

Calculation for flyash conveying 2

Blower calculation

Aerzen Blowers

Type	q0	qv 100	rpm	No load kW
GM3S	1.016	0.42	4800	0.42
GM4S	1.38	0.51	4800	0.56
GM7L	2.07	0.75	4800	1.0
GM10S	2.8	0.77	4800	1.4
GM15L	4.14	1.1	4800	2.1
GM25S	5.63	1.08	4800	3.5
GM30L	7.96	1.56	4800	4.2
GM35S	11.36	1.6	3800	4.9
GM50L	16.04	2.1	3800	7
GM60S	21.71	2.7	3800	8.4
GM80L	30.8	4	3000	11.2
GM90S	41.52	3.8	2400	12.5
GM130L	60.4	6.3	2400	18
GM150S	90.7	6.5	1900	20
GM220L	131.6	10	1900	30
GM240S	232	14	1220	30

Show blower data

Table calculation

Blower type: 1 x GM35S

Pressure	Q1 m3/sec	Q1 m3/min	Mass displ. kg/sec	Vol. Eff %	d(temp) degr.C	Outlet temp degr.C	Power kW
0	0.596	35.7	0.706	100	0	25	4
1000	0.568	34.1	0.673	95.3	8	33	10.3
2000	0.556	33.4	0.659	93.3	17	42	16.6
3000	0.548	32.8	0.649	91.9	27	52	22.8
4000	0.54	32.4	0.64	90.6	37	62	29.1
5000	0.534	32	0.632	89.5	46	71	35.4
6000	0.528	31.6	0.625	88.5	56	81	41.7
7000	0.522	31.3	0.619	87.6	67	92	48
8000	0.517	31	0.613	86.7	77	102	54.2
9000	0.512	30.7	0.607	85.9	87	112	60.5
10000	0.508	30.4	0.602	85.2	98	123	66.8

Table calculation

Data

Air

q0 per revolution: 11.36 dm3/rev
 qv 100: 1.6 m3/min/100 mbar
 No load power at nominal rpm: 4.9 kW
 RPM nominal: 3800 /min
 RPM actual: 3150 /min
 Mechanical efficiency: 95 %
 Ambient temperature: 25 degrC
 Ambient pressure: 1000 mbar
 Blower intake temperature: 25 degrC
 Pressure: 10000 mmWC

Number of pumps: 1 -
 Pump displacement (Q0): 0.596 m3/sec
 Air displacement (Q1): 0.508 m3/sec
 30.49 m3/min
 Mass displacement: 0.602 kg/sec
 Volumetric efficiency: 85.2 %
 Power: 66.8 kW
 Outlet temperature: 123 degrC

Predefined blowers Calculate airflow/power

Accept/back to input screen

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Pressure pneumatic conveying calculation Input screen

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

Gas medium
 Air Nitrogen Oxygen

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

Maximum compressor pressure: 1 bar
 Maximum conveying pressure: mmWC
 Gas volume: 0.508 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
 Eductor feeder: No

Ambient (Compressor intake)
 Ambient temperature: 25 degrC Altitude: 0 m
 Intake temperature: 25 degrC 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 degrC Pressure dewpoint: degrC
 Compressor gas cooling: degrC Dryer: degrC
 Booster gas cooling: degrC Dryer: degrC
 Heat transmission factor pipewall: 0.1 kCal/sec/degC/m2

Material properties
 Fly ash particle density: 2270 kg/m3
 Bulk density: 720 kg/m3
 Particle size <mesh >: 80 micron
 Suspension velocity: 2.1 m/sec
 Product loss constant: 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 Change product

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: 55.7 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 Calculate

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Calculation Table Pressure Conveying

Client: Forum
 Filepath: c:\Vdifa356.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 bar: 0,5078 m3/sec
 Volumetric efficiency: 85,15 %
 Booster displacement: 0 m3/sec
 Rotarylock leakage: 0 m3/sec
 Gas displacement at end: 0,5252 m3/sec

Capacity: 55,7 tons/hr at 10000 mmWC 1 bar
 Back pressure: 0 mmWC 0 bar
 Pressure drop: 10000 mmWC 1 bar
 Loading ratio: 25,7

Pipeline energy consumption: 1,19 kWh/ton
 Compressor power: 66 kW
 Conveying energy: 37,1 kW
 Pneumatic conveying efficiency: 55,6 %
 Bend losses: 7,4 kW Material intake loss: 0,3 kW

Re-number: 2,544 * 10⁵
 Empty pipeline pressure drop: 731 mmWC
 Empty pipeline filter press. drop: 113 mmWC
 Material loss factor constant: 0,0177
 Material Loss factor: 4,58E-12
 Material intake pressure drop: 100 mmWC

Progress Filter Iteration

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	% kW	Sediment	RH%
1	Intake 154 hor	1	14,91	12,33	622	0,93	4,04	0,1014	1	42	1,7	4,7				56
2	Pipe 154 hor	4	16,55	14,64	1097	0,89	4,44	0,3834	4	42	1,3	3,5				57
3	Bend		20,09	7,1	1097	0,89		0,4152	0	42	0		1,2	3,4		
4	Pipe 154 up	35	26,15	21,7	8594	0,14	5,51	2,4572	33	35	26,8	72,2				47
5	Bend		29,45	10,93	8595	0,14		2,4784	0	36	0		2,7	7,3		
6	Pipe 154 hor	5	29,29	24,61	9906	0	5,81	2,7034	3	35	6,4	17,2				43
7	Bend		32,44	12,54	9907	0		2,722	0	35	0		3,4	9,3		
8	Outlet		32,44	12,54	9907	0		2,722	35	0,3190	0,8					43
9	After Filter	60	m2	0,5	m/min	10000	-0,01	2,722		0,4823	1,2		dp = 92			42

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Calculation results pressure conveying

Client: Forum
 Filepath: c:\Vdifa356.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 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

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: 253,9 tons/hr
 Nominal capacity: 50 tons/hr
 Vessel volume: 1,4 m³ Vessel content: 0,72 tons
 Vessel product volume: 1 m³ pipe volume: 0,83 m³
 pressure begin pressurizing: -0,05 bar pipe content: 44,6 kgs
 pressure valve open: 2,5 bar
 pressure valve close: 25 % > 0,25 bar
 temperature begin pressurizing: 35 C Pipeline capacity: 55,7 tons/hr
 temperature after pressurizing: 60 C System capacity: 46 tons/hr
 pressurizing time: 4,7 seconds at pressure: 1 bar
 Discharging time: 46,4 seconds
 purging time of pipe: 2 seconds
 valve time: 2 seconds Pipeline energy consumption: 1,19 kWh/ton
 filling time: seconds System energy consumption: 1,28 kWh/ton
 cycletime: 55,2 seconds Total energy consumption: 1,28 kWh/ton
 Number of kettles/hr: 65,1 -

Kettle capacity > capacity --> extra air valve active Calculate system capacity

Pressure drops
 Product intake: 100 mmWC 0,9 %
 Nozzle (total dp): 622 mmWC 6,2 %
 Acceleration excl product dp: 2367 mmWC 23,6 %
 Product resistance: 3374 mmWC 33,7 %
 Elevation: 1508 mmWC 15 %
 Suspension: 2208 mmWC 22 %
 Gas: 410 mmWC 4,1 %
 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: 0,225 kW/ton
 Product loss energy bends -> heat: 0,133 kW/ton
 Pipeline energy consumption/ton: 1,199 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: 55,7 tons/hr
 Begin pressure: 10000 mmWc
 lowest pressure: 2000 mmWc
 pressure decrement: 400 mmWc

Calculate table

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Table calculation

Client: Filepath: Product: MM-DD-YY: 11-10-2010

Convey distance horizontal: m
 Convey distance vertical: m-up m-down
 Total conveying length: m
 Number of Bends:
 Altitude: m
 Pipe diameter begin: mm
 Pipe diameter end: mm

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

Pressure conveying

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	55.7	46.9	65.1	>capacity	25.7	14.9	32.4	44.6	1.28	2.72	No sedimentation	No condensation
0.96	54.5	46.1	64	>capacity	25	15.2	32.3	42.8	1.26	2.67	No sedimentation	No condensation
0.92	53.2	45.2	62.8	>capacity	24.4	15.6	32.3	41	1.24	2.63	No sedimentation	No condensation
0.88	52	44.3	61.6	>capacity	23.7	16	32.2	39.2	1.21	2.58	No sedimentation	No condensation
0.84	50.7	43.4	60.3	>capacity	23	16.4	32.2	37.4	1.19	2.54	No sedimentation	No condensation
0.8	49.3	42.4	58.9	>capacity	22.3	16.9	32.1	35.6	1.16	2.49	No sedimentation	No condensation
0.76	47.9	41.3	57.4	>capacity	21.6	17.3	32.1	33.9	1.14	2.45	No sedimentation	No condensation
0.72	46.3	40.2	55.9	>capacity	20.8	17.8	32	32.1	1.12	2.4	No sedimentation	No condensation
0.68	44.8	39.1	54.3	>capacity	20	18.3	32	30.3	1.1	2.36	No sedimentation	No condensation
0.64	43.1	37.8	52.5	>capacity	19.2	18.8	31.9	28.6	1.08	2.31	No sedimentation	No condensation
0.6	41.4	36.5	50.7	>capacity	18.3	19.4	31.8	26.8	1.05	2.27	No sedimentation	No condensation
0.56	39.5	35	48.7	>capacity	17.4	19.9	31.8	25	1.04	2.22	No sedimentation	No condensation
0.52	37.5	33.5	46.5	>capacity	16.5	20.6	31.7	23.2	1.02	2.17	No sedimentation	No condensation
0.48	35.4	31.8	44.1	>capacity	15.5	21.2	31.6	21.3	1	2.13	No sedimentation	No condensation
0.44	33	29.9	41.5	>capacity	14.4	21.9	31.5	19.4	0.99	2.08	No sedimentation	No condensation
0.4	30.5	27.8	38.6	>capacity	13.2	22.6	31.4	17.5	0.99	2.04	No sedimentation	No condensation
0.36	27.7	25.5	35.4	>capacity	11.9	23.4	31.3	15.6	0.99	2	No sedimentation	No condensation
0.32	24.7	22.9	31.9	>capacity	10.6	24.2	31.1	13.5	1	1.96	No sedimentation	No condensation
0.28	21.3	20	27.8	>capacity	9.1	25	31	11.4	1.03	1.92	No sedimentation	No condensation
0.24	17.6	16.7	23.2	>capacity	7.5	25.9	30.8	9.2	1.1	1.88	No sedimentation	No condensation
0.2	13.6	13	18.1	>capacity	5.7	26.9	30.6	6.9	1.24	1.85	No sedimentation	No condensation

Empty pipeline system pressure drop: mmWC Filter without exhaust fan

Buttons: