

Helix Technologies Pty Ltd

Project	Demo QA	Client	Helix Demo
Project No.	4567	Design Date	10/06/2017
Category	Demo Slurry Bingham	Atmos. Press	100.19 psi
Network Type	Liquid	Calc. Method	Darcy
Description	Bingham Slurry Worked Example 5-2		

Slurry Systems Handbook, Baha Abulnaga, McGraw Hill Example 5-2 pg 5.5

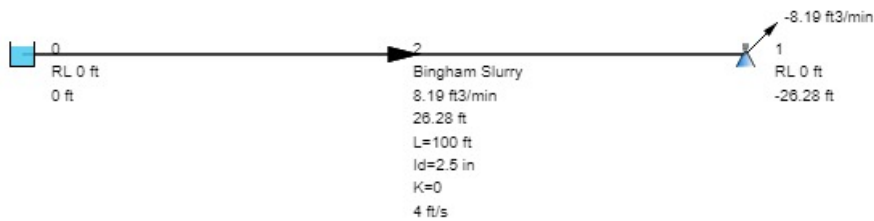
A Bingham slurry with $C_w = 50\%$ is tested in a plastic lined pipe with id of 2.5 inches. the tests indicate a yield stress of 1.5Pa and co-efficient of rigidity of 0.4 Pa-s. Assuming a flow speed of 4 ft/s in laminar regime, determine the friction by Buckingham's equation.

Description	Published value	Helix deltaQ
Reynolds number	298	298.42
Darcy Friction Factor	0.3248	0.2197 <--- Helix uses methods shown in Warman slurry manual.

Flow is in laminar region as $V = 4.0\text{ft/s}$ is less than Critical velocity $V_c = 16.40\text{ ft/s}$

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Bingham Slurry Worked Example 5-2

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Description	Bingham Slurry Worked Example 5-2		
Pipe No	2	From node to node	0 - 1
Description	Equipment No		
Slurry Type	Bingham Plastic		
Slurry Description	Bingham Slurry		
Slurry Reference	Slurry Systems Handbook 5-2		
SG Carrier Liquid Sl	1	Liquid Viscosity	400 cP
SG of Dry Solids	3.35	SG of Mixture	1.54
Conc. by Mass Cw	50 % w/w	Concentration by Vol	22.99 % v/v
Solids Flow Rate	6.56 lbs/s	Particle Size d50	0 in
Yield Stress To	1.5 Pa	Co-eff of Rigidity n	0.4 Pa-s
Yield Stress Tw 8V/D	63.003 Pa	Shear Rate 8V/D	12813.168 -s
Hedstrom No.	58	Pressure Drop / m	3968.71 Pa/m
Critical Velocity Vc	8.21 ft/s	Critical Flow Rate	55.09 ft ³ /min
Reynolds No at Vc	2069.74		
Pump Wear Factor Pw	1	Pump Head Ratio HR	1
Pipe Description	Polyethylene PE100 AS4130	Pipe Class	PN12.5
Nominal Diameter	2.5 in	Inside Diameter	2.5 in
Outside Diameter	3 in	Pipe Length	100 ft
Pipe Roughness	0.00015 in	Allowable Press.	1250 psi
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	0	Total Fittings kf	0
Flow Rate	8.19 ft ³ /min	Velocity	4 ft/s
Friction Loss	26.28 ft	Fitting Losses	0 ft
Slurry Losses	0 ft	Orifice Losses	0 ft
Fixed Head Loss	0 ft	Booster Pump Head	0 ft
Total Head Loss	26.28 ft	Total Pressure Drop	17.55 psi
Entry Total Head	0 ft	Exit Total Head	-26.28 ft
Entry Gauge Head	0 ft	Exit Gauge Head	-26.28 ft
Reynolds No.	298.42	Friction Factor	0.2197 (Darcy f)

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Node No	0	Node Type	Tank
Description		Equipment No	
Rel. Level (RL)	0 ft	Pressure Input	0 psi
Nozzle K value	-	Ext Flow (+In/-Out)	-
Int.(Gauge) Head	-	Int.(Gauge) Pressure	-
Total Node Head	0 ft		

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Node No	1	Node Type	Nozzle
Description		Equipment No	
Rel. Level (RL)	0 ft	Pressure Input	0 psi
Nozzle K value	0	Ext Flow (+In/-Out)	-8.19 ft ³ /min
Int.(Gauge) Head	-26.28 ft	Int.(Gauge) Pressure	-17.55 psi
Total Node Head	-26.28 ft		