Helix Technologies Pty Ltd

Project	Helix QA	Client	Helix QA
Project No.	4567	Design Date	16/03/2017
Category	Demo Liquid QA	Atmos. Press	101.33 kPa
Network Type	Liquid	Calc. Method	Darcy
Description	Lube Oil Crane 410M ex 4-9 pg 4-5		

Oil Flow ref. 'Flow of Fuids Through Valves, Fittings and Pipe', Crane Technical Paper 410 M Example 4-9 pg 4-5
SAE 70 Lube Oil at 40 deg C flows through a pipe 5" Sch 40 at a rate of 2300l/min. Determine the velocity and pressure difference between gauges 1 and 2.

Calculation Results	Crane 410	Helix
Flow Rate	2300 l/min	2300 l/min given
Velocity	2.97 m/s	2.97 m/s
Reynolds no	760	761
Friction factor	0.084 for pipe	0.08415 used for all
Friction factor	0.016 for fittings	
Pressure Drop dP	3.64 bar	3.67 bar

Correlation is good but for some reason the Crane published example used a frcition factor of 0.016 for the fitting K value calculation, eve though the actual frcition factor is 0.084 and is laminar flow condition.

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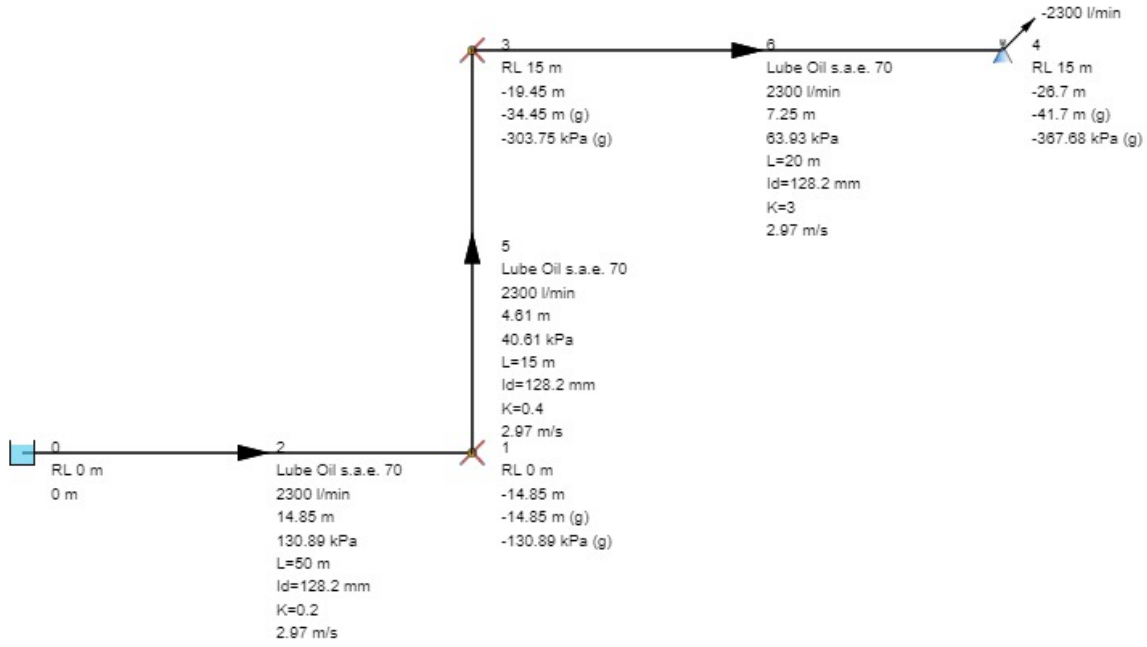

Lube Oil Crane 410M ex 4-9 pg 4-5

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Project No.	4567	Design Date	16/03/2017
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Description	Lube Oil Crane 410M ex 4-9 pg 4-5		

Pipe No	2	From node to node	0 - 1
Description		Equipment No	
Liquid	Lube Oil s.a.e. 70	Viscosity	450 cp
Temperature	40 C	Density	899 kg/m3
Vapour Pressure	0 kPa		
Pipe Description	Steel Pipes 5" AS1836 (ANSI B36.10)	Pipe Class	Sch 40
Nominal Diameter	125 mm	Inside Diameter	128.2 mm
Outside Diameter	141.3 mm	Pipe Length	50 m
Pipe Roughness	0.03 mm	Allowable Press.	999 kPa
Orifice Plate Dia	-	Non Return Valve	No

Pipe Fitting Description	Qty	K value	Kft value
Gate Valve	1	0.2	8

Total Fittings k	0.2	Total Fittings kf	0
Flow Rate	2300 l/min	Velocity	2.97 m/s
Friction Loss	14.76 m	Fitting Losses	0.09 m
Slurry Losses	0 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	14.85 m	Total Pressure Drop	130.89 kPa
Entry Total Head	0 m	Exit Total Head	-14.85 m
Entry Gauge Head	0 m	Exit Gauge Head	-14.85 m
Reynolds No.	760.58	Friction Factor	0.08415 (Darcy f)

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Description	Lube Oil Crane 410M ex 4-9 pg 4-5		

Pipe No	5	From node to node	1 - 3
Description		Equipment No	
Liquid	Lube Oil s.a.e. 70	Viscosity	450 cp
Temperature	40 C	Density	899 kg/m3
Vapour Pressure	0 kPa		
Pipe Description	Steel Pipes 5" AS1836 (ANSI B36.10)	Pipe Class	Sch 40
Nominal Diameter	125 mm	Inside Diameter	128.2 mm
Outside Diameter	141.3 mm	Pipe Length	15 m
Pipe Roughness	0.03 mm	Allowable Press.	999 kPa
Orifice Plate Dia	-	Non Return Valve	No

Pipe Fitting Description	Qty	K value	Kft value
Bend - Standard 90 degree elbow	1	0.4	20

Total Fittings k	0.4	Total Fittings kf	0
Flow Rate	2300 l/min	Velocity	2.97 m/s
Friction Loss	4.43 m	Fitting Losses	0.18 m
Slurry Losses	0 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	4.61 m	Total Pressure Drop	40.61 kPa
Entry Total Head	-14.85 m	Exit Total Head	-19.45 m
Entry Gauge Head	-14.85 m	Exit Gauge Head	-34.45 m
Reynolds No.	760.58	Friction Factor	0.08415 (Darcy f)

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Project	Helix QA	Client	Helix QA
Project No.	4567	Design Date	16/03/2017
Category	Demo Liquid QA	Atmos. Press	101.33 kPa
Description	Lube Oil Crane 410M ex 4-9 pg 4-5		

Pipe No	6	From node to node	3 - 4
Description		Equipment No	
Liquid	Lube Oil s.a.e. 70	Viscosity	450 cp
Temperature	40 C	Density	899 kg/m3
Vapour Pressure	0 kPa		
Pipe Description	Steel Pipes 5" AS1836 (ANSI B36.10)	Pipe Class	Sch 40
Nominal Diameter	125 mm	Inside Diameter	128.2 mm
Outside Diameter	141.3 mm	Pipe Length	20 m
Pipe Roughness	0.03 mm	Allowable Press.	999 kPa
Orifice Plate Dia	-	Non Return Valve	No

Pipe Fitting Description	Qty	K value	Kft value
Angle Valve combined 90 deg bend	1	3	150

Total Fittings k	3	Total Fittings kf	0
Flow Rate	2300 l/min	Velocity	2.97 m/s
Friction Loss	5.9 m	Fitting Losses	1.35 m
Slurry Losses	0 m	Orifice Losses	0 m
Fixed Head Loss	0 m	Booster Pump Head	0 m
Total Head Loss	7.25 m	Total Pressure Drop	63.93 kPa
Entry Total Head	-19.45 m	Exit Total Head	-26.7 m
Entry Gauge Head	-34.45 m	Exit Gauge Head	-41.7 m
Reynolds No.	760.58	Friction Factor	0.08415 (Darcy f)

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Project	Helix QA	Client	Helix QA
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Category	Demo Liquid QA	Atmos. Press	101.33 kPa
Description	Lube Oil Crane 410M ex 4-9 pg 4-5		

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

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Node No	1	Node Type	Junction
Description		Equipment No	
Rel. Level (RL)	0 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	0 l/min
Int.(Gauge) Head	-14.85 m	Int.(Gauge) Pressure	-130.89 kPa
Total Node Head	-14.85 m		

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Node No	3	Node Type	Junction
Description		Equipment No	
Rel. Level (RL)	15 m	Pressure Input	0 kPa
Nozzle K value	-	Ext Flow (+In/-Out)	0 l/min
Int.(Gauge) Head	-34.45 m	Int.(Gauge) Pressure	-303.75 kPa
Total Node Head	-19.45 m		

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Node No	4	Node Type	Nozzle
Description		Equipment No	
Rel. Level (RL)	15 m	Pressure Input	0 kPa
Nozzle K value	0	Ext Flow (+In/-Out)	-2300 l/min
Int.(Gauge) Head	-41.7 m	Int.(Gauge) Pressure	-367.68 kPa
Total Node Head	-26.7 m		