

Input

Pressure pneumatic conveying calculation Input screen

Client: Mike Kaufman File path: c:\Vdkf400.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 mass: 1,184 kg/sec

Booster: Installed Screwcompressor Predefined screwcompressor Blower data Predefined blower

Gas Volume: m3/sec Injection point: m3/sec

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

Ambient (Compressor intake): Ambient temperature: 25 degr C Ambient pressure: 1000 mbar

Temperatures: Cement temperature: 105 degr C Screwcompressor air cooling: degr C Booster air 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 Product loss factor: 1,4866E-12 Wall friction factor: 0,5 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

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: 88 tons/hr at 2.5 bar Set capacity: 110,3 tons/hr Pressure: 25000 mmWC Back pressure: 0 mmWC Set pressure drop: 25000 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

Filter: Filter area: 50 m2

Buttons: Back to start menu, Calculate

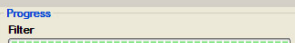

Double tank system

Calculation Table Pressure Conveying

Client: Mike Kaufman Filepath: c:\Vdkf400.txt 5 of 5 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(o): 0,9995 m3/sec Volumetric efficiency: 0 % Booster displacement: 0 m3/sec Rotarylock leakage: 0 m3/sec Gas displacement at end: 1,0079 m3/sec Capacity: 110,3 tons/hr Pressure: 25000 mmWC Back pressure: 0 mmWC Pressure drop: 25000 mmWc Loading ratio: 25,8 Pipeline energy consumption: 2,17 kWh/ton Compressor power: 239 kW Conveying energy: 128,5 kW Pneumatic conveying efficiency: 53,6 % Bend losses: 25,1 kW Material intake loss: 0,34 kW Re-number * 10⁻⁵: 3,918 Empty pipeline pressure drop: 3777 mmWc Empty pipeline filter press. drop: 479 mmWc Material loss factor: 0,012 Lossfactor at end: 1,4866E-12 Intake pressure drop: 100 mmWc

Progress:  Iteration: 

Part	Part description	Length(l) 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	1	11,69	9,26	717	4,04	0,116	3	2,4	1,9		
2	Pipe	2	11,85	11,61	1355	4,98	0,292	5	2,2	1,7		
3	Bend		14,34	6,87	1356		0,3397	1	0		1,3	1
4	Pipe	150	11,27	11,39	6056	4,82	13,7217	444	16,2	12,6		
5	Bend		14,14	6,73	6057		13,7701	1	0		1,2	1
6	Pipe	168,0	15,15	14,87	13088	5,58	26,6012	421	28	21,8		
7	Bend		17,36	8,78	13089		26,6384	1	0		2,2	1,7
8	Pipe	22,01	16,33	15,9	14665	5,77	28,0614	46	7,4	5,8		
9	Bend		18,54	9,1	14666		28,0966	1	0		2,6	2
10	Pipe	27,01	22,37	20,56	20119	6,67	29,6096	48	31,3	24,4		
11	Bend		24,35	12,13	20120		29,6366	0	0		4,2	3,2
12	Pipe	10,01	25	23,23	21679	7,01	30,0896	14	11,1	8,6		
13	Bend		26,8	13,71	21680		30,1134	0	0		5,3	4,1
14	Pipe	20,01	31,81	28,57	24513	7,85	30,8844	24	24	18,7		
15	Bend		33,37	16,97	24515		30,9038	0	0		8	6,2
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
16	Outlet		33,37	16,97	24515		30,9038		0,6709	0,5		
17	Filter	50 m2	1,1	m/min	25000		30,9038		4,6610	3,6	dp = 484	mmWC

Buttons: Back to start menu, Print calculation, Change product, New Calculation, Calculation results

Table calculation

Pressure conveying

Client: Mike Kaufman
 Filepath: c:\V\d\k400.txt
 Product: Cement

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

Mass displ. pump: 1.184 kg/sec (Sonoc choke/turbo)
 Booster displacement: 0 m³/sec
 Gas volume end: 1.0008 m³/sec

Two vessel installation

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	System energy consumption kWh/ton	residence time seconds	Sediment
2.5	110.3	92	16.7	>capacity	25.8	11.6	33.3	2.37	30.9	No sedimentation
2.4	108	90	16.5	>capacity	25.3	11.9	33.2	2.43	30.26	No sedimentation
2.3	105.6	89	16.2	>capacity	24.7	12.3	33.2	2.47	29.62	No sedimentation
2.2	103.1	87	15.9	>capacity	24.2	12.6	33.1	2.53	28.97	No sedimentation
2.1	100.6	86	15.6	>capacity	23.6	12.9	33	2.57	28.31	No sedimentation
2	97.9	84	15.3	>capacity	22.9	13.3	32.9	2.64	27.65	No sedimentation
1.9	95.2	82	14.9	>capacity	22.3	13.7	32.8	2.71	26.98	No sedimentation
1.8	92.3	80	14.6	>capacity	21.6	14.2	32.7	2.78	26.31	No sedimentation
1.7	89.3	78	14.2	>capacity	20.9	14.6	32.6	2.86	25.63	No sedimentation
1.6	86.1	76	13.8	>capacity	20.2	15.1	32.5	2.95	24.94	No sedimentation
1.5	82.8	73	13.3	>capacity	19.4	15.6	32.4	3.08	24.25	No sedimentation
1.4	79.3	70	12.8	>capacity	18.6	16.2	32.3	3.22	23.54	No sedimentation
1.3	75.5	67	12.3	>capacity	17.7	16.8	32.2	3.38	22.83	No sedimentation
1.2	71.3	64	11.7	>capacity	16.7	17.5	32.1	3.55	22.12	No sedimentation
1.1	66.8	61	11.1	>capacity	15.6	18.2	32	3.74	21.4	No sedimentation
1	61.8	56	10.3	>capacity	14.5	18.9	31.8	4.09	20.67	No sedimentation
0.9	56.1	52	9.4	>capacity	13.1	19.6	31.7	4.43	19.93	No sedimentation
0.8	49.5	46	8.4	>capacity	11.6	20.4	31.5	5.03	19.18	No sedimentation
0.7	41.4	39	7.1	>capacity	9.7	21	31.3	5.97	18.43	No sedimentation
0.6	31.4	30	5.4	>capacity	7.3	21.1	31	7.81	17.68	No sedimentation
0.5	18.8	18	3.3	>capacity	4.4	19.7	30.8	13.14	16.94	No sedimentation

Empty pipeline system pressure drop: 3771 mmWC

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

Screwfeeder installation

Calculation results pressure conveying

Client: Mike Kaufman
 Filepath: c:\V\d\k400.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: 0.999 m³/sec
 Booster displacement: 0 m³/sec

Calculation results

Capacity	110.3	tons/hr
Pressure	25000	mmWC
Booster pressure	0	mmWC
Back pressure	0	mmWC
Pressure drop	25000	mmWC
Loading ratio	25.8	
Empty pipeline pressure	3777	mmWC
Residence time	30.9	seconds
Re-number * 10 ⁵	3.918	
Mixture density	31.9	kg/m ³
Mass of material in pipeline	1017.9	kg
Exit dynamic force	5.58	kN

Pressure drops

Product intake	100	mmWC
Nozzle	717	mmWC
Acceleration excl product resistance	5329	mmWC
Product resistance	13984	mmWC
Elevation	1688	mmWC
Suspension	1838	mmWC
Gas	1644	mmWC
Filter	484	mmWC

Energy

(Screwcompressor)
 Compressor power: 239 kW
 Booster power: 0 kW
 Pipeline energy consumption/ton: 2.171 kW/ton

Temperatures

Ambient temperature	25	degr C
Outlet temperature compressor	-273	degr C
Outlet temperature booster	0	degr C
Mixture temperature begin	88	degr C
Mixture temperature end	27	degr C

Table calculation

Begin capacity	110.3	tons/hr
Begin pressure	25000	mmWC
lowest pressure	5000	mmWC
pressure decrement	1000	mmWC

Feeder system

Installation system:
 2-vessel system
 3-vessel system
 screw feeder
 Rotary lock feeder
 silo unloading airslides
 Bulk trailer unloading

Vessel factor: tons/hr/bar(a)
 Vessel capacity: tons/hr

Nominal capacity: tons/hr
 Silo volume: m³
 Silo product volume: 1000 m³
 pipe volume: 12.71 m³

pressure begin pressurizing: bar
 pressure valve open: bar
 temperature begin pressurizing: C
 temperature after pressurizing: C

pressurizing time: seconds
 Silo discharge time: 9.9 hrs
 purging time: seconds
 valve time: seconds
 overlaptime: seconds
 cycltime: seconds
 Number of kettles/hr: -

Pipeline capacity: 110.3 tons/hr
 System capacity at pressure: 110 tons/hr
 Pipeline content: 1017.9 kgs
 Silo content: 1100 tons

Pipeline energy consumption: 2.17 kWh/ton
 System energy consumption: 2.17 kWh/ton
 Feeder energy consumption: 0.97 kWh/ton
 Total energy consumption: 3.14 kWh/ton

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

Table calculation

Pressure conveying

Client: Filepath: Product:

Convey distance horizontal: m Convey distance vertical: m-up m-down Mass displ. pump: kg/sec (Sonoc choke/turbo) Booster displacement: m3/sec

Total conveying length: m Number of Bends: Gas volume end: m3/sec

Pipe diameter begin: mm Pipe diameter end: mm

Screwfeeder installation

Table

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Silo disch time hrs	Solid Loading Ratio SLR	gas velocity begin m/sec	gas velocity end m/sec	System energy consumption kWh/Ton	residence time seconds	Sediment
2.5	110.3	110	9.96	25.8	11.6	33.3	3.14	30.9	No sedimentation
2.4	108	108	10.18	25.3	11.9	33.2	3.15	30.26	No sedimentation
2.3	105.6	105	10.41	24.7	12.3	33.2	3.16	29.62	No sedimentation
2.2	103.1	103	10.66	24.2	12.6	33.1	3.17	28.97	No sedimentation
2.1	100.6	100	10.93	23.6	12.9	33	3.19	28.31	No sedimentation
2	97.9	97	11.22	22.9	13.3	32.9	3.22	27.65	No sedimentation
1.9	95.2	95	11.55	22.3	13.7	32.8	3.25	26.98	No sedimentation
1.8	92.3	92	11.91	21.6	14.2	32.7	3.29	26.31	No sedimentation
1.7	89.3	89	12.31	20.9	14.6	32.6	3.34	25.63	No sedimentation
1.6	86.1	86	12.76	20.2	15.1	32.5	3.4	24.94	No sedimentation
1.5	82.8	82	13.27	19.4	15.6	32.4	3.47	24.25	No sedimentation
1.4	79.3	79	13.87	18.6	16.2	32.3	3.56	23.54	No sedimentation
1.3	75.5	75	14.56	17.7	16.8	32.2	3.67	22.83	No sedimentation
1.2	71.3	71	15.4	16.7	17.5	32.1	3.82	22.12	No sedimentation
1.1	66.8	66	16.44	15.6	18.2	32	4.01	21.4	No sedimentation
1	61.8	61	17.77	14.5	18.9	31.8	4.26	20.67	No sedimentation
0.9	56.1	56	19.57	13.1	19.6	31.7	4.62	19.93	No sedimentation
0.8	49.5	49	22.2	11.6	20.4	31.5	5.15	19.18	No sedimentation
0.7	41.4	41	26.51	9.7	21	31.3	6.05	18.43	No sedimentation
0.6	31.4	31	34.99	7.3	21.1	31	7.86	17.68	No sedimentation
0.5	18.8	18	58.26	4.4	19.7	30.8	12.93	16.94	No sedimentation

Empty pipeline system pressure drop: mmWC

1st June 2009