



Technology Training that Works

Best Practice Design, Maintenance and Troubleshooting of Conveyors and Chutes

Contents

1	Introduction	1
1.1	Introduction	1
1.2	Classification and characteristics of materials	1
1.3	Properties of the conveyed material	3
1.4	Classification of conveying machines	11
1.5	Selection of conveying machines	12
1.6	Trends	13
2	Belt Conveyors	15
2.1	Applications	15
2.2	Conveyor nomenclature and arrangement	21
2.3	Effect of material characteristics on belt conveyor	22
2.4	Capacity	22
2.5	Belt conveyor idlers	26
2.6	Belt tension, power, and drive engineering	28
2.7	Belt selection	38
2.8	Relative advantages and disadvantages of hot vulcanized, cold vulcanized and mechanical splices	43
2.9	Conveyor belt selection	44
2.10	Pulleys and shafts	47
2.11	Concave and convex curves	48
2.12	Belt takeups, cleaners and accessories	48
2.13	Conveyor feeding and discharge	49
2.14	Electrical	50
2.15	Some tips to achieve cost savings in belt conveyors	52
2.16	Nomenclature	52

3	Mechanical Conveyors	55
3.1	Introduction	55
3.2	Screw conveyors	55
3.3	Power requirement of screw conveyors	65
3.4	Vertical screw conveyor	65
3.5	Bucket elevators	68
3.6	Flight conveyors	83
3.7	Apron conveyors	95
3.8	Vibratory conveyors	111
4	Pneumatic and Hydraulic Conveying	115
4.1	Preface	115
4.2	Introduction	115
4.3	Negative pressure pneumatic conveying systems	116
4.4	Positive pressure pneumatic conveying systems	122
4.5	Negative-positive pressure pneumatic conveying systems	125
4.6	Hydraulic conveying	130
5	Feeders	139
5.1	Introduction	139
5.2	Feeder loans	140
5.3	Belt feeders	144
5.4	Drive power	146
5.5	Apron feeders	147
5.6	Bar-flight feeder	149
5.7	Rotary drum, vane and value feeders	149
5.8	Rotary table feeders	151
5.9	Circular bin dischargers	153
5.10	Rotary plough feeders	154
5.11	Screw feeders	158
5.12	Reciprocating plate feeders	161
5.13	Vibratory feeders	162
5.14	Capacity	166
5.15	Support for trough feeders	167
5.16	Feeder flow patterns	168
5.17	Hopper gates	170
5.18	Conclusion	171

6	Storage and Flow in Bins and Bunkers	173
6.1	Introduction	173
6.2	Flow behavior of bulk solids	173
6.3	Classification of bulk materials	177
6.4	Design of bins and hoppers	178
6.5	Coarse materials	185
6.6	Pressure in mass flow bins	189
6.7	Shapes of outlets of bins and hoppers	194
6.8	Vibration of hopper walls	199
7	Transfer Chutes	201
7.1	Introduction	201
7.2	Transfer Chute Theory	202
7.3	General transfer chute design considerations	211
7.4	Design principles for chutes	211
7.5	Recommendations on chute design	214
7.6	Special chute design	215
7.7	Software availability for chute design	217
7.8	Installation and maintenance of chutes	219
7.9	Troubleshooting chutes	221
8	Conveyor Design and Safety	225
8.1	Design of conveyor belt	225
8.2	Factors determining conveyor belt selection	236
8.3	Capacity of a troughed belt	237
8.4	Vertical curves and tension calculations	239
8.5	Hazard vs risk	252
9	Operation, Maintenance and Troubleshooting	257
9.1	Introduction	257
9.2	Operation	257
9.3	General maintenance considerations	257
9.4	Splice failures	258
9.5	Mechanical splice failures	260
9.6	Splice inspections	262
9.7	Loading point considerations	262
9.8	Conveyor troubleshooting	263
9.9	Systematic approach to belt tracking	269

9.10	Systematic approach to tracking	270
9.11	Root cause process	271
<hr/>		
	Appendix A	275
<hr/>		
	Conveyor Belt Design	
<hr/>		
	Appendix B	289
<hr/>		
	Trajectory Derivation	
<hr/>		
	Appendix C	295
<hr/>		
	Estimation of Surcharge Angle	
<hr/>		
	Appendix D	299
<hr/>		
	Belt Cleaners and Scrapers	
<hr/>		
	Appendix E	311
<hr/>		
	Effect of Water Sprays on Belts	
<hr/>		
	Appendix F	317
<hr/>		
	Practical Exercises	