

# Broken maize (corn)

**Pressure pneumatic conveying calculation Input screen**

Client: **Matec** File path: **c:\Vdhelio.txt** Product: **Broken Corn**

**Gas medium:**  Air  Nitrogen

**Gas pump:**  Screwcompressor  Blower  Compressor data  Predefined screwcompressor  Blower data  1x Blower GM35S 3800 rpm  Constant mass pump (sonic choke/turbo)  Centrifugal fan

Maximum compressor pressure: 1 bar  
Maximum conveying pressure: mmWC  
Gas volume: 0,631 m3/sec

**Booster:**  Installed  Screwcompressor  Predefined screwcompressor  Blower data  Predefined blower

Gas Volume: m3/sec  
Injection point:

**Rotary lock feeder:**  Installed (Capacity) 55 tons/hr  
Lock volume: 0,115 m3  
RPM: 15 /min  
Leakage: 0,048 m3/sec

**Eductor feeder:**  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 %   
 Override RH air density calculation for >373 degrC and >220 bar

**Temperatures:**  
Broken Corn temperature: 25 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:**  
Broken Corn particle density: 1400 kg/m3  
Bulk density: 760 kg/m3  
Particle size <mesh >: 500 micron  
Suspension velocity: 2,94 m/sec  
Product loss constant: 0,054  
Product loss factor:  Wall friction factor: 0,9  
Material intake pressure drop: 100 mmWC  
v-wall / v-susp: 1,2  
Filter resistance factor: 350000  
Specific heat content: 0,15 kCal/kg/C  
 product loss factor constant y/n

**Filter:**  
Filter area: 80 m2  Filter exhaust fan

**Convey pipeline:**  
Convey distance horizontal: 8 m  
Convey distance vertical: 46 m-up 0 m-down  
Convey distance slope: 2 m-up 0 m-down  
Total conveying length: 56 m  
Number of Bends: 6  
Pipe diameter begin: 185 mm  
Pipe diameter end: 210 mm  
 mmWC

**Calculation settings:**  
Set capacity: 49,9 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  
 product loss factor (cwp) kept constant

**Calculation Table Pressure Conveying**

Client: **Matec** Filepath: **c:\Vdhelio.txt** Product: **Broken Corn**

Convey distance horizontal: 8 m  
Convey distance vertical: 48 m  
Total conveying length: 56 m  
Number of Bends: 6  
Compr. displ 1 bar: 0,5823 m3/sec  
Volumetric efficiency: 87,69 %  
Booster displacement: 0 m3/sec  
Rotarylock leakage: 0,0485 m3/sec  
Gas displacement at end: 0,5841 m3/sec

Capacity: 49,9 tons/hr at 10000 mmWC 1 bar  
Back pressure: 0 mmWC 0 bar  
Pressure drop: 10000 mmWC 1 bar  
Loading ratio: 20,1  
Pipeline energy consumption: 1,61 kWh/ton  
Compressor power: 80 kW  
Conveying energy: 41 kW  
Pneumatic conveying efficiency: 50,8 %  
Bend losses: 4,3 kW Material intake loss: 0,35 kW  
Re-number: 2,18 \* 10<sup>5</sup>  
Empty pipeline pressure drop: 22 mmWC  
Empty pipeline filter press. drop: 410 mmWC  
Material loss factor constant: 0,054  
Material loss factor:  
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 185 hor	1	11,54	11,81	533	0,94	2,83	0,1032	1	32	1,6	4				98
2	Pipe 185 up	6	12,85	10,27	1595	0,84	2,46	0,6902	8	30	3,3	8,1				98
3	Bend		18,31	2,44	1595	0,84		0,8139	2	31	0		0,6	1,6		
4	Pipe 185 up	5	13,64	10,81	2774	0,72	2,54	1,3029	7	30	3,9	9,5				96
5	Bend		15,13	7,39	2774	0,72		1,3194	0	30	0		0,4	1		
6	Pipe 185 slope up	2	13,96	11,13	3222	0,67	2,56	1,5104	2	29	1,5	3,7				96
7	Bend		15,47	7,46	3222	0,67		1,5265	0	29	0		0,4	1,1		
8	Pipe 185 up	12,01	16,06	12,36	5575	0,44	2,74	2,5625	15	28	8,9	21,7				89
9	Bend		19,15	4,46	5576	0,44		2,6503	1	28	0		0,9	2,2		
10	Pipe 185 hor	1,01	16,39	12,48	5879	0,41	2,77	2,7462	1	28	1,2	3				88
11	Bend		20,76	3,41	5879	0,41		2,8428	1	28	0		0,9	2,4		
12	Pipe 185 up	7,01	18,23	13,68	7397	0,26	2,91	3,3938	7	27	6,6	16,2				82
13	Diameter Transfer		13,98	13,68	7406	0,25		3,3938			0	0,1				
14	Pipe 210 up	16,01	16,73	12,01	9449	0,05	2,42	4,8018	20	26	10,3	25,2				73
15	Bend		19,14	4,39	9449	0,05		4,9039	1	26	0		0,8	2,1		
16	Pipe 210 hor	6	17,54	13,16	9984	0	2,48	5,3979	6	26	3	7,4				70
17	Outlet		17,54	13,16	9984	0		5,3979		26	0,1069	0,2				70
18	After Filter	80	0,4	m/min	10000	-0,01		5,3979			0,0911	0,2	dp = 15			70

Condensation intake 2.8 ltrs/hr

**Calculation results pressure conveying**

Client: Maitec  
 Filepath: c:\V\dhelio.txt  
 Product: Broken Corn

**Installation**

Convey distance horizontal: 8 m  
 Convey distance vertical: 48 m  
 Total conveying length: 56 m  
 Number of Bends: 6  
 Pipe diameter(s): 185 mm / 210 mm  
 Compressor displacement: 0.631 m<sup>3</sup>/sec / 0.74 kg/sec  
 Booster displacement: 0 m<sup>3</sup>/sec / 0 kg/sec  
 Total gas displacement: 0.631 m<sup>3</sup>/sec / 0.74 kg/sec

**Calculation results**

Capacity: 49.9 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: 20.1  
 Volumetric loading ratio: 0.0316 to 0.0226  
 Empty pipeline pressure: 410 mmWc  
 Residence time: 5.39 seconds  
 Re-number \* 10<sup>-5</sup>: 2.18  
 Mixture density: 24.9 kg/m<sup>3</sup>  
 Mass of material in pipeline: 79.6 kg  
 Exit dynamic force: 1.32 kN

**Pressure drops**

Product intake: 100 mmWC / 0.9 %  
 Nozzle (total dp): 533 mmWC / 5.3 %  
 Acceleration excl product dp: 1453 mmWC / 14.5 %  
 Product resistance: 3446 mmWC / 34.4 %  
 Elevation: 1612 mmWC / 16.1 %  
 Suspension: 3185 mmWC / 31.8 %  
 Gas: 205 mmWC / 2 %  
 Filter: 15 mmWC / 0.1 %

**Energy**  
 (Blower 1x GM35S 3800 rpm)  
 Compressor power: 80 kW  
 Mechanical efficiency: 95 %

No booster  
 Product loss energy pipes -> heat: 0.282 kW/Ton  
 Product loss energy bends -> heat: 0.087 kW/Ton  
 Pipeline energy consumption/Ton: 1.614 kW/Ton

**Temperatures**

Ambient temperature: 25 degr C  
 Outlet temperature compressor: 121 degr C

No booster  
 Material temperature: 25 degr C  
 Mixture temperature begin: 32 degr C  
 Mixture temperature end: 26 degr C

**Table calculation**

Begin capacity: 49.9 tons/hr  
 Begin pressure: 10000 mmWc  
 lowest pressure: 2000 mmWc  
 pressure decrement: 400 mmWc

**Feeder system**

Installation system: Rotary lock feeder

Vessel factor: tons/hr/m<sup>3</sup>/bar(a)  
 Nominal capacity: tons/hr  
 Silo volume: m<sup>3</sup>  
 Silo product volume: 1000 m<sup>3</sup>  
 pressure begin pressurizing: bar  
 pressure valve open: bar

temperature begin pressurizing: C  
 temperature after pressurizing: C  
 pressurizing time: seconds  
 Silo discharge time: 15.21 hrs  
 purging time of pipe: seconds  
 valve time: seconds  
 filling time: seconds  
 cycletime: seconds

vessel capacity: tons/hr  
 Silo content: 760 tons  
 pipevolume: 1.67 m<sup>3</sup>  
 pipe content: 79.6 kgs

Pipeline capacity: 49.9 tons/hr  
 System capacity at pressure: tons/hr  
 Pipeline energy consumption: 1.61 kWh/Ton  
 System energy consumption: 1.61 kWh/Ton  
 Total energy consumption: 1.61 kWh/Ton

Calculate system capacity

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**Table calculation**

**Pressure conveying**

Convey distance horizontal: 10 m  
 Convey distance vertical: 46 m-up / m-down  
 Total conveying length: 56 m  
 Number of Bends: 6  
 Pipe diameter begin: 185 mm  
 Pipe diameter end: 210 mm

Pump displacement: 0.631 m<sup>3</sup>/sec (Blower 1x GM35S 3800 rpm)  
 Booster displacement: 0 m<sup>3</sup>/sec

Client: Maitec  
 Filepath: c:\V\dhelio.txt  
 Product: Corn  
 Altitude: 0 m

Gas volume end: 0.6716 m<sup>3</sup>/sec / 0.788 kg/sec at 0.2 bar

Rotary lock feeder installation

MM-DD-YY  
08-24-2010

Pressure bar	pipe line capacity tons/hr	system capacity tons/hr	Number of kettles/hr	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	49.9	49.9	0	20.1	11.5	17.5	79.6	1.61	5.39	No sedimentation	Condensation
0.96	48	48	0	19.1	11.8	17.5	75.2	1.61	5.33	No sedimentation	Condensation
0.92	46.2	46.2	0	18.3	12.1	17.7	71.1	1.61	5.25	No sedimentation	Condensation
0.88	44.3	44.3	0	17.4	12.5	17.8	66.9	1.61	5.19	No sedimentation	Condensation
0.84	42.4	42.4	0	16.6	12.8	17.8	62.9	1.61	5.12	No sedimentation	Condensation
0.8	40.4	40.4	0	15.7	13.2	17.9	58.9	1.62	5.05	No sedimentation	Condensation
0.76	38.4	38.4	0	14.8	13.5	18	55	1.62	4.98	No sedimentation	Condensation
0.72	36.4	36.4	0	13.9	13.9	18.1	51.2	1.63	4.91	No sedimentation	Condensation
0.68	34.4	34.4	0	13.1	14.3	18.2	47.4	1.63	4.84	No sedimentation	Condensation
0.64	32.3	32.3	0	12.2	14.8	18.3	43.8	1.65	4.78	No sedimentation	Condensation
0.6	30.2	30.2	0	11.3	15.2	18.4	40.3	1.66	4.71	No sedimentation	Condensation
0.56	28.1	28.1	0	10.5	15.7	18.5	36.8	1.68	4.64	No sedimentation	Condensation
0.52	26	26	0	9.6	16.2	18.6	33.4	1.7	4.57	No sedimentation	Condensation
0.48	23.9	23.9	0	8.8	16.8	18.6	30.1	1.72	4.51	No sedimentation	Condensation
0.44	21.7	21.7	0	7.9	17.3	18.7	26.9	1.76	4.44	No sedimentation	Condensation
0.4	19.5	19.5	0	7.1	17.9	18.8	23.7	1.8	4.37	No sedimentation	Condensation
0.36	17.4	17.4	0	6.2	18.6	18.9	20.7	1.84	4.31	No sedimentation	Condensation
0.32	15.2	15.2	0	5.4	19.3	19.1	17.7	1.91	4.24	No sedimentation	Condensation
0.28	12.9	12.9	0	4.6	20	19.2	14.8	2.02	4.17	No sedimentation	Condensation
0.24	10.7	10.7	0	3.7	20.8	19.3	12	2.15	4.11	No sedimentation	Condensation
0.2	8.5	8.5	0	2.9	21.6	19.4	9.3	2.35	4.04	No sedimentation	Condensation

Empty pipeline system pressure drop: 406 mmWC  
 Filter without exhaust fan

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