Helix Technologies Pty Ltd

Project	Quality Assurance	Client	Helix Demo
Project No.	4567	Design Date	24/02/2021
Category	Demo Air	Atmos. Press	100.19 kPa
Network Type	Gas	Calc. Method	Isothermal
Description	Piping Calculations Manual ex 5.10 pg 268		

Air flows through a 500m long, 200mm inside dia. pipe at 20 deg. C. Upstream pressure is 1035kPa and downstream is 900kPa. Calculate the flow rate.
Pipe relative roughness e/D = 0.0003 therefore absolute roughness = 0.0003 * 200 = 0.06mm.

Results	Publication	Helix delta-Q
Darcy f	0.0152 (look up)	0.0150 (calculated)
Mass flow kN/s	0.0877	
Mass flow lb/s	= 19.716	19.88 lb/s
Velocity		23.34 m/s
Pressure Drop	135 kPa	135 kPa (given)

The results are close.

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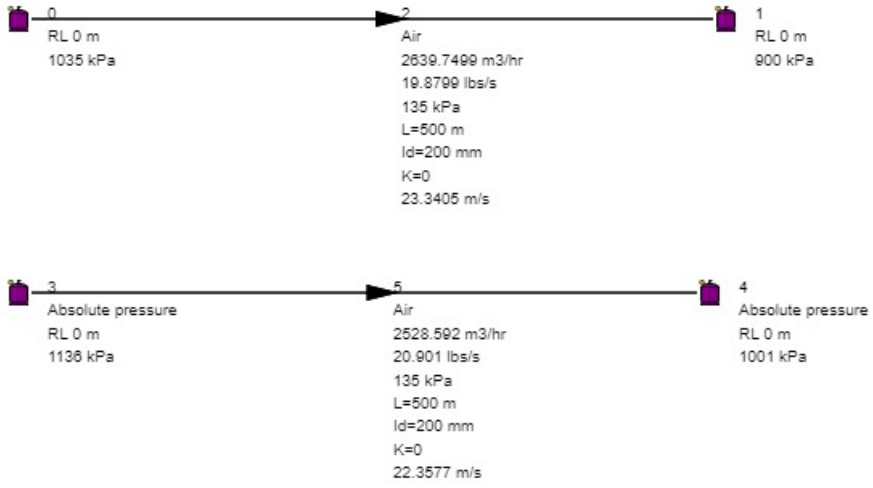
Description	Piping Calculations Manual ex 5.10 pg 268		



Piping Calculations Manual ex 5.10 pg 268

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Project	Quality Assurance	Client	Helix Demo
Project No.	4567	Design Date	24/02/2021
Category	Demo Air	Atmos. Press	100.19 kPa
Description	Piping Calculations Manual ex 5.10 pg 268		

Pipe No	2	From node to node	0 - 1
Description		Equipment No	
Gas	Air	Molecular Mass	28.96 kg/kmol
Ratio Cp/Cv	1.4	Viscosity	0.0181 cP
Temperature	20 C	Density	12.2976 kg/m3
Gas SG to Air	1	Gas Specific Vol	0.0813 m3/kg
Gas Constant R	287.0991	Abs. Gas Temp.	0.0813 deg K
Flow Condition	Free Flow	Net Exp.Factor Y	1
Pipe Description	Steel Pipes AS1836 (ANSI B36.10)	Pipe Class	
Nominal Diameter	200 mm	Inside Diameter	200 mm
Outside Diameter	219 mm	Pipe Length	500 m
Pipe Roughness	0.06 mm	Allowable Press.	4140 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	0	Total Fittings kf	0
Flow Rate	2639.7499 m3/hr	Flow at SMC	26490.4357 m3/hr
Mass Flow Rate	19.8799 lbs/s	Velocity	23.3405 m/s
Mach number	0.451		
Friction Loss	135 kPa	Fitting Losses	0 kPa
Orifice Losses	0 kPa	Fixed Pressure Drop	0 kPa
Total Pressure Drop	135 kPa		
Entry Total Pressure	1035 kPa	Exit Total Pressure	900 kPa
Reynolds No.	39003093.71	Friction Factor	0.0149576 (Darcy f)

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Project	Quality Assurance	Client	Helix Demo
Project No.	4567	Design Date	24/02/2021
Category	Demo Air	Atmos. Press	100.19 kPa
Description	Piping Calculations Manual ex 5.10 pg 268		

Pipe No	5	From node to node	3 - 4
Description		Equipment No	
Gas	Air	Molecular Mass	28.96 kg/kmol
Ratio Cp/Cv	1.4	Viscosity	0.0181 cP
Temperature	20 C	Density	13.4976 kg/m3
Gas SG to Air	1	Gas Specific Vol	0.0741 m3/kg
Gas Constant R	287.0991	Abs. Gas Temp.	0.0741 deg K
Flow Condition	Free Flow	Net Exp.Factor Y	1
Pipe Description	Steel Pipes AS1836 (ANSI B36.10)	Pipe Class	
Nominal Diameter	200 mm	Inside Diameter	200 mm
Outside Diameter	219 mm	Pipe Length	500 m
Pipe Roughness	0.06 mm	Allowable Press.	4140 kPa
Orifice Plate Dia	-	Non Return Valve	No
Total Fittings k	0	Total Fittings kf	0
Flow Rate	2528.592 m3/hr	Flow at SMC	27851.1459 m3/hr
Mass Flow Rate	20.901 lbs/s	Velocity	22.3577 m/s
Mach number	0.428		
Friction Loss	135 kPa	Fitting Losses	0 kPa
Orifice Losses	0 kPa	Fixed Pressure Drop	0 kPa
Total Pressure Drop	135 kPa		
Entry Total Pressure	1136 kPa	Exit Total Pressure	1001 kPa
Reynolds No.	45008133.6873	Friction Factor	0.0149548 (Darcy f)

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Category	Demo Air	Atmos. Press	100.19 kPa
Description	Piping Calculations Manual ex 5.10 pg 268		

Node No	0	Node Type	Tank
Description		Equipment No	
Rel. Level (RL)	0 m	Pressure Input	1035 kPa
Ext Flow (+In/-Out)	-	Abs. Node Pressure	1035 kPa
Int.(Gauge) Head	0 kPa		

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Project	Quality Assurance	Client	Helix Demo
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Description	Piping Calculations Manual ex 5.10 pg 268		

Node No	1	Node Type	Tank
Description		Equipment No	
Rel. Level (RL)	0 m	Pressure Input	900 kPa
Ext Flow (+In/-Out)	-	Abs. Node Pressure	900 kPa
Int.(Gauge) Head	0 kPa		

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Description	Piping Calculations Manual ex 5.10 pg 268		

Node No	3	Node Type	Tank
Description	Absolute pressure	Equipment No	
Rel. Level (RL)	0 m	Pressure Input	1136 kPa
Ext Flow (+In/-Out)	-	Abs. Node Pressure	1136 kPa
Int.(Gauge) Head	0 kPa		

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Project No.	4567	Design Date	24/02/2021
Category	Demo Air	Atmos. Press	100.19 kPa
Description	Piping Calculations Manual ex 5.10 pg 268		

Node No	4	Node Type	Tank
Description	Absolute pressure	Equipment No	
Rel. Level (RL)	0 m	Pressure Input	1001 kPa
Ext Flow (+In/-Out)	-	Abs. Node Pressure	1001 kPa
Int.(Gauge) Head	0 kPa		