

Calculation for Aerzen screwcompressor

Pressure pneumatic conveying calculation Input screen

Client: Forum File path: c:\Vd\fa356.txt Product: Fly ash

Gas medium: Air Nitrogen

Gas pump: Screwcompressor 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: 0,5 m3/sec

Boosted: Installed Capacity: tons/hr
 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 degrC and >220 bar

Temperatures:
 Fly ash 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:
 Fly ash particle density: 2270 kg/m3
 Bulk density: 970 kg/m3
 Particle size <mesh>: 30 micron
 Suspension velocity: 1,29 m/sec
 Product loss constant:
 Product loss factor: 4,58E-12
 Wall friction factor: 0,5
 Material intake pressure drop: 100 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: 60 m2 Filter exhaust fan

Convey pipeline:
 Convey distance horizontal: 10 m
 Convey distance vertical: 35 m-up 0 m-down
 Convey distance slope: 0 m-up 0 m-down
 Total conveying length: 45 m
 Number of Bends: 3
 Pipe diameter: begin 154 mm end 154 mm
 Gussed air only pressure drop: mmWC
 Re-/Calculate empty pipeline pressure: mmWC

Calculation settings:
 Set capacity: 60 tons/hr
 Conveying pressure: 11760 mmWC 1,17 bar
 Back pressure: 0 mmWC 0 bar
 Set pressure drop: 11760 mmWC 1,17 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

Back to start menu

Calculation Table Pressure Conveying

Client: Forum File path: c:\Vd\fa356.txt Product: Fly ash

Convey distance horizontal: 10 m
 Convey distance vertical: 35 m
 Total conveying length: 45 m
 Number of Bends: 3
 Compr. displ. 1.17 bar: 0,5224 m3/sec
 Volumetric efficiency: 91,41 %
 Booster displacement: 0 m3/sec
 Rotarylock leakage: 0 m3/sec
 Gas displacement at end: 0,5415 m3/sec

Capacity: 60 tons/hr at 11760 mmWC 1,17 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 11760 mmWC 1,17 bar
 Loading ratio: 26,9

Pipeline energy consumption: 1,22 kWh/ton
 Compressor power: 73 kW
 Conveying energy: 42,9 kW
 Pneumatic conveying efficiency: 58,1 %
 Bend losses: 8,8 kW Material intake loss: 0,28 kW

Re-number: 2,613 * 10⁵
 Empty pipeline pressure drop: 718 mmWC
 Empty pipeline filter press. drop: 108 mmWC
 Material loss factor constant: 0,0204
 Material Loss factor: 4,58E-12
 Material intake pressure drop: 100 mmWC

Progress: Filter Iteration

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's
1	Intake 154 hor	1	14,17	12,85	740	1,1	6,52	0,0891	1	43	1,9	4,6				58
2	Pipe 154 hor	4,01	15,47	14,3	1230	1,05	7,05	0,3741	5	42	1,3	3				60
3	Bend		18,04	6,92	1231	1,05		0,4067	0	42	0		1,3	3		
4	Pipe 154 up	35,01	25,69	22,72	9944	0,18	8,97	2,4217	35	36	30,2	70,4				47
5	Bend		28,06	11,44	9945	0,18		2,442	0	36	0		3,2	7,4		
6	Pipe 154 hor	5	29,8	26,45	11661	0	9,64	2,647	3	35	8,5	19,8				42
7	Bend		32,1	13,46	11662	0		2,6643	0	36	0		4,3	10		
8	Outlet		32,1	13,46	11662	0		2,6643		36	0,3214	0,7				41
9	After Filter	60	0,5	m/min	11760	-0,01		2,6643			0,5269	1,2	dp = 98			41

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Calculation results pressure conveying

Client: Forum
 Filepath: c:\vdfa356.txt
 Product: Fly ash

Installation

Convey distance horizontal: 10 m
 Convey distance vertical: 35 m
 Total conveying length: 45 m
 Number of Bends: 3
 Pipe diameter(s): 154 mm
 Compressor displacement: 0,5 m3/sec, 0,586 kg/sec
 Booster displacement: 0 m3/sec, 0 kg/sec
 Total gas displacement: 0,5 m3/sec, 0,586 kg/sec

Calculation results

Capacity: 60 tons/hr
 Pressure: 11760 mmWC, 1,17 bar
 Booster pressure: 0 mmWC, 0 bar
 Back pressure: 0 mmWC, 0 bar
 Pressure drop: 11760 mmWC, 1,17 bar
 Loading ratio: 26,9
 Volumetric loading ratio: 0,0306 to 0,0154
 Empty pipeline pressure: 718 mmWC
 Residence time: 2,66 seconds
 Re-number * 10⁻⁵: 2,613
 Mixture density: 33 kg/m³
 Mass of material in pipeline: 46,4 kg
 Exit dynamic force: 3,17 kN

Pressure drops

Product intake: 100 mmWC, 0,8 %
 Nozzle (total dp): 740 mmWC, 6,2 %
 Acceleration excl product dp: 2843 mmWC, 24,1 %
 Product resistance: 4535 mmWC, 38,5 %
 Elevation: 1685 mmWC, 14,3 %
 Suspension: 2148 mmWC, 18,2 %
 Gas: 409 mmWC, 3,4 %
 Filter: 98 mmWC, 0,8 %

Energy (Screwcompressor)

Compressor power: 73 kW
 Mechanical efficiency: 90 %

No booster

Product loss energy pipes -> heat: 0,275 kW/ton
 Product loss energy bends -> heat: 0,147 kW/ton
 Pipeline energy consumption/ton: 1,229 kW/ton

Temperatures

Ambient temperature: 25 degr C
 Outlet temperature compressor: 147 degr C
 Outlet temperature eductor: degr C

No booster

Material temperature: 40 degr C
 Mixture temperature begin: 43 degr C
 Mixture temperature end: 36 degr C

Table calculation

Begin capacity: 60 tons/hr
 Begin pressure: 12000 mmWC
 lowest pressure: 2000 mmWC
 pressure decrement: 500 mmWC

Kettle capacity > capacity --> extra air valve active

Calculate system capacity

Back to start menu | Print calculation result | New Calculation

Table calculation

Client: Forum | Filepath: c:\vdfa356.txt | Product: Fly ash | MM-DD-YY: 11-09-2010

Convey distance horizontal: 10 m
 Convey distance vertical: 35 m-up, m-down
 Total conveying length: 45 m
 Number of Bends: 3
 Altitude: 0 m
 Pipe diameter begin: 154 mm
 Pipe diameter end: 154 mm

Pump displacement: 0,5 m3/sec (Screwcompressor)
 Booster displacement: 0 m3/sec
 Gas volume end: 0,5555 m3/sec, 0,646 kg/sec at 0,2 bar

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	mass in pipeline kg	System energy consumption kWh/ton	residence time seconds	Sediment	Condensation
1.2	60,6	53	54,6	>capacity	27,2	14	32,1	47,4	1,29	2,68	No sedimentation	No condensation
1.15	59,3	52	53,6	>capacity	26,5	14,3	32	45,4	1,29	2,63	No sedimentation	No condensation
1.1	57,9	51	52,6	>capacity	25,9	14,7	32	43,5	1,3	2,59	No sedimentation	No condensation
1.05	56,5	49,9	51,5	>capacity	25,2	15,1	31,9	41,5	1,3	2,54	No sedimentation	No condensation
1	55,1	48,8	50,3	>capacity	24,5	15,5	31,9	39,6	1,31	2,49	No sedimentation	No condensation
0.95	53,6	47,6	49,1	>capacity	23,8	16	31,8	37,7	1,32	2,44	No sedimentation	No condensation
0.9	52	46,4	47,9	>capacity	23	16,4	31,8	35,8	1,33	2,39	No sedimentation	No condensation
0.85	50,4	45,1	46,5	>capacity	22,3	16,9	31,7	33,9	1,35	2,35	No sedimentation	No condensation
0.8	48,7	43,8	45,1	>capacity	21,5	17,5	31,7	32	1,36	2,3	No sedimentation	No condensation
0.75	46,9	42,3	43,6	>capacity	20,6	18	31,6	30,1	1,39	2,25	No sedimentation	No condensation
0.7	44,9	40,8	42	>capacity	19,7	18,6	31,5	28,2	1,41	2,2	No sedimentation	No condensation
0.65	42,9	39,1	40,3	>capacity	18,8	19,3	31,5	26,2	1,45	2,15	No sedimentation	No condensation
0.6	40,8	37,3	38,5	>capacity	17,8	19,9	31,4	24,3	1,49	2,1	No sedimentation	No condensation
0.55	38,4	35,4	36,5	>capacity	16,7	20,6	31,3	22,3	1,54	2,06	No sedimentation	No condensation
0.5	35,9	33,2	34,3	>capacity	15,6	21,4	31,2	20,3	1,61	2,01	No sedimentation	No condensation
0.45	33,1	30,8	31,8	>capacity	14,3	22,2	31,1	18,3	1,7	1,96	No sedimentation	No condensation
0.4	30	28,2	29	>capacity	12,9	23,1	30,9	16,1	1,82	1,92	No sedimentation	No condensation
0.35	26,6	25,1	25,9	>capacity	11,4	24	30,8	13,9	2,01	1,87	No sedimentation	No condensation
0.3	22,7	21,6	22,3	>capacity	9,7	25	30,6	11,6	2,29	1,83	No sedimentation	No condensation
0.25	18,3	17,6	18,2	>capacity	7,8	26,1	30,4	9,1	2,75	1,79	No sedimentation	No condensation
0.2	13,4	13	13,4	>capacity	5,7	27,3	30,1	6,5	3,66	1,75	No sedimentation	No condensation

Empty pipeline system pressure drop: 716 mmWC | Filter without exhaust fan

Back to start menu | Print table | New Calculation

Calculation for Aerzen Blower

Pressure pneumatic conveying calculation Input screen

Client: Forum File path: c:\v\dfa356.txt Product: Fly ash

Gas medium: Air Nitrogen

Gas pump: Screwcompressor Blower Compressor data Predefined screwcompressor Blower data 1x Blower GM35S 3150 rpm Constant mass pump (sonic choke/turbo) Centrifugal fan

Maximum compressor pressure: 1 bar
Maximum conveying pressure: mmWC
Gas volume: 0,508 m3/sec

Boosters: 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 degC Altitude: 0 m Intake temperature: 25 degC Altitude pressure: 1013 mbar Ambient pressure: 1000 mbar 1 bar Relative Humidity: 80 %

Temperatures: Fly ash temperature: 40 degC Pressure dewpoint: Compressor gas cooling: degC Dryer: degC Booster gas cooling: degC Dryer: degC Heat transmission factor pipewall: 0,1 kCal/sec/degC/m2

Material properties: Fly ash particle density: 2270 kg/m3 Bulk density: 970 kg/m3 Particle size <mesh>: 30 micron Suspension velocity: 1,29 m/sec Product loss constant: Product loss factor: 4,58E-12 Wall friction factor: 0,5 Material intake pressure drop: 100 mmWC v-wall / v-susp: 2,1 Filter resistance factor: 1500000 Specific heat content: 0,25 kCal/kg/C

Convey pipeline: Convey distance horizontal: 10 m Convey distance vertical: 35 m-up 0 m-down Convey distance slope: 0 m-up 0 m-down Total conveying length: 45 m Number of Bends: 3 Pipe diameter: begin 154 mm end 154 mm Gussed air only pressure drop: mmWC Re-/Calculate empty pipeline pressure: mmWC

Calculation settings: Set capacity: 54,8 tons/hr Conveying pressure: 10000 mmWC 1 bar Back pressure: 0 mmWC 0 bar Set pressure drop: 10000 mmWC 1 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: Forum Filepath: c:\v\dfa356.txt Product: Fly ash

Convey distance horizontal: 10 m Convey distance vertical: 35 m Total conveying length: 45 m Number of Bends: 3

Capacity: 54,8 tons/hr at 10000 mmWC 1 bar Back pressure: 0 mmWC 0 bar Pressure drop: 10000 mmWC 1 bar Loading ratio: 25,3

Pipeline energy consumption: 1,21 kWh/ton Compressor power: 66 kW Conveying energy: 37,1 kW Pneumatic conveying efficiency: 55,5 % Bend losses: 8 kW Material intake loss: 0,3 kW

Re-number: 2,545 * 10⁵ Empty pipeline pressure drop: 650 mmWC Empty pipeline filter press. drop: 113 mmWC Material loss factor constant: 0,017 Material Loss factor: 4,58E-12 Material intake pressure drop: 100 mmWC

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 degC	kW	% kW	Bend loss kW	Sediment % kW	RH%
1	Intake 154 hor	1	14,98	13,55	707	0,92	6,6	0,0852	1	43	1,9	5,3			55
2	Pipe 154 hor	4	16,17	15	1116	0,88	7,06	0,3562	4	42	1,1	3,1			57
3	Bend		18,43	7,29	1116	0,88		0,3872	0	42	0		1,3	3,5	
4	Pipe 154 up	35,01	25,44	22,65	8475	0,15	8,77	2,3442	31	35	26,2	70,6			48
5	Bend		27,57	11,42	8475	0,15		2,3645	0	35	0		2,9	7,8	
6	Pipe 154 hor	5,02	28,84	25,88	9906	0	9,32	2,5735	3	35	6,9	18,7			44
7	Bend		30,91	13,17	9907	0		2,5912	0	35	0		3,7	10,1	
8	Outlet		30,91	13,17	9907	0		2,5912		35	0,2896	0,7			43
9	After Filter	60	0,5	m/min	10000	-0,01		2,5912		0,4818	1,2		dp = 92		43

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

Calculation results pressure conveying

Client: Forum
 Filepath: c:\vdfa356.txt
 Product: Fly ash

Installation

Convey distance horizontal: 10 m
 Convey distance vertical: 35 m
 Total conveying length: 45 m
 Number of Bends: 3
 Pipe diameter(s): 154 mm
 Compressor displacement: 0,508 m3/sec, 0,596 kg/sec
 Booster displacement: 0 m3/sec, 0 kg/sec
 Total gas displacement: 0,508 m3/sec, 0,596 kg/sec

Calculation results

Capacity: 54,8 tons/hr
 Pressure: 10000 mmWC, 1 bar
 Booster pressure: 0 mmWC, 0 bar
 Back pressure: 0 mmWC, 0 bar
 Pressure drop: 10000 mmWC, 1 bar
 Loading ratio: 25,3
 Volumetric loading ratio: 0,0265 to 0,0143
 Empty pipeline pressure: 750 mmWc
 Residence time: 2,59 seconds
 Re-number * 10⁻⁵: 2,545
 Mixture density: 31,1 kg/m³
 Mass of material in pipeline: 41 kg
 Exit dynamic force: 2,77 kN

Pressure drops

Product intake: 100 mmWC, 0,9 %
 Nozzle (total dp): 707 mmWC, 7 %
 Acceleration excl product dp: 2548 mmWC, 25,4 %
 Product resistance: 3528 mmWC, 35,2 %
 Elevation: 1493 mmWC, 14,9 %
 Suspension: 1889 mmWC, 18,8 %
 Gas: 403 mmWC, 4 %
 Filter: 92 mmWC, 0,9 %

Energy

(Blower 1x GM35S 3150 rpm)
 Compressor power: 66 kW
 Mechanical efficiency: 95 %

No booster
 Product loss energy pipes -> heat: 0,238 kW/ton
 Product loss energy bends -> heat: 0,146 kW/ton
 Pipeline energy consumption/ton: 1,217 kW/ton

Temperatures

Ambient temperature: 25 degr C
 Outlet temperature compressor: 124 degr C
 Outlet temperature eductor: degr C

No booster
 Material temperature: 40 degr C
 Mixture temperature begin: 43 degr C
 Mixture temperature end: 35 degr C

Table calculation

Begin capacity: 54,8 tons/hr
 Begin pressure: 10000 mmWC
 lowest pressure: 1000 mmWC
 pressure decrement: 450 mmWC

Kettle capacity > capacity --> extra air valve active

Calculate system capacity

Back to start menu | Print calculation result | New Calculation

Table calculation

Client: Forum
 Filepath: c:\vdfa356.txt
 Product: Fly ash
 MM-DD-YY: 11-09-2010

Convey distance horizontal: 10 m
 Convey distance vertical: 35 m-up, m-down
 Total conveying length: 45 m
 Number of Bends: 3
 Altitude: 0 m
 Pipe diameter begin: 154 mm
 Pipe diameter end: 154 mm

Pump displacement: 0,508 m3/sec (Blower 1x GM35S 3150 rpm)
 Booster displacement: 0 m3/sec
 Gas volume end: 0,5689 m3/sec, 0,666 kg/sec at 0,1 bar

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	mass in pipeline kg	System energy consumption kWh/ton	residence time seconds	Sediment	Condensation
1	54,8	48,6	50,1	>capacity	25,3	14,9	30,9	41	1,27	2,59	No sedimentation	No condensation
0,955	53,5	47,6	49,1	>capacity	24,6	15,3	30,9	39,2	1,25	2,54	No sedimentation	No condensation
0,91	52,2	46,5	48	>capacity	23,9	15,8	30,9	37,4	1,22	2,49	No sedimentation	No condensation
0,865	50,7	45,4	46,8	>capacity	23,1	16,2	30,9	35,5	1,2	2,44	No sedimentation	No condensation
0,82	49,3	44,3	45,6	>capacity	22,3	16,7	30,9	33,7	1,17	2,39	No sedimentation	No condensation
0,775	47,7	43	44,3	>capacity	21,5	17,2	30,9	31,9	1,15	2,34	No sedimentation	No condensation
0,73	46,1	41,7	43	>capacity	20,7	17,8	30,9	30,1	1,12	2,29	No sedimentation	No condensation
0,685	44,3	40,3	41,5	>capacity	19,8	18,3	30,9	28,3	1,1	2,24	No sedimentation	No condensation
0,64	42,5	38,8	40	>capacity	18,9	18,9	30,8	26,5	1,07	2,19	No sedimentation	No condensation
0,595	40,5	37,2	38,3	>capacity	18	19,5	30,8	24,6	1,05	2,14	No sedimentation	No condensation
0,55	38,5	35,4	36,5	>capacity	17	20,2	30,8	22,8	1,03	2,09	No sedimentation	No condensation
0,505	36,2	33,5	34,5	>capacity	15,9	20,9	30,8	20,9	1,01	2,05	No sedimentation	No condensation
0,46	33,7	31,4	32,4	>capacity	14,7	21,7	30,8	19	1	2	No sedimentation	No condensation
0,415	31,1	29,1	30	>capacity	13,5	22,5	30,7	17	0,99	1,95	No sedimentation	No condensation
0,37	28,1	26,5	27,3	>capacity	12,1	23,3	30,7	15	0,99	1,91	No sedimentation	No condensation
0,325	24,8	23,5	24,2	>capacity	10,6	24,2	30,6	12,9	1	1,86	No sedimentation	No condensation
0,28	21	20,1	20,7	>capacity	8,9	25,2	30,5	10,7	1,04	1,82	No sedimentation	No condensation
0,235	16,9	16,3	16,8	>capacity	7,1	26,2	30,4	8,3	1,12	1,78	No sedimentation	No condensation
0,19	12,3	12	12,4	>capacity	5,1	27,2	30,3	5,9	1,31	1,75	No sedimentation	No condensation
0,145	7,4	7,3	7,5	>capacity	3,1	28,3	30,2	3,5	1,78	1,71	No sedimentation	No condensation
0,1	2,3	2,3	2,3	>capacity	0,9	29,4	30,2	1	4,48	1,69	No sedimentation	No condensation

Empty pipeline system pressure drop: 748 mmWC
 Filter without exhaust fan

Back to start menu | Print table | New Calculation