

Flour preliminary pneumatic conveying calculation (175m- 4")

Modelling pipeline geometry

Installation description
 Client * MERSEM
 Drive * c
 Directory * f
 Installation name * mersem1754
 Version s/d * d s = Suction or vacuum system
 d = Discharge or pressure system
 Full Path c:\Vdmersem1754.txt

Bend orientation
 (1) Vertical ascending to horizontal
 (2) Horizontal to vertical descending
 (3) Vertical descending to horizontal
 (4) Horizontal to vertical ascending
 (5) Horizontal to horizontal

Standard ID	Standard ID	Standard ID	Standard ID	Standard ID
2" 54 mm	10" 254 mm	24" 590 mm		
3" 78 mm	12" 304 mm	26" 643 mm		
4" 102 mm	14" 336 mm	28" 693 mm		
5" 128 mm	16" 387 mm	30" 743 mm		
6" 154 mm	18" 438 mm	32" 793 mm		
8" 203 mm	20" 489 mm	34" 843 mm		

Part	Description	Diameter mm	Length m	Angle degrees	Radius mm	Bend angle degrees	Start angle degrees	Orientation
1	Intake	102	1	0				
2	Pipe	102	18	0				
3	Bend	102			204	90	30	5
4	Pipe	102	18	0				
5	Bend	102			204	90	30	5
6	Pipe	102	18	0				
7	Bend	102			204	90	30	5
8	Pipe	102	18	0				
9	Bend	102			204	90	30	5
10	Pipe	102	18	0				
11	Bend	102			204	90	30	5
12	Pipe	102	19	0				
13	Bend	102			204	90	30	5
14	Pipe	102	12	0				
15	Diameter Tra							
16	Pipe	102	7	0				
17	Bend	102			204	90	30	5
18	Pipe	102	118	0				
19	Bend	102			204	90	30	5
20	Pipe	102	18	0				
21	Bend	102			204	90	30	4
22	Pipe	102	0	90				
23	Diameter Tra							
24	Pipe	102	8	90				
25	Bend	102			204	90	30	1
26	Pipe	102	10	0				
27	Bend	102			204	90	30	2
28	Outlet	102						
29	Filter	40	m2					Total length 283 m
30	Pump	0.2	m3/sec					Number of bends 11

Bend radii 1,5 *D

Buttons: Back to menu, Back to Viewing/modifying installation, Save

Pressure pneumatic conveying calculation Input screen

Client MERSEM File path c:\Vdmersem1754.txt Product Flour

Gas medium: Air Nitrogen

Gas pump: Screwcompressor 2-stage
 Blower
 Compressor data
 Predefined screwcompressor
 Blower data
 Predefined blower
 Constant mass pump (sonic choke/turbo)
 Centrifugal fan

Maximum compressor pressure 3,5 bar
 Maximum conveying pressure mmWC
 Gas volume 0,12 m3/sec

Booster: Installed
 Screwcompressor
 Predefined screwcompressor
 Blower data
 Predefined blower

Rotary lock feeder: Install
 Capacity tons/hr
 Lock volume m3
 RPM /min
 Leakage m3/sec

Eductor feeder: No

Ambient (Compressor intake)
 Ambient temperature 25 degr C Altitude 0 m
 Intake temperature 25 degr C Altitude pressure 1013 mbar
 Ambient pressure 1000 mbar 1 bar
 Relative Humidity 80 % Show air intake conditions
 Override RH air density calculation for >373 degC and >220 bar

Temperatures
 Flour temperature 40 degr C Pressure dewpoint
 Compressor gas cooling degr C Dryer degr C
 Booster gas cooling degr C Dryer degr C
 Heat transmission factor pipewall 0,1 kCal/sec/degC/m2

Material properties
 Flour particle density 1420 kg/m3
 Bulk density 750 kg/m3
 Particle size <mesh 80 > micron
 Suspension velocity 1,38 m/sec
 Product loss constant
 Product loss factor 1,10585E-08
 Wall friction factor 0,5
 Material intake pressure drop v-wall / v-susp 1,5 mmWC
 Filter resistance factor 1500000
 Specific heat content 0,2 kCal/kg/C
 product loss factor constant y/n

Filter
 Filter area 40 m2 Filter exhaust fan

Convey pipeline
 Convey distance horizontal 275 m
 Convey distance vertical 8 m-up 0 m-down
 Convey distance slope 0 m-up 0 m-down
 Total conveying length 283 m
 Number of Bends 11
 Pipe diameter begin 102 mm
 Pipe diameter end 102 mm
 Calculate empty pipeline pressure drop mmWC

Calculation settings
 Set capacity 4 tons/hr
 Conveying pressure 28500 mmWC 2,85 bar
 Back pressure 0 mmWC 0 bar
 Set pressure drop 28500 mmWC 2,85 bar
 Calculate intake gas pressure drop Yes
 Time domain dt 0,001 seconds Default

Calculation selection
 Pressure fixed -> capacity calculated
 Capacity fixed -> pressure calculated
 Pressure and capacity fixed -> intake pressure drop calculated
 Pressure and capacity fixed -> constant loss factor calculated
 Pressure and capacity fixed -> material loss factor calculated
 product loss factor (cwp) kept constant

Buttons: Back to start menu, Calculate

Calculation Table Pressure Conveying

Client: MERSEM
 Filepath: c:\Vdmersem1754.txt
 Product: Flour

Convey distance horizontal: 275 m
 Convey distance vertical: 8 m
 Total conveying length: 283 m
 Number of Bends: 11

Capacity: 4 tons/hr at 28500 mmWC 2.85 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 28500 mmWC 2.85 bar
 Loading ratio: 7.88

Table calculation

Part	Part description	Length(l) m	v-gas m/sec	v-product m/sec	Pressure drop mmWC	Pressure bar	v-wall/v-susp	residence time	mass kg	temperature degrC	kW	% kW	Bend loss kW	Sediment % kW	RH% RH%
1	Intake 102 hor	1	4.34	5.36	327	2.81	3.13	0.1905	0	63	0.1	0.7			40
2	Pipe 102 hor	18	4.18	3.66	1680	2.68	2.25	4.9945	5	28	0.4	2.7			98
3	Bend		4.68	1.87	1680	2.68		5.0831	0	28	0		0	0	
4	Pipe 102 hor	18	4.3	3.75	3122	2.53	2.28	9.9351	5	25	0.4	2.9			99
5	Bend		4.81	1.92	3122	2.53		10.0216	0	25	0		0	0	
6	Pipe 102 hor	18	4.48	3.88	4596	2.39	2.31	14.7286	5	25	0.5	3.1			97
7	Bend		4.98	1.98	4596	2.39		14.8122	0	25	0		0	0	
8	Pipe 102 hor	18	4.68	4.03	6103	2.23	2.36	19.3523	5	24	0.5	3.3			93
9	Bend		5.18	2.06	6103	2.23		19.4327	0	24	0		0	0	
10	Pipe 102 hor	18	4.9	4.19	7648	2.08	2.41	23.8008	5	24	0.5	3.6			88
11	Bend		5.41	2.14	7648	2.08		23.8782	0	24	0		0	0	
12	Pipe 102 hor	19	5.17	4.38	9322	1.91	2.48	28.2952	5	24	0.6	4.1			83
13	Bend		5.68	2.25	9322	1.91		28.3691	0	24	0		0	0	
14	Pipe 102 hor	12	5.37	4.52	10413	1.8	2.52	31.0551	3	24	0.4	2.8			80
15	Diameter Transfer		5.37	4.52	10413	1.8		31.0551	0	0	0				
16	Pipe 102 hor	7	5.49	4.61	11049	1.74	2.55	32.5821	1	24	0.2	1.6			78
17	Bend		6	2.36	11049	1.74		32.6525	0	24	0		0	0	
18	Pipe 102 hor	118	9.83	7.29	23395	0.51	3.39	53.6954	23	24	7	44.1			42
19	Bend		10.41	3.73	23395	0.51		53.7399	0	24	0		0	0.1	
20	Pipe 102 hor	18	11.57	8.19	25706	0.27	3.67	56.0629	2	24	1.9	12.2			36
21	Bend		12.24	3.85	25707	0.27		56.1041	0	25	0		0	0.1	
22	Pipe 102 up	0	11.84	4.4	25710	0.27	3.75	56.1051	0	24	0		0	0	
23	Diameter Transfer		11.84	4.4	25710	0.27		56.1051	0	0	0				
24	Pipe 102 up	8	12.93	8.73	27062	0.14	3.88	57.0551	1	24	1.3	8.2			32
25	Bend		13.57	4.48	27062	0.14		57.0925	0	24	0		0	0.1	
26	Pipe 102 hor	10	14.74	9.65	28489	0	4.14	58.1725	1	24	1.5	9.8			28
27	Bend		15.38	5.21	28489	0		58.2053	0	24	0		0	0.2	
28	Outlet		15.38	5.21	28489	0		58.2053		24	0.0168	0.1			28
29	After Filter	40	m2	0.1	m/min	28500	-0.01		58.2053		0.0132	0	dp = 11	mmWC	28

Condensation: 5.2 lbs/hr

Calculation results pressure conveying

Client: MERSEM
 Filepath: c:\Vdmersem1754.txt
 Product: Flour

Installation
 Convey distance horizontal: 275 m
 Convey distance vertical: 8 m
 Total conveying length: 283 m
 Number of Bends: 11
 Pipe diameter(s): 102 mm

Feeder system
 Installation system: 2-vessel system
 Vessel factor: 1000 tons/hr/m³/bar(a)
 Nominal capacity: 0 tons/hr
 Vessel volume: 2 m³
 Vessel product volume: 1.5 m³
 pressure begin pressurizing: -0.05 bar
 pressure valve open: 2.5 bar
 pressure valve close: 25% → 0.71 bar
 temperature begin pressurizing: 35 C
 temperature after pressurizing: 60 C
 pressurizing time: 22.2 seconds
 Discharging time: 1011.5 seconds
 purging time of pipe: 43.7 seconds
 valve time: 2 seconds
 filling time: seconds
 cycletime: 1079.5 seconds
 Number of kettles/hr: 3.3

Kettle capacity > capacity → extra air valve active

Calculation results
 Capacity: 4 tons/hr
 Pressure: 28500 mmWC 2.85 bar
 Booster pressure: 0 mmWC 0 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 28500 mmWC 2.85 bar
 Loading ratio: 7.88
 Volumetric loading ratio: 0.0180 to 0.0100
 Empty pipeline pressure: 1533 mmWC
 Residence time: 58.2 seconds
 Re-number * 10⁻⁵: 0.92
 Mixture density: 10.5 kg/m³
 Mass of material in pipeline: 66.8 kg
 Exit dynamic force: 0.1 kN

Pressure drops
 Product intake: 150 mmWC 0.5 %
 Nozzle (total dp): 327 mmWC 1.1 %
 Acceleration excl product dp: 305 mmWC 1 %
 Product resistance: 25894 mmWC 90.8 %
 Elevation: 90 mmWC 0.3 %
 Suspension: 1454 mmWC 5.1 %
 Gas: 609 mmWC 2.1 %
 Filter: 11 mmWC 0 %

Energy (Screwcompressor)
 Compressor power: 31 kW
 Mechanical efficiency: 90 %

No booster
 Product loss energy pipes → heat: 3.635 kW/ton
 Product loss energy bends → heat: 0.041 kW/ton
 Pipeline energy consumption/ton: 7.782 kW/ton

Temperatures
 Ambient temperature: 25 degr C
 Outlet temperature compressor: 214 degr C

No booster
 Material temperature: 40 degr C
 Mixture temperature begin: 63 degr C
 Mixture temperature end: 24 degr C

Table calculation
 Begin capacity: 4 tons/hr
 Begin pressure: 28500 mmWC
 lowest pressure: 8500 mmWC
 pressure decrement: 1000 mmWC

Table calculation

Pressure conveying

Client: MERSEM
 Filepath: c:\N\dmrsem1754.txt
 Product: Flour
 Altitude: 0 m

Convey distance horizontal: 275 m
 Convey distance vertical: 8 m-up / m-down
 Total conveying length: 283 m
 Number of Bends: 11
 Pipe diameter begin: 102 mm
 Pipe diameter end: 102 mm

Pump displacement: 0.12 m3/sec (Screwcompressor)
 Booster displacement: 0 m3/sec

Gas volume end: 0.125 m3/sec, 0.147 kg/sec at 0.85 bar

Two vessel installation

MM-DD-YY
08-27-2010

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Number of kettles/hr	< Kettle range>	Solid Loading Ratio SLR	gas velocity begin m/sec	gas velocity end m/sec	mass in pipeline kg	System energy consumption kWh/ton	residence time seconds	Sediment	Condensation
2.85	4	3.7	3.3	>capacity	7.8	4.3	15.3	66.8	8.14	58.2	No sedimentation	Condensation
2.75	3.9	3.7	3.2	>capacity	7.7	4.4	15.3	64.4	7.99	56.91	No sedimentation	Condensation
2.65	3.8	3.6	3.2	>capacity	7.6	4.5	15.4	61.9	8.06	55.61	No sedimentation	Condensation
2.55	3.8	3.6	3.2	>capacity	7.4	4.7	15.4	59.4	7.9	54.31	No sedimentation	Condensation
2.45	3.7	3.5	3.1	>capacity	7.3	4.8	15.4	57	7.97	53.01	No sedimentation	Condensation
2.35	3.7	3.5	3.1	>capacity	7.2	5	15.4	54.6	7.81	51.7	No sedimentation	Condensation
2.25	3.6	3.4	3	>capacity	7	5.1	15.4	52.3	7.87	50.38	No sedimentation	Condensation
2.15	3.5	3.4	3	>capacity	6.9	5.3	15.4	49.9	7.71	49.06	No sedimentation	Condensation
2.05	3.5	3.3	2.9	>capacity	6.8	5.5	15.4	47.6	7.77	47.73	No sedimentation	Condensation
1.95	3.4	3.2	2.9	>capacity	6.6	5.7	15.5	45.3	7.83	46.4	No sedimentation	Condensation
1.85	3.3	3.2	2.8	>capacity	6.5	5.9	15.5	43	7.66	45.06	No sedimentation	Condensation
1.75	3.3	3.1	2.8	>capacity	6.3	6.1	15.5	40.8	7.72	43.72	No sedimentation	Condensation
1.65	3.2	3	2.7	>capacity	6.1	6.3	15.5	38.6	7.79	42.37	No sedimentation	Condensation
1.55	3.1	3	2.6	>capacity	6	6.6	15.5	36.4	7.6	41.01	No sedimentation	Condensation
1.45	3	2.9	2.6	>capacity	5.8	6.9	15.5	34.2	7.66	39.65	No sedimentation	Condensation
1.35	2.9	2.8	2.5	>capacity	5.6	7.2	15.6	32.1	7.73	38.28	No sedimentation	Condensation
1.25	2.8	2.7	2.4	>capacity	5.4	7.5	15.6	29.9	7.81	36.9	No sedimentation	Condensation
1.15	2.8	2.7	2.4	>capacity	5.2	7.9	15.6	27.8	7.6	35.52	No sedimentation	Condensation
1.05	2.7	2.6	2.3	>capacity	5	8.3	15.6	25.7	7.67	34.13	No sedimentation	Condensation
0.95	2.5	2.5	2.2	>capacity	4.8	8.8	15.7	23.7	7.75	32.73	No sedimentation	Condensation
0.85	2.4	2.4	2.1	>capacity	4.6	9.3	15.7	21.6	7.83	31.31	No sedimentation	Condensation

Empty pipeline system pressure drop: 1532 mmWC
 Filter without exhaust fan

Buttons: Back to start menu, Print table, New Calculation