

Pressure pneumatic conveying calculation input screen

Client: Mike Kaufman File path: c:\Vdmike3.txt Product: Cement

Gas medium: Air Nitrogen

Gas pump: Screwcompressor Predefined screwcompressor Blower data Predefined blower Constant mas pump (sonic choke/turbo) Centrifugal fan

Gas volume: 0,967 m³/sec Maximum pressure: 3,5 bar

Booster: Installed Screwcompressor Predefined screwcompressor Blower data Predefined blower

Gas Volume: m³/sec Injection point:

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

Ambient (Compressor intake): Ambient temperature: 25 degr C Altitude: 0 m Ambient pressure: 1000 mbar Altitude pressure: 1013 mbar

Temperatures: Cement temperature: 40 degr C Compressor gas cooling: degr C Booster gas cooling: degr C Heat transmission factor pipewall: 0,18 kCal/degC/m

Material properties: **Cement** Product density: 3100 kg/m³ Bulk density: 1100 kg/m³ Particle size: 50 micron Suspension velocity: 1,8 m/sec Product loss constant: 0,095 Wall friction factor: 1,4866E-12 Intake pressure drop pressure discharge: 100 mmWC v-wall / v-susp: 1,75 Filter resistance factor: 1500000 Specific heat content: 0,2 kCal/Kg/C product loss factor constant y/n: n

Filter: Filter area: 116,04 m²

Convey pipeline: Convey distance horizontal: 370 m Convey distance vertical: 30 m-up 0 m-down Convey distance slope: 0 m-up 0 m-down Total conveying length: 400 m Number of Bends: 7 Pipe diameter begin: 200 mm Pipe diameter end: 200 mm

Calculation settings: Predicted capacity: 89,2 tons/tr at 2.5 bar Set capacity: 81,4 tons/hr Pressure: 16000 mmWC Back pressure: 0 mmWC Set pressure drop: 16000 mmWC

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

Calculate

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Calculation Table Pressure Conveying

Client: Mike Kaufman Filepath: c:\Vdmike3.txt Product: Cement

Convey distance horizontal: 370 m Convey distance vertical: 30 m Total conveying length: 400 m Number of Bends: 7 Pump displacement at 2.5 bar(p): 0,967 m³/sec Volumetric efficiency: 88,82 % Booster displacement: 0 m³/sec Rotarylock leakage: 0 m³/sec Gas displacement at end: 1,0038 m³/sec Capacity: 81,4 tons/tr Pressure: 16000 mmWC Back pressure: 0 mmWC Pressure drop: 16000 mmWC Loading ratio: 19,1 Pipeline energy consumption: 2,06 kWh/ton Compressor power: 168 kW Conveying energy: 96,8 kW Pneumatic conveying efficiency: 57,5 % Bend losses: 22,7 kW Material intake loss: 0,46 kW Re-number * 10⁵: 3,921 Empty pipeline pressure drop: 6960 mmWC Empty pipeline filter press. drop: 104 mmWC Material loss factor: 0,0049 Lossfactor at end: 1,4866E-12 Intake pressure drop: 100 mmWC

Table calculation:

Part	Part description	Length(θ) m	v-gas m/sec	v-product m/sec	Pressure drop mmWC	v-wall/v-susp	residence time	mass kg	kW	% kW	Bend loss % kW	Sediment % kW
1	Intake 200 hor	1	13,62	12,55	591	4,92	0,088	1	2,5	2,5		
2	Pipe 200 hor	71,8	13,86	13,89	2263	5,31	5,326	124	7	7,2		
3	Bend		15,54	8,2	2264		5,3658	1	0		1,4	1,4
4	Pipe 200 hor	71,8	15	14,94	4277	5,51	10,3317	117	8,9	9,2		
5	Bend		16,65	8,82	4278		10,3687	0	0		1,6	1,6
6	Pipe 200 hor	71,8	16,58	16,4	6379	5,77	14,9317	107	10,1	10,5		
7	Bend		18,18	9,69	6380		14,9653	0	0		1,9	2
8	Pipe 200 hor	50,27	18,13	17,82	8061	6,01	17,8883	68	8,9	9,2		
9	Diameter Transfer		18,13	17,82	8061		17,8883	0	0			
10	Pipe 200 hor	21,53	18,71	18,35	8618	6,1	19,0794	27	3,1	3,2		
11	Bend		20,27	10,82	8619		19,1096	0	0		2,4	2,5
12	Pipe 200 hor	71,8	21,84	21,16	11095	6,56	22,7276	84	15,3	15,8		
13	Bend		23,35	12,25	11096		22,754	0	0		3,3	3,4
14	Pipe 200 up	0,01	21,89	13,02	11130	6,7	22,755	0	0,2	0,2		
15	Diameter Transfer		21,89	13,02	11130		22,755	0	0			
16	Pipe 200 up	30	28,92	26,58	14715	7,5	24,035	29	27,6	28,5		
17	Bend		30,33	15,69	14717		24,0558	0	0		5,2	5,3
18	Pipe 200 hor	10,01	32,35	30,2	15911	7,91	24,4098	8	11,2	11,5		
19	Bend		33,62	17,98	15912		24,428	0	0		6,6	6,8
20	Outlet		33,62	17,98	15912		24,428		0,6802	NaN		
21	Filter	116,04 m ²	0,5 m/min		16000		24,428		0,8688	0,7	dp = 87 mmWC	

Progress: Filter [Progress Bar] Iteration [Progress Bar]

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Calculation results pressure conveying

Client: Mike Kaufman
 Filepath: c:\V\d\mike3.txt
 Product: Cement

Installation

Convey distance horizontal: 370 m
 Convey distance vertical: 30 m
 Total conveying length: 400 m
 Number of Bends: 7
 Pipe diameter(s): 200, 200 mm
 Compressor displacement: 0.967 m3/sec
 Booster displacement: 0 m3/sec

Calculation results

Capacity: 81.4 tons/hr
 Pressure: 16000 mmWC
 Booster pressure: 0 mmWC
 Back pressure: 0 mmWC
 Pressure drop: 16000 mmWc
 Loading ratio: 19.1
 Empty pipeline pressure: 3960 mmWc
 Residence time: 24.42 seconds
 Re-number * 10⁻⁵: 3.921
 Mixture density: 23.9 kg/m³
 Mass of material in pipeline: 576.5 kg
 Exit dynamic force: 4.25 kN

Pressure drops

Product intake: 100 mmWC
 Nozzle: 591 mmWC
 Acceleration excl product resistance: 4292 mmWC
 Product resistance: 5696 mmWC
 Elevation: 870 mmWC
 Suspension: 2924 mmWC
 Gas: 2097 mmWC
 Filter: 87 mmWC

Energy

(Screwcompressor)
 Compressor power: 168 kW
 No booster
 Pipeline energy consumption/ton: 2,066 kW/Ton

Temperatures

Ambient temperature: 25 degr C
 Outlet temperature compressor: 121 degr C
 No booster
 Material temperature: 40 degr C
 Mixture temperature begin: 44 degr C
 Mixture temperature end: 26 degr C

Table calculation

Begin capacity: 81.4 tons/hr
 Begin pressure: 16000 mmWc
 lowest pressure: 2500 mmWc
 pressure decrement: 675 mmWc

Feeder system

Installation system:
 1-vessel system 3-vessel system screw feeder
 2-vessel system Bulk trailer unloading

Vessel factor: 1000 tons/hr/bar(a) vessel capacity: 384.6 tons/hr
 Nominal capacity: 80 tons/hr
 Vessel volume: 6.2 m³ Vessel content: 5.5 tons
 Vessel product volume: 5 m³ pipe content: 576.5 kgs
 pipevolume: 12.56 m³
 pressure begin pressurizing: -0.05 bar
 pressure valve open: 2 bar
 temperature begin pressurizing: 35 C
 temperature after pressurizing: 60 C
 Pipeline capacity: 81.4 tons/hr
 System capacity at pressure: 72 tons/hr
 pressurizing time: 8 seconds
 Discharging time: 242.9 seconds
 purging time: 18.3 seconds
 Pipeline energy consumption: 2.06 kWh/ton
 System energy consumption: 2.17 kWh/ton
 valve time: 2 seconds
 Total energy consumption: 2.17 kWh/ton
 overaptime: seconds
 filling time: seconds
 cycletime: 271.3 seconds
 Number of kettles/hr: 13.2

Kettle capacity > capacity Calculate system capacity

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Table calculation

Pressure conveying

Client: Mike Kaufman
 Filepath: c:\V\d\mike3.txt
 Product: Cement
 Altitude: 0 m

Convey distance horizontal: 370 m
 Convey distance vertical: 30 m-up 0 m-down
 Total conveying length: 400 m
 Number of Bends: 7
 Pipe diameter begin: 200 mm
 Pipe diameter end: 200 mm

Pump displacement: 0.967 m3/sec (Screwcompressor)
 Booster displacement: 0 m3/sec
 Gas volume end: 1,0492 m3/sec

Two vessel installation 07-20-2009

Table

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Number of kettles/hr	Solid Loading Ratio SLR	gas velocity begin m/sec	gas velocity end m/sec	System energy consumption kWh/ton	residence time seconds	Sediment
1.6	81.4	72.9	13.2	19.1	13.6	33.6	2.18	24.42	No sedimentation
1.55	79.9	71.8	13	18.7	13.9	33.6	2.17	24.04	No sedimentation
1.5	78.4	70.6	12.8	18.3	14.1	33.6	2.16	23.65	No sedimentation
1.45	76.8	69.3	12.6	17.9	14.5	33.6	2.15	23.26	No sedimentation
1.4	75.1	68	12.3	17.5	14.8	33.6	2.15	22.87	No sedimentation
1.35	73.3	66.7	12.1	17	15.1	33.7	2.15	22.48	No sedimentation
1.3	71.5	65.2	11.8	16.5	15.5	33.7	2.15	22.08	No sedimentation
1.25	69.6	63.7	11.5	16.1	15.8	33.7	2.15	21.69	No sedimentation
1.2	67.6	62	11.2	15.6	16.2	33.7	2.16	21.29	No sedimentation
1.15	65.3	60.1	10.9	15	16.6	33.5	2.17	20.92	No sedimentation
1.1	63.2	58.5	10.6	14.5	17	33.7	2.18	20.49	No sedimentation
1.05	60.8	56.5	10.2	13.9	17.5	33.7	2.2	20.08	No sedimentation
1	58.3	54.3	9.8	13.3	17.9	33.7	2.23	19.67	No sedimentation
0.95	55.6	52	9.4	12.6	18.4	33.8	2.27	19.27	No sedimentation
0.9	52.6	49.4	8.9	11.9	18.9	33.8	2.33	18.86	No sedimentation
0.85	49.4	46.6	8.4	11.2	19.5	33.8	2.4	18.44	No sedimentation
0.8	45.9	43.5	7.9	10.4	20	33.8	2.5	18.03	No sedimentation
0.75	42.1	40.1	7.2	9.5	20.6	33.7	2.63	17.61	No sedimentation
0.7	37.8	36.2	6.5	8.5	21.3	33.7	2.83	17.19	No sedimentation
0.65	33	31.8	5.7	7.4	21.9	33.7	3.12	16.77	No sedimentation
0.6	27.8	26.9	4.9	6.2	22.7	33.7	3.58	16.36	No sedimentation

Empty pipeline system pressure drop: 3956 mmWC

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