## SPECIFYING & MAINTAINING CONVEYORS FOR BULK SOLIDS



# SPECIFYING & & MAINTAINING CONVEYORS FOR BULK SOLIDS

by H. Colijn

#### **Your Company Name**

3900 River Road Your City, New Jersey 08110 Phone: 732-928-4363 FAX: 732-928- xxxx

	TABLE OF CONTENTS	
Chapter 1	The Beaumont Birch Story	5
Chapter 2	Prelude to Belt & Chain Conveyors	9
•	A - Introduction	9
	B - Standards, Terms and Definitions	10
	1 - Capacity (Operating, Rated, Peak, Design)	11
	2 - Equipment Specifications for Procurement	13
	3 - Contract Requirements	14
	4 - Engineering Requirements	15
	5 - Quality & performance	16
	C - Analysis & Selection	18
	1 - Material Classification	20
	2 - Engineering and Systems Approach	21
	3 - Plant Layout	26
	4 - Sources of Supply	27
	D - Bibliography	28
Chapter 3	Specifying Belt Conveyors	29
	A - Comments & Definitions	29
	1 - Applications & Limitations	30
	B - Layout & Capacity	32
	1 - Layout Arrangements	32
	2 - Angles of Incline	33
	3 - Belt Widths & Belt Speeds	37
	4 - Belt Conveyor Capacities	40

	C - Belt Tension & Horsepower	44
	1 - Values for Weight Factors & Belt Weights	46
	2 - Tension, Slack Tension & Wrap Factor	48
	3 - Minimum Tension, Belt Sag & Idler Spacing	50
	4 - Graphical or Tension Diagrams	51
	5 - Acceleration and Braking Forces	59
	D - Belting	60
	1 - Grades of Conveyor Belting & Their Uses	62
	2 - Conveyor Belting Construction	64
	3 - Belt Selection	68
	4 - Min & Maxi Ply & Minimum Pulley Diameter	70
	E - Idlers & Pulleys	73
	1 - Types of Idler Design	75
	2 - Idler Selection	80
	3 - Pulley Terminals	84
	4 - Transition From Trough to Flat Pulley	85
	5 - Idler & Belt Conveyor Alignment	86
	F - Conveyor Loading & Discharging	87
	1 - Loading Material on the Belt	88
	2 - Discharging Material from the Belt	93
	G - Belt Conveyor Drive Systems	96
	1 - Drive Location and Arrangements	97
	2 - Torque Control Devices	99
	3 - Field Determination of Belt Tension	102
	H - Bibliography	103
Chapter 4	Specifying Chain Conveyors	105
-	A Introduction	105
	A - Introduction	
	1 - Conveyor Classes	107
	2 - Terms and Definitions	108

B - Conveyor or Engineering Chains	
1 - Types of Chains	
2 - Attachments	119
3 - Chain Metals	119
C - Chain Design Considerations	112
1 - Direction of Travel	128
2 - Notes on Operation and Maintenance	
3 - Conveyor Chain Selection	131
4 - Sprockets	140
D - Apron Conveyors	
1 - Types of Apron Pans	143
2 - Supporting Structure	146
3 - Apron Conveyor Speed	147
E - Drag Conveyors	148
F - Scraper and Flight Conveyors	
1 - Layout and Arrangements	151
G - "En Masse" Conveyors	
1 - Layout and Arrangements	157
2 - Capacity and Required Power	158
3 - Tubular Conveyors	161
H - Bibliography	162
Appendix	163
ndov	165

#### **FORWARD**

(We'll substitute your story)

Thanks to modern conveyor technology one dockworker can unload 230 times more grain in a day than 10 slaves of the Roman Empire could 2000 years ago.

Vast quantities of bulk solids such as coal, ash, sludge, cement, grains, potash, limestone, sand, metal ore and their various by-products must be handled, transported, stored and processed. The infinite variety of bulk solids that must be moved continues to increase constantly in today's expanding economy. This has resulted in a considerable number of technical problems for the efficient handling of these materials. These problems can range from minor inconvenience to major stoppages with resultant loss of production. Since large bulk handling units are often integrated into overall processing systems, these stoppages and interruptions to production are often economically damaging.

BEAUMONT BIRCH COMPANY, INC. is publishing this book to assist professionals in the chemical, food, waste treatment and power generating industries in the intricate process of Specifying and Maintaining Conveyors for Bulk Solids.

We hope that this reference, excerpt from "Mechanical Conveyors for Bulk Solids" by well-known author, engineer, lecturer and college professor, H. Colijn will provide the information necessary to aid in the selection and operation of complex bulk solid conveying systems.

Beaumont Birch management will welcome questions, comments or suggestions by readers on how we can improve this reference and serve industry better.

Your Name, President

**Your Company Name** 

3900 River Road Your City, New Jersey 08110

Phone: 732-928-4363 FAX: 732-928- xxxx

### **INDEX**

400 class pintle, 112 700 class pintle, 115 800 class bushed, 115

**-A**-

Acceleration and braking forces, 59

Alignment, 86, 87, 119, 124

Allowable chain pull, 110

Angle of inclination, 143, 144

Angle of inclination, 33, 88, 91

Angle of repose, 33, 40, 41

Angle of surcharge, 40-42, 76

Angles of incline, 33

Applications and limitations, 30

Applications, 30

Apron conveyor pan, 143

Apron conveyor speed, 147

Apron conveyor, 142-148, 151, 152

Apron conveyors, 142, 148

Apron, 107, 116, 142, 143, 145, 147, 148, 151, 152

Arm body, 140

Assembled tension diagram, 54

Attachment strength, 130

Attachments, 109, 115, 119, 130, 139

Average ultimate strength, 110

-B-

Bearing, 62, 67, 73, 77, 79, 80, 110, 122, 124, 128, 138

Beaumont Birch Story, 4-7

Belt alignment, 87

Belt carcass, 61-72

Belt cleaners, 87, 95

Belt construction, 32, 64, 75

Belt conveyor arrangement, 30

Belt training, 32, 85-87

Belt weights, 46

Belt width, 32, 37, 40-43, 78, 82, 86, 87, 89

Belt widths and belt speeds, 37

Belting fiber characteristics, 66

Belting, 45, 47, 60, 63-66, 73

Bibliography, 28, 103, 162

Breakers, 62

Brinell, 120, 121, 122

Brinnel hardness scale, 123

CEMA idler specifications, 78

CEMA material classification, 23

CEMA material tables, 22

CEMA, 10, 20-23, 44, 45, 77, 78

Centrifugal clutch couplings, 101

Chain and sprocket wear, 129

Chain attachments, 144, 151

Chain conveyor, 10, 106, 108, 111, 117, 136, 143, 150, 162

Chain conveyors and bucket elevators, 162

Chain design considerations, 122

Chain friction factors, 133

Chain metals, 119

Chain pull, 110, 116, 131-140, 147

Chain rolling, 108, 134

Chain selection table, 139

Chain sliding, 107, 133, 139

Chain types, 137

Chain wear, 125, 129, 130

Cleanout door, 7

Coal bunker, 7

Colijn, H., 28

Combination, 59, 116, 139

Commercial evaluation of bids, 15

Comparitive hardness guide, 123

Conveyor belt construction, 64

Conveyor bucket, 7

Conveyor capacity, 37, 42

Conveyor chain selection procedure, 131

Conveyor chain selection, 131

Conveyor chain, 7, 112, 119, 120, 128, 131, 136

Conveyor classes, 107, 132

Conveyor Equipment Manufacturer's Association, 10

Conveyor loading and discharging, 87

Conveyor or engineering chains, 111

Conveyor tension formulas, 46

Conveyors and related equipment, 103, 162

Conveyors, 10, 28, 47, 71, 103, 138, 158, 160, 162

Corrosive conditions, 130

Cost, 6, 21

Covers, 60, 63, 64

Cross sectional area, 43

Design considerations, 88, 122

Design working strength, 110

Detachable link, 112

Determine the class of conveyor, 132

Determine the design working load, 136

Determining belt tension distribution, 51

DIN 22101, 45

DIN, 37, 44, 45

Direction of travel, 128

Discharging material from the belt, 93

Drag chain conveyor, 108

Drag conveyor, 6, 7, 114, 148, 149

Drag, 6, 7, 11, 106-108, 114, 118, 139, 148, 149, 152

Drive location and arrangement, 97

Drop forged rivetless, 117, 153

Dry fluid couplings, 100

Ductile iron, 121

Duramal, 120

-E-

Eddy current couplings, 99

Effect of acceleration or braking, 59

Effective tensionslack and wrap factor,, 48

Elastomer characteristics, 66

Elevator bucket, 7

Empty and load friction tensions, 53

En-Masse conveyor, 108

Engineering and systems approach, 21

Engineering chain, 108, 109, 111

Estimate the total required chain pull, 132

-F-

Fatigue, 126

Feeder, 31, 88, 106, 143, 153

Field determination of belt speed, 102

Filling weave., 67

Flight and scraper conveyors, 150

Flight conveyor, 7, 108, 148, 150, 151, 153

Flight, 118, 148, 150, 151, 153, 161

Fluid couplings, 100, 101

FPM, 66, 102, 147, 149, 153, 158, 160

Friction factor and length factor, 46

Friction, 44, 46, 53, 58, 133, 134

Furnace & boiler door, 7

-G-

General definition of a conveyor, 11

General design and selection of conveyor systems, 28

Grade 1 belting, 63

Grade 2 belting., 64

Grade 3 belting., 64

Grades of conveyor belting & their uses, 62

Graphical or tension diagram method, 51

-H-

Head drive, 53, 55, 57, 58

Hoppers, 7

Horizontal head drive conveyor, 55

Horsepower calculation, 46

Horsepower, 10, 44-49, 53, 58, 73, 96, 98, 99, 102, 135

-I-

Idler and belt conveyor alignment, 86

Idler selection, 80, 83

Idler service factor, 82

Idler, 40, 42-45, 50-51, 70-87, 92, 102, 148, 152

Idlers & pulleys, 73, 86

Inclination, 33, 40, 88, 89, 91, 143, 144

Incline conveyor, 53, 56, 57

Incline load and belt weight tensions, 53

Industrial car, 7

-L-

Layout and arrangements, 151, 157

Layout and capacities, 32

Layout arrangements, 32

Layout, 22, 26, 27, 32, 87, 151, 157, 161

Length factor, 46

Leno weave, 62, 67

Load rating, 51, 77, 79, 84

Loading material on the belt, 88

-M-

Make tentative chain selection, 137

Malleable iron, 119

Malleable roller, 116

Manganese bronze, 121

Material classification, 20

Material friction factors, 134

Material weight and lump factor, 83

Maximum angle of incline, 35

Maximum lump sizes and speeds for apron conveyors, 148

Maximum plies for troughing, 73

Mechanical Conveyors for Bulk Solids, 28

Minimum and maximum ply & pulley diameter, 70

Minimum plies for load support, 74

Minimum tension, belt sag and idler spacing, 50

Multiple grade conveyor head drive, 58

#### \*\*\*CLICK HERE FOR DETAILS\*\*\* TO BUY BOOK RIGHTS AND DOMAIN NAME

-N-

Notes on operation and maintenance, 129

-0-

Operating capacity, 12, 13

Operations, 11, 24, 31, 127

Oscillation of chain speed at sprockets, 126

-P-

Pan conveyor, 7

Peak capacity, 12

Pearlitic, 120, 121

Perduro, 121

Permaclad, 121

Phone, 4

Pins, 110, 139

Pitch, 109

Plain weave., 67

Plant layout, 26, 27

Plate body, 140

Pneumatic conveyor, 7

Preferred drive location, 53-58

Pulley diameter, 64, 69, 70, 73, 75, 95, 96

Pulley terminal, 84

Pulley, 49, 50, 75, 85

-R-

Rated capacity, 12, 13, 126

Recommended minimum drive pulley diameters, 75

Redler, 155, 156

Rivetless chain, 117

RMA, 70

Roll, 34, 40, 42, 71, 73, 76-79, 92, 107

Rollers, 110, 134

Rubber Manufacturers Association, 70

**-S-**

Scraper conveyor, 116, 148, 150, 152, 154

Scraper of flight conveyor, 108

Scraper, 107, 108, 116, 118, 148, 150, 151, 152, 153, 154

Screw conveyor, 6, 7, 11

Screw feeder, 153

Screw, 6, 7, 11, 49, 50

Selection of attachment links, 139

Selection, 10, 18, 28, 75, 99, 131, 137, 139

Service factors, 136

Shock loads, 126

Slack side tension, 48, 130

Solid hub bodies, 141

Solid weave., 67

Sources of supply, 27

Spacing, 47, 50, 51, 73, 89, 138

Special applications, 157

Special chains, 118

Speed factor, 137

Speed, 37, 48, 100, 102, 126, 137, 147, 160

Split (arm or plate) body, 140

Split hub bodies, 142

Sprockets, 109-112, 118, 123-130, 138, 140-144, 147

Steel, 66, 117, 118, 121, 133, 134, 139, 149, 153

Stetigforderer, 103, 162

Storage bins, 7

Straight sidebar, 109

Straight warp weave, 67

Suggested normal spacing of belt idlers, 51

Supermal, 120

Supporting structure, 146

Systems approach, 21, 24

-T-

Tanks & Silos, 7

Tensile loads, 122

Tensile strength, 121

Tension ratings of conveyor belts, 70

Terms and definitions, 10, 108

Torque control devices, 99

Tradenames, 120

Training empty conveyor belts on idlers, 73

Transition from troughed idlers to terminal pulleys, 85

Troughing angle, 40, 41, 70, 76

Troughing idler, 40, 51, 85, 86, 92

Troughing, 40-42, 51, 70, 73, 76, 85-87, 92

Tubular conveyor gallery, 31

Tubular conveyor, 31, 161

Types of chains, 112

Types of idlers and design, 75

Types, 82, 112, 132, 143

Typical idler bearing assembly, 80

**-V**-

Values for weight factors and belt weights, 46 Variable speed hydraulic couplings, 100 Verify chain selection, 139

-W-

Wear strips, 130 Wear, 123, 124, 129, 130 Welded steel, 118, 149, 153 Wrap factor, 48-50