

Flour preliminary pneumatic conveying calculation.

Pipe length:

- 175 m horizontal
- 8 m vertical
- 11 bends
- pipe diameter 6" (154 mm)

Pressure pneumatic conveying calculation Input screen

Client: MERSEM File path: c:\Vdmersem175.txt Product: Flour

Gas medium: Air Nitrogen

Gas pump: Screwcompressor Blower Compressor data Predefined screwcompressor Blower data 1x Blower GM25S 2950 rpm Constant mass pump (sonic choke/turbo) Centrifugal fan

Maximum compressor pressure: 1 bar
Maximum conveying pressure: mmWC
Gas volume: 0,217 m3/sec

Booster: Installed Screwcompressor Predefined screwcompressor Blower data Predefined blower

Gas Volume: m3/sec
Injection point:

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 % Override RH air density calculation for >373 degrC and >220 bar

Temperatures: Flour temperature: 25 degr C Pressure dewpoint: 3 degr C Compressor gas cooling degr C Booster gas cooling degr C Dryer 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: 840 kg/m3 Particle size <mesh>: 80 micron Suspension velocity: 1,38 m/sec Product loss constant: 1,10585E-08 Product loss factor: 0,9 Wall friction factor: 1,2 Material intake pressure drop v-wall / v-susp: 350000 Filter resistance factor: 0,15 kCal/kg/C Specific heat content: n product loss factor constant y/n

Filter: Filter area: 60 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: 154 mm Pipe diameter end: 154 mm Calculate empty pipeline pressure drop: 764 mmWC

Calculation settings: Set capacity: 5 tons/hr Conveying pressure: 7500 mmWC 0,75 bar Back pressure: 0 mmWC 0 bar Set pressure drop: 7500 mmWC 0,75 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

Back to start menu

Calculate

Calculation Table Pressure Conveying

Client: MERSEM
 Filepath: c:\Vdmersem175.txt
 Product: Flour

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

Compr. displ 0.75 bar: 0,225 m3/sec
 Volumetric efficiency: 81.3 %
 Booster displacement: 0 m3/sec
 Rotarylock leakage: 0 m3/sec
 Gas displacement at end: 0,2233 m3/sec

Capacity: 5 tons/hr at 7500 mmWC 0.75 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 7500 mmWC 0.75 bar
 Loading ratio: 5,24

Pipeline energy consumption: 4,77 kWh/ton
 Compressor power: 24 kW
 Conveying energy: 12,5 kW
 Pneumatic conveying efficiency: 52,2 %
 Bend losses: 0,3 kW Material intake loss: 0,15 kW

Re-number: 1,151 * 10⁵
 Empty pipeline pressure drop: 5 mmWC
 Empty pipeline filter press. drop: 746 mmWC
 Material loss factor constant: 0,1462
 Material Loss factor: 1,10585E-08
 Material intake pressure drop: 100 mmWC

Progress: Filter, Iteration

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%
1	Intake 154 hor	1	6.81	7.45	169	0.73	3.31	0.1441	0	19	0.2	1.9			32
2	Pipe 154 hor	18	7.17	6.12	558	0.69	2.67	3.112	4	24	0.5	4			23
3	Bend		7.56	2.06	558	0.69		3.2133	0	24	0		0	0.1	
4	Pipe 154 hor	18	7.36	6.25	976	0.65	2.71	6.1264	4	24	0.5	4.4			22
5	Bend		7.75	2.1	976	0.65		6.2255	0	25	0		0	0.1	
6	Pipe 154 hor	18	7.55	6.39	1400	0.6	2.74	9.0775	4	24	0.5	4.6			21
7	Bend		7.94	2.15	1400	0.6		9.1745	0	25	0		0	0.2	
8	Pipe 154 hor	18	7.75	6.53	1830	0.56	2.78	11.9644	3	24	0.6	4.8			21
9	Bend		8.15	2.2	1830	0.56		12.0593	0	25	0		0	0.2	
10	Pipe 154 hor	18	7.97	6.69	2266	0.52	2.82	14.7853	3	24	0.6	5			20
11	Bend		8.37	2.25	2266	0.52		14.878	0	25	0		0	0.2	
12	Pipe 154 hor	19	8.22	6.86	2733	0.47	2.86	17.686	3	24	0.6	5.5			19
13	Bend		8.62	2.31	2733	0.47		17.7763	0	25	0		0	0.2	
14	Pipe 154 hor	12	8.39	6.98	3039	0.44	2.89	19.5164	2	24	0.4	3.7			19
15	Diameter Transfer		8.39	6.98	3039	0.44		19.5164		0	0				
16	Pipe 154 hor	7	8.49	7.05	3209	0.42	2.91	20.5124	1	24	0.2	2			19
17	Bend		8.9	2.37	3209	0.42		20.6003	0	25	0		0	0.2	
18	Pipe 154 hor	118	10.79	8.55	6275	0.12	3.27	35.8653	21	24	5.3	42.9			15
19	Bend		11.22	2.88	6275	0.12		35.9378	0	25	0		0	0.3	
20	Pipe 154 hor	18	11.31	8.88	6799	0.07	3.35	38.0078	2	24	1	8.5			14
21	Bend		11.86	2.34	6800	0.06		38.0852	0	25	0		0	0.4	
22	Pipe 154 up	0	11.6	2.88	6801	0.06	3.43	38.0862	0	25	0				14
23	Diameter Transfer		11.6	2.88	6801	0.06		38.0862			0				
24	Pipe 154 up	8	11.73	8.89	7183	0.03	3.41	39.0072	1	24	0.8	6.4			13
25	Bend		12.17	3.2	7183	0.03		39.0759	0	24	0		0	0.3	
26	Pipe 154 hor	10	12.09	9.35	7495	0	3.46	40.1659	1	24	0.6	5.4			13
27	Bend		12.5	3.65	7495	0		40.2277	0	25	0		0	0.4	
28	Outlet		12.5	3.65	7495	0		40.2277		25	0.0209	0.1			13
29	After Filter	60	m2	0.2	m/min	7500	-0.01				0.0092	0			dp = 4 mmWC 13

Buttons: Back to start menu, Print calculation, Change product, New Calculation, Calculation results, No condensation

Calculation results pressure conveying

Client: MERSEM
 Filepath: c:\Vdmersem175.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): 154 mm
 Compressor displacement: 0.217 m3/sec 0.254 kg/sec
 Booster displacement: 0 m3/sec 0 kg/sec
 Total gas displacement: 0.217 m3/sec 0.254 kg/sec

Feeder system:
 Installation system: 1-vessel system, 2-vessel system, 3-vessel system, Bulk trailer unloading
 Vessel factor: 1000 tons/hr/m³/bar(a) vessel capacity: 123,9 tons/hr
 Nominal capacity: 0 tons/hr
 Vessel volume: 2 m³ Vessel content: 1,26 tons
 Vessel product volume: 1,5 m³ pipe volume: 5,27 m³
 pressure begin pressurizing: -0,05 bar pipe content: 56,4 kgs
 pressure valve open: 2,5 bar
 pressure valve close: 0,18 bar
 temperature begin pressurizing: 35 C Pipeline capacity: 5 tons/hr
 temperature after pressurizing: 60 C System capacity: 4,7 tons/hr
 pressurizing time: 11,3 seconds at pressure: 0,75 bar
 Discharging time: 901,6 seconds Pipeline energy consumption: 4,77 kWh/ton
 purging time of pipe: 30,5 seconds System energy consumption: 4,88 kWh/ton
 valve time: 2 seconds Total energy consumption: 4,88 kWh/ton
 filling time: seconds
 cycletime: 945,5 seconds
 Number of kettles/hr: 3,8

Kettle capacity > capacity --> extra air valve active

Calculation results:
 Capacity: 5 tons/hr
 Pressure: 7500 mmWC 0.75 bar
 Booster pressure: 0 mmWC 0 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 7500 mmWC 0.75 bar
 Loading ratio: 5,24
 Volumetric loading ratio: 0,0070 to 0,0056
 Empty pipeline pressure: 746 mmWC
 Residence time: 40,22 seconds
 Re-number * 10⁵: 1,151
 Mixture density: 7,4 kg/m³
 Mass of material in pipeline: 56,4 kg
 Exit dynamic force: 0,1 kN

Pressure drops:
 Product intake: 100 mmWC 1,3 %
 Nozzle (total dp): 169 mmWC 2,2 %
 Acceleration excl product dp: 242 mmWC 3,2 %
 Product resistance: 6185 mmWC 82,4 %
 Elevation: 52 mmWC 0,6 %
 Suspension: 508 mmWC 6,7 %
 Gas: 416 mmWC 5,5 %
 Filter: 4 mmWC 0 %

Energy:
 (Blower 1x GM25S 2950 rpm)
 Compressor power: 24 kW
 Mechanical efficiency: 95 %
 No booster
 Product loss energy pipes -> heat: 2,056 kW/ton
 Product loss energy bends -> heat: 0,076 kW/ton
 Pipeline energy consumption/ton: 4,771 kW/ton

Temperatures:
 Ambient temperature: 25 degr C
 Outlet temperature compressor: 103 degr C
 Compressed air dewpoint drying: 3 degr C
 No booster
 Material temperature: 25 degr C
 Mixture temperature begin: 19 degr C
 Mixture temperature end: 25 degr C

Table calculation:
 Begin capacity: 5 tons/hr
 Begin pressure: 7500 mmWC
 lowest pressure: 2500 mmWC
 pressure decrement: 250 mmWC

Buttons: Back to start menu, Print calculation result, New Calculation, Calculate system capacity, Calculate table

Table calculation

Pressure conveying

Client: MERSEM

Filepath: c:\N\dmersem175.bt

Product: Flour

Altitude: 0 m

Convey distance horizontal: 275 m

Convey distance vertical: 8 m-up

Total conveying length: 283 m

Number of Bends: 11

Pipe diameter begin: 154 mm

Pipe diameter end: 154 mm

Pump displacement: 0,217 m3/sec (Blower 1x GM25S 2950 rpm)

Booster displacement: 0 m3/sec

Gas volume end: 0,245 m3/sec, 0,289 kg/sec at 0,25 bar

Two vessel installation

MM-DD-YY
08-26-2010

Table

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
0.75	5	4.7	3.8	>capacity	5.2	6.8	12.5	56.4	4.98	40.22	No sedimentation	No condensation
0.725	4.9	4.7	3.7	>capacity	5.1	6.9	12.5	54.8	4.83	39.62	No sedimentation	No condensation
0.7	4.9	4.6	3.7	>capacity	5	7	12.5	53.3	4.78	39.02	No sedimentation	No condensation
0.675	4.8	4.6	3.6	>capacity	4.9	7.2	12.6	51.7	4.63	38.42	No sedimentation	No condensation
0.65	4.7	4.5	3.6	>capacity	4.8	7.3	12.6	50.1	4.58	37.81	No sedimentation	No condensation
0.625	4.6	4.5	3.5	>capacity	4.7	7.4	12.7	48.6	4.42	37.21	No sedimentation	No condensation
0.6	4.6	4.4	3.5	>capacity	4.6	7.6	12.7	47	4.36	36.61	No sedimentation	No condensation
0.575	4.5	4.3	3.4	>capacity	4.6	7.7	12.7	45.5	4.3	36	No sedimentation	No condensation
0.55	4.4	4.2	3.4	>capacity	4.5	7.9	12.8	43.9	4.24	35.4	No sedimentation	No condensation
0.525	4.3	4.2	3.3	>capacity	4.4	8	12.8	42.4	4.07	34.79	No sedimentation	No condensation
0.5	4.3	4.1	3.2	>capacity	4.3	8.2	12.9	40.8	4	34.18	No sedimentation	No condensation
0.475	4.2	4	3.2	>capacity	4.1	8.4	12.9	39.2	3.92	33.57	No sedimentation	No condensation
0.45	4.1	3.9	3.1	>capacity	4	8.6	13	37.7	3.84	32.96	No sedimentation	No condensation
0.425	4	3.9	3	>capacity	3.9	8.8	13	36.1	3.66	32.34	No sedimentation	No condensation
0.4	3.9	3.8	3	>capacity	3.8	9	13.1	34.5	3.57	31.72	No sedimentation	No condensation
0.375	3.8	3.7	2.9	>capacity	3.7	9.2	13.1	32.9	3.47	31.09	No sedimentation	No condensation
0.35	3.7	3.6	2.8	>capacity	3.6	9.4	13.2	31.3	3.37	30.46	No sedimentation	No condensation
0.325	3.6	3.5	2.7	>capacity	3.4	9.6	13.3	29.7	3.27	29.83	No sedimentation	No condensation
0.3	3.4	3.3	2.6	>capacity	3.3	9.8	13.3	28	3.25	29.18	No sedimentation	No condensation
0.275	3.3	3.2	2.5	>capacity	3.1	10.1	13.4	26.3	3.13	28.53	No sedimentation	No condensation
0.25	3.1	3.1	2.4	>capacity	3	10.3	13.4	24.5	3	27.86	No sedimentation	No condensation

Empty pipeline system pressure drop: 746 mmWC

Filter without exhaust fan

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