

# Flyash conveying 1.2 km

Pressure pneumatic conveying calculation Input screen

Client:  File path: Quick modeling Product: Fly ash

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: 1,916 m<sup>3</sup>/sec

Boosters:  Installed  
 Screwcompressor  
 Predefined screwcompressor  
 Blower data  
 Predefined blower

Gas Volume: m<sup>3</sup>/sec  
 Injection point:

Rotary lock feeder:  Install  
 Capacity: tons/hr  
 Lock volume: m<sup>3</sup>  
 RPM: /min  
 Leakage: m<sup>3</sup>/sec

Eductor feeder:  No

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Ambient (Compressor intake)  
 Ambient temperature: 35 degr C  
 Intake temperature: 35 degr C  
 Ambient pressure: 1000 mbar  
 Relative Humidity: 80 %  
 Altitude: 0 m  
 Altitude pressure: 1013 mbar  
 Override RH air density calculation for >373 degrC and >220 bar

Temperatures  
 Fly ash temperature: 150 degr C  
 Compressor gas cooling  
 Booster gas cooling  
 Heat transmission factor pipewall: 0,1 kCal/sec/degC/m<sup>2</sup>

Material properties  
 Fly ash particle density: 2270 kg/m<sup>3</sup>  
 Bulk density: 970 kg/m<sup>3</sup>  
 Particle size <mesh>: 30 micron  
 Suspension velocity: 1,29 m/sec  
 Product loss constant: 4,58E-12  
 Wall friction factor: 0,5  
 Material intake pressure drop: 0 mmWC  
 v-wall / v-susp: 2,1  
 Filter resistance factor: 1500000  
 Specific heat content: 0,25 kCal/kg/C  
 product loss factor constant y/n

Filter  
 Filter area: 230,00 m<sup>2</sup>  
 Filter exhaust fan

Change product

Convey pipeline  
 Convey distance horizontal: 1180 m  
 Convey distance vertical: 20 m-up 0 m-down  
 Convey distance slope: 0 m-up 0 m-down  
 Total conveying length: 1200 m  
 Number of Bends: 10  
 Pipe diameter begin: 304 mm  
 Pipe diameter end: 304 mm

Calculate empty pipeline pressure drop: 5003 mmWC

Calculation settings  
 Set capacity: 142 tons/hr  
 Conveying pressure: 27500 mmWC 2,75 bar  
 Back pressure: 0 mmWC 0 bar  
 Set pressure drop: 27500 mmWC 2,75 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

Calculate

Calculation Table Pressure Conveying

Client:  Filepath: Quick modeling Product: Fly ash

Convey distance horizontal: 1180 m  
 Convey distance vertical: 20 m  
 Total conveying length: 1200 m  
 Number of Bends: 10  
 Compr. displ: 1,8981 m<sup>3</sup>/sec  
 Volumetric efficiency: 83,18 %  
 Booster displacement: 0 m<sup>3</sup>/sec  
 Rotarylock leakage: 0 m<sup>3</sup>/sec  
 Gas displacement at end: 1,8797 m<sup>3</sup>/sec

Capacity: 142,2 tons/hr at 27500 mmWC 2,75 bar  
 Back pressure: 0 mmWC 0 bar  
 Pressure drop: 27500 mmWC 2,75 bar  
 Loading ratio: 18,1

Pipeline energy consumption: 3,1 kWh/ton  
 Compressor power: 441 kW  
 Conveying energy: 253,9 kW  
 Pneumatic conveying efficiency: 57,5 %  
 Bend losses: 33,3 kW  
 Material intake loss: 0 kW

Re-number: 4,822 \* 10<sup>-5</sup>  
 Empty pipeline pressure drop: 4531 mmWC  
 Empty pipeline filter press. drop: 117 mmWC

Material loss factor constant: 0,0132  
 Material Loss factor: 4,58E-12  
 Material intake pressure drop: 0 mmWC

Progress  
 Filter:   
 Iteration:

Table calculation

Part	Part description	Length(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	% kW	Sediment	RH%
1	Intake 304	1	9,5	8,91	265	2,72	5,23	0,1264	4	155	1,8	0,7				0
2	Pipe 304	146,1	8,83	8,53	2648	2,48	5,28	16,4683	677	66	15	5,9				57
3	Bend		10,59	4,37	2649	2,48		16,5815	5	66	0		1	0,4		
4	Pipe 304	146,1	8,87	8,33	5276	2,22	5,38	34,1136	729	43	15,7	6,1				98
5	Bend		10,74	4,27	5276	2,22		34,2296	5	43	0		1	0,3		
6	Pipe 304	146,1	9,43	8,9	7983	1,95	5,53	51,1915	703	37	16,7	6,6				99
7	Bend		11,32	4,56	7984	1,95		51,3001	5	37	0		1,1	0,4		
8	Pipe 304	146,1	10,31	9,91	10810	1,66	5,7	66,7851	639	35	19	7,4				97
9	Bend		12,17	5,08	10811	1,66		66,8826	4	35	0		1,4	0,5		
10	Pipe 304	146,1	11,51	11,03	13761	1,37	6,01	80,8377	573	35	22	8,6				88
11	Bend		13,4	5,65	13762	1,37		80,9253	4	35	0		1,7	0,6		
12	Pipe 304	68,37	12,27	11,75	15325	1,21	6,19	86,9153	244	35	12,8	5				83
13	Diameter Transfer		12,27	11,75	15325	1,21		86,9153			0	0				
14	Pipe 304	77,75	13,16	12,58	16897	1,06	6,4	93,3103	260	35	13,8	5,4				77
15	Bend		15,1	6,45	16897	1,06		93,3871	3	35	0		2,3	0,9		
16	Pipe 304	146,1	15,7	14,94	20350	0,71	6,97	104,0411	431	34	34,5	13,5				64
17	Bend		17,72	7,65	20350	0,71		104,1058	2	35	0		3,2	1,2		
18	Pipe 304	146,1	20,41	19,26	24425	0,3	7,91	112,7548	347	34	51	20				48
19	Bend		22,67	9,44	24426	0,3		112,806	2	35	0		5,5	2,1		
20	Pipe 304	0	21,05	10,35	24452	0,3	8,14	112,807	0	35	0,3	0,1				48
21	Diameter Transfer		21,05	10,35	24452	0,3		112,807			0	0				
22	Pipe 304	20,02	24,28	22,21	26563	0,09	8,61	113,786	39	34	33,1	13				40
23	Bend		26,58	11,38	26564	0,09		113,8297	1	34	0		7,1	2,8		
24	Pipe 304	10	26,23	24,53	27405	0	8,94	114,2567	16	34	15	5,9				37
25	Bend		28,65	12,89	27406	0		114,2957	1	34	0		8,6	3,3		
26	Outlet		28,65	12,89	27406	0		114,2957			0,8934	0,3				37
27	After Filter	230,0	0,4	m/min	27500	-0,01		114,2957			1,7492	0,6	dp = 93			36

Condensation: 120,67 ltrs/hr

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Calculation results pressure conveying

Client:

Filepath: Quick modeling

Product: Fly ash

Installation

Convey distance horizontal: 1180 m

Convey distance vertical: 20 m

Total conveying length: 1200 m

Number of Bends: 10

Pipe diameter(s): 304 mm

Compressor displacement: 1,916 m3/sec

Booster displacement: 0 m3/sec

Total gas displacement: 1,916 m3/sec

Calculation results

Capacity: 142.2 tons/hr

Pressure: 27500 mmWC 2,75 bar

Booster pressure: 0 mmWC 0 bar

Back pressure: 0 mmWC 0 bar

Pressure drop: 27500 mmWC 2,75 bar

Loading ratio: 18,1

Volumetric loading ratio: 0,0261 to 0,0099

Empty pipeline pressure: 4831 mmWc

Residence time: 114,29 seconds

Re-number \* 10<sup>-5</sup>: 4,822

Mixture density: 22,7 kg/m<sup>3</sup>

Mass of material in pipeline: 4707,2 kg

Exit dynamic force: 6,78 kN

Pressure drops

Product intake: 0 mmWC 0 %

Nozzle (total dp): 265 mmWC 0,9 %

Acceleration excl product dp: 3342 mmWC 12,1 %

Product resistance: 15839 mmWC 57,5 %

Elevation: 489 mmWC 1,7 %

Suspension: 5725 mmWC 20,8 %

Gas: 2057 mmWC 7,4 %

Filter: 93 mmWC 0,3 %

Energy (Screwcompressor)

Compressor power: 441 kW

Mechanical efficiency: 90 %

No booster

Product loss energy pipes -> heat: 1,028 kW/Ton

Product loss energy bends -> heat: 0,234 kW/Ton

Pipeline energy consumption/Ton: 3,104 kW/Ton

Temperatures

Ambient temperature: 35 degr C

Outlet temperature compressor: 265 degr C

Outlet temperature eductor: degr C

No booster

Material temperature: 150 degr C

Mixture temperature begin: 155 degr C

Mixture temperature end: 34 degr C

Table calculation

Begin capacity: 142,2 tons/hr

Begin pressure: 27500 mmWc

lowest pressure: 2500 mmWc

pressure decrement: 1250 mmWc

Kettle capacity > capacity -> extra air valve active

Calculate system capacity

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Table calculation

Client:

Filepath: Quick modeling

Product: Fly ash

MM-DD-YY: 11-01-2010

Convey distance horizontal: 1180 m

Convey distance vertical: 20 m-up m-down

Total conveying length: 1200 m

Number of Bends: 10

Altitude: 0 m

Pipe diameter begin: 304 mm

Pipe diameter end: 304 mm

Pump displacement: 1,916 m3/sec (Screwcompressor)

Booster displacement: 0 m3/sec

Gas volume end: 2,0737 m3/sec 2,346 kg/sec at 0,75 bar

Two vessel installation

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Number of kettles/tr	< 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
2,75	142,2	118,4	6,1	>capacity	18,1	9,5	28,6	4707,1	3,38	114,29	No sedimentation	Condensation
2,65	139,9	117,1	6	>capacity	17,8	9,7	28,7	4514,2	3,35	111,66	No sedimentation	Condensation
2,55	137,5	115,7	5,9	>capacity	17,4	10,1	28,7	4322,4	3,31	109,02	No sedimentation	Condensation
2,45	135,1	114,3	5,8	>capacity	17	10,4	28,8	4131	3,28	106,35	No sedimentation	Condensation
2,35	132,5	112,7	5,8	>capacity	16,6	10,7	28,8	3943,5	3,25	103,71	No sedimentation	Condensation
2,25	129,9	111,1	5,7	>capacity	16,2	11,1	28,9	3757,5	3,23	101,07	No sedimentation	Condensation
2,15	127,1	109,3	5,6	>capacity	15,8	11,5	29	3572,6	3,2	98,42	No sedimentation	Condensation
2,05	124,2	107,4	5,5	>capacity	15,4	11,9	29,1	3389,4	3,18	95,76	No sedimentation	Condensation
1,95	121,2	105,4	5,4	>capacity	14,9	12,4	29,1	3207,2	3,16	93,08	No sedimentation	Condensation
1,85	118	103,2	5,3	>capacity	14,5	12,9	29,2	3026	3,14	90,4	No sedimentation	Condensation
1,75	114,6	100,8	5,2	>capacity	14	13,4	29,3	2844,3	3,13	87,7	No sedimentation	Condensation
1,65	111	98,3	5	>capacity	13,5	14	29,3	2664,3	3,12	84,98	No sedimentation	Condensation
1,55	107,1	95,5	4,9	>capacity	13	14,6	29,4	2484,3	3,12	82,27	No sedimentation	Condensation
1,45	103	92,4	4,7	>capacity	12,4	15,3	29,5	2304,3	3,13	79,53	No sedimentation	Condensation
1,35	98,5	89	4,5	>capacity	11,8	16	29,6	2123,6	3,15	76,79	No sedimentation	Condensation
1,25	93,6	85,1	4,3	>capacity	11,2	16,8	29,6	1941,5	3,19	74,04	No sedimentation	Condensation
1,15	88,2	80,7	4,1	>capacity	10,5	17,7	29,7	1756,3	3,26	71,26	No sedimentation	Condensation
1,05	81,9	75,6	3,9	>capacity	9,7	18,6	29,8	1565,5	3,36	68,44	No sedimentation	Condensation
0,95	74,6	69,5	3,5	>capacity	8,8	19,7	29,8	1369,3	3,53	65,58	No sedimentation	Condensation
0,85	65,7	61,8	3,1	>capacity	7,7	20,8	29,9	1160,9	3,83	62,7	No sedimentation	Condensation
0,75	53,8	51,2	2,6	>capacity	6,2	22,1	29,9	925	4,46	59,68	No sedimentation	Condensation

Empty pipeline system pressure drop: 4826 mmWC

Filter without exhaust fan

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