

Pressure pneumatic conveying calculation Input screen

Client: _____ File path: Quick modeling Product: LLDPE pellets Date: 11-17-2012 Time: 10:15:06

Gas medium: Air Nitrogen (generator) Oxygen

Gas pump: Screwcompressor Blower Compressor data Predefined screwcompressor Blower data 1x Blower GM 010S 4200 rpm Predefined Hybrid blower Const. mass pump (sonic choke/turbo/oil filled) Blower data curve operating points Centrifugal fan

Max. compr. press. 1 bar
Maximum conveying pressure 10000 mmWC
Compr. displ. 0.15289 m3/sec < 0.3188 m3/sec
Compr. displ. _____ CFM = _____ m3/sec

Booster: Installed Screwcompressor Blower data Predefined screwcompressor Predefined blower Constant mass at Fixed _____ bar

Rotary lock feeder (RLF) / screw-feeder (SF)
 Rotary Lock Feeder Screw Feeder
Capacity 10.9 tons/hr
Lock vol. 0.0261 m3
RPM 15 /min Diam 0.321 m
Vol. eff. 0.85
Leakage 0.004 m3/sec

Eductor feeder No

Ambient (Compressor intake)
Ambient temperature 35 degr C Altitude 0 m
Inlet temperature 35 degr C Altitude pressure 1013 mbar
Inlet pressure drop 15 mbar 0.015 bar
Ambient pressure 1000 mbar 1 bar <- Accept
Relative Humidity 80 % Show air intake conditions
 Override RH air density calculation for >373 degC and >220 bar

Temperatures
LLDPE pellets temp. 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
degr F -> _____ degr C

Material properties
LLDPE pellets particle density 946 kg/m3
Bulk density 640 kg/m3
Part. size 5 mesh -> acc.> 3500 susp.> 3500 micron
Susp. vel. 7.62 m/sec -> acc.> 7.62 susp.> 7.62 m/sec
Product loss constant 0.585
Product loss factor
Wall friction factor 0.5
Mat. intake press. drop 100 mmWC
v-wall / v-susp 1.4
Filter resistance factor 350000
Specific heat content 0.4 kcal/kg/C
product loss factor constant y/n y
Change product No particle size distribution

Filter
Filter area 21.8 m2 No filter exhaust fan/Filter calculated
 Fixed filtersize

Convey pipeline
Convey distance horizontal 5.5 m
Convey distance vertical 5.5 m-up 0 m-down
Convey distance slope 0 m-up 0 m-down Pipe diameter
Total conveying length 11 m begin 102 mm
Number of Bends 3 - end 102 mm

Guessed air only pressure drop _____ mmWC
Calculate empty pipeline pressure _____ mmWC
Air only compr. press. with filter _____ bar
Volumetric eff. _____ Gas displacement _____ m3/sec

Gas supply/vent piping
Length 5 0 m Guessed press. drop _____ mmWC
Nu of bends 3 0 - Air press. drop _____ mmWC
Diameter 102 0 mm Air press. drop _____ bar
End pressure 2750 mmWC Re-/Calculate pressure drop

Gas supply piping 0 mmWC 0 bar
 Vent piping 0 mmWC 0 bar
 Calculate Gas supply piping Calculate Vent piping

Calculation settings
Set capacity 13668 lbs/hr -> 6.2 tons/hr
Compressor pressure 0.27 bar 2750 mmWC Press. 3.911 psi
Back pressure 0 bar 0 mmWC Air press. drop 2749 mmWC
Set pressure drop 0.27 bar 2750 mmWC <- Accept
Calc. intake gas press. drop Yes Time domain dt 0.001 sec 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
 product loss factor (cwp) kept constant Calculate

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Calculation Table Pressure Conveying

Client: _____ Filepath: Quick modeling Product: LLDPE pellets

Conv. dist.: Horizontal 5.5 m Bends 3
Vertical 5.5 m-up 0 m-down
Slope 0 m-up 0 m-down Total 11 m

Conveying gas: Air
Compr. displ at 0.27 bar 0.169 m3/s 0.19 kg/s
Volumetric efficiency 88.37 %
Booster displacement 0 m3/sec
Rotarylock leakage 0.0055 m3/sec
Gas displacement at end 0.1732 m3/sec
New set capacity 10 tons/hr
Capacity 6.21 tons/hr at 2750 mmWC 0.27 bar
Pressure drop 2750 mmWC 0.275 bar
Booster pressure _____ mmWC bar
Back pressure 0 mmWC 0 bar

Empty pipeline pressure drop 396 mmWC
Empty pipeline filter press. drop 26 mmWC
Loading ratio 9.05
Pipeline energy consumption 1.12 kWh/ton
Compressor power 7 kW
Conveying power 4.3 kW
Pneumatic conveying efficiency 61.4 %
Bend losses 0 kW Material intake loss 0.15 kW
Re-number 1,602 * 10⁵
Material loss factor constant 0.585
Material loss factor
Mat. int. press. drop 100 mmWC
Filter receiver diameter => 0.33 m

Progress Filter Iteration 5 5

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	RH%
1	Intake 102 hor	1	17.06	3.16	212	0.2537	0.96	0.3572	0	41	0.3	7.3			69
2	Pipe 102 hor	2.25	31.65	5.13	824	0.1925	1.78	0.8062	4	39	0.8	20.1			71
3	Diameter Transfer		19.07	5.13	824	0.1925		0.8062			0	0			
4	Pipe 102 hor	0	19.5	5.07	824	0.1925	1.07	0.8072	0	39	0	0			71
5	Bend		24.05	1.99	825	0.1924		0.8788	0	39			0	0.4	
6	Pipe 102 up	4.08	25.7	4.16	1837	0.0912	1.37	1.8768	4	38	1.5	35.6			71
7	Diameter Transfer		21.1	4.16	1837	0.0912		1.8768			0	0			
8	Pipe 102 up	1.41	26.88	4.16	2161	0.0588	1.41	2.2148	1	37	0.5	12			70
9	Bend		27.04	2.15	2162	0.0587		2.2943	0	37			0	0.2	
10	Pipe 102 hor	2.25	34.23	5.26	2744	0.0005	1.76	2.7333	3	37	0.9	22.6			67
11	Bend		26.32	3.17	2744	0.0005		2.7904	0	37			0	0.3	
12	Outlet		23.66	3.17	2744	0.0005		2.7904		37	0.054	1.2			67
13	After Filter	21.8	m2	0.4	m/min	2764	0.0014		2.7904		0.034	0.8	dp = 19		mmWC 67

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Calculation results pressure conveying

Client:

Filepath: Quick modeling

Product: LLDPE pellets

Installation

Convey dist. horizontal: 5,5 m

Convey dist. vertical: 5,5 m-up 0 m-down

Convey dist. slope: 0 m-up 0 m-down

Total conv. length: 11 m

Nu of Bends: 3

Pipe diameter(s): 102 mm 102 mm

Compressor displacement: 0.152 m3/sec 0.172 kg/sec

Booster displacement: 0 m3/sec 0 kg/sec

Total gas displacement: 0.152 m3/sec 0.172 kg/sec

Calculation results

Capacity: 6,3 tons/hr

Pressure: 2778 mmWC 0,27 bar

Booster pressure: 0 mmWC 0 bar

Back pressure: 0 mmWC 0 bar

Pressure drop: 2778 mmWC 0,27 bar

Loading ratio: 9,18

Volumetric loading ratio: 0,0727 to 0,0707

Empty pipeline pressure: 392 mmWc

Residence time: 2,78 seconds

Re-number * 10⁵: 1,602

Mixture dens. at int.: 13 at end 11 kg/m³

Material in pipeline: 14,5 kg Sedim. 13,3 kg

Exit dynamic force: 0,25 kN

Pressure drops

Product intake: 100 mmWC 3,6 %

Nozzle (total dp): 213 mmWC 7,7 %

Acceleration excl product dp: 44 mmWC 1,5 %

Product resistance: 1029 mmWC 37,4 %

Elevation: 62 mmWC 2,2 %

Suspension: 1285 mmWC 46,7 %

Gas Air: 268 mmWC 9,7 %

Filter: 20 mmWC 0,7 %

Gas supply piping: mmWC %

Vent piping: mmWC %

Energy (Blower 1x GM 010S 4200 rpm)

Compressor power: 7 kW

Mechanical efficiency: 98 %

No booster

Product loss energy pipes -> heat: 0,254 kW/Ton

Product loss energy bends -> heat: 0,007 kW/Ton

Pipeline energy consumption/Ton: 1,113 kW/Ton

Temperatures

Ambient temperature: 35 degr C

Outlet temperature compressor: 62 degr C

No booster

Material temperature: 40 degr C

Mixture temperature begin: 41 degr C

Mixture temperature end: 37 degr C

Table calculation

Begin capacity: 6,3 tons/hr

Begin pressure: 2778 mmWc

lowest pressure: 800 mmWc

pressure decrement: 98 mmWc

Table 20 steps

Table 40 steps

Table steps

Calculate result

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New Calculation

Table calculation pressure discharge

Client:

Filepath: Quick modeling

Product: LLDPE pellets

MM-DD-YY: 11-17-2012

Pressure conveying

Conveying gas: Air

Pump displacement: 0.152 m3/sec

Booster displacement: 0 m3/sec

Rotary lock feeder installation (Blower 1x GM 010S 4200 rpm)

Convey distance horizontal: 5,5 m

Convey distance vertical: 5,5 m-up 0 m-down

Convey distance slope: 0 m-up 0 m-down

Total conveying length: 11 m 3 bends

Pipe diameter begin: 102 mm end 102 mm

Gas volume end: 0,1771 m3/sec 0,195 kg/sec at 0,215 bar

Altitude: 0 m

Pipeline energy consumption

System energy consumption

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Silo/Cargo disch time min	640 tons	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	Choking
0.275	6,3	6,3	103,72		8,9	17	23,6	14,6	1,11	2,79	Sedimentation	No condensation	
0.27	6,05	6,05	120,24		7,7	17,1	23	14,9	1,14	2,79	Sedimentation	No condensation	Choking
0.265	5,79	5,79	118,09		7,8	17,2	23,2	14,7	1,17	2,79	Sedimentation	No condensation	Choking
0.26	5,54	5,54	116,63		7,9	17,3	23,3	14,5	1,21	2,78	Sedimentation	No condensation	Choking
0.255	5,3	5,3	121,78		7,5	17,4	23,3	14,5	1,25	2,78	Sedimentation	No condensation	Choking
0.25	5,07	5,07	127,67		7,2	17,5	23,2	14,5	1,28	2,78	Sedimentation	No condensation	Choking
0.245	4,83	4,83	132,49		6,9	17,6	23,2	14,5	1,33	2,78	Sedimentation	No condensation	Choking
0.24	4,57	4,57	139,82		6,5	17,7	23,1	14,5	1,38	2,78	Sedimentation	No condensation	Choking
0.235	4,05	4,05	152,74		5,9	17,8	23,1	14,5	1,53	2,78	Sedimentation	No condensation	Choking
0.23	3,83	3,83	163,55		5,5	17,9	23	14,5	1,59	2,78	Sedimentation	No condensation	Choking
0.225	3,61	3,61	176,68		5,1	18,1	22,9	14,5	1,66	2,78	Sedimentation	No condensation	Choking
0.22	3,36	3,36	189,35		4,8	18,2	22,8	14,5	1,76	2,78	Sedimentation	No condensation	Choking
0.215	2,94	2,94	207,35		4,3	18,3	22,8	14,5	1,98	2,78	Sedimentation	No condensation	Choking

Empty pipeline system pressure drop: 396 mmWC

Filter without exhaust fan

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Print table

New Calculation