = 130
T.E.L
120
Pump
T.E.L
60
80

Problem.03

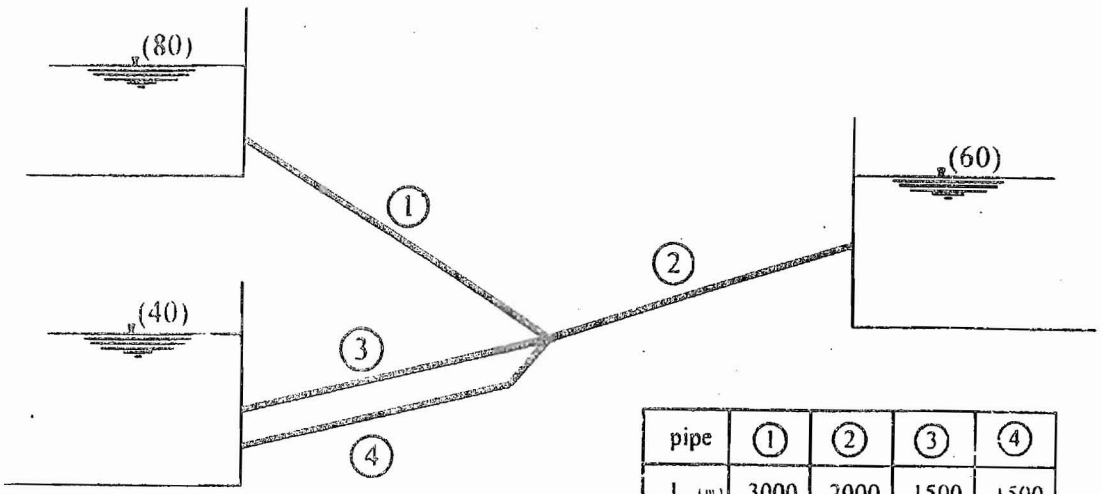


Figure (64)

pipe	①	②	③	④
L (m)	3000	2000	1500	1500
D (cm)	20	20	30	15
f	0.02	0.02	0.02	0.02

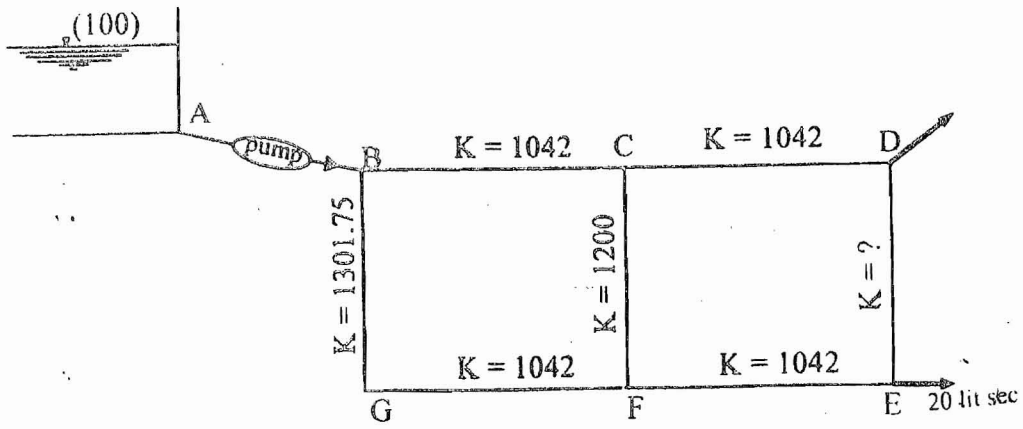
HW. Find the flow through each of the four pipes shown in figure (64) and draw the T.E.L. Neglect minor losses.

Problem.04

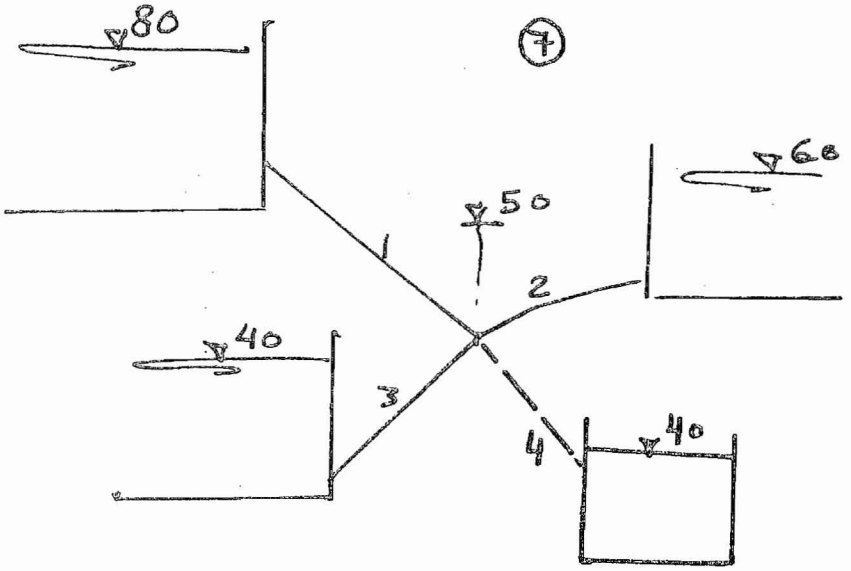
In Fig. (70) water is flowing from the tank to the pump then to the shown pipe network. The free water surface in the tank is at level 100.00 m. The total head given by the pump to the water is 30 m. and the total energy line at node C is at level 105 m. The following data are given:

Pipe AB: length = 1552 m, diameter = 40 cm, velocity = 1.59 m/sec, f = 0.02.
Pipe BC, CD, GF and FE: K=1042,
Pipe BG: K = 1301.75
Pipe CF: K = 1200
Neglecting all minor losses, find:

a) The discharge leaving the pipe network at node (D).
b) The discharge passing through each pipe in m^3/sec., and
c) The value of K for pipe DE.

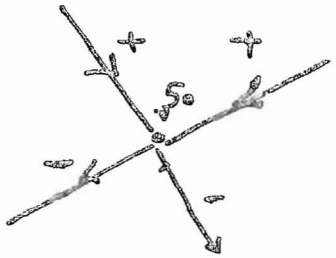


Problem.03



Assume $\nabla J = 50$

① Calculate K



	L	d	f	K
1	3000	0.2	0.02	15492,54
2	2000	0.2	0.02	10328,36
3	1500	0.3	0.02	1020,08
4	1500	0.15	0.02	32642,71

Cycle ①

	h_L	Q	Q/h_L
1	80-50 = 30	0.044	0.00147
2	60-50 = 10	0.0311	0.00311
3	50-40 = 10	-0.099	0.0099
4	40-50 = 10	-0.0175	0.00175
		-0.04139	0.01623

$$dh = \frac{-2 * 0.04139}{0.01623} = -5,1$$

Cycle ② $\nabla TE = 50 - 5,1 = 44$

	h_L	Q	Q/h_L
1	35,1	0.0476	0.00136
2	15,1	0.03824	0.00253
3	4,9	-0.0693	0.01415
4	4,9	-0.01225	0.0025
		0.00428	0.0205

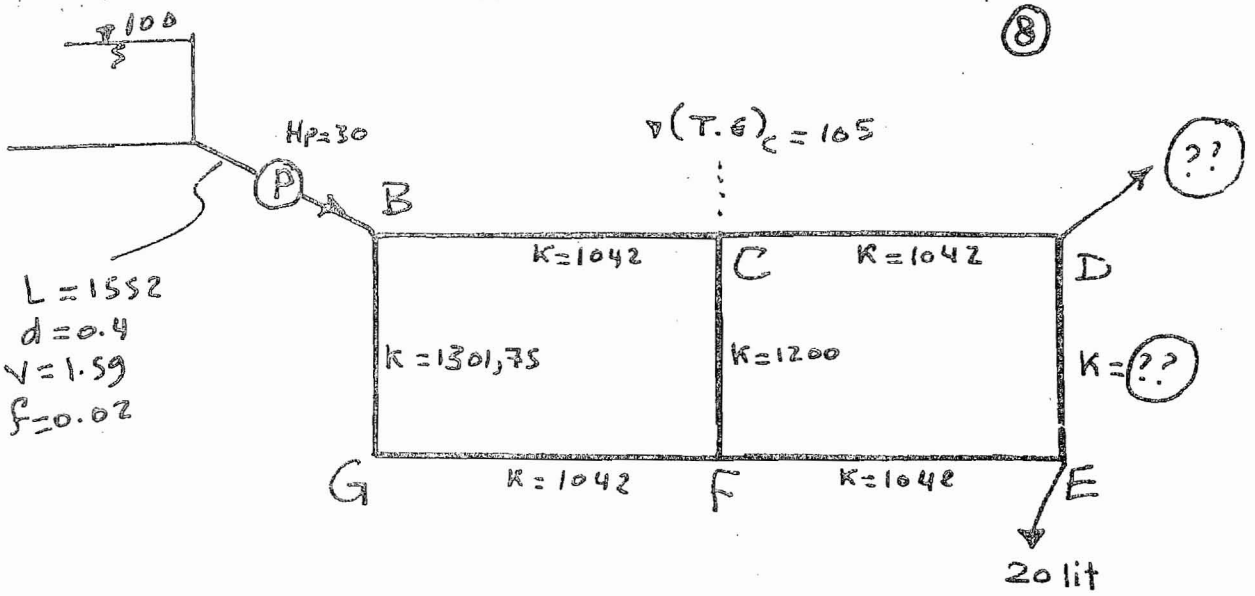
$$dh = \frac{2 * 0.00428}{0.02053} = 0.42m$$

	K	h_L	Q
1	15492,54	34,68	0.04731
2	10328,36	14,68	0.03770
3	1020,08	5,32	-0.07222

Final answer

$\nabla TE\ J = 44,9 + 0.42 = 45,32m$

Problem.04



Find :- 1- Q in each pipe ?

2- K_{ED}

3- Demand at node D

SOL مناسيب الشبكة أعلى من الخزان لذلك نأمر الخزان ترفع المياه للشبكة

$$H_p = H_{st} + h_L \qquad \because Q_{AB} = VA = 1.59 \cdot \frac{\pi}{4} 0.4^2 = 0.2$$

$$30 = H_{st} + \frac{8 * 0.02 * 1522 * 0.2^2}{\pi^2 * 0.4^5 * g}$$

$$H_{st} = 20\ m$$

A أعلى من

$$\therefore \nabla(T.E)_B = 100 + 20 = 120\ m$$

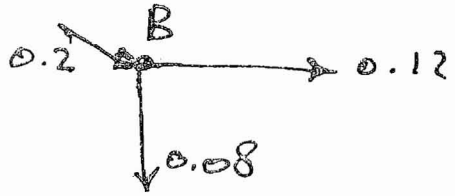
Pipe BC

$$h_{LBC} = 120 - 105 = K * Q^2 = 1042 * Q^2$$

$$Q_{BC} = 0.12\ m^3/sec$$

Pipe (BG)

$$Q_{BG} = 0.2 - 0.12 = 0.08$$

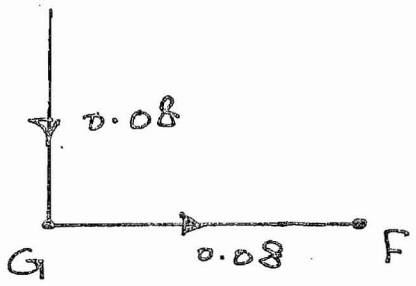


$$h_{LBG} = KQ^2 = 1301,75 * 0.08^2$$

$$= 8,33\ m$$

$$\nabla(T.E)_G = 120 - 8,33 = 111,67\ m$$

Pipe (GF)

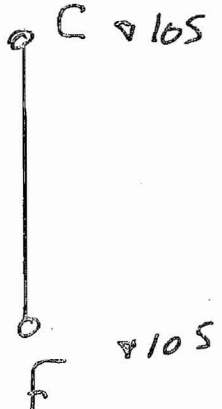


$$\nabla(T.E)_F = (T.E)_G - h_{lGF}$$

$$= 111,67 - 1042 * 0.08^2$$

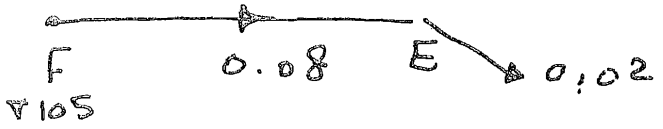
$$= 105\ m$$

Pipe (CF)



∴ No flow in Pipe CF

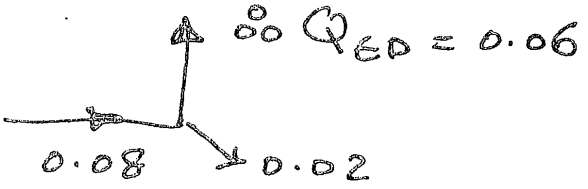
Pipe FE



$$\nabla(T.E)_E = 105 - 0.08^2 * 1042$$

$$= 98,33 \text{ m}$$

Node E



Pipe DC

$$(T.E)_D = 105 - 0.12^2 * 1042$$

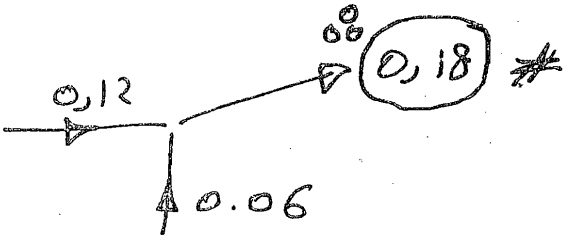
$$= 90 \text{ m}$$

Pipe ED

$$98,33 - 90 = K * 0.06^2$$

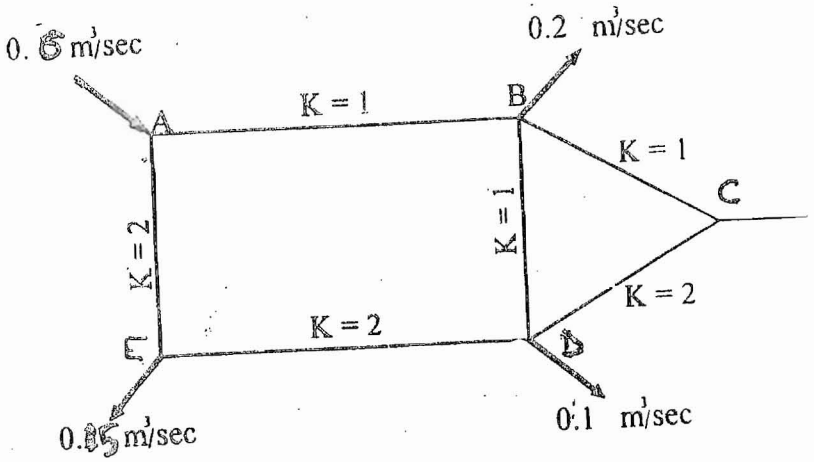
$$K_{ED} = 2314 \#$$

Node D



Problem.05

For the pipe network shown in Fig. (71), determine the flow in each of the six pipelines.



نحل على نفس الناتج
Assume
$Q_{AB} = 0.3$
$Q_{BC} = 20.0$

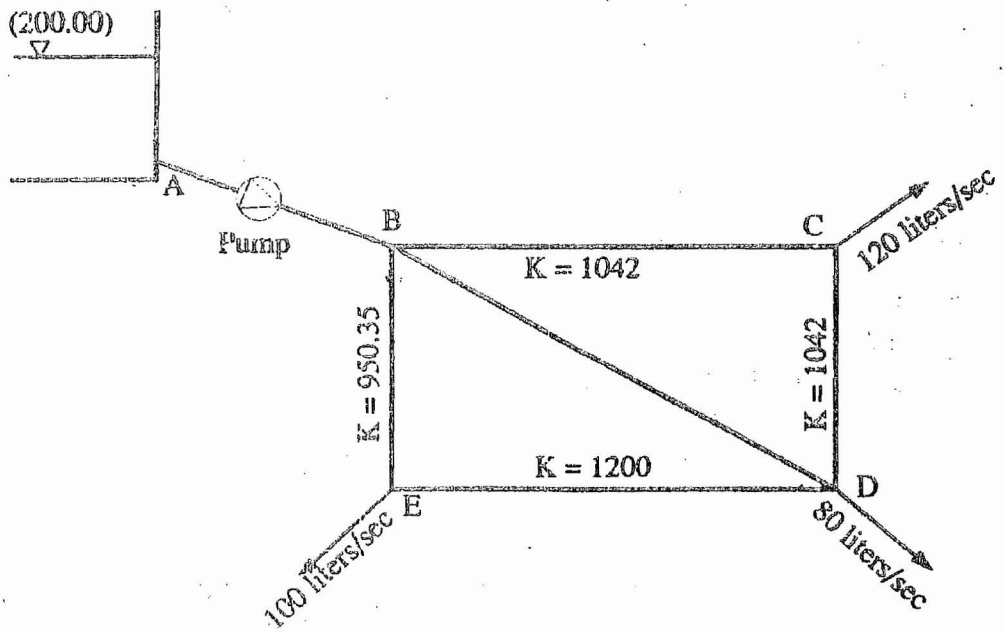
Problem.06

In Figure (5) water is flowing from the tank to the pump then to the pipe network BCDE. The water surface in the tank is at level 200.0 m. The discharges out of nodes C, D and E are 120 liters/sec, 80 liters/sec and 100 liters/sec, respectively. The total energy level at node B is 205.0 m. The following data are given:

- Pipe AB: Length = 1.0 Km, diameter = 50 cm and friction factor = 0.021
- Pipe BD: Length = 200.0 m, diameter 20 cm and friction factor = 0.016
- Pipe BC: K = 1042 - Pipe CD: K = 1042
- Pipe DE: K = 1200 - Pipe EB: K = 950.35

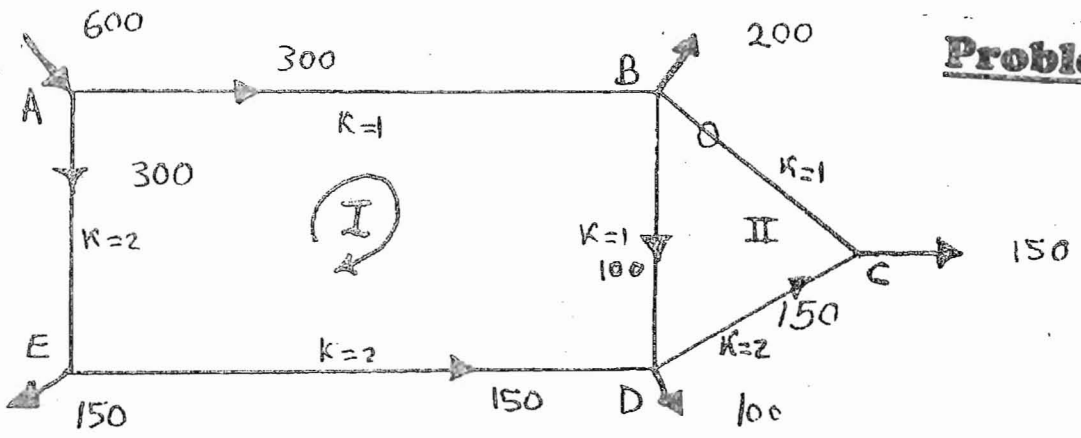
Determine the following:-

i- The power required to operate the pump if its overall efficiency is 80%
ii- The discharge in each pipe and
iii- The total energy line level in each node



Problem.05

(12)



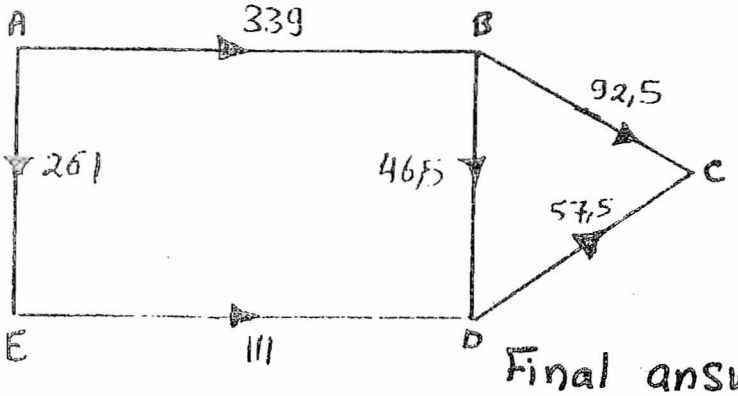
	K	Q	KQ	KQ²		K	Q	KQ	KQ²
AB	1	300	300	90000	BC	1	0	0	0
BD	1	100	100	10000	CD	2	-150	300	-45000
DE	2	-150	300	-45000	DB	1	-100	100	-10000
EA	2	-300	600	-180000					
		Σ	1300	-117500			Σ	400	-55000

$\Delta Q_I = 48$ $\Delta Q_{II} = 69$

	K	Q	KQ	KQ²		K	Q	KQ	KQ²
AB	1	348	348	121104	BC	1	69	69	4761
BD	1	79	79	6241	CD	2	-81	162	-13122
DE	2	-102	204	-20808	DB	1	-79	79	-6241
EA	2	-252	504	-127008					
		Σ	1135	20471			Σ	310	-14602

$\Delta Q_I = -9$ $\Delta Q_{II} = 23,5$

AB	339	BC	92.5
BD	46.5	CD	-69.5
DE	-111	DB	-46.5
EA	-261		



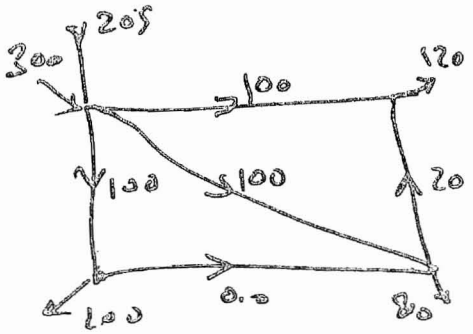
Final answer

Problem.06

$$Q_{AB} = 120 + 80 + 100 = 300 \ m^3/s$$

Pipe AB

$$H_p = H_{st} + h_L \qquad \text{(lift)}$$



$$= (205 - 200) + \frac{8 * 0.021 * 1000 * 0.3^2}{\pi^2 * 0.5^5 * g}$$

$$\therefore H_p = 10 \ m$$

$$\text{Power} = \frac{\gamma Q H_p}{75 * 1.36 * \eta} = \frac{1000 * 0.3 * 10}{75 * 1.36 * 0.8} = 36,7 \ kw$$

Pipe BD

$$K = \frac{8 f L}{\pi^2 d^5 g} = \frac{8 * 0.016 * 200}{\pi^2 * 0.2^5 * 9.81} = 826,27$$

Pipe	BC	CD	DE	EB	BD
K	1042	1042	1200	950.35	826,27
Ki	1.26	1.26	1.452	1.15	1.0

	K	Q	KQ	KQ^2
BC	1.26	100	126.1	126
CD	1.26	-20	25.22	-504,4
DB	1.0	-100	100	-10000
			Σ 251,32	2105,6

$$\Delta q = \frac{-2105,6}{2 * 251,32} = -4.19$$

	K	Q	KQ	KQ^2
BD	1.0	+100	100	+10000
DE	1.452	00	0	0.0
EB	1.15	-100	115	-11500
			Σ 215	-1500

$$\Delta q = \frac{+1500}{2 * 215} = +3.49$$

ويتم عمل دورة أخرى كاملة ودورة ثالثة نتوقف بعدها عندما تصبح "Q" باشرة

Problem.07

For the pipeline system shown in figure (67), neglecting minor losses determine the rate of flow through each of the three pipelines. The total head is 30 meters Data for the three pipelines are given in the following table.

	Pipe 1	Pipe 2	Pipe 3
Length in meter	3350	1650	1650
Diameter in cm	20	20	25
Friction factor, f	0.016	0.018	0017

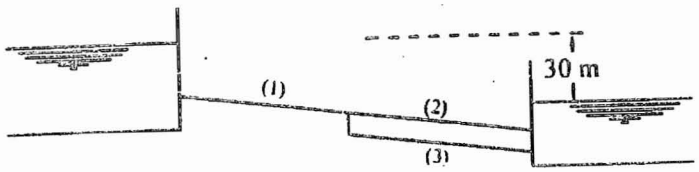


Figure (67)

"final 2009"

Problem.08

For the shown hydraulic system in figure (5), if the pressure at point "D" is 7.0 ton/m^2 and the discharge at the same point is 0.055 m^3/sec. (consider the friction coefficient " f " for all pipes is 0.02 and neglect all minor losses)

1- Determine the pipe diameter (d) shown in the figure.
2- Draw sketch for the T.E.L for the pipes ABCD.

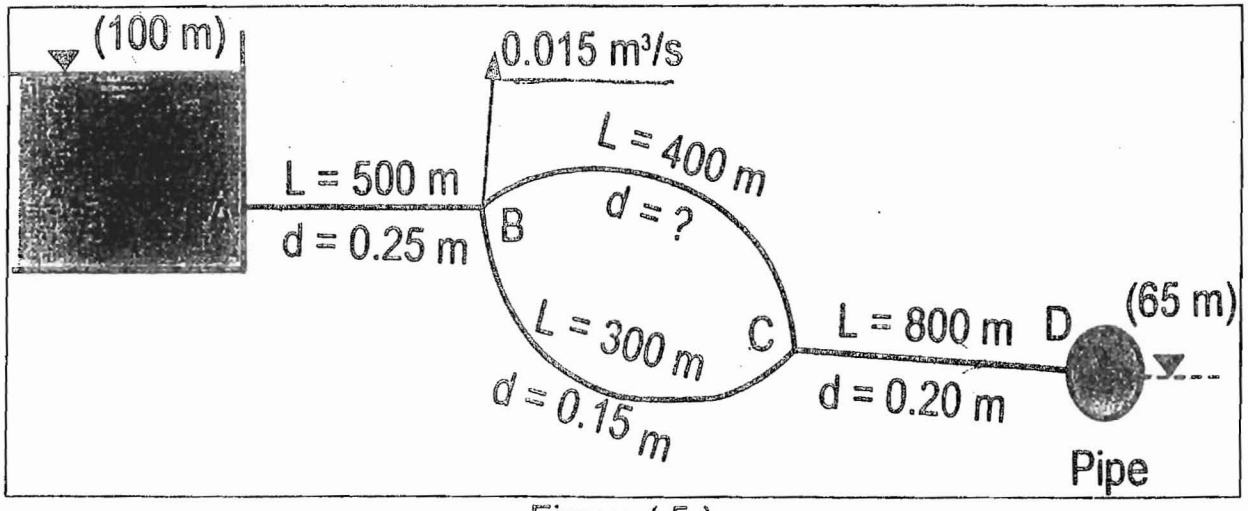
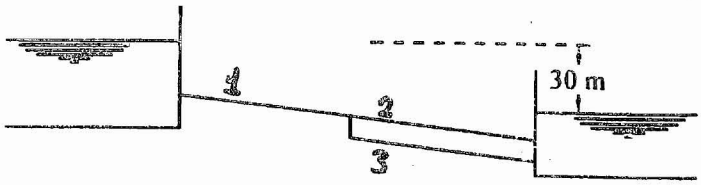


Figure (5)

Problem.07

For the pipeline system shown in figure , neglecting minor losses determine the rate of flow through each of the three pipelines. The total head is 30 meters. Data for the three pipelines are given in the following table.

	Pipe 1	Pipe 2	Pipe 3
Length in meter	3350	1650	1650
Diameter in cm	20	20	25
Friction factor, f	0.016	0.018	0017



$$h_{f_2} = h_{f_3}$$

$$\frac{8 f_2 L_2 Q_2^2}{\pi^2 d_2^5 * g} = \frac{8 f_3 L_3 Q_3^2}{\pi^2 d_2^5 g}$$

$$\frac{8 * 0.018 * 1650 * Q_2^2}{\pi^2 * 0.2^5 * g} = \frac{8 * 0.017 * 1650 * Q_3^2}{\pi^2 * 0.2^5 * g} \qquad 56{,}25\, Q_2^2 = 17{,}408\, Q_3^2$$

$$\therefore \quad \boxed{1.798\, Q_2 = Q_3} \longrightarrow (1)$$

$$Q_1 = Q_2 + Q_3$$

apply $\boxed{Q_1 = 2.798\, Q_2}$ $\longleftarrow (2)$

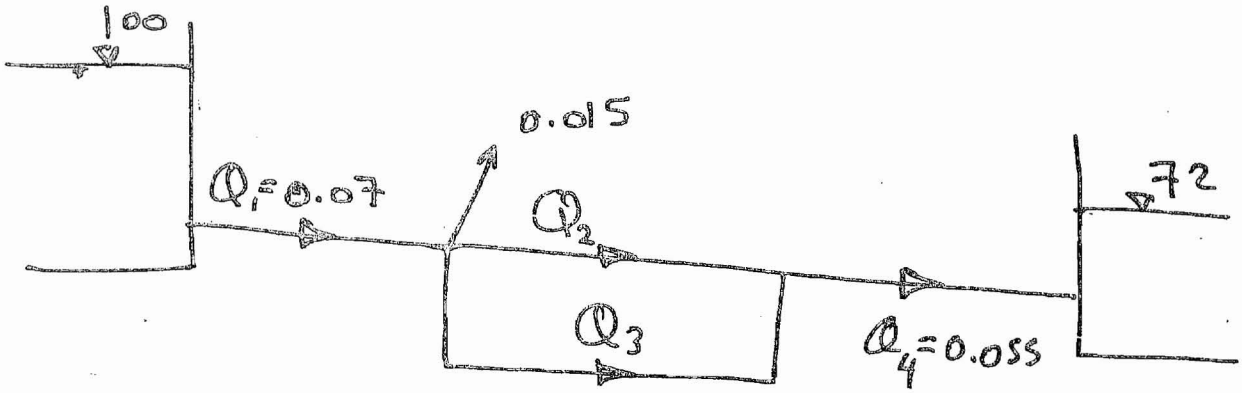
$$h_{st} = h_f = h_{f_1} + \begin{matrix} h_{f_2} \checkmark \\ \text{or} \\ h_{f_3} \end{matrix}$$

$$30 = \frac{8 * 0.016 * 3350 * (2{,}798\, Q_2)^2}{\pi^2 * 0.2^5 * g} + \frac{8 * 0.018 * 1650 * Q_2^2}{\pi^2 * 0.2^5 * g}$$

$30 = 116019{,}4\, Q_2^2$ $\quad \therefore Q_2 = 0.016 \ m^3/s$

$\therefore Q_1 = 0.045 \ m^3/s \quad \therefore Q_3 = 0.029 \ m^3/s$

Problem.08



$$H_{st} = h_L = h_{f_1} + h_{f_3} + h_{f_4}$$

$$100 - 72 = \left(\frac{8fLQ^2}{\pi^2 d^5 g}\right)_1 + \left(\frac{8fLQ^2}{\pi^2 d^5 g}\right)_3 + \left(\frac{8fLQ^2}{\pi^2 d^5 g}\right)_4$$

$$28 = \frac{8*0.02*500*0.07^2}{\pi^2*0.25^5*g} + \frac{8*0.02*300*Q_3^2}{\pi^2*0.15^5*g}$$

$$+ \frac{8*0.02*800*0.055^2}{\pi^2*0.2^5*g}$$

$$\therefore Q_3 = 0.042$$

$$\therefore \quad Q_2 + Q_3 = 0.055$$

$$\therefore Q_2 = 0.013$$

$$h_{f_2} = h_{f_3}$$

$$\left(\frac{8fLQ^2}{\pi^2 d^5 g}\right)_2 = \left(\frac{8fLQ^2}{\pi^2 d^5 g}\right)_3$$

$$\left(\frac{LQ^2}{d^5}\right)_2 = \left(\frac{LQ^2}{d^5}\right)_3$$

$$\frac{400 * 0.013^2}{d_2^5} = \frac{300 * 0.042^2}{0.15^5}$$

$$\therefore \boxed{d_2 = 0.1}$$

Problem.09

For the pipeline system shown below the following data are available:

- The water level in the shown tank is 80 meter.
- The length of each pipe between any two nodes in meters and the out-flow at the nodes in m3/sec are shown on the figure.
- The level of node (8) is 120 meters and the required pressure at this node is 20 ton/m2.

Considering the friction factor for all pipes = 0.02 and the slope of the hydraulic gradient and total energy line for all pipes = 0.002, determine:

A. The diameter of each pipe
B. The head and discharge to be given by the pump.

Neglect minor losses.

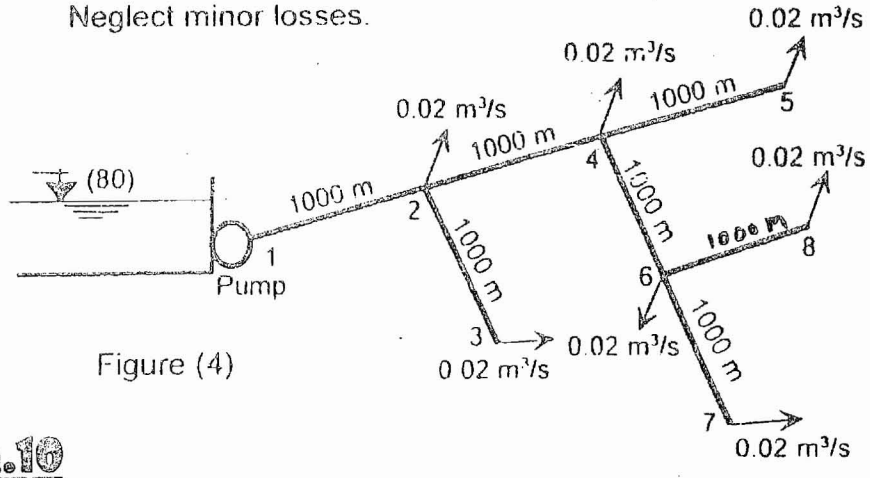


Figure (4)

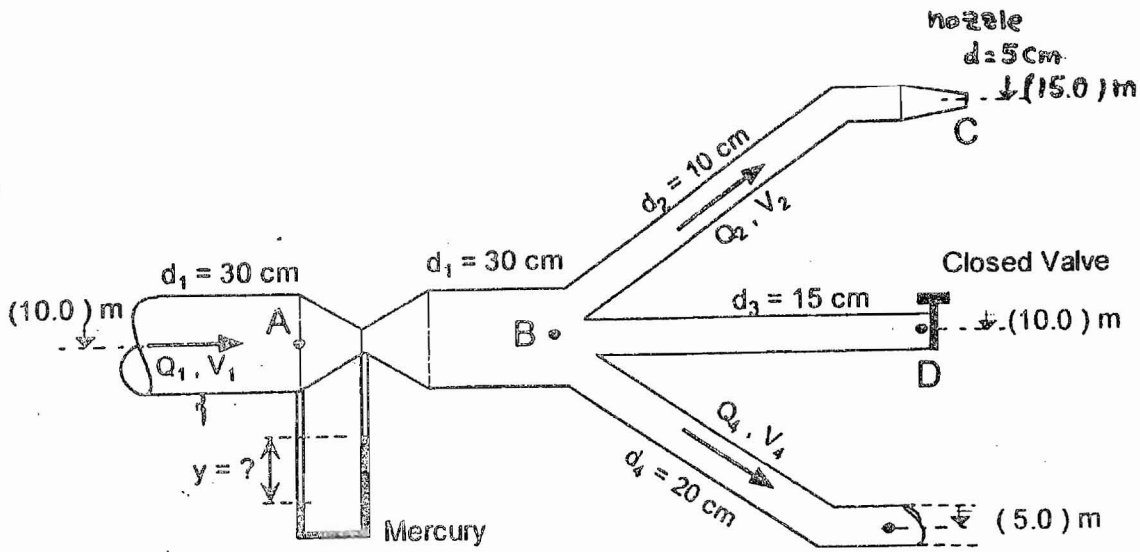
Problem.10

For the shown hydraulic system in figure (2), the following data are available:- Q_1 = 100 lit/sec, P_A = 20 ton/m^2, C_d for the venture-meter is 0.98, the throat diameter of the venturi-meter is 12 cm and the head losses in pipes are as follows:-

Pipe	AB	BC	BE
Head loss (h_L)	$4\,V_1^2/2g$	$20\,V_2^2/2g$	$6\,V_4^2/2g$

It is required to:-

1. Calculate the distance " y " in the given manometer.
2. Determine the discharges Q_2 and Q_4.
3. The pressure at points (D) and (E).
4. Draw the T.E.L and H.G.L for the two pipes ABC and ABD. (in two separate drawing sketches).



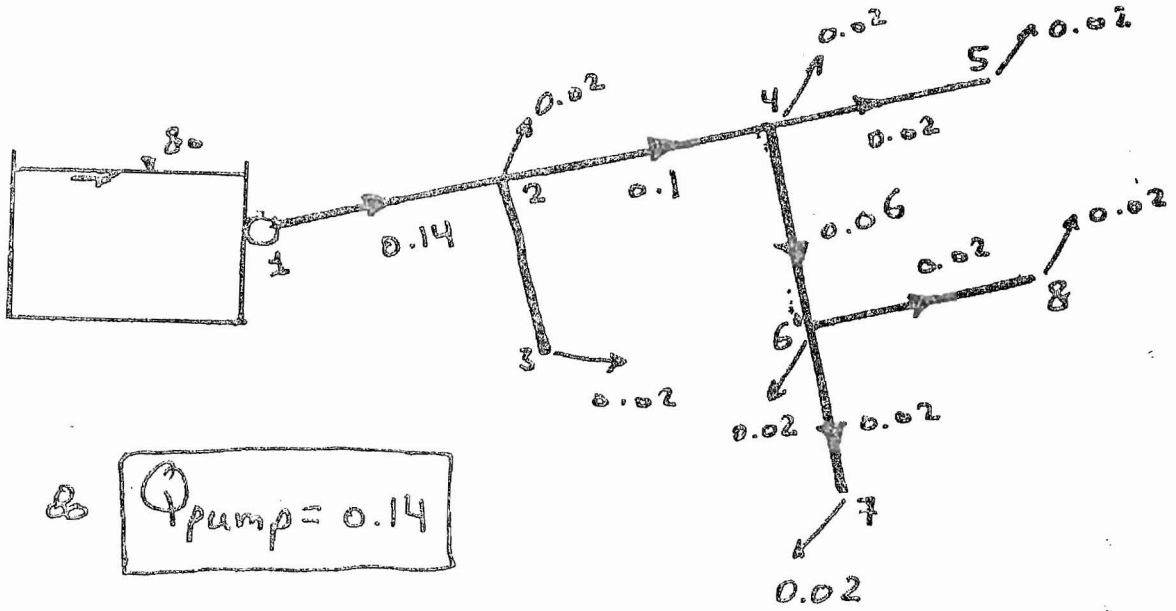
Problem.09

Req : 1- "d" for each pipe

2- Hp & Q_{pump}

Steps:

① Find Q in each pipe



∴ $Q_{pump} = 0.14$

معطى لنا ميل الطاقة $S_e = 0.002$ لكل المواسير

$$S = \frac{h_f}{L}$$

$$S = \frac{8fQ^2}{\pi^2 d^5 g}$$

$$\therefore 0.002 = \frac{8 * 0.02 * Q^2}{\pi^2 * d^5 * 9.81}$$

$$\therefore \quad d^5 = 0.826\, Q^2$$

$$\boxed{d = 0.963\, Q^{2/5}}$$

هذه المعادلة التي تربط بين القطر d والتصرف Q للمواسير المختلفة

- $d_{6-7} = d_{6-8} = d_{4-5} = d_{2-3} = 0.963 * 0.02^{2/5} = 0.2$ m
- $d_{4-6} = 0.963 * 0.06^{2/5} = 0.312$ m
- $d_{2-4} = 0.963 * 0.1^{2/5} = 0.38$ m
- $d_{1-2} = 0.963 * 0.14^{2/5} = 0.438$ m

② Find TE at node "8"

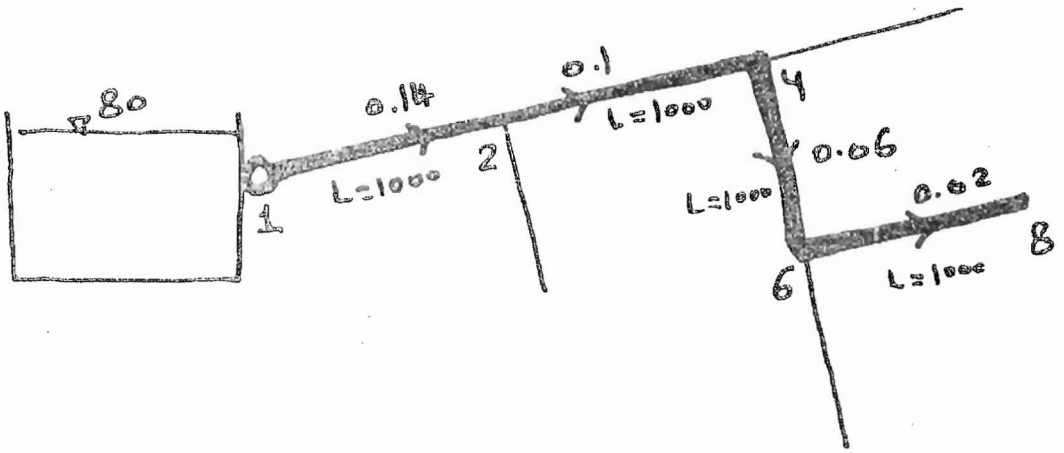
علم الصالح

$$TE = z + P/\gamma + V^2/2g$$

$$= 120 + 20 + \frac{8 * 0.02^2}{\pi^2 * 0.2^4 g} = 140.02$$

• Find "Hp"

لعرفة الضافط عند المضخة يلزم تحديد منسوب
"TE" عندها لذا يتم حساب منسوب TE عند نقطة 8 التي معلوم
عندها TE ثم نصل لنقطة 1 التي عندها المضخة



$\nabla TE \text{ at } 8 = 140\ m$

$$S = \frac{h_f}{L} \qquad \boxed{h_f = S * L}$$

$$\nabla TE = \nabla TE_8 + h_f$$

$$= 140 + 0.002 * 1000 = 142\ m$$

$$\nabla TE_4 = \nabla TE_6 + h_f = 142 + 0.002 * 1000 = 144$$

$$\nabla TE_2 = \nabla TE_4 + h_f = 144 + 0.002 * 1000 = 146$$

$$\nabla TE_1 = \nabla TE_2 + h_f = 146 + 0.002 * 1000 = 148\ m$$

نطلوب رفع الماء من منسوب 80 إلى 148

$$\therefore \boxed{Hp = 68\ m}$$

Problem.10

(1) Find the distance "y" (Venturi)

$A_1 = \pi/4 * 0.3^2 = 0.071 \ m^2$ (22)

$A_2 = \pi/4 * 0.12^2 = 0.0113 \ m^2$

$Q = Cd \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} * \sqrt{2gH}$

$Q = 0.1 \ m^3/s, \quad Cd = 0.98$

$\therefore \boxed{H = 4.05 \ m}$

من تجربة مانومتر مقلوب $H = y\left(\frac{\gamma_m}{\gamma_L} - 1\right)$ $\qquad 4.05 = y\left(\frac{13.6}{1} - 1\right)$

$\therefore \boxed{y = 0.32 \ m}$

(2) Find Q_2, Q_4

$V_A = \frac{Q}{A} = \frac{0.1}{\pi/4 \, 0.3^2} = 1.414$

Apply Eng Eq between A & C

$$Z_A + \frac{P_A}{\gamma} + \frac{V_A^2}{2g} = Z_C + \frac{P_C}{\gamma} + \frac{V_C^2}{2g} + h_{L_{AB}} + h_{L_{BC}}$$

$$10 + \frac{20}{1} + \frac{1.414^2}{2g} = 15 + 0 + \frac{8Q_2^2}{\pi^2 * 0.1^4 g} + 4 * \frac{8 * 0.1^2}{\pi^2 * 0.3^4 * g} + 20 * \frac{8 * Q_2^2}{\pi^2 * 0.1^4 * g}$$

$\therefore Q_2 = 0.0252 \ m^3/s$

$\therefore Q_4 = Q_1 - Q_2 = 0.1 - 0.0252$

$= 0.0748 \ m^3/s$

(3) Pressure at D, E

$$V_E = \frac{Q_E}{A} = \frac{0.0748}{\pi/4 * 0.2^2} = 2.38$$

apply Eng Eq A, E

$$Z_A + \frac{P_A}{\gamma} + \frac{V_A^2}{2g} = Z_E + \frac{P_E}{\gamma} + \frac{V_E^2}{2g} + h_{L_{AB}} + h_{L_{BE}}$$

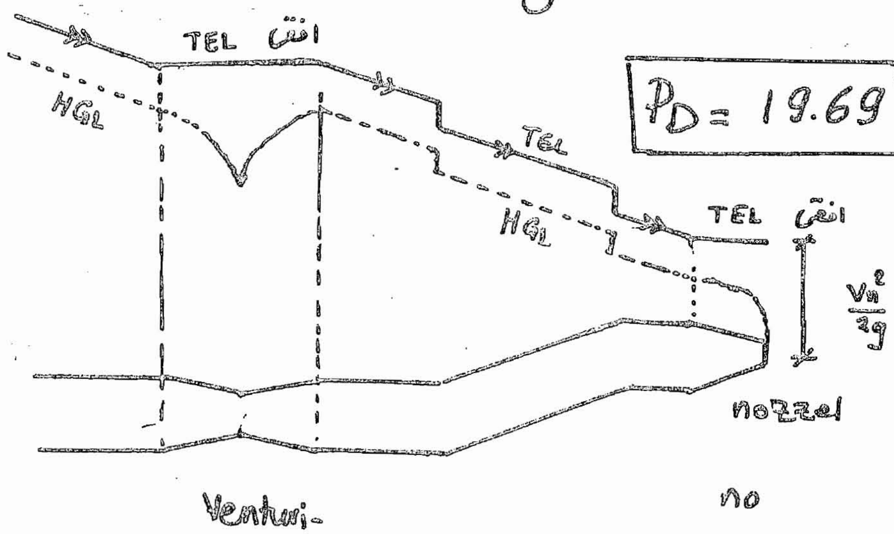
$$\nabla 10 + \frac{20}{1} + \frac{1.414^2}{2g} = 5.0 + \frac{P_E}{1} + \frac{2.38^2}{2g} + 4 * \frac{8 * 0.1^2}{\pi^2 * 0.3^4 * g} + 6 * \frac{8 * 0.0748^2}{\pi^2 * 0.2^4 * g}$$

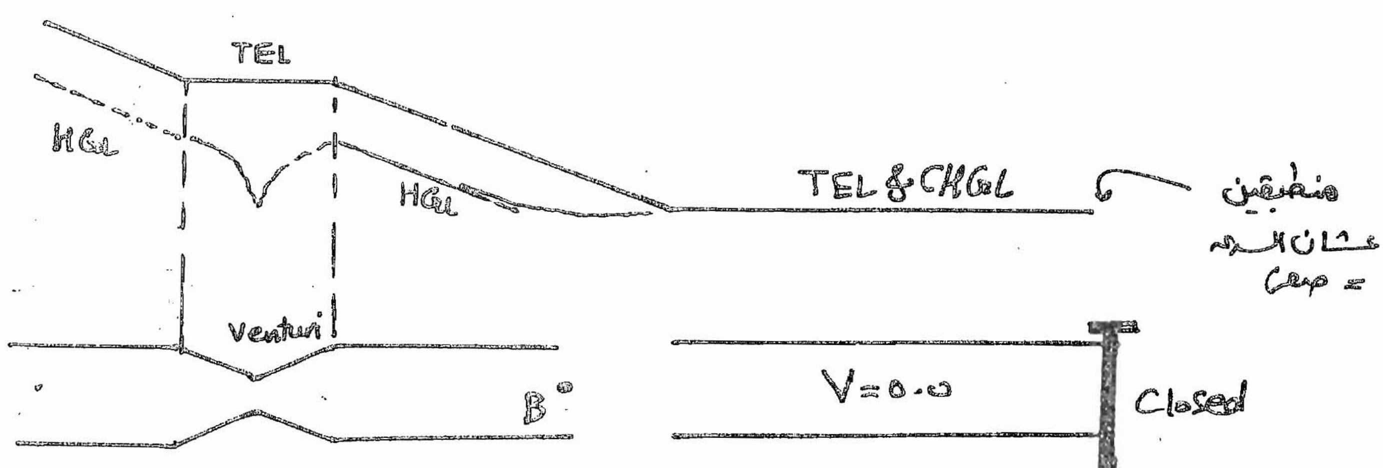
$\therefore$ $\boxed{P_D = 22.67}$ t/m^2

apply Eng Eq A, D

$$\nabla 10 + \frac{20}{1} + \frac{1.414^2}{2g} = \nabla 10 + \frac{P_D}{1} + 0.0 + 4 * \frac{8 * 0.1^2}{\pi^2 * 0.3^4 * g}$$

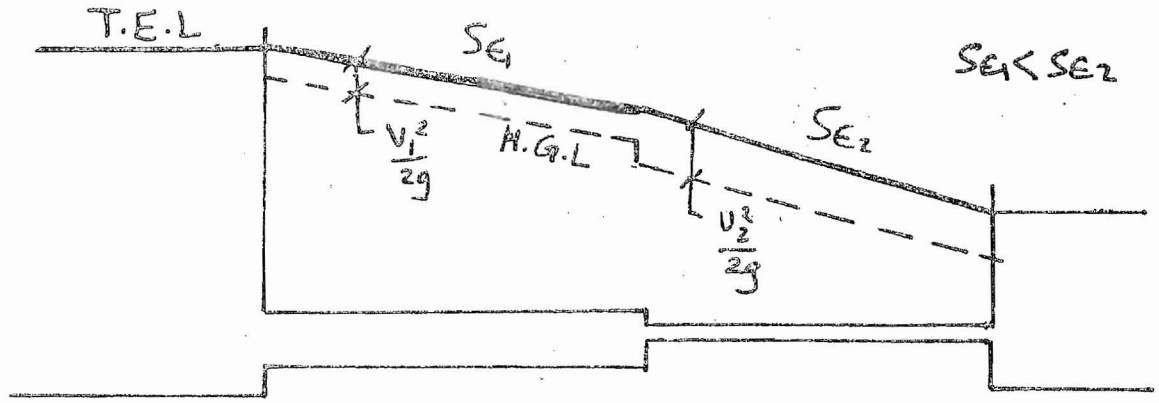
$\boxed{P_D = 19.69}$ t/m^2



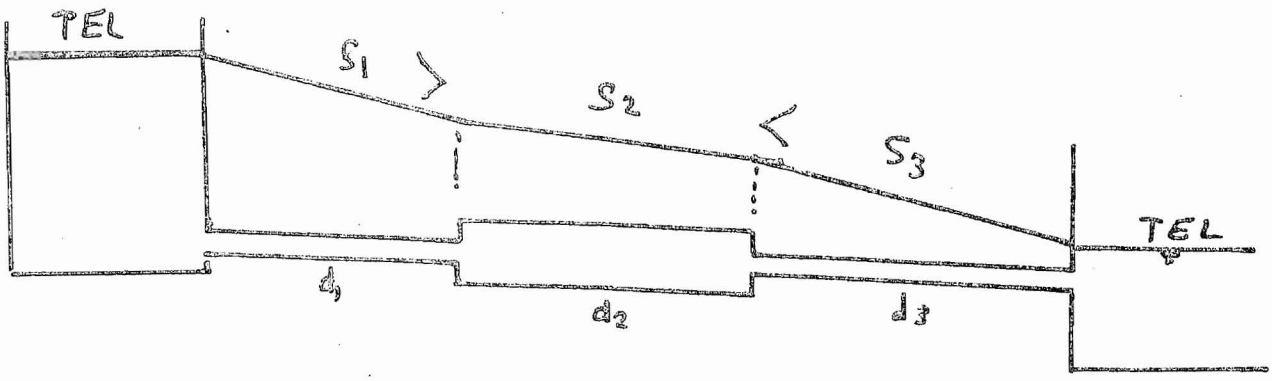


Draw T.E.L and H.G.L in the following cases

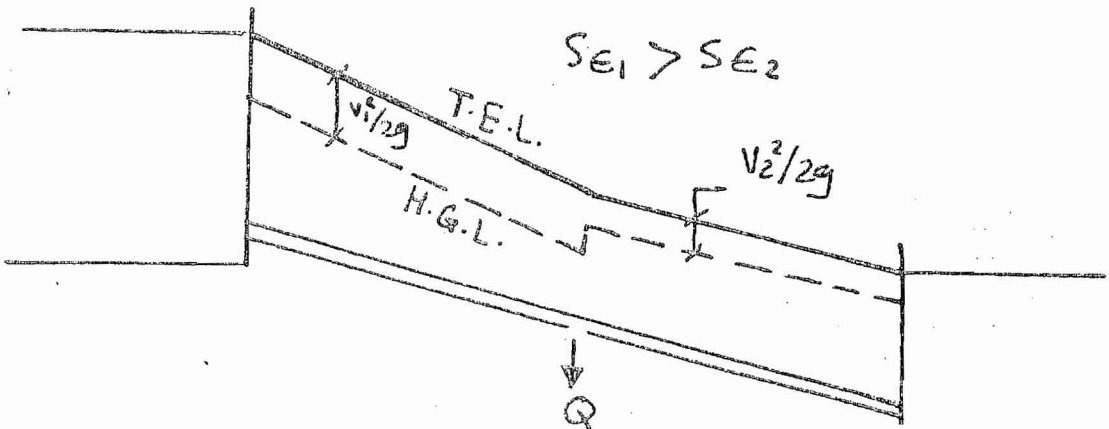
- Two pipelines in series connecting two tanks. The diameter of the first pipeline is larger than the diameter of the second pipeline.



- Two tanks connected by Pipeline having three different diameters $d_1 < d_2 > d_3$



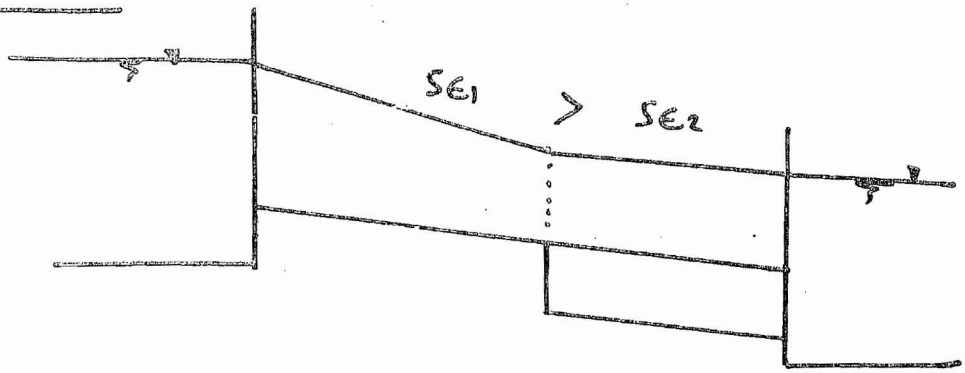
- A pipeline connecting two tanks with a small hole at the middle of the pipelines.



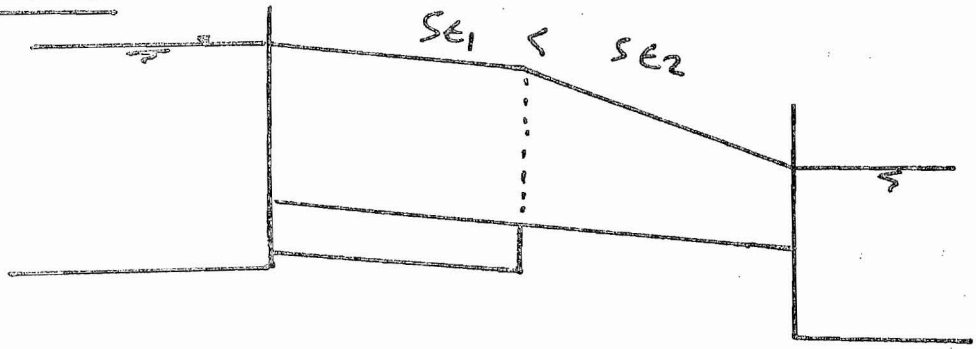
Two tanks are connected by a pipeline and an additional pipe connected in parallel to:

1- The lower tank **2- the upper tank** **3- pipeline mid length**

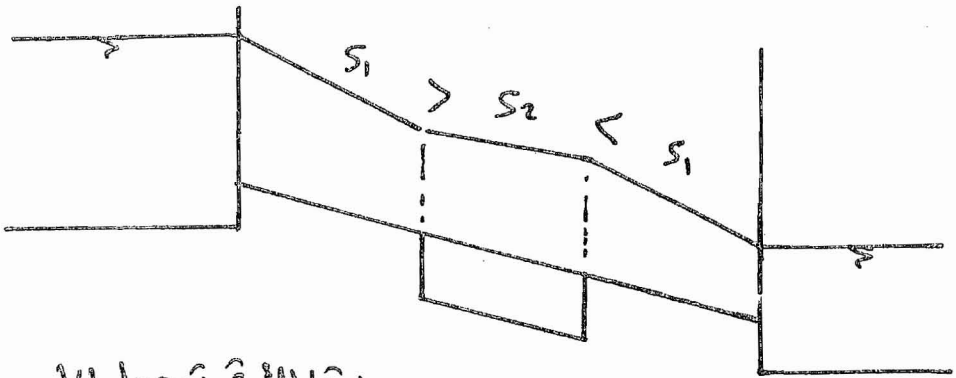
* to the lower tank



* to the upper tank

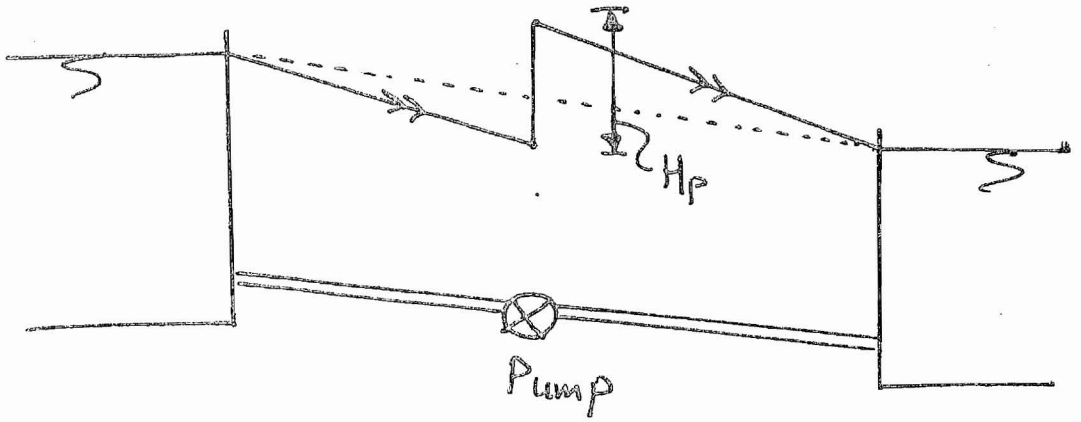


* to Pipe mid- length



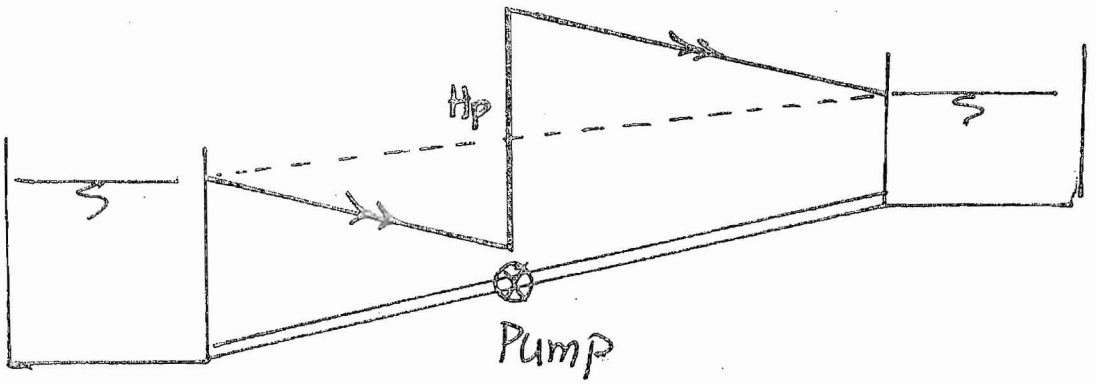
وفي هذه الحالة تم توصيل المورد بحيث تزود الميل في
الاجزاء المتصلة بالخزانين تبقى هذه الحالة

- **A pump connected between two tanks and used to increase the rate of flow.**



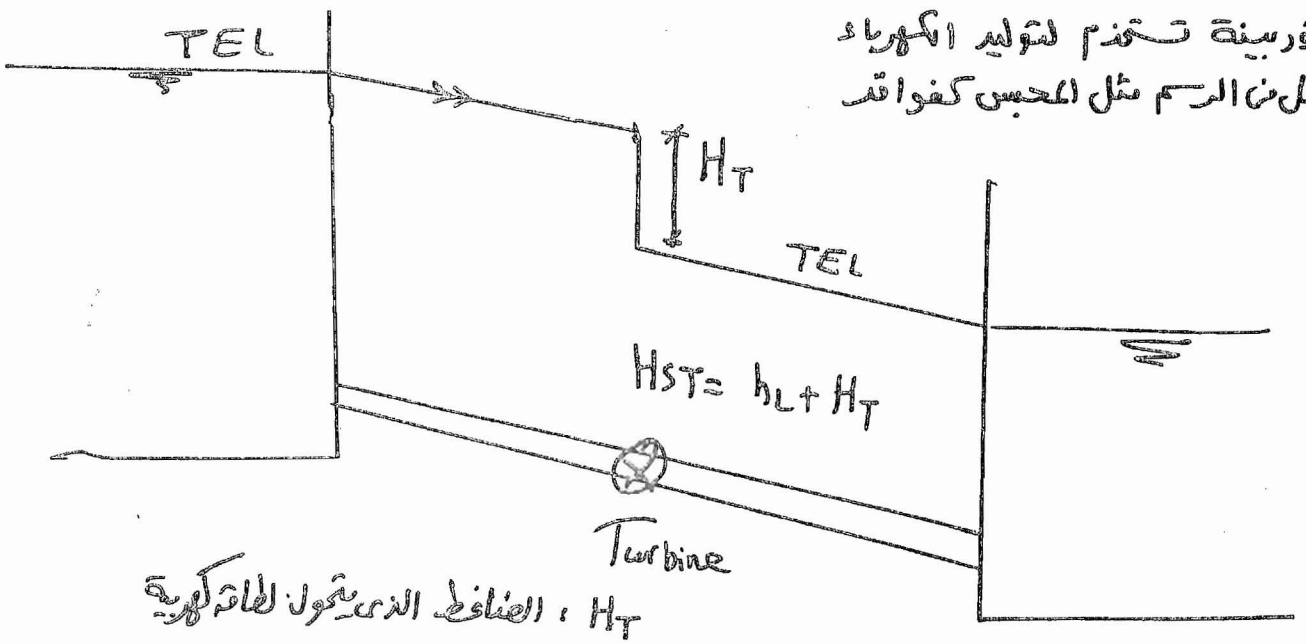
- **A pump lifts water from a river to higher level.**

  A pump is used to reverse the flow direction between two tanks.



توربينة

- **A pipeline provided with hydraulic turbine in its mid length.**



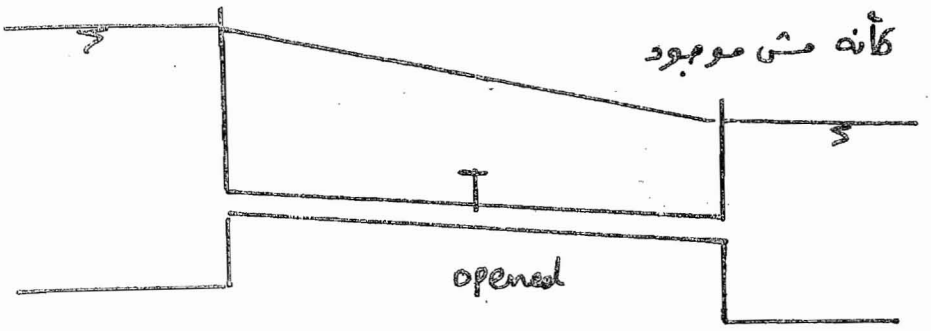
التوربينة تستخدم لتوليد الكهرباء
وتعامل من الرسم مثل المحبس كفواقد

HT : الضاغط الذى يتحول لطاقة كهربية

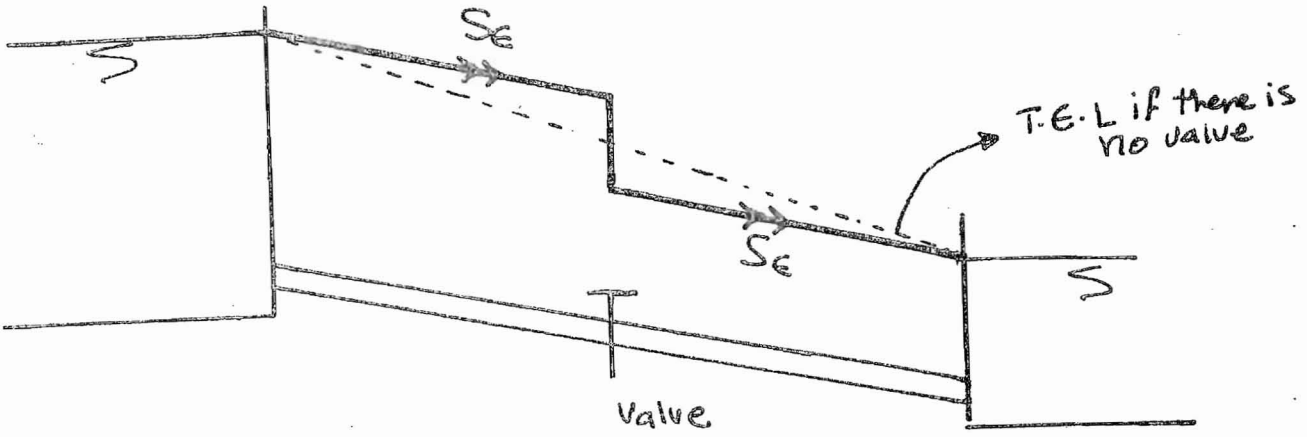
- **A valve is erected at middle of pipeline in three different cases:**

  1- Open valve 2- partially opened 3- closed valve

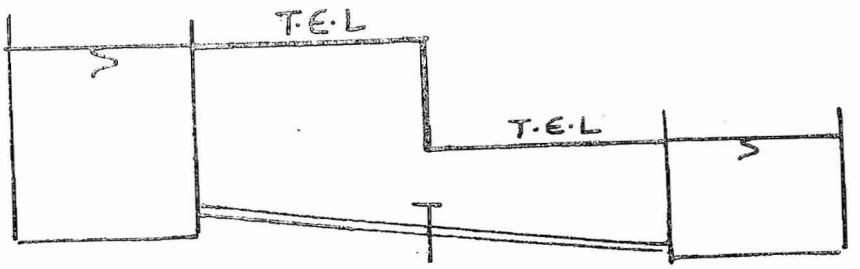
* Open valve



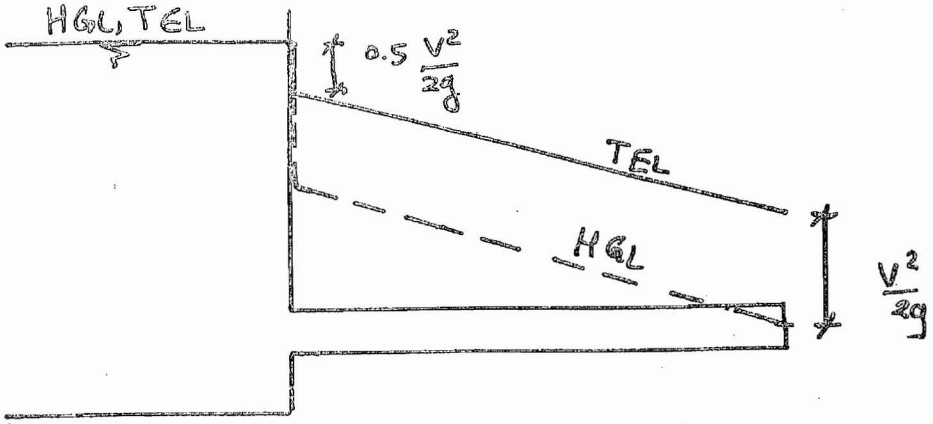
* Partially opened



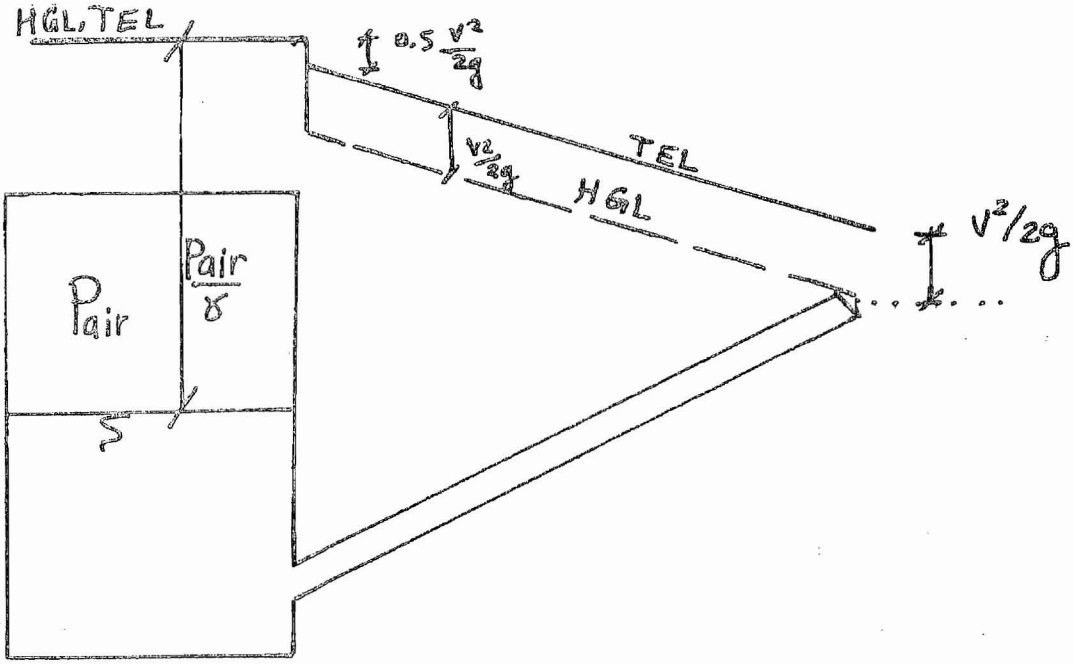
* Closed valve



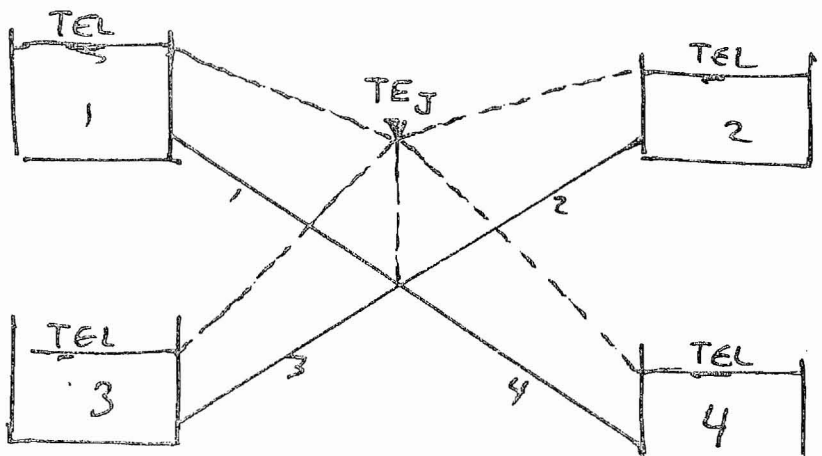
- **A horizontal pipeline discharges to the atmosphere and takes water from tank with head H.**



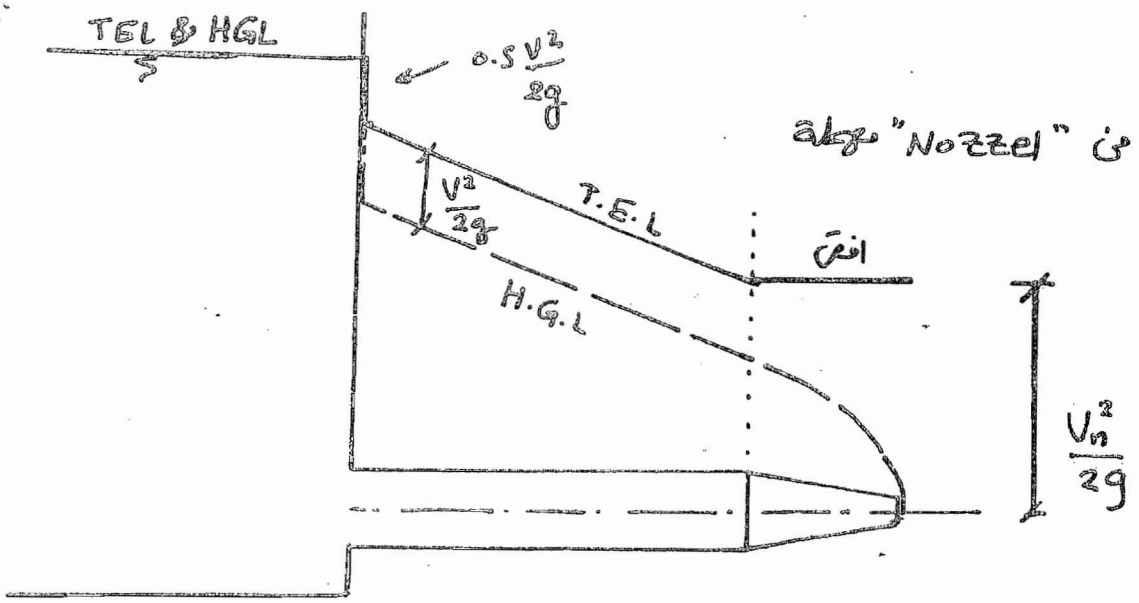
- **A pipeline discharges to the atmosphere and takes water from tank has a compressed air pressure above its surface.**



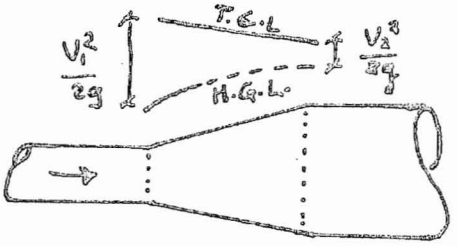
- **Four tanks connected by four pipes having a common junction.**



A nozzle at the end of a horizontal pipeline. The head at the pipeline inlet is H

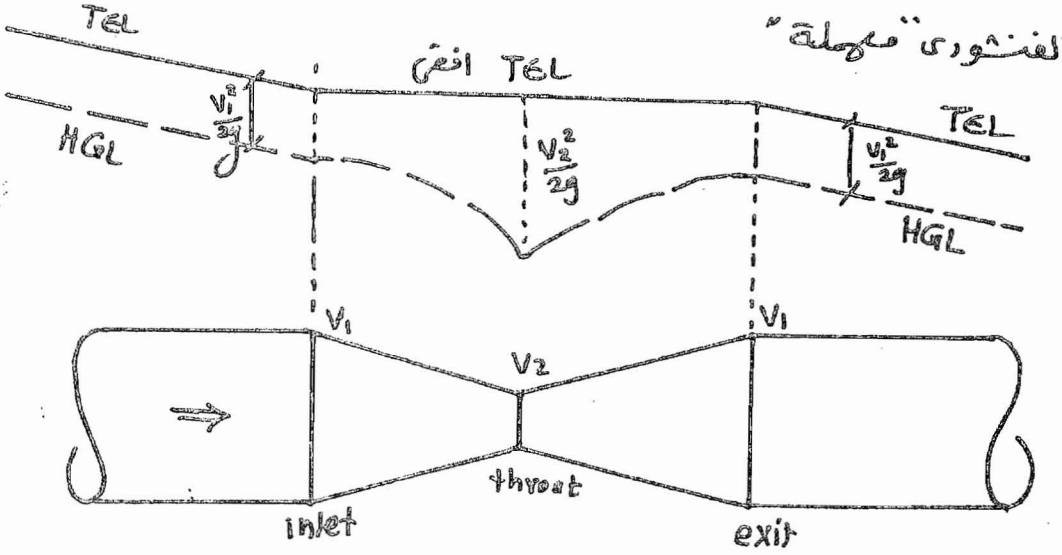


الفواقد من "Nozzel" مجهة



لاحظ يتم رسم "H.G.L" منحنى
فى الاجزاء التى يتغير قطرها تدريجياً

A horizontal venturi-meter connected between two points have different heads.



الفواقد فى الفنشورى "مجهلة"