

ENGR 292 Fluids and Thermodynamics

Design a Pump and Pipe System Step 2 & 3

Supporting Docs

Feb.03, 2017

Steps 2 & 3

□ **Determine the Pipe Sizes:**

- **Discharge** $D_{\text{Discharge}}$
- **Suction** D_{Suction}

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Steps 2 & 3

□ **Fluid flow rate:**

- **Volume flow rate** $Q = Av = \frac{\pi D^2}{4} v$

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Steps 2 & 3

□ **Given:**

Q

□ **Recommended Velocities**

v

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Steps 2 & 3

□ **Given:**

$Q (m^3/s)$

□ **Recommended Velocity**

$v (m/s)$



$D (m)$

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Steps 2 & 3

□ **Recommended Velocities**

□ **The Continuity Equation**

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Steps 2 & 3

□ **The Continuity Equation**

- **Continuity Equation for Any Fluid:**

$$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$$
- **Continuity Equation for Liquids**

$$A_1 v_1 = A_2 v_2$$

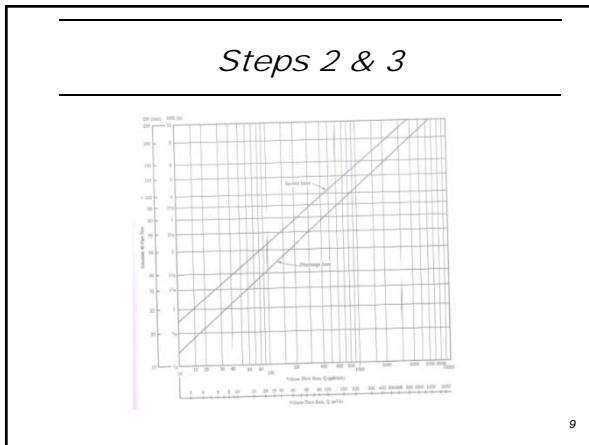
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Steps 2 & 3

□ **The Continuity Equation**

- **The velocity of flow increases as the area of the flow path decreases**
- **Therefore, smaller pipes will cause higher velocities, and larger pipes will provide lower velocities**

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Steps 2 & 3

□ **Figure above provides very rough guidance for specifying pipe sizes as a function of volume flow rate for typical pumped fluid distribution systems.**

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Steps 2 & 3

□ **In general, you should favor the larger pipe size to achieve a lower velocity unless there difficulties with space, cost or compatibility with a given pump connection.**

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Steps 2 & 3

□ **Recommended Range of Velocity**

Type of Service	Recommended Range of Velocity (m/s)
Discharge lines	2.1 – 7.6
Suction lines	0.6 – 1.2
Return lines	1.5 – 4.0

Type of Service	Recommended Range of Velocity	
	ft/s	m/s
Suction lines	2-4	0.6-1.2
Return lines	4-13	1.5-4.0
Discharge lines	7-25	2.1-7.6

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Steps 2 & 3

- **Commercially available pipe and tubing**
- **Specifying piping and tubing for a particular application is the responsibility of the designer (engineer, technologist, etc.) and it has significant impact on**
 - **Cost**
 - **Life,**
 - **Safety**
 - **Performance of the system**

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Steps 2 & 3

- **Commercially available Pipe**

Outside Diameter (mm)	Schedule	Outside Diameter (in)	Wall Thickness (mm)	Wall Thickness (in)	Inside Area (mm ²)	Pipe Weight (kg/m)	Pipe Weight (lb/ft)
50	10	1.915	07.62	0.300	25,368	2,301	2,584
50	20	1.915	15.24	0.600	20,811	1,820	2,047
50	40	1.915	30.48	1.200	17,548	1,438	1,642
50	60	1.915	45.72	1.800	14,801	1,241	1,428
50	80	1.915	60.96	2.400	12,851	1,080	1,242
50	100	1.915	76.20	3.000	11,241	950	1,091
50	120	1.915	91.44	3.600	9,941	840	963
50	140	1.915	106.68	4.200	8,841	750	857
50	160	1.915	121.92	4.800	7,941	680	780

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Steps 2 & 3

- **In general, the size of suction line is one standard size larger than the size of discharge line**

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Steps 2 & 3

- **Commercially available Pipe**

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