

ENVIRONMENTAL ENGINEERING -1

Lecture 12 – Equivalent pipes

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Equivalent Pipes

“ Two pipes, two system of pipes or a single pipe and a system of pipes are said to be equivalent when the losses of head for equal rates of flow in them are equal. Small loops within the grips replace with hydraulic equivalent pipes to make the compilations easy.”

Equivalent Pipes

$$Q = AV$$

$$Q = \frac{\pi}{4} d^2 \times 0.849C \left(\frac{d}{4}\right)^{0.63} \left(\frac{H_L}{L}\right)^{0.54}$$

$$H_L = 10.68 \left(\frac{Q}{C}\right)^{1.85} \frac{L}{d^{4.87}}$$

$$H_L = 10.68 \left(\frac{Q_e}{C_e}\right)^{1.85} \frac{L_e}{d_e^{4.87}}$$

$$10.68 \left(\frac{Q}{C}\right)^{1.85} \frac{L}{d^{4.87}} = 10.68 \left(\frac{Q_e}{C_e}\right)^{1.85} \frac{L_e}{d_e^{4.87}}$$

$$\frac{L}{L_e} = \left(\frac{C}{C_e}\right)^{1.85} \frac{d}{d_e^{4.87}}$$

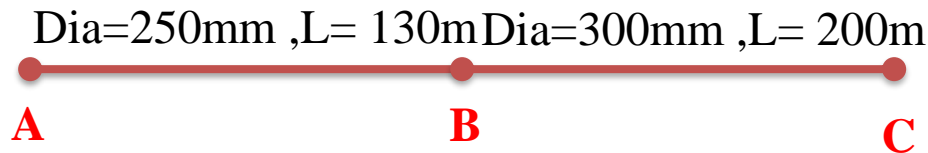
Pipes are equal

$H=H_e$

$Q=Q_e$

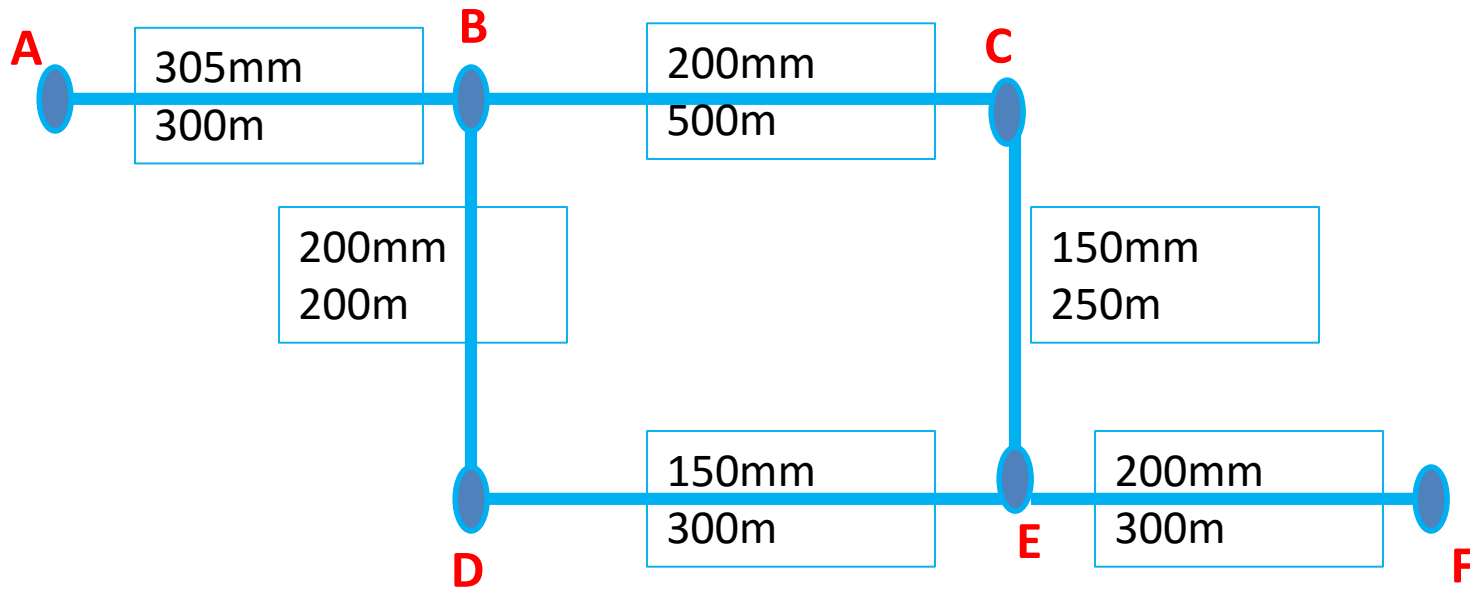
Problem-Equivalent Pipe

Calculate the length of 200 mm diameter of pipe with $C=120$ that will result in same head loss as in above system with $C=100$.



Problem-Equivalent Pipe

- Replace the network shown above with a single pipe diameter of 200mm with roughness coefficient of 100.



Leakage Test

- AWWA has given formula for leakage test

$$L = \frac{ND\sqrt{P}}{C}$$

Where ;

L= leakage ; N=no of joints ;D=Nominal diameter of the pipe;
P=average test pressure during leakage test;C=constant
depending upon units

- **C=326** when **L=L/hr, D=mm, P= Kpa**
- **C=1850** when **L=gal/hr, D= inch , P=Psi**

Disinfection Test

- In the process handling & placing. It is inevitable that the newly laid water mains will be polluted due to :
 - ✓ Storage on the street
 - ✓ By mud at the bottom of trench
 - ✓ By polluted water which may run into trench etc.

Steps for disinfection

1. Flush the lines with water at velocity of at least 0.76 m/s
2. After flashing ,pipe is filled with water having free chlorine of at least 1 mg/L. Water must retained 0.5 mg/L after 24 hrs. Then carry bacteriological analysis of water.
3. If coliforms are still found inside the repeat the process with increase in amount of concentration

Problem-Leakage Test

How much leakage would you allow in 150 mm diameter for the supply pipe.804m in length laid by pipes of 4 m in length. The pipe is design for a pressure of 430kPa.