Heavyweight Engineering Manual

NIBA
The Belting Association®

HEAVYWEIGHT ENGINEERING MANUAL
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HEAVYWEIGHT ENGINEERING MANUAL
SECTION I – INTRODUCTION

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STATEMENT OF PURPOSE

The primary objective of this Manual is the compilation of information collected from various sources which relate to the proper fabrication and operation of flat conveyor belting, recognizing that following production of the belt, independent fabricators/distributors must customize the product for customer use in a variety of applications and utilize a variety of operating equipment.

The Manual is not intended to deal with the production of belts as such, which is currently being handled by the Association for Rubber Products Manufacturers (ARPM) in consultation with the International Standards Organization (ISO) and the Association of PVC Belt Manufacturers. Standards developed by those organizations should be considered as they relate to the efficient operation of the conveyor belting under actual job conditions as well as the safety of its operation.

The Manual attempts to reflect the interest of belt fabricators/distributors, belt manufacturers, vendors of belt-moving equipment, and vendors of auxiliary operating equipment which may or may not be incorporated as part of the final belt fabrication including but not limited to: pulley lagging, skirt boards, pleats, guides, spill-edges, rollers, idlers, belt hooks, belt lacing, equipment to make belt endless providing a variety of applications, tracking equipment, troughing devices, cut-edge finishing, binding materials and devices, belt maintenance tools, take-ups, belt elevator equipment, conveyor belting repair equipment and materials, belt scrapers, and vulcanizing equipment.

FOREWORD

To carry out these purposes, the Association has appointed an Education/Technical Committee consisting of qualified industry members representing various major divisions within the industry. It is contemplated that after the Heavyweight Engineering Manual is first published, it will be supplemented by mailings of additional sections to subscribers as those sections are completed.

In preparing this Manual, the Committee has consulted with the broadest possible segment of the industry, both members and non-members of NIBA. In drafting the Manual, the Committee has tried to compile a variety of material that its members judged to be informative as to the efficient and safe operation of conveyor belting. The Committee did not attempt to develop all-inclusive standards or rigid rules. Likewise, the Manual should not be followed without application of common sense and individual company experience with specific applications. Moreover, the reader is cautioned that these applications cover an extremely wide variety of equipment and operation with belts of an almost infinite variety of construction and specifications. Therefore, this Manual should not be considered a substitute for the specific specifications of the particular product being used, as established by its manufacturer. However, within these limitations, the authors are hopeful the Manual will advance the state-of-the-art in this field.

Suggestions for revisions should be sent, at any time, to the NIBA office at the address indicated above. They will then be given careful consideration by the NIBA Education/Technical Committee.

DISCLAIMER

IMPORTANT INFORMATION

NIBA - The Belting Association does provide information, written and verbal, relative to belting and its use that it considers to be accurate and reliable. Such information is offered as an information-available service only. NIBA - The Belting Association does not assume liability, whatsoever, in regard to the use of this information. The user of this information determines for itself by the exercise of its business judgment the suitability of that information for the particular purposes of the user and is solely responsible for its application of information provided or requested.

**ALL TECHNICAL INFORMATION SUPPLIED
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SHOULD BE USED AS A GUIDE ONLY.**

NIBA - The Belting Association has gathered information pertaining to belting and its use from a multitude of sources. NIBA does not conduct research or perform testing on belting or related products. Accordingly, NIBA cannot guarantee the accuracy of the information presented.

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IF THE USER OF NIBA INFORMATION FEELS HE NEEDS MORE THAN A "GUIDE," HE SHOULD CONTACT HIS BELTING SUPPLIER.

SECTION II – DATA SHEETS

HEAVYWEIGHT CONVEYOR BELT DATA SHEET

Customer: _____ Date: _____

Location: _____ Conveyor No.: _____

Belt Length ___Belt Width ___C-C b/t Terminal Pulleys ____ Lift ☐ or Drop ☐ __ft.

Trough Angle _____ Belt Speed ___fpm Load Rate: Max _____ Avg _____

MATERIAL HANDLED: _____

Weight, lbs/cu/ft _____Max. Lump Size _____ Percent of Fines _, Wet ☐ Dry ☐

Temp. __F. Other Information _____

DRIVE INFORMATION: Type (Single, Dual, or _____ .) Lagged? Yes ☐ No ☐

Belt Wrap _____ Location _____

Pulleys: Type Surface _____ Diameters: Head _ Tail ____

Take-Up _____ Take-Up Bends _____ Drive (if Separate) _____

TAKE-UP Location _____ Type _____

If Gravity – Weight Total _____lbs. Type Splice _____Amount __ ft.

Horizontal Centers _____ft. Slope Degree _____,

Loads from_____ Discharge to _____

Chute Length _____Chute Angle _____ Free Fall of Material _____ ft.

Load Area: Type of Rollers _____

Idlers: Dia. _____ Style _____ Spacing ____ ft. Type _____

Location: _____DRIVE H.P. _____ RPM _____

Type _____ Starting Method _____

Previous Belt Description: _____

Describe Failure: _____

Calculated Operating Tension _____PIW

Belt Recommendation: _____

_____

_____

By _____ Date _____

SECTION II – DATA SHEETS

ELEVATOR DATA SHEET

Company: _____ Date: _____

Location: _____ Elevator: _____

Total Length Required: _____ Width Belt Required: _____

ELEVATOR DATA Centrifugal ☐ or Vertical ☐ or Vertical Lift _____ ft.

Elevator Centers ___(ft.) Continuous ☐ Inclined ☐ Degree of Incline ___

Belt Speed ___(FPM) Motor HP ___ Type of Feed: Scoop ☐ Fly ☐

Tons Per Hour: Max _____ Avg _____ **Bushels** Per Hour: Max _____ Avg _____

Type of fastener or joint used to make endless _____

MATERIAL DATA

Name of Material _____ Size _____ Dust Suppression: Y ☐ N ☐

Weight per Cubic Foot _____ lbs. Temperature _____ F

Material: Dry ☐ Wet ☐ Sticky ☐ Corrosive ☐ Oily ☐ Compact ☐ Fluffy ☐ Other ☐

PULLEY DATA

Type of Take Up _____ Auto _____ Screw Boot Pulley Wing Type? Y ☐ N ☐

Head Pulley _____ " dia. Face Width _____ Head Pulley: Bare ☐ or Lagged ☐

Boot Pulley _____ " dia. Face Width _____

BUCKET DATA

Type or Style _____ Number of Rows _____ Spacing in One Row _____ "

Weight of Each _____ lbs. Gauge Metal _____ Capacity _____ Cu. Ft.

Length _____" Depth _____" Width (projection) _____" Bolt Size _____"

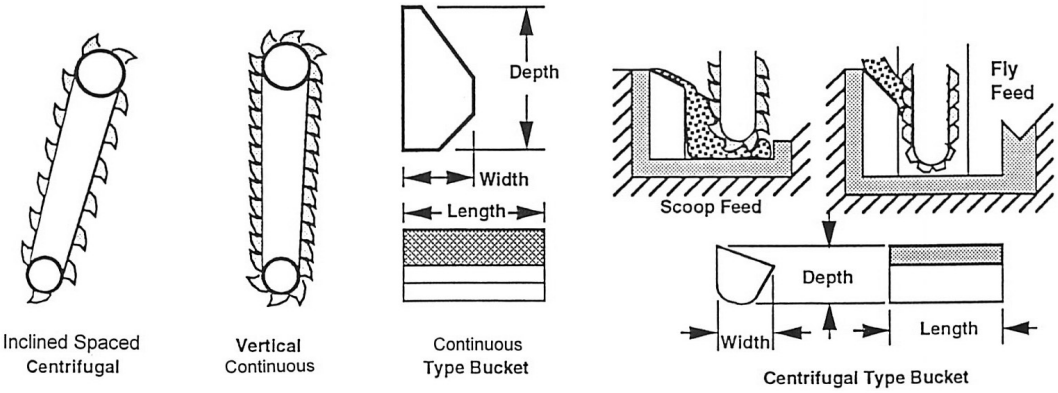
Previous or Current Belt Specification: _____

Reason for Replacement of Existing Belt: _____

_____ Years of Service: _____

Recommendation: _____

By _____ Date _____



Inclined Spaced Centrifugal | Vertical Continuous | Continuous Type Bucket | Centrifugal Type Bucket

HEAVYWEIGHT ENGINEERING MANUAL
SECTION III – BELT SELECTION

The purpose of this section of the NIBA Heavyweight Engineering Manual is to provide the distributor and belt user with a relatively simple and efficient method for selecting the best conveyor belt for many common applications. It may also provide a way to quickly double check a design. If there are doubts, or discrepancies, get a recommendation from a reliable conveyor belt manufacturer or engineer. The best selection will usually result in the lowest total cost-per-ton over the service life of the conveyor belt.

HEAVYWEIGHT BELT SELECTION

The best selection of a heavyweight belt depends on acquiring complete and accurate operating and environmental information. Factors influencing the choice of the belt include the tension requirements, the pulley diameters, the troughability requirements, the impact resistance requirements, the load support at trough requirements, and the temperature and chemical resistance requirements. The information that should be gathered is shown on the "NIBA CONVEYOR DATA SHEET" on page 4. In general this information should include:

1. **CARRYING SURFACE.** State if the load surface of the belt is supported by flat or troughed idlers, or the type of flat slider bed surface. State the angle of the troughed idlers.

2. **DRIVE DATA.**
   a. Record the motor nameplate horsepower.
   b. Identify if single or multiple drive pulleys.
   c. Are drive pulleys bare or lagged?
   d. Measure or calculate the total belt wrap (degrees) on drive pulley(s).
   e. Identify the location of the drive.

3. **ENVIRONMENT.** Note the temperature, chemicals, oils, and any other special conditions.

4. **HEIGHT.** Note the vertical difference in elevation of the head and tail (terminal) pulleys in feet.

5. **LENGTH.** Note the distance (ft.) between the head and tail pulleys.

6. **LOADING RATE.** Note the tons per hour to be loaded on the belt.

7. **MATERIAL.** Record the type, temperature, and weight per Cu. Ft., size and percentage of maximum lumps to which the belt will be exposed.

8. **PULLEYS.** . Record the diameters of the head pulley, drive pulley, and any other pulley that is used to change the belt direction. Identify the purpose of each pulley and include it in the system sketch. Record the face width of the pulleys.

9. **IDLERS.** Record the diameter and trough angles of the carry and return idlers.

10. **SPEED.** Record the belt speed in feet per minute.

10. **TAKE-UP.** Record the type of take-up system (mechanical screw or automatic), location, and total amount of movement. Include this information in the system sketch.

11. **WIDTH OF BELT.** Record the width of the belt in inches.

With this information, the conveyor belt tension calculations can be done.

SECTION III – BELT SELECTION

CONVEYOR BELT TENSION CALCULATION

First, the Effective Belt Tension (TE or T1) must be calculated. TE is the sum of the tension required to move the empty belt (TC), the tension required to move the load horizontally (TL), and the tension required to lift the load (TH). This is given in the following equation:

$TE = TC + TL + TH$

Where,

$TC = F_1 \times L \times CW$

F_1 = .035" (Normal friction factor for average conditions of over 20°F to move the empty belt.)

L = Belt length (ft.)

CW = Weight of conveyor belt components. See Table A.

$TL = F_2 \times L \times MW$

F_2 = .04" [Normal friction factor to move load horizontally.]

L = Belt length (ft.)

MW = Material weight (lbs. per lineal foot).

$$MW = \frac{33.3 \text{ TPH}}{\text{Belt Speed (fpm)}} \quad \text{or} \quad \frac{\text{Total material load in lbs.}}{L}$$

$TH = H \times MW$ H = Difference in elevation of terminal pulleys (ft.)

TABLE A – WEIGHT OF MOVING CONVEYOR COMPONENTS

Belt Width (in.)	CW Factor with Regular 5" Idlers (See Note)
12"	12
18"	18
24"	24
30"	30
36"	36
42"	42
48"	48
54"	54
60"	60

NOTE:

A. For **4" idlers**, multiply the CW factor by 0.85
B. For **6" idlers**, multiply the CW factor by 1.33
C. For belt lengths (L) less than 150 feet, multiply the CW factor by:

100' to 150' by 1.1
75' to 99' by 1.2
50' to 74' by 1.3
30' to 49' by 1.5
15' to 29' by 2.0
less than 15' by 3.0

The next step is to calculate the Slack Side Tension (TS or T2). This is the additional tension required to prevent belt slippage on the drive pulley. With automatic take-up systems, it is normal to use two times this value for the combination of the take-up counterweight and the pulley weight or force.

$TS = D \times TE$

Where, D is the Drive Factor (refer to Table B).

TABLE B – DRIVE FACTOR (D)

Angle of Belt Wrap at Drive	Type of Drive	Screw Take-Up Bare Pulley	Screw Take-Up Lagged Pulley	Gravity or Flexible Take-Up Bare Pulley	Gravity or Flexible Take-Up Lagged Pulley
150°	Plain	1.5	1.0	1.08	.67
160°	Plain	1.4	.9	.99	.60
170°	Plain	1.3	.9	.91	.55
180°	Plain	1.2	.8	.84	.50
190°	Snubbed	1.1	.7	.77	.45
200°	Snubbed	1.0	.7	.72	.42
210°	Snubbed	1.0	.7	.67	.38
220°	Snubbed	.9	.6	.62	.35
230°	Snubbed	.9	.6	.58	.32
240°	Snubbed	.8	.6	.54	.30
340°	Tandem or Dual	.5	.4	.29	.143
360°	Tandem or Dual	.5	.4	.26	.125
380°	Tandem or Dual	.5	.3	.23	.108
400°	Tandem or Dual	.5	.3	.21	.095
420°	Tandem or Dual	.4	.3	.19	.084
440°	Tandem or Dual	–	–	.17	.074
460°	Tandem or Dual	–	–	.15	.064
480°	Tandem or Dual	–	–	.14	.056

The total tension, herein called Operating Tension (TO or T0), is sometimes called the Allowable Working Tension (AWT) and it is calculated by the following equation.

$TO = TE + TS$

This value then divided by the width of the belt in inches provides the tension number that is used to select the reinforcement ply combinations, normally expressed as the belt's PIW (pounds per inch of width) tension requirement.

To determine the Maximum Total Tension (TO-max or T0-max) that a system can generate, given the nameplate horsepower of the drive, the following equation is used:

$$TO\text{-}MAX = \frac{.9\ HP \times 33{,}000 \times (1+D)}{S}$$

Where,

HP = Nameplate horsepower rating
D = Drive factor (See Table B)
S = Speed of the Belt (ft/min)

To express this in a PIW format, divide TO-max by the belt width in inches.

To determine the required motor horsepower, given the calculated Effective Belt Tension and belt speed, use the following equation:

$$HP = \frac{TE \times fpm}{33{,}000}$$

***CAUTION**: If an oversized motor is used, there is the potential for surge loading that could over stress the belt.*

Once the tension calculations have been completed, the next step in the belt selection process is to select the proper reinforcement (usually fabric) combinations. The fabric belt carcass consists of one or more layers of fabric bonded together with rubber. The fabric is typically composed of polyester, nylon, or a combination of both. A number of fabric belt carcass options are available.

TABLE C_1 – CARCASS MATERIAL DESIGNATIONS

FABRIC TYPE	USA	Metric / Outside USA
Polyester	P	E
Nylon	N	P
Carcass		
Poly-Nylon	PN	EP
Nylon-Nylon	NN	PP
Poly-Poly	PP	EE

Note: Outside the USA, the material abbreviations are based on the chemical name.

- Polyester (E) – ethylene glycol
- Nylon (P) – polyamide

When selecting a fabric belt for a conveyor system based on calculated system tension, it is important to understand the nomenclature used to identify belt constructions. In the United States, the term carcass tension represents the maximum safe working tension recommended by the belt manufacturer. The tension is given in PIW (pounds per inch width). Outside of the United States, the carcass tension is the breaking strength of the belt in N/mm (Newtons per millimeter width).

TABLE C_2 – CARCASS DESIGNATIONS

Item	Units	Description	System
PIW	Lb / In. Width	Max. Operating Strength	USA
EP, EE, PP	N / mm OR kN / m	Breaking Strength	Metric / Outside USA

To convert from EP to PIW, multiply by 5.71 to give breaking strength. This number must then be divided by the Safety Factor (SF) to give the rated belt PIW.

Example: Convert EP 1000 to PIW (assuming 10:1 SF)

$$\frac{1000\text{N /mm X } 5.71}{10} = 571 \text{ PIW}$$

TABLE C_3 – TYPICAL SAFETY FACTORS

Item	Safety Factor
PIW	8 to 12
EP, EE, PP	10

TABLE C_4 – CONVERSION TABLE

Safety Factor	EP to PIW Multiply By:	PIW to EP Multiply By:
12	0.571	2.10
11		1.93
10		1.75
9		1.58
8		1.40

The final selection of the belt carcass is determined by considering the flexibility, troughability, impact resistance, load support, and operating conditions of a given conveyor application. The values relating to the ability of the belt to pass the above considerations should be available in the conveyor belt manufacturer reference manuals or printed information for belt selection.

CONVEYOR BELT FLEXIBILITY

The minimum recommended pulley diameters for each fabric ply count combination must be considered at the percent of rated tension of the combination. If this is disregarded, the belt service life will be shortened by ply separation, splice failure, or tracking problems. Refer to Table D for recommended minimum pulley diameters.

TABLE D – RECOMMENDED MINIMUM PULLEY DIAMETER IN INCHES

	110# / Ply				125# / Ply				200# / Ply			
	% Belt Rated Tension				% Belt Rated Tension				% Belt Rated Tension			
# of Plies	80 to 100	60 to 80	40 to 60	Under to 40	80 to 100	60 to 80	40 to 60	Under to 40	80 to 100	60 to 80	40 to 60	Under to 40
2	16	14	10	10	16	14	10	10	16	14	12	10
3	18	16	12	12	18	16	14	12	24	20	18	16
4	24	20	18	16	24	20	18	16	30	20	16	14
5	30	24	20	18	30	24	20	18	36	24	20	18

Note: This is a general guide. If in doubt, check with the engineered ratings of the belt manufacturer. If pulley diameter estimates are requested for a certain belt, a drive or head pulley diameter estimate can be taken from the 80%-100% tension column. Take-up and tail pulley diameter estimates can be taken

from the 40%-60% classification. For snub pulleys, choose minimum diameters based on belt tension. If the wrap is less than 6", the pulley may be decreased to the next smaller standard diameter.

CONVEYOR BELT TROUGHABILITY

Eliminate combinations that will not allow normal belt contact with the carrying idlers, including those in the transition areas, while the belt is empty. A belt with inadequate transverse flexibility will result in poor tracking which may cause edge wear, spillage, poor loading, or early belt failure. Refer to Table E for recommended maximum number of plies for empty belt troughing.

TABLE E – MAXIMUM PLIES FOR EMPTY TROUGHING

	110 piw/ply Idler Angle			125 piw/ply Idler Angle			200 piw/ply Idler Angle		
Belt Width	20°	35°	45°	20°	35°	45°	20°	35°	45°
16" - 20"	2	-	-	-	-	-	2	-	-
24"	3	3	2	2	2	-	3	2	-
30"	-	-	-	-	-	-	4	3	2
36"	4	4	3	3	3	2	5	4	3
42"	5	5	4	4	3	3	6	5	4

NOTE: Long center roll type allows that the next smaller value can be used on the 45° and 35° values.
NOTE: The above is a guide only. Since there are a variety of belt constructions with different physical properties, belt manufacturers must be consulted for specific recommendation.

IMPACT RESISTANCE

The belt must be rated to handle the lump weights and the weight per lineal foot of the material being carried. Loading conditions will vary and must be considered. The selection must be rated for these impact considerations or the belt is prone to be beaten into premature failure. Refer to Table F1 for the means to obtain the lump weight factor of the material for the system. Refer to Table F2 for recommended number of plies to resist the impact.

Careful consideration of the loading conditions must be given in the conveyor belt selection process. If there is a history of belt failure attributed to impact, this may be more significant than any guides, tables, or calculations.

Improvements in load design and/or conveyor equipment may be required if the belting is prematurely failing from material impact. Indications of an impact problem include:

a. Breaks in the belt parallel to the belt angle.
b. Star breaks in the top cover.
c. Gouges in the top cover.
d. Failure of mechanical fasteners from physical abuse.

TABLE F_1 – LUMP WEIGHT FACTOR IN POUNDS

Density lbs. / ft^3	Lump Size - Inches												
	2	3	4	5	6	7	8	9	10	12	14	16	18
50	0.4	1.3	3.0	5.8	10	14	21	30	40	70	100	148	211
75	0.6	1.9	4.5	8.6	15	21	31	44	61	105	149	222	316
100	0.7	2.6	5.9	12.0	20	28	41	59	81	140	199	296	421
125	0.9	3.2	7.4	14.0	25	35	52	74	101	175	248	371	527
150	1.1	3.8	9.0	17.0	30	42	62	89	121	210	298	444	632
175	1.3	4.5	10.4	20.2	35	49	73	104	142	245	348	518	737

Note: These factors are based on a nominal free fall of 4 feet. If the free fall is different than 4 feet, divide the Lump Weight Factor (Table F1) by 4 and multiply by the free fall of the material in feet.

If the material momentum includes a chute preceding the free fall, add this impact force to the Lump Weight Factor (See Table F_1). The additional height to be added in the Lump Weight Factor calculation due to the drop of material in the chute can be determined by multiplying the distance drop in the chute by the sine of the chute angle squared.

Additional Height Factor = Chute Height x $(\text{Sine Angle})^2$

The impact rating (See Table F_2) equals the lump weight factor (See Table F_1) times the free fall.

TABLE F_2 – MAXIMUM IMPACT RATING (FT—LBS)

	Rated Tension (piw/ply)			
Number of Plies	110	125	150	200
2	450	475	600	700
3	600	650	700	800
4	700	750	800	900
5	800	850	900	1000

NOTE: Individual belting manufacturers should be consulted for recommendations on proper reduced ply belting impact resistance.

If large lumps exceed 10% of the material, add one more ply to the minimum rating from Table F_2.

If impact idlers are not used, multiply the Lump Weight Factor by 2 for belts of 4 plies or less, by 1.25 for belts of 5 plies, and by 1.15 for belts of 6 plies or more.

SECTION III – BELT SELECTION

LOAD SUPPORT

The belt must be capable of resisting the load weight at the juncture of the center support idler and the troughing idlers. The belt carcass will break down and split longitudinally in this area if it is loaded beyond its capacity to support the load. Refer to Table G1 for recommendations on the number of plies required for specific fabric strengths and material weight factors.

To prevent longitudinal creasing of the conveyor belt at the troughing roll junctures (angle formed by the horizontal center roll and the angled troughing rolls), the belt carcass must have sufficient body to resist being squeezed between the rolls by the load weight.

The first step in this determination is to calculate the Material Weight (MW) by using one of the following equations.

$$MW = \frac{33.3 \times TPH}{S} \quad \text{or} \quad MW = \frac{\text{Total Load}}{L}$$

Where,

TPH = Tons Per Hour conveyed
S = Belt Speed (ft/min)
Total Load = Maximum load on the belt at any given time (lbs.)
L = Belt length (ft.)

TABLE G_1 – LOAD SUPPORT AT TROUGHING IDLERS (Any Angle)

	Material Weight Factors (MW)				
	Number of Plies				
PIW / ply	2	3	4	5	Belt Width (in)
	85	200	370	550	To 36
	60	160	300	470	37 – 48
	40	120	240	400	49 – 78
110	40	80	170	320	79 - 96
	100	270	480	690	To 36
	75	210	390	600	37 – 48
	50	150	310	520	49 – 78
125	50	90	230	430	79 - 96
	150	400	650	850	To 36
	105	300	540	760	37 – 48
	60	210	440	670	49 – 78
200	60	110	330	580	79 - 96

OPERATING CONDITIONS

Consideration must be given to the operating temperatures, abrasive properties of the material being conveyed, system incline angle, chemical properties of the material being conveyed, and process conditions. Once these factors are accounted for, a proper choice of carcass and cover materials can be made. The conveyor belt manufacturers offer a variety of carcass materials and cover compounds to meet various needs. They should be consulted on the material and cover thickness requirements.

WEIGHTS OF MATERIAL (Density)

	Lbs Per Cubic Ft	Angle Repose
Alumina	50-65	22°
Ammonium Nitrate	45	
Asbestos Ore	80	
Asbestos, Shred	20-25	
Ashes, Dry	35-40	40°
Ashes, Wet	45-50	50°
Asphaltum	80-85	
Batch Glass	90-100	
Bauxite, Run of Mine	80-90	31°
Borax	45-55	
Brickwork (solid)	115	
Bagasse	7-10	
Caliche	100	
Carbon Black, Powder	4-6	
Carbon Black, Pellets	25	
Cement, Portland	94	39°
Cement, Clinker	80-95	30°
Cinders	40-45	35°
Clay, Dry in Lump, Loose	60-70	35°
Coal, Anthracite, Egg	60	27°
Coal, Anthracite, Nut and Stove	60	27°
Coal, Anthracite, Run of Mine	60	27°
Coal, Anthracite, Pea	60	30°
Coal, Anthracite, Buckwheat	60	35°
Coal, Bituminous, Sized	50	35°
Coal, Bituminous, Run of Mine	50	40°
Coal, Bituminous, Slack, Dry	40-45	40°
Coal, Bituminous, Slack, Wet	55	45°
Coke, Sized	25-30	
Coke, Mixed	23-32	30°
Coke, Breeze	25-34	45°
Coke, Petroleum	35-40	
Concrete	115	
Cinder w/ Portland Cement	115	
Sand & Gravel, Portland Cement	150	
Mix Wet	115-125	
Copper Ore	120-150	
Cooperas	50	
Cryolite	62	
Cullet	80-120	
Dolomite, Crushed	90-100	40°
Earth, Common Loam, Moist	73	35°
Earth, Mud, Fluid	110	
Feldspar, 1/8”	65-70	38°
Flue Dust, Blast Furnace	110-125	
Fluorspar	80	
Glass Batch	90-100	
Gneiss	96	
Grains		
Barley (48 lb/bu)	38	23°
Corn, Shelled (56 lb/bu)	45	21°
Flour, Wheat (190 lb/bbl)	35-45	
Oats (32 lb/bu)	26	21°
Rye (56 lb/bu)	44	23°
Wheat (60 lb/bu)	48	28°
Granite	90-100	
Gravel, Dry, Screened	90-100	38°
Gravel, Run of Bank	90-100	38°
Greenstone	107	
Gypsum, Irregular Lumps	70-80	30°
Hemetite, Ore (Nelsonite)	140-160	
Illmenite, Concentrate	150-155	
Iron Ore	120-200	35°
Iron Ore, Crushed	150	35°
Lignite, Air-Dried	45-50	
Lime, Ground	60	43°
Lime, Pebble	50-55	30°
Limestone, Broken	90-100	35°
Limestone, Coarse, Sized	95-100	35°
Limestone, Dust	75-85	
Marble	95-105	
Metals		
Aluminum	165	
Brass, Cast	512	
Copper, Cast	542	
Cast Iron	446	
Wrought Iron	485	
Steel	490	
Lead	710	
Zinc	438	
Mill Scale	125-150	
Molybdenum Ore	100	
Nickel Ore	100	
Paper Pulp (Wet)	60-62	
Phosphate, Rock	75-85	30°
Phosphate, Pebble	85	25°
Potash Ore, 6”	75-85	
Potash Ore, 14 Mesh	68-75	
Quartz, Broken	95-100	25°
Salt, Rock, Crushed, 3/8”	80	36°
Salt, Granulated	70-80	25°
Sand, Dry	90-110	25°
Sand, Damp	110-130	45°
Sand, Foundry	90	39°
Sandstone, Quarried and Piled	82	
Shale, Crushed	90	39°
Sinter	110-135	
Slag, Furnace, Crushed	80	25°
Slag, Granulated	60-65	25°
Slate, Crushed, 1/2”	80-90	28°
Soybeans	46	35°
Sugar, Raw	55-65	
Sugar, Refined	50-55	
Sulphur, Ore	87	
Sulphur, Lumpy	75-85	
Sulphur, Powdered	50-55	
Taconite Pellets	115-130	
Titanium Dioxide, Dry, Fine	50-55	
Traprock, Crushed	105-110	
Wood and Wood Products		
Hardwood (solid)	35-75	
Softwood (solid)	25-40	
Woodchips, Hard	18-30	22°
Woodchips, Soft	16-25	22°
Woodchips, Cooked	35	
Bark	10-20	45°
Bog Fuel, 40% Moisture	16-22	
Woodflour	16-36	
Sawdust	13	36°
Zinc Ore, Crushed	160	38°

SECTION IV – MECHANICAL BELT FASTNERS

SPLICING CONVEYOR BELTS WITH MECHANICAL FASTENERS

Mechanical fasteners offer an economical, reliable and long lasting belt splice method. They are the most common belt splicing materials in use today, for both light and heavy-duty conveyor belt applications. Mechanical belt fasteners are easily installed with only a modest amount of mechanical skills and tools. The purpose of this section of the NIBA HEAVYWEIGHT ENGINEERING MANUAL is intended to acquaint the reader with some of the mechanical fasteners available today. The information contained herein is intentionally general in nature. It is recommended that the fastener manufacturers be consulted for specific product and application information and recommendations.

The majority of belts being manufactured today are made of synthetic materials that lend themselves to mechanical attachment. Most modern conveyor belts are designed for use with mechanical fasteners. This, coupled with constantly improving designs and materials in mechanical belt fasteners, provides belt operators with a reliable, long-lasting and quite inexpensive way to splice belts. The combination of belts designed for mechanical fastener splices and improved fastener designs has extended the use of mechanical fastener splices to service at higher tensions, and this trend will continue with further fastener and belt developments.

Today, mechanical fastener splices today offer a permanence once considered not available. Fasteners are designed and produced with improved materials and modern belts are designed for fastener splices. Other features, such as countersinking which maintains belt profiles, have improved mechanical belt splicing. All belt fastener processes, fastener installation, countersinking, etc. are designed to repair a belt in a short period of time, rather than waiting for outside contractors. This translates into significant cost savings as downtime is minimized and production may continue without substantial interruption.

In summary, some of the benefits of using mechanical fasteners are:

1. **COST** - Typically, mechanical fasteners offer the lowest cost approach to belt splicing. This is due to lower splice material cost for the mechanical fastener splice components and the fact that the work can be done in-house.
2. **SPEED OF INSTALLATION** - Typical splices can be installed in minutes, reducing downtime.
3. **EASE OF INSTALLATION** - Splicing requires relatively simple and inexpensive tooling, which is readily available and can usually be kept on site. While some mechanical skill is needed, it is relatively simple to splice with mechanical fasteners.
4. **SAFE TO USE** - There is little or no exposure to chemicals, sharp instruments or heat when installing mechanical fasteners.
5. **EASE OF INSPECTION** - Splices are visible and show signs of potential failure.
6. **LITTLE EXTRA BELT LENGTH REQUIRED** - The only belting cut off and discarded is that generated in squaring the belt ends when making mechanical fastener belt splices. The extra length of belt required for mechanical fastener splices is measured in inches.
7. **NO SHELF LIFE LIMITATION** - Mechanical fastener splice materials do not deteriorate while in storage.

Mechanical fasteners are in use today in many applications involving conveyor belts. Some specific applications where belt fasteners are used include coal mining; hardrock mining, including quarrying and sand and gravel facilities; package handling and distribution centers; as well as agricultural harvesting and food processing.

HEAVYWEIGHT ENGINEERING MANUAL

SECTION IV – MECHANICAL BELT FASTNERS

TYPES OF MECHANICAL FASTENERS

Mechanical conveyor belt fasteners are manufactured in two styles, solid plate and hinged. Each has its particular advantages and the selection of fasteners should begin with this basic understanding. Solid plate fasteners span opposing belt ends that have been butted together, forming a tight, sift-free splice. Hinged belt fasteners are applied as individual segments to each belt end and then brought together and connected by means of a connecting hinge pin.

Solid plate fasteners are generally employed where a sift-free splice is required, such as bulk conveying applications. The two belt ends, having been brought firmly together, prevent fines from sifting through the splice area. Generally, solid plate fasteners are considered as a permanent attachment and are seldom used where the belt or the conveyor must be frequently taken apart. For the most part, solid plate fasteners require larger minimum pulley diameters than hinged fasteners.

Hinged fasteners, as implied above, can be operated on systems employing smaller pulley diameters. This inherent design feature allows for a broader range of applications than is available with corresponding solid plate fastener styles. Hinged fastener splices can be separated for belt removal or maintenance by removing the hinge pins. Some hinged fasteners have a sift-preventing component and thus can be used on belts conveying fines, but they are more frequently applied in other applications.

As the "working" part of a hinged fastener splice, the hinge pin should be selected as carefully as the fastener itself. Quite often it makes sense to select a pin of the same material as the fastener. For example, a stainless steel pin would be chosen for a stainless steel fastener. Solid (single) wire pins are the easiest to insert and are most often used on non-troughing applications. Stranded cable wire pins are recommended for troughing conveyors, given their greater flexibility.

Both solid wire pins and stranded cable pins are offered either with or without an external polymer covering. This polymer "jacket" serves as a lubricant when positioned between the loops of the hinged fasteners. As such, this pin style is less likely to wear or corrode. However, they are not the preferred choice where fine abrasive materials are being conveyed, wherein a solid wire or unjacketed cable pin is a better selection.

Other hinge pin choices include nonmetallic pins for smooth running at lower belt operating tensions, as well as notched or corrugated pins that reduce the likelihood of pin migration.

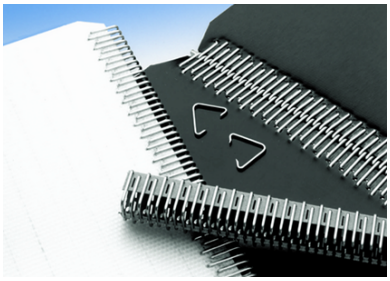
Hinge pin selection is as important as proper-hinged fastener selection. Properly selected and installed, they contribute to maximum splice life and performance. As with selecting hinged fasteners, the fastener manufacturers should be consulted for hinge pin recommendations.

The market for conveyor belt fasteners generally breaks down into two major segments, light duty and heavy duty. NIBA designates light-duty belts as those having a tension rating of 160 PIW or less, and heavy-duty belts as those with tension ratings over 160 PIW. Light-duty conveyor belt fasteners include wire hooks, common bar lacing, stapled plate fasteners, plastic hinged plate fasteners and plastic spiral loop fasteners. Heavy-duty conveyor belt fasteners include bolted and riveted plate fasteners and stapled, bolted, and riveted hinge fasteners. Heavy-duty fasteners are available for operating tensions up to 1500 PIW. While it is suggested that the individual manufacturer fastener catalogs be consulted for application information, a representative sampling of fastener types is illustrated in the following pages for reference.

NOTABLE FEATURES

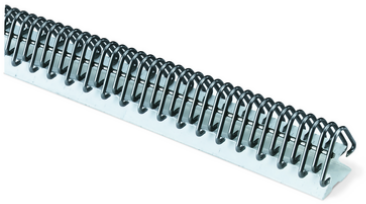
1. A hinged fastener comprised of high strength formed wire hooks utilizing a connecting pin. Generally provides a strong belt splice, which is flexible in both axis of the belt.

WIRE HOOK



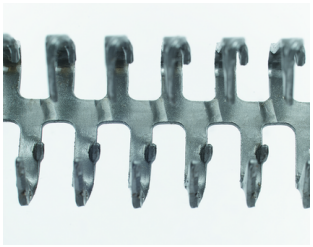
2. The same as above except the welded cross wire decreases the chance of hooks becoming dislodged from the balance of the belt splice.

COMMON BAR WIRE HOOK



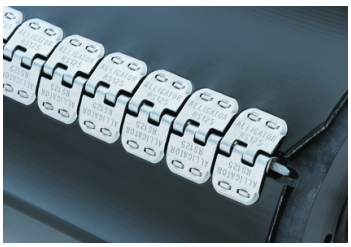
3. A hinged fastener made by stamping and forming teeth from a continuous ribbon of steel. Generally, only a hammer is needed for installation, making it more practical for some applications.

COMMON BAR LACING



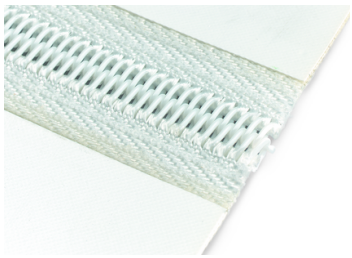
4. A light- to medium-duty hinged plate fastener that derives its strength by the compressive clamping action of either rivets or staples. Provides stronger splices in most types of belts.

STAPLED PLATE



5. A light-duty non-metallic fastener, supplied in a webbing that is vulcanized or cemented to the conveyor belt. Provides a low profile splice that can be used with metal detectors.

PLASTIC SPIRAL LOOP

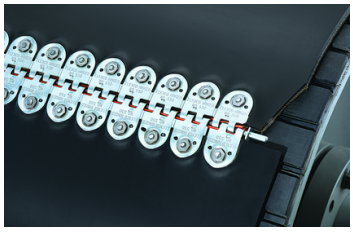


6. A non-metallic hinged fastener for light-duty belts. Available in multiple styles. Can be used with metal detectors. Available in FDA-approved materials. Also available in weather-resistant materials.

PLASTIC HINGED PLATE

7. A heavy-duty bolt hinge fastener for bulk haulage applications. Commonly used in low- to medium-tension industrial belts requiring a hinged splice. The fastener plates are compressed into the belt by special bolts and nuts. Only simple hand tools are needed for installation.

BOLTED HINGE

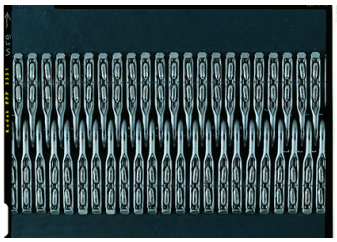


8. A heavy-duty riveted hinge fastener for medium- to high-tension bulk haulage applications. Available in several types of rivets and fasteners. Special rivets are driven through the belts, without pre-punching holes, to compress the fastener plates into the belt.

RIVETED HINGE PLATE

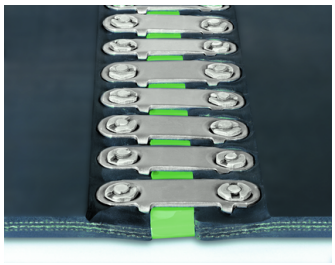
HEAVY STAPLED PLATE

9. A heavy-duty stapled hinged fastener for medium- to high-tension bulk haulage applications. High-strength staples are driven through the belts without pre-punching holes, to compress the fastener plates into the belt. Provides a very flexible splice.



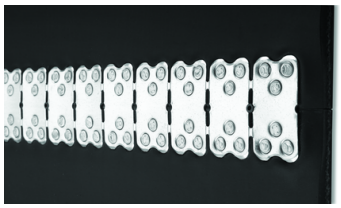
BOLTED SOLID PLATE

10. A solid plate butt joint compression belt splice. Like the bolt hinge, special bolts and nuts are used to compress the plates into the belt surfaces. These fasteners are generally used for the heavier bulk haulage applications where a sift-free, more permanent belt installation is needed. Only simple hand tools are needed for installation.



RIVETED SOLID PLATE

11. A solid plate butt joint compression belt splice for medium- to high-tension bulk haulage applications. Special rivets are driven through the belts without pre-punching holes. These fasteners are generally used for applications where a sift-free, more permanent belt installation is needed.



MECHANICAL FASTENER SELECTION

Mechanical fasteners for belting are to be selected in much the same process as belting. To properly select a mechanical belt fastener, both the physical and environmental factors must be considered, but not to be forgotten are the experience factors. Many belting manufacturers provide a recommended belt fastener style based on working tension, pulley size, and construction of the belting. Mechanical belt fastener manufacturers provide tables that are to be used as guidelines based on belt thickness and pulley diameters.

While the user/installer should refer to the belting and fastener selection guides, the decision process must then include product based on type of service desired (Hinged - Solid Plate), type of material (Carbon Steel - Stainless Steel - Plastic - Other), installation techniques (Hand or Power Tools - Specialized Machines).

The technical manual has provided a description of the various types of mechanical fasteners, the notable features and a chart titled “Fastener Selection”, which summarizes the range of specifications they may fit. In addition, a “Fastener Materials” chart illustrates the "normal use" of each material.

FASTENER SELECTION CHAR

	Wire Hook	Common Bar Wire Hook	Common Bar Lacing	Stapled Hinge Plate	Plastic Spiral Loop	Plastic Hinge Plate	Bolted Hinge	Riveted Hinge Plate	Heavy Stapled Hinge Plate	Bolted Solid Plate	Riveted Solid Plate
Recommended Minimum Pulley Diameter for Smallest Size	1” or 25mm	2” or 50mm	1” or 25mm	2” or 50mm	5/8” or 16mm	3” or 75mm	6” or 150mm	9”or 225mm	6” or 150mm	12” or 300mm	18” or 450mm
Belt Thickness Range (after countersinking if used)	3/64” – 13/32” or 1.2mm – 10.3mm	1/16” – 3/8” or 1.6mm – 9.5mm	1/32” – ½” or .8mm – 12.7mm	1/16” – 5/16” or 1.6mm – 7.9mm	Up to 3/16” or 4.8mm	1/16” – 1/8” or 1.6mm – 3.2mm	1/4” – 7/8” or 6.4mm – 22.2mm	7/32” – 11/16” or 5.6mm – 17.5mm	3/16” – 7/8” or 4.8mm – 22.2mm	3/16” – 1-3/16” or 4.8mm – 30.2mm	7/32” – 15/16” or 5.6mm-23.8mm
Materials Offered	Steel Stainless Nickel Alloy Bronze Hastelloy Carpenter 20 Inconel	Steel Stainless	Steel Stainless Nickel Alloy	Steel Stainless Alloy steel wear plates	Polyether Ether Ketone	Nylon	Steel Stainless Bronze Alloy steel wear plates	Steel Stainless	Steel Stainless	Steel Stainless Bronze Nickel Alloy Alloy steel wear plates	Steel Stainless Alloy steel wear plates
Maximum Belt Ranging	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.	Contact Fastener Mfg.

SECTION IV – MECHANICAL BELT FASTNERS

DESCRIPTION OF METALS

MILD CARBON STEEL	General service where corrosion, sparking or magnetic attraction is not a consideration, sometimes plated to prevent rusting.
HIGH CARBON STEEL	Same as above, except for improved tensile strength and abrasion resistance.
HARDENED ALLOY STEEL	Highly abrasion resistant, providing several times service life of regular steel in highly abrasive situations. Not recommended for corrosive environments.
CAST MALLEABLE STEEL	Severe abrasion in corrosive environments, i.e., coke and sinter operations.
STAINLESS STEEL	**400 Series** Provides some corrosion and chemical resistance when compared with carbon steel; is magnetic and can be used with magnetic tramp removal devices. **300 Series** Non-rusting and provides extra resistance to corrosion from acids and chemicals; excellent where sanitation requirements are high; basically non-magnetic. **Nickel and copper alloy (Monel)** Exceptional corrosive resistance in environments that quickly deteriorate carbon and stainless steel, such as brine, hydrogen fluoride or dry chlorine. Work hardens good abrasion resistance. **Hastelloy and Inconel** Superior corrosion and chemical resistance at elevated temperatures, including sulphur and chloride ions.
BRONZE ALLOY (EVERDUR), SILICON AND PHOSPHOR BRONZE ALLOY	Fully non-magnetic and non- sparking.
OTHERS	Ask your fastener manufacturer for other special materials, metallic and non-metallic, for operating environments.

SECTION IV – MECHANICAL BELT FASTNERS

MECHANICAL FASTENER INSTALLATION RECOMMENDATIONS

Whenever a mechanical fastener is installed, the steps required (which could include pulling slack, squaring, cutting, skiving, lacing, installing hinge pin, etc.) can be made easy and safe by the use of proper tools and procedures. It is recommended that you contact a NIBA member with the specifics of your application. They can make an appropriate recommendation regarding the products and techniques available to meet your need.

SQUARING BELT ENDS

Having carefully selected the best fastener style suited to the application, properly installing these fasteners will greatly improve the splice service life. The first step towards ensuring that the fasteners and belt will work effectively in tandem with each other, and the supporting framework, is to install the fasteners square to the belt centerline. With any mechanical splice, the most common installation error is not applying the splice straight.

Although there are many suggested methods of accomplishing this, placing a carpenter's square along an average centerline of the belt (taken at several points along its length) is the simplest. Using the belt edge as a squaring guide is not generally recommended. Preparation of the belt ends is important and operators should be sure they have the right tools for doing the job properly. These include cutters, pull-up clamps and any special equipment for recessing fasteners in the belt cover. This procedure is generally helpful to extend fastener life and avoid operating problems. Splice life may also be prolonged through a good program of preventive maintenance, including periodic inspection and, where necessary, replacement of worn splice sections or entire splices.

(Refer to Tech Note #14 ***Establishing Centerlines and Squaring Belt Ends For Splicing*** – niba.org.)

COUNTERSINKING / SKIVING

While mechanical conveyor belt fasteners can be readily applied directly to the belt covers, there are some instances where it is advantageous to lower the fasteners into the belt. Countersinking the fasteners lowers the overall profile of the splice and is most frequently done on the carrying side of the belt. Depending on the belt construction, fasteners may also be countersunk into the bottom covers.

When fasteners have been countersunk, less material is left exposed to contact with the contents being conveyed, scrapers, plows, idlers and other related conveyor hardware. Wear through abrasion is greatly minimized thereby extending splice service life. Under running conditions there is also less abusive impact wear to both the splice and the belt.

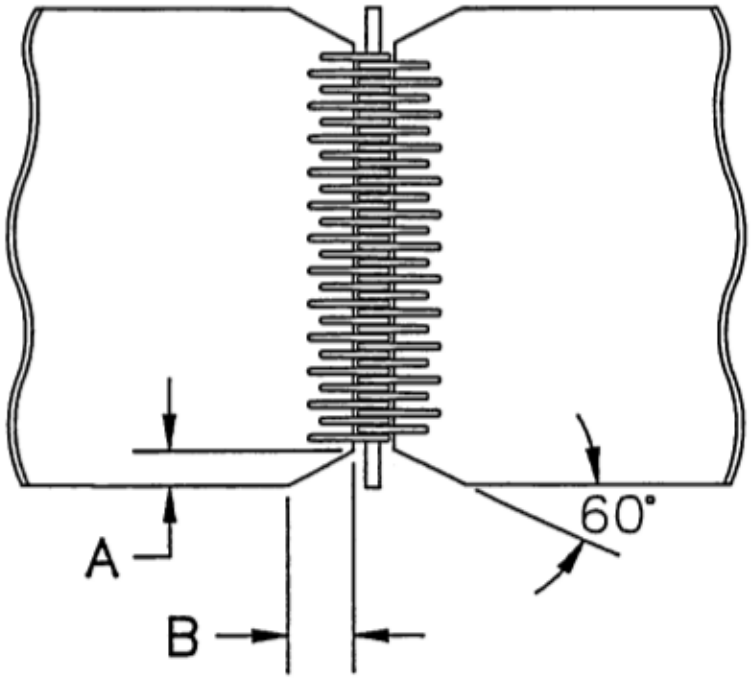
Countersinking is equally suited to light or heavy-duty belts, although generally there are subtly different reasons for choosing to install belt fasteners in this fashion. In the greater number of instances, light-duty belts are more apt to be suspended on slider beds. In these cases, countersinking will reduce abrasive wear of both the fastener and the slider bed.

"Hidden" splices are a form of countersunk fastener. After the belt ends have been prepared and the fasteners installed, replacement cover stock is laid over the fasteners and cured. This replacement cover stock may be from such materials as two component systems or uncured rubber stock. The replacement top cover that hides the splice also serves to protect the fasteners from impact and abrasive wear.

Preparing a belt for countersinking is readily accomplished using only some additional portable tooling. The options range from small hand held tools to larger, more mechanical, devices. All are designed for field use by company personnel. The fastener manufacturers offer these tools, and should be consulted for information relating to them.

BELT NOTCHING

In hinge fastener splices, it is often important to notch or chamfer the corners of the belt ends in the splice, usually at an approximate 60-degree angle. This will help prevent hang-up of the belt corners on conveyor structure should such contact arise. In one-directional belts, it is only necessary to notch the trailing belt end.



$$B = 2 \times A$$

SECTION IV – MECHANICAL BELT FASTNERS

MECHANICAL FASTENER TROUBLESHOOTING GUIDE

PROBLEM	SOLUTION CODE
Fastener "comb-out" through end of belt without opening	2, 3, 4, 5, 6
Fasteners open up and release from belt	1, 2, 3, 7
Belt breaks behind fastener	2, 4, 6
Splice failing at edges	1, 3, 5
Fastener parts fracture and fail	2, 3, 4, 5, 7
Belt fails under splice	1, 3, 6
Fastener wears out prematurely	7, 8

SOLUTION CODES

1 = Improper fastener installation, including splice not in squarely.

2 = Improper fastener selection, particularly in the choice of too large a fastener.

3 = Tension excessive and/or counterweight excessive.

4 = Pulley problems, worn lagging, dual pulley speed differential, too small pulleys, material buildup on pulleys.

5 = Splice "hang-up" on worn idlers or other parts of the conveyor.

6 = Conveyor drive under belted.

7 = Improper metal selection.

8 = Failure to recess splice.

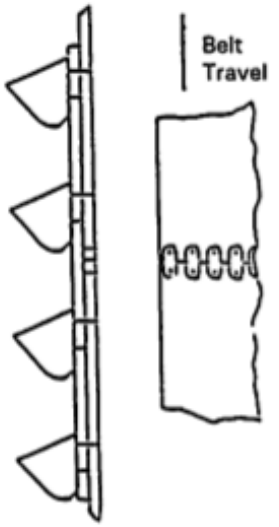
MOST COMMON TYPES OF FAILURE ASSOCIATED WITH MECHANICAL FASTENERS

1. Tensile failure of belt. (Warp yarns fracture with fasteners intact.)
2. Tensile failure of fasteners. (Fasteners open or break with belt intact.)
3. "Comb through" tensile failure of belt. (Fill yarns comb out of end of belt with warp yarns and fasteners left intact.)
4. Fatigue/wear failure of belt. (Used belt fractures warps and ruptures behind fasteners. Differentiated from tensile failure of belt by fact that failure occurs only after extended running time.)
5. Fatigue/wear failure of fasteners. (Fasteners break or open up after extended running time.)
6. Wrong size fastener selected. User tries to standardize one size for all belts.
7. "Bigger is better" mentality. User has failure, so he goes to next size bigger fastener for more strength.

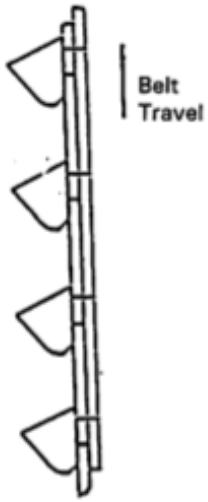
SPECIAL MECHANICAL BELT FASTENER APPLICATIONS

ELEVATOR BELTS

In most cases, the same types of mechanical fastener splices are used in elevator belts as are used in conveyor belts. However, there are alternate types of mechanical fastener splices sometimes used in elevator belts. The overlap splice and the butt strap splice are illustrated below. Bolt plate fasteners are used in both types. The fastener manufacturers or their authorized agents should be contacted for instructions on fastener selection and recommended arrangements for such supplies.



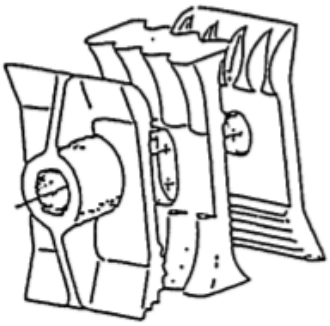
Butt Strap Splice

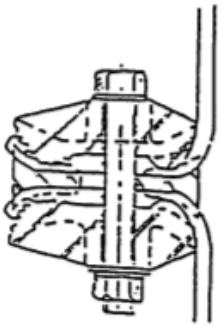


Overlap splice

Another kind of fastener that is used only on elevator belts is a "clamp type" fastener and is illustrated below. This fastener can be used on PVC and rubber belting. It is available in ferrous and non-ferrous metals and accommodates practically any belt thickness and pulleys of 8" (200mm) diameter or greater. (Note: It is not recommended for use with wing type pulleys.)

Contact the manufacturer for maximum tension ratings and further information.





SECTION V – PROBLEMS: CAUSES & SOLUTIONS

CONVEYOR BELT PROBLEMS

The following is a guide to the most common conveyor belt problems. The most common causes and suggested solutions are offered.

PROBLEMS	CAUSE	SOLUTIONS
1. Tracking or Training	a. Mechanical Malfunction	Proper alignment of pulleys, conveyor frame, and idlers
	b. Crooked Splice	Square belt end, replace splice
	c. Crooked Belt	Replacement may be required. (See Cause b)
	d. Material build up on pulleys	Recommend routine maintenance or mechanical cleaning devices
	e. Off center loading	Change or correct feeder/load design
	f. Distorted belt because of run off or accidental damage	Replacement of Belt indicated
	g. Cambered belt	Replace belt if the cambered edge cannot be pulled out
	h. Crooked Cut/Slit Edge Belt	If installed in multiple rolls turn the misaligned section around and reinstall
2. Excessive top cover wear	a. Cleaners, plows or skirt board in contact with belt surface	Adjust or redesign – frequent maintenance required for max service life. Never use old conveyor belt as a wiper.
	b. Frozen return idlers or material build up on return idlers	Free or replace, frequent maintenance required
	c. Improper compound	Recheck environmental conditions and refer to belt manufacturers recommendations
3. Edge Wear	a. Improper tracking or training	Refer to Problem #1
	b. Material build-up	Redesign or adjust loading, belt alignment and/or cleaning mechanisms
4. Excessive bottom cover wear	a. Rough or worn slider bed surface or pulleys	Replace worn surfaces or clean through routine maintenance procedures
	b. Belt slipping on drive pulleys	Adjust counter weight, increase wrap on drive, lag pulley
	c. Frozen idlers or pulleys	Free or replace
	d. Material Build upon idlers or pulleys	Keep clean through routine maintenance or mechanical cleaning devices

5. Fastener Failures	a. Under belted	Recalculate tension requirements, change belt selection or drive design
	b. Undersized pulleys	Replace pulleys or change belt selection
	c. Improper fastener or application procedure	Check overall gauge of belt and system and system pulley sizes with fastener manufacturers recommendations
	d. Conditions to severe for mechanical lacing	Consider a vulcanized splice, or change in drive or loading design.
	e. Transverse breaks directly behind fasteners	Belt fasteners to large, replace with manufacturer's recommendation. Change to larger pulley(s).
6. Fasteners Pulling Out	a. Fasteners wrong size or not tight	Replace fasteners and inspect regularly.
	b. Belt to tight	Adjust counterweight or take-up
	c. Belt too thick for pulleys	Replace belt or switch to larger pulley diameters.
	d. Belt speed to high	Reduce speed or use larger pulley to reduce "whipping" of belt around pulley. Switch to endless belt.
7. Stretching Of Belt	a. Narrowing Belt	Indicates system under belted. Recalculate tension requirements.
	b. Excessive build up on pulleys	Keep pulleys clean with routine maintenance or mechanical cleaning devices
	c. Excessive take-up force	Reduce counterweight tension to point belt will not slip
	d. To frequent take-up adjustments	Recalculate tension requirements
8. Ply Separation	a. Pulleys to small	Replace with larger pulleys or reconsider belt selection.
	b. Excessive pulley crown	Refer to CEMA standard 402-1964 or refer to belt manufacturer
	c. Chemical attack	Check environmental conditions and refer to belt manufacturer for recommendations
	d. Idler Junction Failure	Check tension calculations, transitions, belt specifications
9. Load slipping or sticking	a. Improper compound or cover profile	Refer to manufacturers recommendations for material handling
10. Belt Slippage	a. Insufficient slack side tension	Adjust take-up position or weight, increase wrap on drive with snub pulley or lag/groove pulley

11. Soft and Tacky Cover	a. Improper Compound for service	Check environmental conditions, especially oil and solvents. Refer to belt manufacturers operation and compound recommendations
12. Bottom Cover Transverse cracking	a. Slipping on drive pulley	Adjust counterweight/take-up
	b. Under belted	Recalculate tension and select the proper belt construction
	c. Undersize pulleys	Check all pulleys, especially high tension snub or reverse bend pulleys.
13. Top Cover Cracking	a. Heat	Determine surface temperature and refer to manufacturers rated resistance
	b. Weather age cracking	Refer to manufacturers recommended cover compound for the application
	c. Undersized pulleys	Check minimum pulley diameters for application. Replace pulleys or change belt specification.
	d. Under belted	Recalculate tension, change belt specification or alter drive design.
	e. Shrinkage	Heat or chemicals causing loss of plasticizers and then elasticity. Change belt specification.
14. Transverse breaks at belt edge	a. Folding up of belt edges	Check tracking, increase lateral clearance
	b. Improper transitions	Adjust transition distances, pulley height or idler trough
15. Breaks in belt parallel to belt edge or star breaks in belt	a. Heavy lumps falling on belt or falling from too great a height	Reduce impact of material
	b. Material lodged between belt and pulley or stuck to back of belt	Return run should have cleaners ahead of tail pulley
16. Splice Failure	a. Belt to tight	Adjust take-up tension
	b. Belt carcass too thick for pulleys	Switch to larger diameter pulleys change belt specification.
	c. Belt speed to high	Reduce speed or change pulley diameters.
	d. Under belted	Recalculate tension requirement
	e. Poor splice	Carefully examine failed splice, check adhesions, step length, splice material and workmanship.

17. Top Cover Grooved or Gouged	a. Skirt boards are pressing against belt	Adjust skirt boards, use all rubber – never use old belting
	b. Space between belt and skirt rubber is to great	Adjust to minimum clearance.
	c. Material jammed at chute	Improve material loading points.
	d. Metal sides of chute or skirts to close to belt	Adjust so gap between metal and belt increases in direction of belt travel to avoid jamming.

TROUBLESHOOTING

The enclosed conveyor belt troubleshooting chart can serve as a general guide for some of the more common conveyor belt problems.

If your belt problem does not seem to resolve itself with these corrective measures, or if your belt problem is not found on this list, then contact your Belting Manufacturer and request a visit by one of our factory representatives.

The idler junction is the gap between the functioning surfaces of the center roll and one of the side rolls of the idler (See Fig. 1). This gap poses a potential hazard for the belt by providing a narrow space in which the belt can settle experiencing highly detrimental flex and possible exposure to oil or grease from the idler bearings (See Fig. 2). When slipping of the belt into the idler junction is the cause of belt damage, it is called idler junction failure. The idler gap should be less than .4" or twice belt thickness - whichever is less.

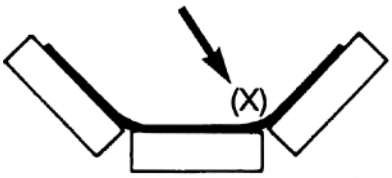


Fig. 1

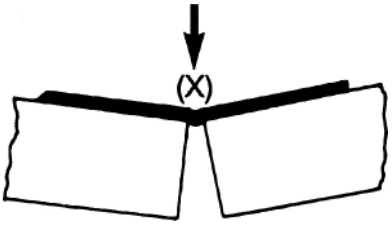


Fig. 2

SECTION V – PROBLEMS: CAUSES & SOLUTIONS

Troubleshooting Problem/Cause	For Solutions, Refer to Answer #
A. Belt runs off at tail pulley.	1 10 19 31 39
B. Belt runs to one side for long distance or entire length of conveyor.	1 5 8 39
C. Particular section of belt runs to one side at all points on conveyor.	6 7 46
D. Belt runs off at head pulley.	1 3 10 33
E. Conveyor runs to one side at given point on structure.	1 2 3 4 5 44
F. Belt runs true when empty, crooked when loaded.	8 51 52
G. Belt slips.	4 10 30 31 33 34
H. Belt slips on starting.	30 31 33 34 42 43
I. Excessive belt stretch.	12 32 35 43
J. Grooving, gouging or stripping of top cover.	4 13 15 16 53
K. Excessive top cover wear, uniform around belt.	8 10 19 20 36
L. Severe pulley cover wear.	1 4 9 10 17 27
M. Longitudinal grooving or cracking of bottom cover.	4 9 10 33 36
N. Covers harden or crack.	23 37
O. Cover swells in spots or streaks.	21
P. Belt breaks at or behind fasteners; fasteners pull out.	22 24 30 47 48 49
Q. Vulcanized splice separation.	12 17 25 30 38
R. Excessive edge wear, broken edges.	7 8 10 38 40 50
S. Transverse breaks at belt edge.	18 25 26
T. Short breaks in carcass parallel to belt edge, star breaks in carcass.	16 17
U. Ply separation.	23 29 30
V. Carcass fatigue at idler junction.*	25 26 27 28 29 36
W. Cover blisters or sand blisters.	21 45
X. Belt Cupping-Old Belt (was OK when new).	21 23

SECTION V – PROBLEMS: CAUSES & SOLUTIONS

CONVEYOR SYSTEM PROBLEM SOLUTIONS

1. Idlers or pulleys out-of square with centerline of belt: Readjust idlers in affected area.
2. Conveyor frame or structure crooked: Straighten in affected area.
3. Idler stands not centered on belt: Readjust idlers in affected area.
4. Sticking idlers: Free idlers and improve maintenance and lubrication.
5. Build-up of material on idlers: Remove accumulation; improve maintenance. Install scrapers or other cleaning devices.
6. Belt not joined squarely: Remove affected splice and re-splice.
7. Bowed belt: For new belt this condition should disappear during break-in; in rare instances belt must be straightened or replaced; check storage and handling of belt rolls.
8. Off-center loading or poor loading: Adjust chute to place load on center of belt; discharge material in direction of belt travel at or near belt speed.
9. Slippage on drive pulley: Increase tension through screw take-up or add counterweight; lag drive pulley; increase arc of contact.
10. Material spillage and build-up: Improve loading and transfer conditions; install cleaning devices; improve maintenance.
11. Bolt heads protruding above lagging: Tighten bolts; replace lagging; use vulcanized-on lagging.
12. Tension too high: Increase speed, same tonnage, same speed; reduce friction with better maintenance and replacement of damaged idlers; decrease tension by increasing arc of contact or go to lagged pulley; reduce CWT to minimum amount.
13. Skirt boards improperly adjusted or of wrong material: Adjust skirt board supports to minimum 1" between metal and belt with gap increasing in direction of belt travel; use skirt board rubber (not old belt).
14. Load jams in chute: Redesign chute for proper angle and width.
15. Material hanging up in or under chute: Improve loading to reduce spillage; install baffles; widen chute.
16. Impact of material on belt: Reduce impact by improving chute design; install impact idlers or impact bed.
17. Material trapped between belt and pulley: Install plows or scrapers on return run ahead of tail pulley.
18. Belt edges folding up on structure: Same corrections as for 1, 2, 3; install limit switches; provide more clearance.
19. Dirty, stuck, or misaligned return rolls: Remove accumulations; install cleaning devices; use self-cleaning return rolls; improve maintenance and lubrication.
20. Cover quality too low: Replace with belt of heavier cover gauge or higher quality rubber or other elastomer.
21. Spilled oil or grease/over-lubrication of idlers: Improve housekeeping; reduce quantity of grease used; check grease seals
22. Wrong type of fastener, fasteners too tight or too loose: Use proper fastener and splice technique; set up schedule for regular fastener inspection.
23. Heat or chemical damage: Use belt designed for specific condition.
24. Fastener plates too long for pulley size: Replace with smaller fasteners; increase pulley size.
25. Improper transition between troughed belt and terminal pulleys: Adjust transition in accordance with CEMA standards and belt manufacturers' catalogs.
26. Severe convex (hump) vertical curve: Decrease idler spacing in curve; increase curve radius.
27. Excessive forward tilt of trough rolls: Reduce forward tilt of idlers to no more than 2° from vertical.
28. Excess gap between idler rolls: Replace idlers; replace with heavier belt.
29. Insufficient transverse stiffness: Replace with the proper belt.

30. Pulleys too small: Use larger diameter pulleys.
31. Counterweight too light: Add counterweight or increase screw take-up tension to value determined from calculations.
32. Counterweight too heavy: Lighten counterweight to value required by calculations.
33. Pulley lagging worn: Replace pulley lagging.
34. Insufficient traction between belt and pulley: Lag drive pulley; increase belt wrap; install belt cleaning devices.
35. System under belted: Recalculate belt tensions and select proper belt.
36. Excessive sag between idlers causing load to work and shuffle on belt as it passes over idlers: Increase tension if unnecessarily low; reduce idler spacing.
37. Improper storage or handling: Refer to your belt manufacturer for proper storage or handling instructions.
38. Belt improperly spliced: Re-splice using proper method as recommended by your belt manufacturer.
39. Belt running off-center around the tail pulley and through the loading area: Install training idlers on the return run prior to tail pulley.
40. Belt hitting structure: Install training idlers on carrying and return run.
41. Improper belt installation causing apparent excessive belt stretch: Pull belt through counterweight with a tension equal to at least empty running tension; run belt in with mechanical fasteners.
42. Improper initial positioning of counterweight in its carriage causing apparent excessive belt stretch: Check with your belt manufacturer for recommended initial position.
43. Insufficient counterweight travel: Consult your belt manufacturer for recommended minimum distances.
44. Structure not level: Level structure in affected area.
45. Cover cuts or very small cover punctures allow fines to work under cover and cut cover away from carcass: Make spot repair with vulcanizer or self-curing repair material.
46. Worn edge: "Press" edge.
47. Interference from belt scrapers: Adjust belt scrapers.
48. Tension too high for fasteners: Use vulcanized splice.
49. Belt carcass too light: Select stronger carcass.
50. Belt misalignment: See training recommendations.
51. Variations in nature and formation of load: Use notched chute to keep load peak in exact center of belt.
52. Belt not making good contact with all idlers: Adjust height so all idlers contact belt.
53. Sharp edges of material or tramp iron coming in contact with cover: Use jingle bars, impact idlers, and magnetic removal equipment.

HEAVYWEIGHT ENGINEERING MANUAL

SECTION VI – VULCANIZED SPLICES

Vulcanized splices provide a method of joining the ends of conveyor belts without interrupting the continuity of the belts, and usually without altering the geometry or dimensions of the belts. Modern conveyor belts made with synthetic fabrics and normally having high adhesion between components, lend themselves to effective and long lasting vulcanized splices. There are some types of conveyor belts that can only be spliced by vulcanizing. This section of the NIBA Heavyweight Engineering Manual is provided to give an overview of vulcanizing. Details are available from belt manufacturers, their authorized agents, and splicing contractors.

The underlying principle in vulcanized splicing is the establishment of adhesion between the components of the two belt ends being joined together in the splices. The goal is to develop adhesion in the splices equal to that in the original belt. There is no intent to physically join the components in the splice, such as stitching together the ends of the fabric plies or joining steel cables with strength-retaining sleeves, etc. The splice lengths, configuration and dimensions are designed to retain continuity of the strength of the belts by the transfer of the tension stresses from one belt end to the other through the adhesion developed between the components mated in the splices.

There are many types of vulcanized splices. Each involves unique procedures, and the materials required depend on the type of belt and the type of vulcanized splice. In the following sections, the more common of the types of vulcanized splices are briefly described along with the types of belt each is used in. No attempt is made herein to provide step-by-step procedures as these vary among belt manufacturers, types of belts, service conditions, etc. The materials required for vulcanized splicing often are unique and specific for the type of belt involved. The procedures and materials or material recommendations must be obtained from the belt manufacturers or their authorized agents.

The term *vulcanized* may imply a process wherein new materials are used which undergo a chemical change or chemical action as a result of the application of heat, pressure and time. However, there are commonly used *cold* vulcanizing processes for rubber belts in which the new splice materials are chemically activated by contact with other chemically active materials, without requiring the use of a vulcanizing press. In general, the step splice geometry is the same for hot and cold vulcanized splices, but the materials differ. Materials and procedures for cold vulcanizing usually must be obtained from the cold vulcanizing material manufacturers.

Technical Note #13 (niba.org), titled *Buffing / Cleaning,* provides details of procedures that are an important part of most vulcanized splicing processes. These procedures are crucial in the process of establishment of adhesion in the following splices.

General splice dimensions for fabric belts using both a step or finger process can be found in *Illustration No. 4.* As always, check with the belt manufacturer as dimensions can vary. Steel Cable belt splice dimensions should be obtained from the belt manufacturers.

Below is a brief description of the most common vulcanized splices.

STEPPED SPLICE

Where Used: Multiple ply rubber belts.
Refer to Illustration No. 1

This splice involves stepping down, ply by ply, the two belt ends to be joined. The dimensions such as step length, cover fill in length, splice angle, etc. will vary depending on the belt ratings and manufacturer. After stepping down, the splice fill in bevels and surface areas are buffed to remove irregularities, buffing into the fabric surfaces is not recommended. The splices are cleaned then built up using primers, cements and uncured rubber. Accurately fitted splice steps and splice straightness are very important. Assembled rubber belt splices are cured in portable vulcanizers with flexible platens using edge irons.

Cover fill in rubber belts are fitted together much like a splice step, with only a narrow section of new rubber at the seam. Cover fill ins are not always used in cold vulcanized splices. Rather, the covers in the two belt ends are butted, both having been beveled, one with an undercut.

FINGER SPLICE

Where Used: Single ply rubber belts, multiple ply rubber belts and Aramid belts.
Refer to Illustration No. 2

The assembled splice could be thicker than the original belt, with an abrupt offset at the belt ends in the splice if the thickness of materials used are not controlled. These splices should be cured in vulcanizers large enough to do this in a single process. The vulcanizer platens should extend well past the splice ends to prevent "pushing" during the cure. The curing time should be based on the splice thickness, not the thickness of the original belt.

The method is to lay out and cut matching pointed, triangular shaped, fingers. The pattern can be done by several methods, including hand layout and a template. The finger patterns may be 90 degree transverse or at a bias angle. It is important that the edge fingers point away from the direction of travel (opposite of travel).

Special equipment is recommended for cutting and stripping out the fingers for this type of splice. High tension rated belt finger splices should only be processed with these special cutting saws and skiving tools.

STEEL CABLE BELT SPLICES

Where Used: Steel cable belts.
Refer to Illustration No. 3

Splices in steel cable belts involve basically removing everything except the cables, with a skin of rubber left on them, from the splice area, and then replacing all of the removed materials with new uncured components. The cables are arrayed in the splice area either in an overlapped pattern, a combination overlapped and butted pattern or exclusively a butted pattern. The choice depends on the amount of space between cables in the original belts, and the cable size. The splices are normally made on a bias angle. They are cured in portable vulcanizers large enough to cure entire splice area in one heat. The platen length should extend well past the splice ends to prevent "pushing" during the cure.

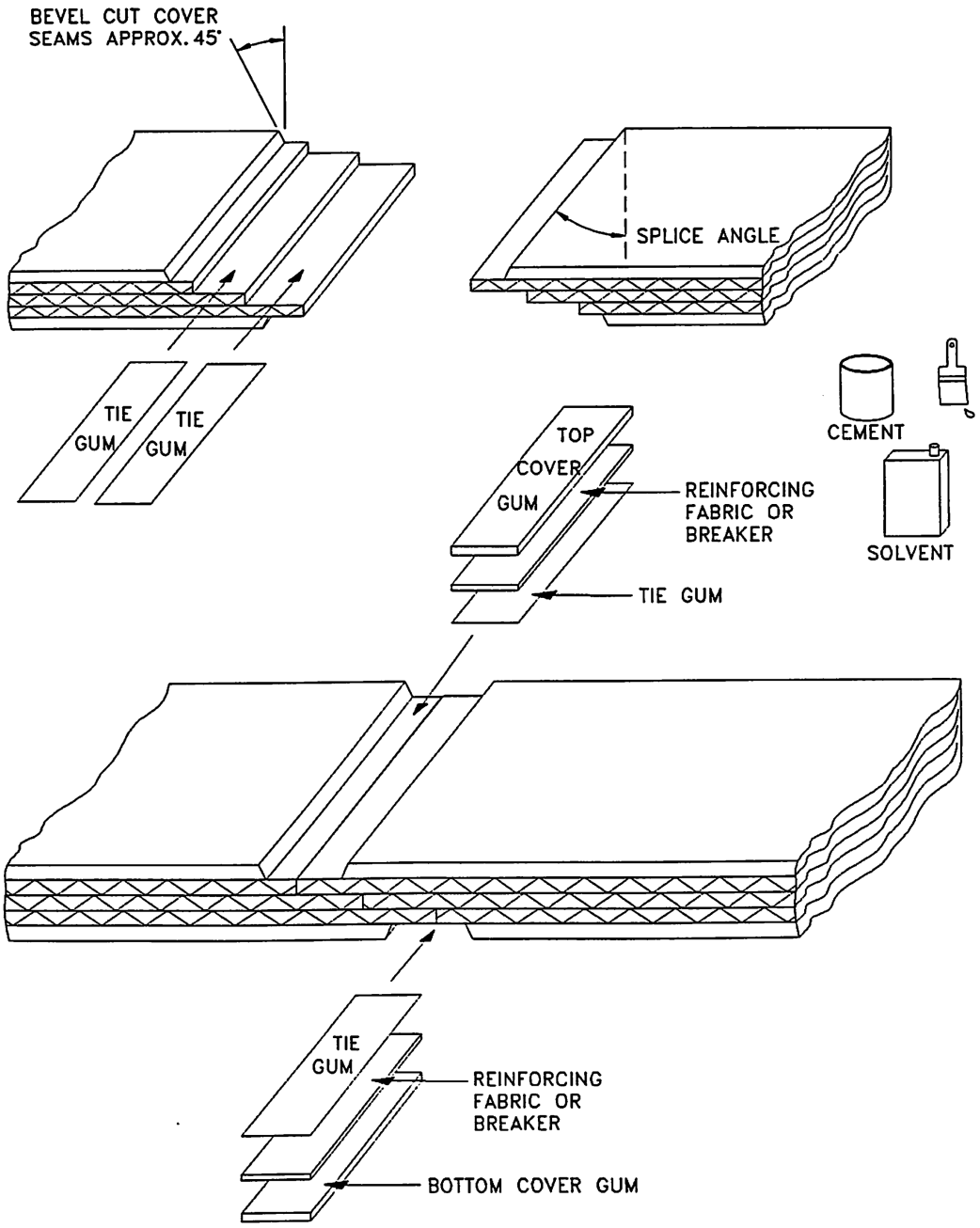
The splices must be made and cured with the belt ends accurately aligned. This applies to all splices, but is especially important with steel cable belts since they don't stretch as much as other belts, and thus are less forgiving to poor alignment.

ARAMID BELT SPLICES

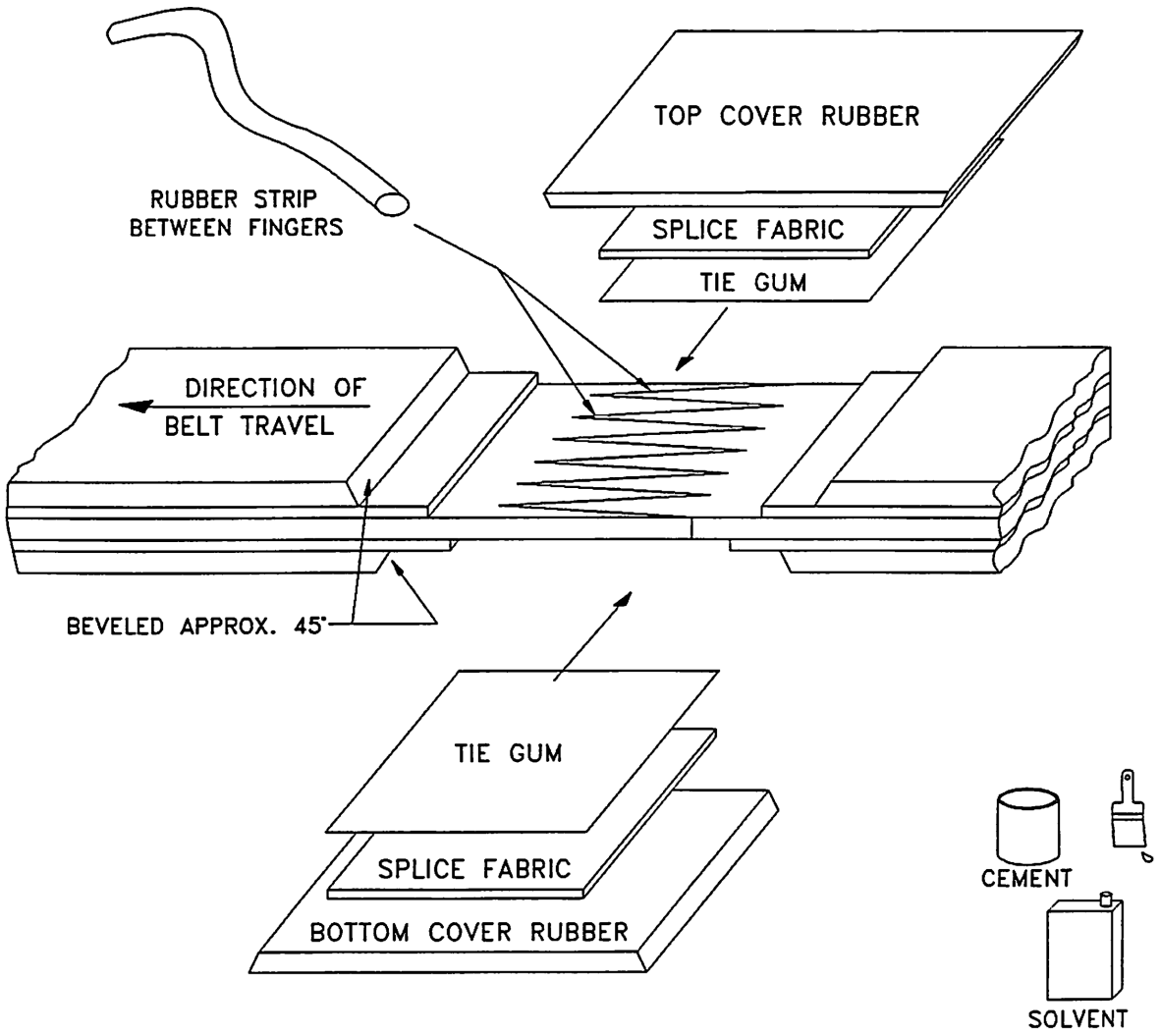
Where Used: Aramid reinforced high tension one and two-ply rubber belts.
Refer to Illustration No. 3

Most Aramid rubber conveyor belts are vulcanize-spliced with a finger type splice as shown in Illustration No. 6. A few are spliced with the overlap type splice described in an earlier section. This description applies only to the finger type splice. In general, the best manufacturers insist that all splice jobs for Aramid belts be referred to them for specific instructions and proper materials. The normal procedure involves stripping the belt ends down to the Aramid ply (plies) top and bottom, then cutting long narrow fingers in the Aramid carcass, and then rebuilding the splice area with tie gum, breaker, or reinforcing fabric and cover rubber. The fingers are interlaced but not touching, with a rubber strip separating them. The splices usually are made 90 degree transverse but can be made on an angle. They are cured in vulcanizers large enough to cure entire splices in one heat. As with steel cable belts, it is especially important that the two belt ends are aligned accurately, as Aramid belts are high modulus and thus don't stretch much to forgive crooked splices.

ILL. 1: MULTI-PLY CONVEYOR BELT STEP SPLICE



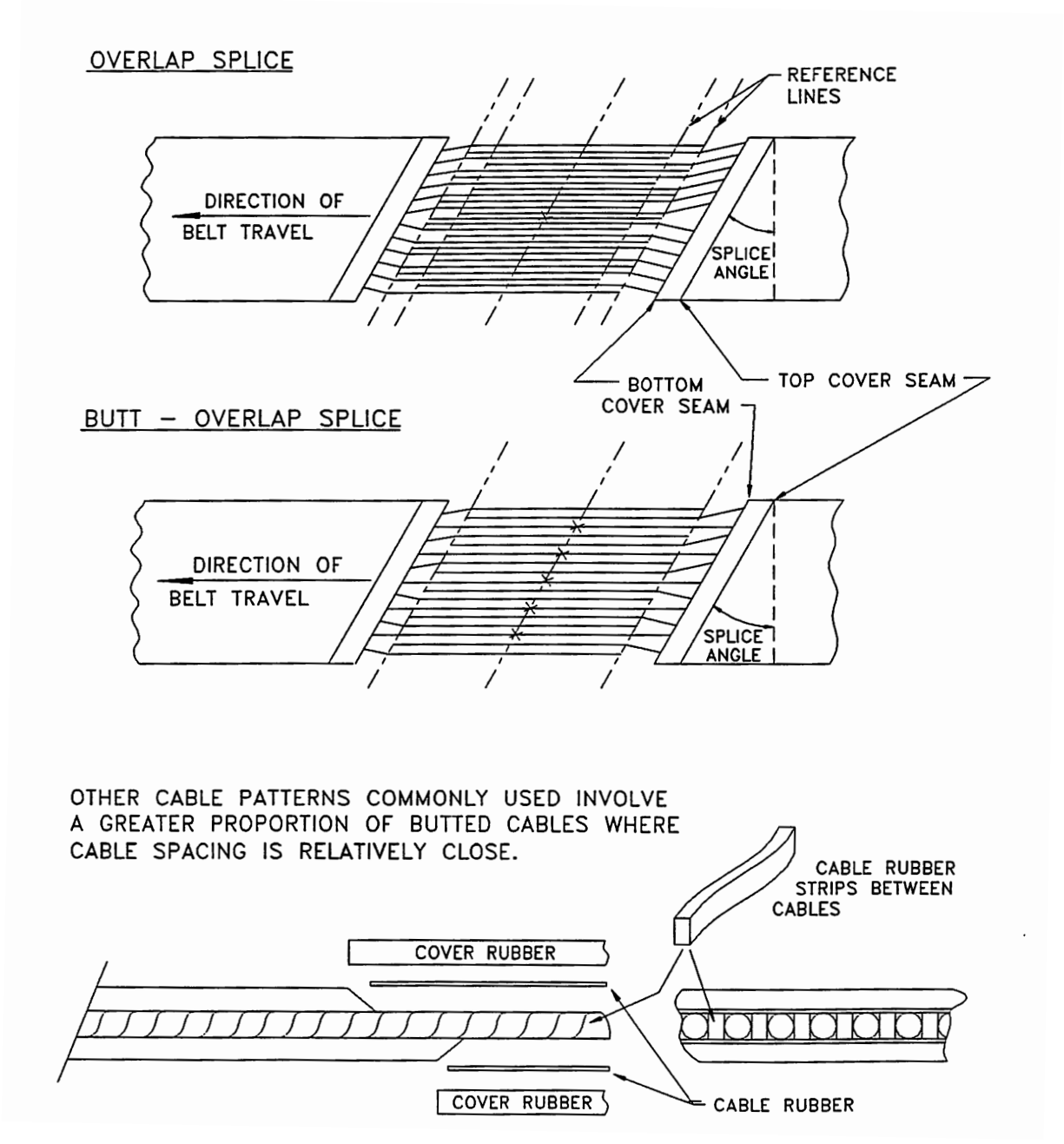
ILL. 2: SINGLE & MULTI-PLY CONVEYOR BELT FINGER SPLICE



LAY OUT THE SPLICE SO THAT NO TWO SEAMS OCCUR AT THE SAME LONGITUDINAL LOCATION

ILLUSTRATION SHOWS CUT EDGE, BUT ARAMID BELTS ALWAYS HAVE RUBBER EDGES.

ILL. 3: STEEL CORD CONVEYOR BELT SPLICE



ILL. 4: CONVEYOR BELT STEP SPLICE AND FINGER SPLICE DIMENSIONS

Finger Splice Dimensions

Belt PIW Rating	Finger Length (Inches)	Finger Base (Inches)	Transition Length Each End (Inches)	Pull-Back One End (Inches)	Total Splice Length (Inches)	Total Press Length (inches)
220	14	2	2	1	19	27
330	18	2	2	1.5	23.5	31.5
440	22	2	2	2	28	36
550	24	2	2	2	30	38
660	28	2	2	2.5	34.5	42.5
800	34	2	2	3	41	49
1000	45	2	2	3.5	52.5	60.5
1250	55	2	2	4.5	63.5	71.5
1500	63	2	2	5	72	80
2000	90	2	2	6	100	108

Plied Belting Step Splice Dimensions

Belt PIW Rating	No. of Steps	Step Length (Inches)	Fill-In Length (Inches)	Overall Splice Length (in) w/o bias angle	Total Press Length (inches)
2-220	1	8	4	12	18
3-240	2	6	4	16	22
2-250	1	10	4	14	20
2-300	1	12	4	16	22
3-330	2	8	4	20	26
3-375	2	10	4	24	30
2-400	1	15	4	19	25
4-440	3	8	4	28	34
3-450	2	12	4	28	34
2-500	1	18	4	22	28
4-500	3	10	4	34	40
5-550	4	8	4	36	42
2-600	1	20	4	24	30
3-600	2	15	4	34	40
4-600	3	12	4	40	46
3-750	2	18	4	40	46
5-750	4	12	4	52	58
4-800	3	15	4	49	55
3-900	2	20	4	44	50
4-1000	3	18	4	58	64
5-1000	4	15	4	64	70
4-1200	3	20	4	64	70
5-1250	4	18	4	76	82
3-1500	2	30	12	72	78
5-1500	4	20	4	84	90
4-2000	3	30	12	102	108

This chart is intended as a general guideline. Contact the manufacturer for recommended step length.

HEAVYWEIGHT ENGINEERING MANUAL
SECTION VII – CHEMICAL RESISTANCE CHART

NOTE:

The following information pertaining to Chemical Resistance is intended to serve as a general guide. Unless otherwise indicated, all chemical exposures are at room temperature. The user should confirm proper belt selection with the manufacturer prior to making the decision to purchase.

The information listed does not take into account variables that can be encountered in actual use. Thus, it is advisable to test material under actual or simulated service conditions.

Specific polymers of the same generic type and their compounds can vary widely with respect to Chemical Resistance. This chart does not refer to chemical blends or combination of chemical exposures.

— NIBA Education/Technical Committee

Key:

E = Excellent
F = Fair (Good)
C = Conditional
N/R = Not Recommended

HEAVYWEIGHT ENGINEERING MANUAL
SECTION VII – CHEMICAL RESISTANCE CHART

CHEMICAL	PVC		Rubber						Other			
	Standard	Oil Resistant	Nitrile	SBR	Natural	Neoprene	Butyl	EPDM	Urethane	Silicone	Teflon	Hytrel
Acetaldehyde	N/R	N/R	N/R	N/R	C	C	F	E	N/R	C	E	C
Acetic Acid (Glacial)	N/R	N/R	C	C	C	C	C	E	C	F	E	E
Acetic Acid - 30%	C	C	C	C	F	N/R	C	E	C	E	E	E
Acetic Anhydride	C	C	C	N/R	C	F	F	F	F	C	E	C
Acetone	N/R	N/R	N/R	N/R	N/R	F	C	F	N/R	C	E	F
Alcohols	C	C	E	N/R	F	E	E	E	N/R	F	E	E
Aluminum Chloride	E	E	E	E	E	E	E	F	E	E	E	F
Aluminum Nitrate	E	E	E	E	E	E	E	E	E	E	E	E
Ammonium Carbonate	E	E	F	E	E	E	E	E	E	E	E	E
Ammonium Hydroxide	E	E	N/R	N/R	N/R	E	E	E	F	F	E	E
Ammonium Nitrate	E	E	E	E	N/R	F	E	E	E	E	E	E
Ammonium Phosphate	F	E	E	E	F	E	E	E	E	E	E	E
Ammonium Sulfate	F	E	E	E	E	E	E	F	E	E	E	E
Animal Fats	N/R	F	F	N/R	N/R	F	F	F	C	C	E	E
Asphalt	N/R	C	F	N/R	N/R	N/R	N/R	N/R	F	F	E	F
Barium Chloride	E	E	E	E	E	E	E	E	E	E	E	F
Borax	E	E	F	F	F	E	E	E	E	E	E	E
Boric Acid	E	E	E	E	E	E	E	E	E	E	E	E
Butter	N/R	F	E	N/R	N/R	C	F	N/R	F	C	E	E
Calcium Chloride	E	E	E	E	E	E	E	E	E	E	E	E
Calcium Hydroxide	E	E	E	E	E	E	E	E	F	F	E	F
Calcium Nitrate	E	E	E	E	E	E	E	E	E	E	E	E
Carbolic Acid	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	F	N/R
Castor Oil	N/R	E	E	N/R	N/R	E	E	F	E	E	E	E
Chlorinated Solvents	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	C	F	N/R
Chlorine Solutions	C	C	C	E	E	E	E	E	C	C	E	N/R
Citric Acid	E	E	E	E	E	E	E	E	E	F	E	E

HEAVYWEIGHT ENGINEERING MANUAL
SECTION VII – CHEMICAL RESISTANCE CHART

CHEMICAL	PVC		Rubber						Other			
	Standard	Oil Resistant	Nitrile	SBR	Natural	Neoprene	Butyl	EPDM	Urethane	Silicone	Teflon	Hytrel
Coal	C	E	E	C	N/R	F	N/R	E	E	E	E	
Coconut Oil	N/R	F	E	N/R	N/R	F	E	E	E	C	E	E
Copper Sulfate	E	E	E	E	F	E	E	E	E	E	E	E
Corn Oil	N/R	F	E	C	N/R	F	F	C	F	F	E	E
Cotton Seed Oil	N/R	F	E	C	N/R	F	F	C	F	F	E	E
Denatured Alcohol	C	C	E	C	E	E	E	E	N/R	F	E	E
Diesel Fuel	N/R	F	E	N/R	N/R	F	N/R	N/R	E	C	E	E
Ethyl Alcohol	C	C	E	C	E	E	E	E	N/R	F	E	E
Ethyl Cellulose	C	F	E	E	E	E	E	E	N/R	E	E	E
Ethylene Glycol	C	C	E	E	F	E	E	E	F	F	E	E
Fatty Acids	N/R	C	F	C	N/R	F	N/R	N/R	F	F	E	F
Ferric Chloride	E	E	E	E	E	E	E	E	E	E	E	F
Ferric Sulfate	E	E	E	E	E	E	E	E	E	E	E	E
Formaldehyde	E	E	F	N/R	N/R	F	E	E	E	E	E	F
Fuel Oils	N/R	F	E	N/R	N/R	F	N/R	N/R	C	C	E	E
Furfural	N/R	N/R	E	N/R	N/R	E	F	F	N/R	E	E	
Gasoline	N/R	N/R	E	N/R	N/R	F	N/R	N/R	F	C	E	E
Glucose	E	E	E	E	E	E	E	E	E	E	E	E
Glycerine	E	E	E	E	E	E	E	E	E	E	E	E
Hydraulic Oil	N/R	F	F	C	N/R	F	N/R	N/R	N/R	C	E	E
Hydrochloric Acid	C	C	N/R	C	F	E	E	E	N/R	C	E	F
Kerosene	N/R	N/R	F	N/R	N/R	C	N/R	N/R	N/R	C	E	F
Lacquers	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	E
Lard	N/R	F	F	C	N/R	C	N/R	N/R	F	E	E	E
Limestone	E	E	E	E	E	E	F	E	E	E	E	E
Linseed Oil	N/R	F	E	C	N/R	F	F	F	N/R	F	E	E
Lubricating Oil	N/R	E	E	C	N/R	F	N/R	N/R	C	C	E	F
Magnesium Chloride	E	E	E	E	E	E	E	E	E	E	E	F
Magnesium Hydroxide	E	E	F	F	F	E	E	E	E	E	E	F
Magnesium Sulfate	E	E	E	E	F	E	E	E	E	E	E	F

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CHEMICAL	PVC		Rubber						Other			
	Standard	Oil Resistant	Nitrile	SBR	Natural	Neoprene	Butyl	EPDM	Urethane	Silicone	Teflon	Hytrel
Methyl Alcohol	C	C	E	C	E	E	E	E	N/R	F	E	E
Methyl Ethyl Ketone	N/R	N/R	N/R	N/R	N/R	N/R	E	E	N/R	C	E	E
Mineral Oil	C	E	E	C	N/R	F	C	N/R	E	C	E	E
Mineral Spirits	N/R	N/R	C	N/R	N/R	F	N/R	N/R	N/R	C	E	E
Molasses	E	E	E	E	E	E	E	E	E	E	E	E
Naptha	N/R	N/R	C	N/R	N/R	N/R	N/R	N/R	N/R	C	E	E
Nitric Acid	C	C	N/R	N/R	N/R	N/R	C	F	N/R	C	E	C
Oil Sands	N/R	E	E	C	N/R	F	N/R	N/R	E	C	E	E
Oil Shale	N/R	E	E	C	N/R	F	N/R	N/R	E	F	E	E
Ozone	C	C	N/R	N/R	N/R	F	F	E	E	F	E	
Paraffin	F	E	E	F	N/R	F	F	F	C	E	E	E
Peanut Oil	N/R	F	F	C	N/R	F	C	C	F	F	E	E
Petroleum Oils	N/R	F	E	N/R	N/R	F	C	N/R	C	F	E	E
Phosphate Ore	F	F	E	E	E	E	E	E	E	E	E	E
Phosphoric Acid	E	E	F	C	C	F	F	E	C	C	E	E
Pine Oil	C	E	E	C	N/R	N/R	N/R	N/R	F	F	E	F
Potassium Chloride	E	E	E	E	E	E	E	E	E	E	E	F
Potassium Hydroxide	E	E	F	F	F	E	E	E	F	F	E	E
Potassium Nitrate	E	E	E	E	E	E	E	E	E	E	E	E
Potassium Sulfate	E	E	E	E	F	E	E	E	E	E	E	E
Silicone Oil	F	E	E	F	C	E	E	F	E	E	E	E
Soda Ash	E	E	E	E	E	E	E	E	E	E	E	E
Sodium Bicarbonate	E	E	E	E	E	E	E	F	E	E	E	E
Sodium Bisulfate	E	E	E	F	F	E	E	E	E	E	E	E
Sodium Chloride	E	E	E	E	E	E	E	E	E	E	E	E
Sodium Hydroxide	E	E	F	E	E	E	E	E	F	C	E	E
Sodium Hypochlorite	C	C	C	C	C	F	F	F	C	C	E	E
Sodium Nitrate	E	E	F	F	F	E	E	E	E	E	E	E

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CHEMICAL	PVC		Rubber						Other			
	Standard	Oil Resistant	Nitrile	SBR	Natural	Neoprene	Butyl	EPDM	Urethane	Silicone	Teflon	Hytrel
Sodium Peroxide	E	E	F	F	F	E	E	E	E	E	E	E
Sodium Phosphates	E	E	E	E	E	E	E	E	E	E	E	E
Sodium Silicate	E	E	E	E	E	E	E	E	E	E	E	E
Sodium Sulfate	E	E	E	C	F	E	E	F	E	E	E	E
Sodium Sulfide	E	E	N/R	C	C	F	F	F	E	E	E	E
Soybean Oil	C	F	E	C	N/R	F	E	F	F	F	E	E
Sugar Beets	E	E	E	E	E	E	E	E	E	E	E	E
Sugar Cane	E	E	E	E	E	E	E	E	E	E	E	E
Sulfur	E	E	N/R	N/R	N/R	E	E	E	E	E	E	E
Sulfuric Acid	F	F	N/R	C	C	E	F	F	C	C	E	E
Tar (Bituminous)	C	E	E	C	N/R	F	N/R	N/R	E	E	E	E
Tartaric Acid	E	E	E	F	F	F	F	F	E	E	E	F
Tetrachloroe-thylene	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Toluene	N/R	C	C	N/R	N/R	N/R	N/R	N/R	N/R	N/R	E	F
Trichloroethylene	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Trichloroethane	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	E	N/R
Turpentine	N/R	C	E	C	N/R	N/R	N/R	N/R	N/R	C	E	N/R
Ultra-Violet Light	E	E	C	C	F	E	E	F	F	E	E	F
Urea	E	E	E	E	E	E	E	E	E	E	E	E
Urine	E	E	F	F	F	F	F	F	F	E	E	F
Vegetable Oils	N/R	F	E	C	N/R	F	C	C	F	F	E	E
Vinegar	E	E	F	F	F	E	E	E	E	F	E	E
Water	E	E	E	E	E	E	E	E	E	E	E	E
Wood Oils	C	E	E	F	N/R	F	N/R	N/R	E	E	E	E
Xylene	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	E	F
Zinc Chloride	E	E	E	E	E	E	E	E	E	E	E	E
Zinc Sulfate	E	E	E	E	F	E	E	E	E	E	E	E

A

Abraded: Worn away by friction.

Abrasion: Wearing away by friction.

Abrasion test: Determination of the rate of wearing away by friction.

Abrasion tester: A machine for determining relative abrasion resistance.

Accelerated aging: Intensive exposure to operating conditions to obtain an early change in physical properties of an elastomer.

Accelerated life test: A method designed to approximate in a short time the deteriorating effects obtained under normal service conditions.

Across the line starting tension: Tension developed in a belt when full electrical power is applied to the drive system.

Adhesion: Basically, the adhering, clinging, bonding or sticking of two material surfaces to one another, such as rubber to rubber, rubber to metal, rubber to wood, rubber to fabric.

Adhesion failure: The separation of two adjoining surfaces due to service conditions.

Adhesive: A material which, when applied, will cause two surfaces in contact with each other to stick together.
Adhesive coating: A coating applied to a surface to increase its bond to an adjoining surface.

Adhesive fabric: A fabric with a surface treatment which will bond two surfaces together when interposed between them.

Aftercure: A continuation of the process of vulcanization after the cure has been carried to the desired degree and the source of heat removed.

Afterglow: In fire resistance testing, the red glow persisting after extinction of the flame.

Aging: To undergo changes in physical properties with age or lapse of time.
Air bomb aging: A means of accelerating changes in the physical properties of material by exposing them to the action of air at elevated temperature and pressure.

Air checks: The surface markings or depressions which occur due to air trapped between the material and the mold or press surface.

Air curing: The vulcanization of a rubber product in air as distinguished from vulcanizing in a press or steam vulcanizer.

Air oven aging: A means of accelerating a change in the physical properties of rubber compounds by exposing them to the action of air at an elevated temperature at atmospheric pressure.

Air trap: See air checks.

Ambient temperature: The environment temperature surrounding the object under consideration.

Angle of repose: The angle to the horizontal which a material will naturally assume when dropped in a pile.

Angle of slide: The angle at which material begins to slide down an inclined surface.

ANSI: American National Standards Institute

Anti-backdrop: See backstop.

Anti-static: See static conductive.

Antioxidant: A compounding ingredient used to retard deterioration caused by oxygen.

Antiozonant: A compounding ingredient used to retard deterioration caused by ozone.

Antislip surface: A specially treated surface to obtain greater than normal traction.

Apron feed: An intermediate feed system.

Arc of contact: (1) The portion of a curved surface which is engaged. (2) In belts, it refers to the portion of a pulley which is engaged by the belt and is usually expressed in degrees.

Armored belt: A conveyor belt with crosswise insertions in the cover such as steel cables to minimize gouging or tearing of the cover by sharp objects.

Army duck: See duck.

Artificial weathering: Exposure to cyclic laboratory conditions involving changes in temperature, relative humidity, and radiant energy, with or without direct water spray, attempting to produce changes in the material similar to that observed after long-term continuous outdoor exposure.

ASME: American Society of Mechanical Engineers.

ASTM: American Society for Testing and Materials.

Atmospheric cracking: Small fissures in the surface of a belt cover caused by exposure to atmospheric conditions.

Automatic take-up: A mechanical device to maintain proper tension in a belt automatically compensating for belt stretch or shrinkage in service.

Average modulus: The total change of stress divided by the total change of strain.

B

Back cover: See bottom cover.

Backstop: A mechanical device for preventing a loaded, inclined conveyor or elevator belt from running backwards after the belt has been stopped.

Banbury mixer: A specific type of internal mixer used to incorporate filler and other ingredients in rubber or plastic operations.

Bare back: The textile face of an article which is free of any treatment or covering.

Bare duck: The duck surface of a fabricated article wherein the exposed duck surface is free of any covering.

Bare duck belt: A belt in which at least one side has the exposed duck surface free of any covering.

Bare pulley: A pulley whose face surface is not covered or lagged.

Bareback surface: A belt surface where the textile surface is without any coating.

Base belt: The portion of a closed belt in a closed belt conveyor which remains flat and provides the necessary tensile strength.

Basic tension bearing yarns: One of the two warp systems in a straight warp fabric where the warp yarns are substantially without crimp and provide the tensile strength for the belt.

Basket weave: A fabric with ends of yarn side by side in both the warp and filling in a plain weave construction.

Bead rubber: An extruded polymeric compound used to fill the void between butted joint of two pieces of fabric.

Bed: A continuous surface over which a conveyor belt may slide.

Belt: A flexible reinforced band placed around two or more pulleys to carry materials from one place to another.

Belt carcass: See carcass.

Belt clamp: Beams or metal plates secured transversely on both sides of belt ends to hold the ends in a desired position.

Belt cleaning device: A scraper or rotating device pressed against the belt surface to remove material stuck to the belt.

SECTION VIII – GLOSSARY OF INDUSTRY TERMS

Belt conveyor: A mechanical system composed of suitable head, tail, bend pulleys and belt idlers or a slider bed to handle bulk materials, packages, or other objects placed directly upon it.

Belt drive: An assembly of power-driven pulley(s) used to transmit motion to a conveyor or elevator belt.

Belt duck: An open weave duck made from plied yarns with strength predominately in the warp direction. Used primarily in the manufacture of belts.

Belt fastener: A device for holding the ends of belt together.

Belt fleet: The lateral movement of a conveyor belt to either side of its intended path.

Belt grade: A classification of belting according to the quality and properties of the belt cover.

Belt modulus: The ratio of stress to strain.

Belt pitch line: See pitch line.

Belt sag: The amount of vertical deflection of a conveyor belt from a straight line between idlers, usually expressed as a percentage of the center to center spacing of the idlers.

Belt slip: The action that takes place, causing a differential movement between the pulley surface and the belt.

Belt slope tension: See tension, slope.

Belt surface finish: Final surface condition of belt.

Belt tracking switch: A limit switch actuated by the edge of a conveyor belt when the belt moves abnormally to either side of its centered path.

Belt training idler: An idler having a belt-actuated swivel mechanism to control the side runout of a conveyor belt.**Belt turnover:** A system of pulleys arranged to turn a belt over. Frequently used to prevent building-up on return idlers by turning the dirty side (carrying side) up. See also twist.

Belting deflector: A mechanism which deflects the conveyed material off of the belt at specific points along the conveyor.

Belting, flat conveyor: See flat belt.

Bench test: A modified service test in which the service conditions are approximated in the laboratory.

Bend pulley: A pulley used to change direction of belt run.

Bending force: The force required to bend a belt under prescribed conditions.

Bending modulus: That force required to induce bending around a specified radius and, hence, a measure of stiffness.

Bias angle: The smaller included angle between the warp yarns of a fabric and the diagonal line across the warp yarns.

Bias cut: A cut of a textile material made diagonally at an angle less than 90 degrees to the longitudinal axis.

Bias laid: Material laid on or wrapped around so the warp yarns are at an angle less than 90 degrees to the longitudinal direction.

Bias seam: The seam at which bias cut fabrics are joined together.

Binder warp yarn: One of the warp systems in a straight warp fabric interlaced with the filling yarn to provide the strength to hold mechanical fasteners.

Bite: See nip

Bleeding: Migration to the surface of plasticizer, waxes or similar materials to form a film or beads. See also Bloom.

Blemish: A mark, deformity, or injury which impairs the appearance.

Blisters: A raised spot on the surface or a separation between layers usually forming a void or air-filled space in the vulcanized article.

Bloom: A discoloration or change in appearance of the surface of a rubber product caused by the migration of a liquid or solid to the surface. Examples: sulfur bloom, wax bloom. Not to be confused with dust on the surface from external sources.

Blow-up: A blister between plies of an article.

Bolted plate hinge fastener: Steel plates both sides and both ends of two belt ends to be fastened together (secured to the belt with bolts with the ends of the plates constructed into a circular hole for accepting a hinge pin to secure the two ends of the belt(s) together.

Bond: See Adhesion.

Boot: Enclosure for the loading end of a bucket elevator belt.

Bootlegging: (1) Progressive ply delamination. (2) The separation of plies in belting due to flexing.

Bottom cover: The protective rubber cover on the surface contacting the driving mechanism of a conveyor belt.

Bow: (1) Curvature from flat plane in the surface. (2) The deviation from the straight line of the fill yarn in a fabric. (3) The deviation from the straight line of a product when unrolled and laid on a flat surface.

Brand: A mark or symbol identifying or describing a product and/or manufacturer: may be either embossed, inlaid, or printed.

Breaker ply: An open weave fabric used next to the carcass fabric and/or in the cover to improve the attachment of the cover to the carcass and to improve cover cut and gouge resistance.

Breaking strength: The tensile which a textile yarn or cable, a steel cord, or a belt is at rupture.

Brushed finish: The mechanical removal of any surface impregnation or coating from the belt fabric.

Bucket: One of the cups on an elevator belt.

Bucket cover: The cover of an elevator belt next to the carrying buckets.

Bucket elevator: Belt with buckets attached.

Bucket projection: The distance the bucket protrudes beyond an elevator belt.

Buckled ply: A deformed ply, usually the result of a fold or wrinkle, which distorts it from its normal plane.

Buffing marks: The characteristic surface condition after a buffing operation.

Bumping: In the operation of a flat press, the alternative application and release of ram pressure to vent trapped air and gases.

Butt seam: A seam made by placing the two pieces to be joined edge to edge.

Butt strap joint: The connection of elevator belt ends with a piece of belting the width of the elevator belt placed over the butted belt ends, usually extending under at least two buckets and secured with bolts to the belt.

C

Cable yarn: Two or more plied yarns twisted together.

Calculated center distance: In belt drives, the distance between two shaft centers calculated from pulley diameters and belt length being used.

Calender: A machine with three or more internally heated or cooled cylinders used to (1) continuously sheet out polymeric compound or fused PVC (2) to wipe polymeric compound into the interstices of a fabric leaving a small portion of it on the surface of the fabric, or (3) to lay a continuous sheet of compound on a fabric.

Calendered "rubber" sheets: Continuous film of uncured elastomer produced from a calendar.

Camber: The curvature of a belt relative to the center line (see bow).

SECTION VIII – GLOSSARY OF INDUSTRY TERMS

Capacity: The maximum number of pieces, volume, or weight of material a belt conveyor can handle in a given time interval and belt speed.

Capped edge: A rubber protective edge placed around a product internally reinforced with textile or other material.

Capped end: A belt end covered with an elastomer to protect the carcass end.

Carcass: The fabric, cord and/or metal reinforcing section of any rubber product such as a belt, as distinguished from the rubber cover.

Carcass break: A ply or plies of fabric ruptured by impact or gouging.

Carcass tear strength: The resistance of a belt against tearing.

Carcass tear test: The determination of the tension at which a belt may be torn.

Carrier: See idler (2).

Carry (or carrying) side cover: See top cover.

Carrying roller: See carrying idler.

Carrying run: The portion of a conveyor that carries the load between the loading and discharge points.

Carrying surface: The outward face or side of the belt which carries the conveyed material.

Castfilm: A film made by depositing a layer of plastic, either molten, in solution, or in a dispersion onto a surface, solidifying and removing the film from the surface.

Catenary idler: A type of flexible belt-carrying idler with ends supported in pivoted stands. The tube or rollers sag under the weight of the load to form trough.

CEMA: Conveyor Equipment Manufacturers Association.

Cement: A mixture of polymeric compound or elastomer used as an adhesive or sealant.

Cemented edge: An application of cement around the edge of a fabricated product with or without internal reinforcement for protection or adhesion. (A form of Capped Edge.)

Cemented end: A belt end sealed with the application of elastomeric cement.

Center roll: The horizontal roll between the side troughing rolls.

Center-to-center: The distance between the center of two pulleys or idlers. Also called centers or center distance.

Centrifugal bucket elevator: A type of bucket elevator having a belt which travels at sufficient speed to discharge material from the buckets by centrifugal force.

Chafer duck: A relatively open weave duck of approximately square woven construction made with single or ply yarn.

Chalking: Formation of a powdery surface condition due to disintegration of surface binder or elastomer due in turn to weathering or other destructive environments.

Checking: Short shallow cracks on the surface generally due to effect of destructive action of environmental conditions.

Chevron: A ridge or profile arranged in a Vee shaped configuration on a belt carrying cover to stabilize material carried up an incline.

Chute lining: Highly abrasion resistant elastomeric lining in a chute to protect the metal chute from abrasion wear.

Chute slope: Angle relative to the horizontal a chute is inclined.

Cleated belt: Transverse raised sections on a conveyor belt to stabilize material carried up an incline.

Closed belt conveyor: A moving, endless conveyor belt formed into a tubular shape by joining its edges while carrying material, and opening the edges while in motion to receive and discharge material.

Cloth impression: See fabric impression.

Cluster end: A flat disc idler with several discs adjacent to each other at the ends of the idler.

Coefficient of friction: The ratio of the force required to move a package across a belt surface to the weight of the package.

Cog: A tooth on the rim of a wheel or rubber product.

Cogged V-belt: A V-belt cut or produced with a series of evenly spaced V-shaped indentations in the inner face.

Cohesive: Tendency of a material to stick to itself.

Cold feed: The introduction of plastic pellets into processing equipment without milling.

Cold flex: See low temperature flexing.

Cold flexibility: The relative ease of bending following exposure to low temperature.

Cold flow: Continued deformation under stress. See Creep.

Cold splice/bond: Usually the joining of two or more sub-straits together, using a two-part cement that is chemically cured without using supplemental heat from an external source.

"Cold bond cement" usually is an uncured mixture of varied elastomers, chemicals, and solvents that will not self-cure or vulcanize until mixed with an activator to create a chemical vulcanization (usually exo-thermic).

Commercially smooth: A degree of smoothness of an article which is acceptable in accordance with industry practice.

Compound: A mixture of a polymer(s) and other materials to give the desired chemical and physical properties in the elastomeric components of a belt.

Compression member: The portion of a belt beneath the pitch line as the belt bends around a pulley.

Compression set: The deformation in a material remaining after it has been subjected to and released from a compressive force.

Conductivity: Quality of power of conducting or transmitting heat or electricity.

Contact stain: When staining occurs on the area of an object directly in contact with the rubber article it is known as "contact stain".

Continuous bucket elevator: A bucket elevator belt that discharges by gravity over the inverted bottom of the preceding bucket on the descending side of the elevator.

Control: A material or a product of known characteristics included in a series of tests to provide a basis for evaluation of other products.

Conveyor: A system for the continuous movement or transport of bulk materials, packages or objects along a predetermined path.

Conveyor belt: A belt that carries materials from one place to another

Conveyor belt package deflector: A mechanical diverter placed at an angle across the belt to deflect packages off the belt at specific locations.

Conveyor belt stretch: The increase in belt length which takes place when tension is imposed. Stretch is either elastic or permanent. Elastic stretch is a temporary change in length which varies directly with the pull. Permanent stretch is the residual change in length after tension has been removed; it generally accumulates over a period of time.

Conveyor width: In belt conveyors, the width of a belt.

Copolymer: A substance consisting of molecules characterized by the repetition of two or more types of monomeric units.

Cord: Several strands of yarn twisted together.

Cord belt: A belt with textile or steel cords for the longitudinal tension-bearing member.

Cord fabric: A fabric with plied or cabled yarns in the warp direction and a light weight filling yarn spaced only sufficiently to process the fabric.

Cotton: A natural fiber of high cellulosic content.

Count: In fabric, the number of warp ends, the number of filling picks, or both in a square inch of fabric.

Counter weight: In conveyor belting, the weight applied to the take-up assembly to maintain proper belt tension.

Cover: The outer component of a belt.

Cover seam: See cover splice.

Cover splice: The transverse joint formed by connecting two lengths of cover stock.

Cover surface profile: A cross-sectional view of the cover surface.

Cover wear: The loss of material during use due to abrasion, cutting, or gouging.

Cracking: A sharp break or fissure in the surface. Generally due to excessive strain.
Crater: A small shallow surface imperfection.

Crazing: A cover surface with many fissures.

Creep: (1) The deformation occurring with the lapse of time in both cured and uncured rubber, in a body under stress in addition to the immediate elastic deformation. Some related terms and properties are stress-relaxation, hysteresis, damping, flow, compression set and viscosity. See Cold Flow. (2) In belts, the action of a belt alternately losing speed on the driving pulley and gaining speed on the driven pulley.

Creeper drive: An auxiliary drive, usually consisting of a small motor and speed reducer, used to keep a belt conveyor in motion at a very low speed during non-operating periods in extremely cold weather. It is used to prevent freezing of a belt and other components.

Crimp: (1) The waviness of the yarn in a woven fabric. (2) The difference in distance between two points on a yarn as it lies in a fabric and the same two points when the yarn has been removed and straightened. Expressed as a percentage of the distance between the two points as the yarn lies in the fabric.

Crown: The difference between the diameter at the center and at the edges of a pulley or a roll.

Crowned pulley: A pulley with a greater diameter at the center, or other points, than at the edges.

Crystallization: A change in physical properties resulting from the crystalline reorientation caused by temperature.

Cure: The act of vulcanization.

Cure time: Time required, at a given temperature, to produce optimum physical properties in an elastomer.

Curing temperature: The temperature at which the rubber product is vulcanized.

Curl: The action of the edges of a belt bending upward on the carrying run and downward on the return run. Also called cupping.

Cushion breaker: A leno or cord breaker imbedded in a belt cover.

Cut belts: See cut edge.

Cut edge: The uncovered edge of a laminated product, such a belt, created by cutting after vulcanization.

Cut resistance: The ability of a belt cover to withstand the cutting action of sharp objects.

D

Data code: Any combination of numbers, letters, symbols, or other methods used by a manufacturer to identify the date of manufacture.

SECTION VIII – GLOSSARY OF INDUSTRY TERMS

Decking: A protective covering over the return run of a belt conveyor.

Deflector: A board or plate at an angle across the path of a belt traveling over a flat surface to transfer material off the belt.

Deformation: Any change of form or shape produced in a body by a stress.

Degradation: A deleterious change in the chemical structure of a material.

Delamination: The separation of layers of material in a laminate.

Denier: A yarn sizing system for continuous filament synthetic fibers on the basis of the weight in grams of 9000 meters of the yarn.

Density: The ratio of the mass of a body to its volume or the mass per unit volume of the substance. For ordinary practical purposes, density and specific gravity may be regarded as equivalent.

Diameter: The length of a straight line passing through the geometric center to the periphery of an object.

Dielectric strength: The measure of electric potential strength of a rubber product. Measure of its ability as an insulating compound to resist passage of a disruptive discharge produced by an electric stress. Measured as volts per mil of thickness.

Dip coat: A thin coat on a surface obtained by dipping the material to be coated into the coating materials.

Dipped fabric: Coated with rubber compound by passing through a rubber solution and drying.

Discharge: Removal of material from a belt.

Dog leg: A bending from a straight line.

Double plate bolt fastener: Two ends of belting joined together with a plate on both sides across both ends of the joint.

Drive: An assembly of electrical and mechanical parts that provide motive power to a belt.

Drive, dual: See dual drive.

Drive factor: A numerical factor used for calculating the belt minimum slack side tension required for a given driving condition and or configuration.

Drive, head-tail: See head-tail drive.

Drive pulley: A pulley mounted on a drive shaft which transmits power to the belt.D

Drive, single: A one-pulley drive.

Drive snubbed pulley: An undriven pulley located close to the drive pulley to provide a greater arc of contact around the drive pulley.

Drive, tandem: See tandem drive.

Drive-on hinged fastener: Two ends of belting joined together with a pre-packaged fastener assembly having prongs for driving through the belt end.

Drive-on plate fastener: Two ends of belting joined with a single plate, across the top cover joint, with rivets or sharp teeth clinched over on the bottom cover side of the belting.

Drop ply: The omission of a reinforcing ply for a specified distance from each edge. Usually the bottom or next to bottom ply in flat conveyor belting.

Dry blend: A free-flowering dry compound prepared without fluxing.

Dual drive: A belt driving system employing two adjacent pulleys each powered with its own motor.

Duck: A term applied to a wide range of medium and heavyweight fabrics, commonly made of cotton, including the heaviest and strongest of all single-woven fabrics. There are three main types: number duck, army-type duck and flat duck.

Dumbbell: A test specimen with lesser width at the middle of its length than at its ends.

Durometer: An instrument for measuring the hardness of rubber. Measures the resistance to the penetration of an indentor point into the surface of rubber.

Durometer hardness: An arbitrary numerical value which measures the resistance to penetration of the indentor point of the durometer. Value may be taken immediately or after a very short specified time.

Dutchman: A short section of belting mechanically spliced into a length of belting and removed when the take-up allowance is exceeded.

Dynamic fatigue: Loss in properties of a material when continually subjected to flexing and or cyclic stress.

Dynamometer: An apparatus capable of inducing various loads for evaluation of dynamic belting properties.

E

Edge wear: Damage to the edge of a belt by abrasion.

Effective tension: Difference between the tight side and the slack side tension at the drive pulley providing the necessary pull to move the load.

Elastic limit: The limiting extent to which a material may be deformed and yet return to approximately its original shape after removal of the deforming force.

Elasticity: The property of an article which tends to return it to its original shape after deformation.

Elastomer: An elastic rubber-like substance, such as natural or synthetic rubber.

Elastomeric properties: The chemical and physical properties of an elastomer.

Elevator belt: A belt that raises material vertically in buckets attached to the belt.

Elongation: Increase in length expressed numerically as a fraction or percentage of initial length.

Embossing: Operation of transferring a design to a rubber or rubber-like surface.
Endless belt: A belt made endless without a joint.

Ends: See fabric count.

Equivalent free fall: The calculated vertical distance material falls from the discharge point to end of a belt.

Exposed fabric: An area of a belt where the fabric reinforcement shows due to lack of cover.

Extensibility: The capability of increased center distance in a belt conveyor.

Extensible conveyor: An adjustable conveyor system with a loop of belting between the carrying idlers and the return idlers for changing the center distance.

Extraction test: A test in which certain components are separated from a solid by dissolving them in a liquid solvent under suitable conditions.

Extruded: Forced through die of tubing machine in either solid or hollow cross section.

Extrusion: A process whereby heated or unheated plastic forced through a shaping orifice becomes a continuously formed piece.

F

Fabric: A planar structure produced by nonwoven or interwoven yarns, fibers, or filaments.

Fabric count: The number of warp ends per inch and the number of filling picks per inch.

Fabric design: The combination of size and numbers of fibers or yarns, in both warp and filling, and the manner in which they are processed.

Fabric finish: See fabric impression.

Fabric impression: A pattern in the cover of a belt formed by contact with a fabric during processing.
Fabric picks/inch: The number of filling (weft) yarns per inch.

Fabric rating: The maximum tension per ply of fabric a belt should be operated under ideal conditions.

Face: The outer surface of a pulley or belt.

Face cover: See top cover.

Fastener: See belt fastener.

Fatigue: The weakening or deterioration of a material caused by a repetition of stress or strain.

Feeder belt: A belt that discharges material onto another conveyor belt.

Fiber: A unit of matter having a length at least 100 times its diameter and which can be spun into a yarn.

Filament: A continuous fiber of extreme length.

Filler: A material mixed with a polymer to improve quality or lower cost of a compound.

Filler seam: Extruded polymeric compound used to fill the void between two pieces of belt cover or fabric.

Filling threads: The yarns in a fabric running at right angle to the warp.

Filling yarns: The transverse yarns in a fabric.

Film: A sheet of plastic not greater then 0.010" in thickness.

Finger splice: Belt ends cut into mating fingers.

Finish, fabric: See fabric impression.

Finish, plate: See plate finish.

Finish, platen: See platen finish.

Fire resistance: See flame retardance.

Fire resistant: Retards the burning action of fire or flame.

Fisheye: A small globule that has not blended completely into the surrounding material.

Flame performance: The manner in which belting after being ignited will burn and/or self extinguish.

Flame retardance: Intensity of flame diminished by fire retardant ingredient(s) in the plastic compound.

Flame test: A means, under specific condition, for establishing the flame performance of a belt. This will not indicate the performance of the belt in any fire in which the belt may be involved.

Flange: A raised edge on a plastic article.

Flanged edge: In conveyor belting, an edge built up to prevent spillage.

Flanged pulley: A pulley with a raised rim at the edges for the purpose of keeping the belt on the pulley.

Flash: Material protruding from the surface of a molded part, appearing at the mold parting line or mold vent points.

Flat belt: (1) A belt the cross section of which is in the general form of a rectangle; (2) A belt which operates on a smooth flat bed or straight idlers or rollers.

Flat press: A belt finishing press with flat platens, between which the belt is heated and compressed.

Flat spots: Thin spots on a conveyor belt surface stored on a flat surface for a long time.

Flat wire braid: Flattened braided wire, frequently used for armoring the belt.

Fleet: The lateral movement of a conveyor belt to either side of its intended path.

Flex cracking: A surface cracking induced by repeated bending or flexing.

Flex life: The relative ability of a rubber article to withstand dynamic bending stresses.

Flex life test: A laboratory method used to determine the life of a plastic product when subjected to dynamic bending stresses.

Flexibility: The ability to be bent repeatedly without cracking.

Flexing: The bending of a belt.

Flight: (1) One of a series of belt conveyors discharging one to another. (2) A series of cleats or profiles on a belt.

Floating breaker: A leno or cord breaker embedded in a belt cover with a distinct layer of elastomer separating the breaker from the carcass.

Floating idler pulley: See take-up pulley.

Flow crack: A surface imperfection caused by improper flow and failure of a compound to blend with itself during the molding operation.

Flow line: See flow mark.

Flow mark: A surface imperfection similar to a flow crack, but with a minor depression.

Folded-edge: (1) A belt construction wherein the inner carcass is enclosed in an envelope ply or plies. (2) An edge where an outer covering has been wrapped around a carcass and folded over the edge so that the carcass is closed on the edges.

FPM: Abbreviation for "Feet per Minute".

Frequency factor: The duration of time in minutes required for one complete cycle of a conveyor belt.

Friction: (1) The resistance to motion of a belt due to the contact between two surfaces. (2) Improperly used to indicate the bond between two surfaces.

Friction coat: An impregnation of rubber material calendered by friction motion to a fabric so that the material is forced into the weave of the fabric.

Friction, coefficient of: The ration between the force pressing the surfaces together and the force required to move it.

Friction, kinetic: The force which is required to keep a body sliding at a uniform rate. Also called "friction of motion".

Friction pull: See adhesion.

Friction, static: The force which is required to start a body sliding.

Friction surface: The exposed portion of a belt finished with a layer of impregnated plastic as distinguished from being completely covered with a layer of plastic.

Frictioned fabric: Coated with rubber compound on a friction (uneven speed) calender.

Frosting: Light scattering surface resembling fine crystals.

Full rated tension: See rating.

Fungicide: An agent that destroys fungi or inhibits their growth.

Fusion: An irreversible process during which a PVC compound or platisol undergoes a physical change and becomes a homogeneous mixture by the mutual solvation of the PVC resin and the plasticizer in the compound, as result of heating to an appropriate temperature.

G

Gauge: The measure of thickness of the individual elements making up a rubber product.

Gel: The initial semi-solid stage that develops during the solvation of a resin by a plasticizer.

Gel point: The stage at which a liquid begins to exhibit pseudo-elastic properties.

Glass fiber: Glass extruded through a die with many fine holes into continuous filaments.

Gouging: The effect of sharp heavy material falling onto a conveyor belt cover to loosen or tear out pieces of the cover.

Grab test: A tensile test for woven fabric using specimens considerably wider than the jaws holding the ends of the test specimen.

Grade: The ration of incline or decline of a conveyor expressed a s percent of the vertical height to the horizontal distance.

Grade of belting: The quality of belting cover on the basis or gouge, cut, and abrasion resistance.

Gravity take-up: A mechanical system that adjusts for the stretch or shrinking of a conveyor belt automatically by a weighted pulley in the system.

Grooved lagging: Lagging with round or angular grooves to minimize material buildup on the pulley.

Ground finish: Surface produced by grinding or buffing. See Buffing.

H

Hammock belt idler: See catenary idler.

Hank: A length of 840 yards of a yarn.

Hardening: An increase in resistance to indentation.

Hardness: Property or extent of being hard. Measured by extent of failure of the indentor point of any one of a number of standard hardness testing instruments to penetrate the product.

Haze: The cloudy appearance of an otherwise transparent film.

Hazing: A dull finish.

Head: The delivery end of a conveyor belt.

Head pulley: The terminal pulley at the discharge end of the conveyor.

Head-tail drive: A belt driving system using one or more powered pulleys at or near both the head and tail pulleys with each pulley independently driven.

Heat degradation: Change in chemical and/or physical properties due to excessive exposure to heat.

Heat mark: Extremely shallow depression or groove in the surface of a plastic visible because of a sharply defined rim or roughened surface.

Heavy weight belt: A belt with a rated maximum working tension equal to or greater than 160 pounds per inch width, when operating under ideal conditions.

Herringbone weave: The longitudinal appearance of a row of parallel lines slanting at an angle in the opposite direction to another row of slanting parallel lines.

Hinge pin: A cable or rod to join together hinged fasteners.

Hinged fastener: A fastener attached independently to each of the belt ends designed with an opening in the end of the fastener to accept a pin through the opening to complete the joint.

Hold back: See backstop.

Holland cloth: A filled sheeting (usually starch filled) with a smooth, glossy finish on both sides, used as separating medium.

Homogenous: Of uniform composition throughout.

Horizontal belt curve: The portion of a conveyor system which deviates from a straight line in the same horizontal plane as the rest of the system.

Horsepower: A unit of power equal to 33,000 foot-pounds per minute (746 watts).

Horseshoe: A fold in a surface in a definite U-shaped pattern. Particularly used in describing squeezed-out blisters in a belt cover. Also called ring blisters, dog ears and pig ears. Colloquial.

Hot air cure: Vulcanization by using heated air, with or without pressure.

Hugger belt conveyor: Two belt conveyors whose conveying surfaces combine to convey loads up steep inclines or vertically.

Hysteresis: A loss of energy due to successive deformation and relaxation. A measurement of the area between the deformation and relaxation stress-strain curves.

Hysteresis loop: The configuration of the graphical plot of stress and strain from the initial application of stress to some reduced stress. The measure of hysteresis is the area under stress-strain curves of increasing and decreasing stress.

Hysteresis loss: A loss of mechanical energy due to successive deformation and relaxation. It is measured by the area between the deformation and relaxation stress-strain curves.

I

Idler: (1) A nonpowered pulley around which a belt travels (2) a nonpowered roll or rolls supporting a belt.

Idler pulley: See idler.

Idler stand: The mechanical system that supports an idler pulley.

Immediate set: The amount of deformation measured immediately after removal of the load causing the deformation.

Impact: The single instantaneous stroke or contact of a moving body with another either moving or at rest, such as a large lump of material dropping on a conveyor belt.

Impact energy: The effective combination of force (weight of the body and height) when one body falls on another.

Impact force: The energy power of impact.

Impact idler: A belt idler having a resilient roll covering, resilient molded elastomer rings, pneumatic tires, springs or other means of absorbing impact energy at or close to the place where material contacts the belt.

Impact rating: The maximum rating of a belt construction based on the fabric, impact rolls, design of loading, size of material falling on the belt, relative speed of the material and the belt, etc. to withstand the energy of impact loading.

Impact resistance: The relative ability of a conveyor belt assembly to absorb impact loading without damage to the belt.

Impregnated: Fabric interstices filled and/or yarns saturated with plastic compound.

Impregnation: To fill the interstices of an article with a rubber compound. Generally applies to treatment of textile fabrics, yarns and cords.

Impression: Design formed during vulcanization in the surface of any rubber article by a method of transfer, such as fabric impression or molded impression.

Impulse: An application of force in a manner to produce sudden strain or motion.

Indentation: (1) The extent of deformation by the indentor point of any one of a number of standard hardness testing instruments; (2) A recess in the surface of a belt cover.

Inside length: A belt length measured along its inside circumference.

Installation allowance: The amount by which the center distance can be adjusted so a belt can be installed without damaging.

Instantaneous modulus: The ratio of stress to strain at a single point on the stress-strain curve.

Interstice: A small opening, such as between fibers in a cord or threads in a woven or braided fabric.

Interstice of fabric: Spaces between the yarns or cord of a woven fabric.

Interwoven conveyor belt: A type of conveyor belt construction similar to that of a solid woven belt, with plies interwoven such that it is impossible to separate them.

Irons: Strips of metal at the edges of a belt in a flat press to confine the edge elastomer for making a molded edge or to obtain uniform thickness of the edges of a slit edge belt near its edges.

ISO: The abbreviation for the International Organization for Standardization.

J

Jaws: Clamps to hold a specimen when applying stress to the specimen for certain tests.

Joint: The area where two ends of a belt are fastened together, either by heat and pressure or mechanical means. See also splice.

K

Kinking: A temporary or permanent distortion of belting caused by doubling the belt on itself.

Knitted Ply: Spirally interlaced loops of yarn forming a continuous tubular structure.

Knuckles: Raised loops of a woven textile structure.

L

Lagged drive pulley: See lagged pulley.

Lagged pulley: A pulley having its surface covered with lagging.

Lagging: A smooth or embossed covering on a pulley to increase friction between belt and pulley.

Laminate: A product made by bonding together two or more layers of material.

Laminated: Build up from thinner layers.

Lap joint: An elevator joint where one end of the belt laps over the other end with the leading edge on the bucket side.

Lap: A part that extends over itself or a like part.

Lap seam: A seam made by placing the edge of one piece of material extending flat over the edge of the second piece of material.

Lateral: Coming from the side.

Lateral misalignment: Offset of pulleys, idlers, or structure from a design longitudinal reference line.

Leno breaker: An open-mesh fabric made from coarse ply yarns, with a leno weave. A leno weave is one in which certain warp threads-termed doup or crossing threads-are passed from side to side of one or more ends-termed standard threads and are found in by the filling in this position. Where the crossed interlacing occurs an open, perforated structure is formed.

Leno weave: An open mesh fabric in which the warp yarns are held by the filling yarns with the filling yarns twisted around alternating warp yarns in opposite direction.

Life test: A laboratory procedure used to determine the resistance of rubber article to a specific set of destructive forces or conditions.

Lift: The net vertical distance material is moved by a conveyor or bucket elevator.

Light weight belt: A belt with a rated maximum working tension of less than 160 pounds per inch width.

Lined bolt holes: Bolt holes which have been given a protective coating to cover the exposed carcass.

Liner: A separator, usually cloth, plastic film, or

paper, used to prevent adjacent layers of material from sticking together.

Live roller conveyor: A roller bed conveyor system with frequently placed rollers above and in contact with the belt so the powered belt turns-makes "alive"-the rollers above the belt. The packages, etc. are conveyed on the rollers above the belt.

Live rolls: A series of rolls over which objects are moved by application of power to all or some of the rolls.

Live storage: (1) The storage of objects on a conveyor belt having a low coefficient of friction surface or on live rollers so the objects can accumulate while they are added to or removed at different rates (2) The storage of material in a silo while material is being discharged or poured in at the same time (3) An extensible conveyor with a loop of belting between the carrying and return idlers where the length of the loop is continuously decreased as the equipment at the mining face is advanced.

Load support: The ability of a fully loaded conveyor belt to bridge the idler gap without creasing into the idler gap and carry material without excessive sag between the carrying idler pulleys.

Load weight: The weight of material per unit of time.

Loading angle: The angle to the horizontal at which material is loaded onto a conveyor belt.

Loading impact: The energy with which material is loaded onto a conveyor belt.

Longitudinal: A lengthwise direction.

Longitudinal seam: A seam joining two materials in the length of the finished product.

Loop edge: A selvage formed by having the filling loop around a catch cord or wire, which is later withdrawn, leaving small loops along the edge of the cloth.

Loose cover: A separation of the cover from the carcass or textile reinforcement.

Loose edge: An edge which has separated from a textile carcass.

Loose ply: A separation between adjacent plies of fabric.

Low spot: A depression below the general surface of an object.

Low temperature flexibility: The ability of belting to be bent or flexed at low temperatures without loss of serviceability.

Low temperature flexing: The act of bending a product under conditions of a cold environment.

Lump size: The size of larger material on a conveyor belt.

M

Masterbatch: A preliminary mixture of two or more compound ingredients for purposes of more thorough dispersion or better processing, and which will later become part of the final compound in a subsequent mixing operation.

Maximum horsepower: The highest power requirement.

Maximum ply: (1) The maximum number of plies permissible that will permit for satisfactory troughability; (2) The maximum number of plies permissible to satisfactorily operate around a pulley of a given diameter.

Maximum safe working stress: The greatest tension at which a belt should be operated.

Maximum tension: See tension, maximum.

Mechanical fastener: Any mechanical device used to join the ends of belting.

Migration: The transfer of an ingredient in a rubber compound from one layer to an adjacent layer or to the surface.

Migration stain: When staining occurs on the area of an object adjacent to the rubber article it is known as "migration stain".

Mildew: Growth on organic matter produced by fungi, generally in textile components of rubber articles. Usually causes deterioration.

Mildew inhibited: The article contains material to prevent or retard mildew.

Mill: A machine with two horizontal rolls revolving in opposite directions used for the mastication or mixing of rubber.

Minimum accelerating time: The least time allowed to accelerate a conveyor belt from rest to normal speed without exceeding its maximum safe working stress.

Minimum braking time: The least time allowed to decelerate a conveyor belt from normal speed to rest without exceeding the maximum safe working stress or causing the belt to double up on itself.

Minimum ply: The least number of plies that will support the load on a belt without damaging deformation.

Minimum pulley diameter: The smallest pulley diameter around which a belt is recommended to operate.

Minimum tension: See tension, minimum.

Mirror finish: A bright, polished surface appearance.

Mix: See compound

Modified grab test: A tensile test for woven fabric using specimens wider than the jaws holding the specimen cut midway between the jaws to the warp yarns held by the jaws. Minimizes warp yarn popout experienced by raveled specimen test.

Modulus: (1) A coefficient or numerical measure of some property. (2) In rubber, modulus usually refers to one of several measurements of stiffness or resistance to deformation. The use of the word without modifying terms may be confusing and such use should not be encouraged. Modulus in rubber may be either static or dynamic; static moduli are subdivided into tangent, chord, and compounder's. Compounder's modulus is always in tension, but all the others may be in shear, compression or tension. Other terms used in connection with "modulus" are elasticity, rigidity, Young's tangent, and elongation. (3) All elastic moduli in rubber (except compounder's) are ratios of stress to the strain produced by that stress, the stress, usually p.s.i.

Modulus, belt: The force per unit width of belt required to produce a stated percentage of elongation.

Modulus of elasticity: The force divided by the percent elongation (divided by 100) to cause the elongation.

Moisture regain: The reabsorption of water by a textile.
Mold edge: A belt edge formed during vulcanization by curing in a mold or against edge irons.

Mold lubricant: The material used to coat the surfaces of a mold to prevent the rubber adhering to the metal during vulcanization.

Mold mark: An indentation or embossment on the surface of a molded product caused by irregularities in the mold surface.

Mold register: The means used to align the parts of a mold.

Mold release: See mold lubricant.

Monofilament: A single extruded strand of material.**Monomer:** A relatively simple compound which can react to form a polymer.

Mooney viscosity: A measure of the plasticity of a polymeric compound determined in a Mooney shearing disc viscometer.

MSHA: Abbreviation for Mine Safety and Health Administration.

MSHA flame retardant test: Flame test procedure for underground conveyor belting prescribed by the Mine Safety & Health Administration of the U.S. Department of Labor.

MSHA flame retardant test: Flame procedure for underground conveyor belting prescribed by the Mine Safety & Health Administration of the U.S. Department of Labor.

Multifilament: Many extruded fine strands of material grouped together.

N

Narrow disc idler: A flat pulley with discs attached around the pulley at certain intervals across the pulley.

Necking down: A localized decrease in the cross-sectional area of a product.

Needle punched: Nonwoven fabric punched with a hack latched needle to improve its strength and stability.

Net endless length: The manufactured length necessary to provide proper initial fit and tensioning of a belt on a specified drive.

Nicks: Cuts in the surface or edge of belting.

Nip: The clearance between two rolls of a calender.

Nitrile: Common name for nitrile-butadiene polymer.

Nominal: An approximate amount.

Nonblooming: The absence of bloom.

Nonwoven fabric: A mat of nonaligned fiber bonded together.

Norway type elevator bolt: Flat top, squared shoulder bolt for attaching elevator buckets to elevator belts.

NR: Abbreviation for isoprene polymer.

Numbered duck: Fabric weight designated by numbers based on linear yard of cloth 22" in width.

Nylon: Common name for polyamide fiber.

O

Offset idler: The center carrying roller which is offset and transversely lapping the troughing idlers.

Oil proof: Not adversely affected by exposure to oil.

Oil resistant: Withstands the deterioration effect of oil(generally refers to petroleum) on the physical properties.

Oil swell: The change in volume of a rubber article due to absorption of oil.

Oil well splice: Two ends of a belt each bent 90 degrees around a steel form and bolted together through the belt and steel form.

Oligomer: A polymer consisting of only a few monomer units such as in dimer, a trimer, a tetramer etc. & their mixtures.

One side: Pertains to one of the two outward faces or surfaces of a conveyor belt (not the edges of the belt).

Open seam: A seam whose edges do not meet creating a void.

Operating tensions: The tension of longitudinal sections of a belt system (tight side and slack side) when moving material, as distinguished from tension when the belt is running empty.

Optimum cure: The time, temperature and compression of vulcanization or of fusion at which a desired combination of properties is attained in an elastomer.

Organosol: A suspension of a finely divided plastic in a plasticizer with a volatile organic solvent.

Outside diameter eccentricity: The degree a pulley is out-of-round with respect to is central axis.

Oven: A low pressure hot air chamber used for the purpose of heating, drying, baking or vulcanizing rubber products. See Aging.

Oxidation: The reaction of oxygen on a rubber product, usually detected by a change in the appearance or feel of the surface or by a change in physical properties.

Oxygen bomb: A chamber capable of holding oxygen at an elevated pressure which can be heated to an elevated temperature. Used for an accelerated aging test.

Oxygen bomb aging: A means of accelerating change in the physical properties of rubber compounds by exposing them to the action of oxygen at an elevated temperature and pressure.

Ozone cracking: Belt cover cracks or crazing caused by exposure to ozone in the atmosphere.

Ozone resistant: Withstands the deteriorating effects of ozone (generally cracking).

P

Package conveyor: A conveyor which transports packaged, boxed, or bagged material.

Package deflector: See conveyor belt package deflector.

Packed material: Material on belting compacted as the belting moves along the system.

Performance test: See service test.

Permanent set: The amount by which an elastic material fails to return to its original form after deformation.

Permanent stretch: Elongation permanently removed from belting when it is first used.

Permeability: The quality or condition of allowing passage of liquids or gases through a rubber layer.

Physical properties: A measure of mechanical characteristics of a material.

Pick: An individual filling yarn of a fabric.

Picking idler: A short-sided troughing idler for readily removing material by hand from a belt.

Pierce tape: A woven mesh of steel wire or cord.

Pimple: A small sharp or conical elevation on the surface of a product.

Pit: A small crater in the surface of a product with width about the same as its depth.

Pitch line: The plane within a belt which undergoes neither stretching nor compression when the belt rounds the pulley, i.e., the neutral plane of the belt structure.

Plain weave: The simplest type of weave with both adjacent warp and filling yarns crossing over and under each other.

Planished cover: An irregular coated surface transformed into a smooth surface by some means.

Planished finish: See planished cover.

Plastic: A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, can be shaped by flow.

Plasticity: (1) A measure of the resistance to shear of an unvulcanized elastomer; (2) a measurement of resistance to shear with heat history.

Plasticizer: A compounding ingredient which can change the physical and chemical properties and processibility of a polymeric compound.

Plastisol: A dispersion of a powderous polymer in a plasticizer.

Plate finish: A finish resulting from contact with commercially smooth but not polished press platens.

Plied yarn: A yarn made by twisting together two or more single yarns.

Plows: Plates across a belt to remove material lying on or sticking to the belt.

Ply: A layer of rubberized fabric.

Ply adhesion: The force required to separate two adjoining strength reinforcing members in a rubber product.

Ply separation: Lack of adhesion between plies.

Ply tensile: The ultimate breaking strength of a belt expressed in force per inch width per ply.

Polymer: A macromolecular material formed by the chemical combination of monomers having either the same or different chemical composition.

Polymerization: The process that converts monomers into polymers.

Polyvinyl chloride: A polymer prepared by the polymerization of vinyl chloride as the sole monomer.

Porosity: The condition of containing numerous small holes or voids.

Portable conveyor: A conveyor system readily moved from one place to another.

Portable vulcanizer: A vulcanizer readily moved from one place to another, usually used for making field splices and repairs.

Pot life: The period of time during which a reacting polymeric compound remains suitable for its intended use after having been mixed with a reaction-initiating agent.

Powered roller conveyor: A term used by the U.S. Postal Service to mean a live roller conveyor. See live roller conveyor.

Press: A machine consisting of two or more heated plates which can be brought together and separated by hydraulic pressure or mechanical action.

Press cold ends: The area of reduced temperature at the press platen end.

Press lap: The area of overlap of one press cure length on the next.

Press length: The length of a belt which can be pressed at one time.

Press marks: Irregularities in the surface of a vulcanized product caused by the press ends or by corresponding irregularities in the press surface.

Press, rotary: See rotary press.

Pricker marks: Small marks in the cover of a vulcanized belt where a roll with sharp needles had penetrated the uncured belt to allow trapped air in the uncured belt composite to escape.

Processing: The operations in the manufacture of a belt.

Profile top cover: Belt surface having a series of continuous or interrupted, straight or curved ridges, across the belt at regular intervals to enhance the belts ability to move materials up inclines or down declines.

Prong: The sharp point of a mechanical fastener that penetrates the belt.

Pulley: A cylinder, mounted on a central axis rod.

Pulley cover: See bottom cover.

Pulley lagging: See lagging.

Pulley projection: The amount a pulley face width extends beyond belt edge.

Pulley wear cover: (1) Elastomeric material attached to the pulley to minimize pulley surface wear (2) Additional belt bottom cover thickness where extraordinary wear is anticipated.

Pulley wrap: See arc of contact.

Pure gum compound: A natural rubber or isoprene compound containing only the ingredients necessary to process it, to protect it from aging, and to cause vulcanization.

PVC cover: Cover using a PVC compound.

PVC impregnated: Impregnated with PVC compound.

Q

Qualification conformance inspection: The examination of samples from a production run to determine conformance to a given specification.

Qualification inspection test: The examination of samples from a typical production run to determine conformance to a given specification for approval to become a supplier.

Quarter turn drive: A belt system in which the axes of the adjacent pulleys are at right angles to each other to cause a 90 degree twist in the belt about its longitudinal axis.

R

RAC: Abbreviation for The Rubber Association of Canada.

Raised cover center: A belt cover with increased thickness along the center portion of the belt.

Raised edge: A flanged edge conveyor belt to minimize spillage.

Raised rib belt: A belt with transverse or diagonal bars or cleats on the top cover.

Rated conveyor belt: The manufacturer's recommended maximum working tension for a conveyor belt.

Rated working tension: See rating.

Rating: The normal working tension recommended for a belt.

Raw edge: The uncovered square edge of a belt created by cutting after vulcanization.

Recovery: The degree an elastomeric material returns to its original dimensions after being stressed.

Reefed: A belt folded back and forth on itself.

Reinforcement: The textile strengthening member of a belt. See also carcass.

Reinforcement agent: An ingredient in a polymeric compound not basic to its vulcanization used to increase its chemical and physical properties.

Reinforcing element: The strengthening members of a belt.

Repair: The area of new material replacing damaged material in a belt.

Repose angle: See angle of repose.

Resin: Certain materials produced by chemical synthesis.

Resistance: The property or ability of matter to withstand the effects of force, pressure, heat or chemical action.

Return idler: A roll(s) that supports a belt on its return run.

Return run: The part of a conveyor system where the belt returns to the tail.

Reversion: (1) The change which occurs in vulcanized rubber as the result of aging or overcuring in the presence of air or oxygen usually resulting in a semi-plastic mass. (2) It is the basis of rubber reclaiming processes and is aided by the use of swelling solvents, chemical plasticizer and mechanical disintegration to obtain a workable mass.

Ribbon blender: A type of internal mixer used to mix powders and liquids into a dry powderous viscous or liquid mass.

Ribs: Transverse configurations on the carrying side of a belt to facilitate carrying material on an incline.

Riveted plate joint: A mechanical fastener with rivets projecting through a plate on both sides of the belt.

RMA: Abbreviation for The Rubber Manufacturers Association, Inc.

RMBT: Abbreviation for Rated Manufacturers Belt Tension.

Roll belting: Belting made to ordered width but of nominal lengths for cutting later into shorter lengths.

Roller bed conveyor: A conveyor belt operating over a series of steel support rollers.

Rosin: The hard amber-colored material of the residue from the distillation of oil of turpentine.

Rotary press: A vulcanizing machine consisting of a rotating, heated drum with a flexible steel band partially encircling the drum, which continuously advances a material while under pressure and heat between drum and band.

Rotocure: See rotary press.

Rough top: A belt made with projections in the carrying surface to improve the ability of the belt to carry material on inclines.

Rubber cement: A mixture of polymeric compound or elastomer used as an adhesive or sealant.

Rubberized: Coated with rubber compound.

Run: The distance or route covered by a conveyor.

S

Saddle: An additional short length of belting added to an existing belt. See butt strap.

Safety factor: The ratio of the maximum stress that a belt or a belt splice can withstand to the maximum stress recommended for it by the manufacturer. The ratio of breaking strength to rated working tension.

Safe working strength: The manufacturer's recommended maximum working tension for a conveyor belt operating in ideal conditions.

Sag: The amount of vertical deflection of a conveyor belt from a straight line between idlers, usually expressed as a percentage of the spacing between idlers.

Sag belt tension: The minimum tension in any portion of the carrying run of a belt necessary to prevent excessive sag of the belt between idlers.

Sample: A piece of material removed for evaluation.

Scraper: A device for cleaning the surface of belting.

Screw take-up: A take-up for a conveyor system in which movement of a pulley-bearing block is accomplished by means of a screw. See also take-up.

Seam: The place where two edges of fabric or elastomer are adjacent to each other to form a single ply or layer.

Seaming strip: A strip of polymeric material laid over and/or in a seam to fill any voids between the adjacent plies of material.

Self-aligning idler: An idler having a belt-activated swivel mechanism to control the side movement of an operating conveyor belt.

Selvage: The lengthwise woven edge of a fabric. Also called selvedge.

Semi-cure: A partial or incomplete cure.

Service condition: All the conditions of operation to which a conveyor or elevator belt is exposed.

Service factor: The amount by which the normal rating of a unit is altered to compensate for specific service requirements.

Service test: A test in which the product is made to operate under service conditions in the actual equipment.

Set: The amount of deformation remaining after complete release of the load producing the deformation.

Shadowing: A bas-relief or outline of a reinforcement which appears on a cover after vulcanization.

Sheeting: A form of plastic in which the thickness is very small in proportion to length and width and in which the plastic is present as a continuous phase throughout.

Shelf storage life: The period of time prior to use during which a product retains its intended performance capability.

Simulated service test: See bench test.

Singles yarn: The product from aligning and twisting together fibers or twisting together filament fibers.

Sink: A collapsed blister or bubble leaving a depression in a product.

Skew: Amount by which the ends of a single pick yarn in a fabric are offset longitudinally.

Skim: A thin layer of polymeric compound applied to a fabric.

Skim or skim coat: A layer of rubber material laid on a fabric but not forced into the weave. Normally laid on a frictioned fabric.

Skirt board: In a conveyor system, the vertical or inclined plates located longitudinally and closely above the belt to confine the conveyed material.

Skive: A cut made on an angle to the surface to produce a tapered or feathered cut.

Slab belting: Belting made in wide widths and long lengths for later slitting into narrower widths and cutting into shorter lengths.

Slack side tension: The lessor of the tensions in a belt on an operating conveyor. Usually immediately following the drive pulley.

Slider bed: A stationary surface on which a belt slides.

Slider bed conveyor: A conveyor belt operating all, or in part of its length, over a flat support surface as opposed to being supported by a series of rollers.

Slip: The action that takes place, causing a differential movement between the pulley surface and the belt.

Slip and sequence system: An interlocking belt conveyor system that stops the system when the speed of the conveyor belt drive pulley exceeds a certain speed of the conveyor belt.

Slit belt: A belt cut to lesser width.

Slit edge: The square finished edge of a belt after trimming to width.

Slit edge belt: See cut edge.

Slope belt: A conveyor belt used to carry material along an inclined flight.

Slope tension: See tension, slope.

Snub pulley: A pulley adjacent to a drive pulley that increases the arc of contact on the drive pulley to increase the effectiveness of the drive.

Solid woven belt: A type of conveyor belt wherein the carcass is a single ply consisting of multiple layers of warp and filling yarns interwoven. The carcass usually is impregnated and/or coated with polymeric compound.

Specification: Detail description of specific requirements.

Specimen: A piece cut from a sample of belting to test.

Splice angle: The angle at which belting is spliced.

Splice: Methods for joining the ends of belting together without using a mechanical fastener.

Spread: To apply a thin coat of liquid material over a surface by means of a knife, bar, or doctor blade.

Spread coat: To apply a thin coat of material over a surface determined by means of a knife, bar, or doctor blade.

Spread coated fabric: A fabric coated with a liquid plastic by a spreading process and then heated to fuse the coating.

Spring take-up: A mechanical device on both sides of the conveyor system where a variable force spring is secured to the conveyor structure and to the tail pulley block for the purpose of maintaining a uniform tension in the belt.

Spun yarn: A yarn produced from short fibers by aligning and twisting them together.

Square edge: An edge of plastic-covered belting finished against rectangular irons.

Stacker: A conveyor adapted to piling or stacking bulk material, packages, or objects.

Stamped metal: Perforated metal sheet used for making a rough top design on a conveyor belt.

Standard: A quality level set for the results from a belt test.

Staple: A textile fiber of relatively short (1" to 3") length which when spun and twisted forms a yarn.

Staple fiber: The short fibers from which a spun yarn is made.

Starting tension: The tension necessary to accelerate a belt from rest to normal operating speed.

Static conductive: Capability to conduct static electricity.

Static electricity: Electrical potential resulting from two surfaces rubbing together or parting one from the other.

Static friction: The resistance which must be overcome to start a body sliding down a belt surface.

Steel cable: Several steel cords twisted together.

Steel cord: Several steel wires twisted together.

Steel cord belt: A conveyor belt having a tension bearing member of steel cords lying in the same plane with a definite spacing between the cords, elastomer between the cords and an elastomeric cover on both sides of the belt.

Step ply: A conveyor belt having a plied textile carcass in which the upper ply or plies are set back toward the edges to increase the cover gauge in loading area.

Stepped splice: The joint of one end of multi-ply belting with plies of fabric removed so respective ply ends will butt together and overlap adjacent plies of fabric.

Stiffness: Resistance to flexing.

Stitched belt: (1) A belt made from plies of non-rubberized fabric sewed together to make a unit structure. (2) A rubberized belt in which the plies have bee sewed.

Stitching: A method of butting or joining two pieces of material together, usually by means of a stitcher roller.

Stock roll: A belt made to some nominal length and width for subsequent cutting to required length and width.

Straight face pulley: A pulley without any crown.

Straight warp weave: Two warp yarn systems and a filling yarn system where one warp system is essentially without crimp and is the tension bearing member, while the other warp system is interlaced with the filling yarn and provides mechanical fastener holding capability.

Strain: Deformation resulting from a force applied to a body.

Stress: Force applied to a body that results in the body being deformed.

Stress-strain: The relationship of force and deformation in a body during compression, extension, or shear. In a belt this is the relationship of tension (stress) and resulting elongation (strain).

Stretch: An increase in length.

Striated cover: A cover having grooved or channeled lines, due to transfer of irregularities from contact with surfaces of forming or finishing equipment.

Strike through: Penetration of plastic compound through the fabric.

Strip test: In fabric testing, a tensile strength test made on a strip of fabric with cut edge or raveled down to a specified number of threads or width of fabric, all of which are firmly held in gripping jaws wider than the test piece.

Sun check: Fine cracks and crazing of an elastomeric surface primarily due to the sun's ultraviolet rays.

Surface finish: See belt surface finish.

Swelling: An increase in volume of an elastomer or belt.

T

Tack: Having a property of temporary adhesion.

Tail end: The end of a conveyor, usually near its loading points.

Tail pulley: The belt pulley near the loading end of the conveyor system.

Take-up: (1) Removal of slack or stretch in a belt (2) An assembly of structural and mechanical parts to maintain proper belt tension.

Take-up, automatic: See automatic take-up.

Take-up, gravity: See gravity take-up.

Take-up pulley: A pulley which can move in space due to gravity, a spring, or other forces in order to maintain relatively constant tension in a specific strand of a belt.

Take-up, screw: See screw take-up.

Take-up tension: See tension, take-up.

Take-up travel: The distance the take-up can move during the belt operation.

Tandem drive: A belt driving system employing two adjacent powered pulleys.

Tape line measurement-maximum length: The inside circumference of a belt measured around the pulley surfaces when the take-up idler(s) are moved out to where they take up all the belt slack their movement permits.

Tape line measurement-minimum length: The inside circumference of a belt measured around the pulley surfaces when the take-up idler(s) are moved in for the installation of the shortest belt possible.

Tear down: The removal of a ply of fabric in a multi-ply fabric belt to prepare the stepped down configuration for a stepped splice.

Tear Propagation: Continuation of tear.

Telescoped roll: At the outside end of a roll of belting, turns of the belting progressively loosened and moved outward from the remainder of the evenly wound turns of the belting.

Template: A pattern to guide the punching of holes or cuts in belt ends.

Tensile member: See carcass.

Tensile strength: The maximum force, stress, applied to a specimen at rupture.

Tensile stress: The force applied to stretch a test piece (specimen).

Tension: Stress on a material tending to cause extension of the material.

Tension, effective: In a belt drive, it is the difference between the two tensions in a belt as it approaches and leaves a driving or driven pulley. In a two-pulley drive, it is the difference between tight and slack side tensions. Being a measure of power requirement, it is sometimes referred to as horsepower pull.

Tension, maximum: (1) The highest tension occurring in any portion of a belt drive. In a two-pulley drive it is the tight side tension. (2) In conveyors, the maximum tension may occur at a point other than the drive pulley.

Tension member: See carcass.

Tension minimum: The lowest tension occurring in a belt in a conveyor or elevator system under operating conditions.

Tension rating: Maximum safe working tension recommended by a belt manufacturer.

Tension ratio: In an operating belt system, the ratio of the larger to the smaller tension as the belt approaches and leaves a driving or driven pulley.

Tension, slack side: In a belt system, where the two portions of the length of a belt on either side of a driving or driven pulley have different tensions, the slack side tension is the smallest of the two.

Tension, slope: The tension in an inclined belt caused by the weight of the material being elevated in addition to the belt weight and independent of friction and other sources of tension.

Tension, take-up: The amount of tension in each of the runs of belting approaching and leaving the take-up pulley, the total of which is the force exerted by the take-up device.

Tension, tight side: In an operating conveyor system, the greater of the tensions as the belt approaches and leaves the drive pulley.

Tension, working: The maximum working tension for a fabric or belt recommended by the manufacturer.

Terminal position: The maximum working tension for a fabric or belt recommended by the manufacturer.

Terminal pulley: The pulley at or near the discharge end of a conveyor belt system.

Tex: A yarn size system defined as the weight in grams of 1000 meters of yarn.

Textile: A general term applied to yarn, cord, nonwoven, or woven fabric made from a fibrous material.

Thermoplastic: Capable of being repeatedly softened by heating and hardened by cooling and in the softened state can be shaped by flow.

Tie cloth breaker: A leno or other open weave fabric breaker between a belt cover and the carcass.

Tie gum: A thin sheet of unvulcanized rubber inserted between plies in vulcanized repairs of splices.

Tight side tension: See tension, tight side.

Tilted troughing idlers: Used for belt training.

Time cycle: The duration of time, in minutes, required for one complete cycle of a conveyor belt.

Tire bead wire: Steel wire placed in or beneath the top cover to minimize rips in the belt by objects that penetrate the belt.

Tolerances: The limiting values for a dimension.

Top cover: Loss of the elastomer due to abrasion.

Top cover wear: The protective rubber cover on the material conveying surface or surfaces of a conveyor belt.

Tracking alignment: See training.

Traction: The friction between a drive pulley and the conveyor belt.

Traction top: See rough top.

Training: The process of adjusting idlers, pulleys, and loading conditions to insure the belt runs straight.

Training idler: An idler mounted on a mechanical device, actuated by the belt moving against it to make the belt run straight.

Trajectory: The arc made by material freely discharged from a conveyor system.

Transfer system: A combination of mechanisms to move objects or bulk material to or from a conveyor.

Transition distance: The distance between the last fully troughed idler and the flat driving or discharge pulley.

Transition idler: A troughed belt idler having a lesser degree of trough than the previous carrying idlers.

Transverse: A crosswise direction of a belt.

Transverse cord breaker: A cord fabric laid in the top cover at right angles to the belt edges.

Transverse rigidity: Resistance to belt deformation in the belt crosswise direction.

Transverse seam: The joint, across the belt, of two ends of a fabric ply in the belt or cover material.

Trapped air: Air which is enclosed in a product or between a product and a mold surface during cure.

Traveling deflector: A mechanism which moves over the carrying surface of the belt and deflects the conveyed material off of the belt.

Tripper: A fixed or moveable mechanism at some intermediate place in the conveyor system to discharge material from the belt.

Troughability: The property of a belt that permits it to conform to the contour of troughing idlers.

Troughability index: The ratio of the deflection of a freely supported transverse section of a belt to the distance between the freely supported ends.

Troughed belt: A belt operating in a conveyor system with inclined side idlers to cause the belt edges to turn up and increase the amount of material carried while minimizing side spillage of the material.

Troughing angle: The angle troughing idlers are to the horizontal extension of the flat carrying idler.

Troughing idlers: An idler system which supports a belt in a troughed configuration. Usually it consists of a center horizontal roll with an inclined roll on each side. See also catenary idler.

Twill weave: A fabric woven with the appearance of diagonal lines.

Twist: The rotation of a belt on its longitudinal axis. A 180 degree twist is used as a means of inverting a belt through the zone of the twist.

U

Ultimate elongation: Elongation at rupture.

Ultimate strength: The force required to rupture a specimen.

Ultimate tensile: Tensile stress at rupture.

Undercure: A less than optimal state of vulcanization which may be evidenced by tackiness or inferior physical properties.

Uncured: Not vulcanized.

V

Vanner edge: See flanged edge.

Vertical curve: The portion of a conveyor belt where the angle of incline increases.

Viscosity: The flow property of a material.

Void: The absence of material or an area devoid of materials where not intended. See also blister and sink.

Volume swell: See swelling.

Vulcanization: A process over a range in temperature during which a polymeric compound, through a change in molecular structure (e.g., crosslinking) becomes less plastic and causes changes in the physical and chemical properties of the resulting elastomer.

Vulcanized splice: A joint in a belt made by means of vulcanization.

Vulcanized splice step length: The longitudinal distance between steps in the splice.

W

Warp: (1) The yarns that run lengthwise in a woven fabric or jacket. (2) The total deviation from a straight line of a hose when subjected to internal pressure.

Warp-yarn: (1) A longitudinal yarn in a fabric. (2) A corner yarn in a braid.

Weathering: Surface deterioration, evidenced by cracks and crazing of an elastomer, during outdoor exposure.

Weave: A fabric pattern description denoting a specific relationship of warp and filling yarns at specific locations in the fabric.

Weft: The crosswise threads in a fabric; filling threads. The treads or yarns running at right angle to the warp.

Weftless cord: A cord ply without filling yarns.

Winged pulley: A pulley with radial vanes extending from a supporting structure to the center shaft to minimize trapping material that otherwise would build up and damage the belt.

Wire hook fastener: A mechanical fastener consisting of wires capable of being driven through the belt end and bent back into the belt by a special tool device.

Wires: Metal in the form of a fine flexible rod.

Working load: See working tension.

Working tension: Stress on the belt when the belt is loaded with conveyed material and moving.

Woven fabric: A flat structure composed of two series of interlacing yarns of filaments, one parallel to the fabric and the other transverse.

Woven wire carcass: A belt with woven wire fabric.

Wrinkled ply: See buckled ply.

Y

Yarn: A generic term for continuous strands of textile fibers or filaments in a form suitable for knitting, weaving, or otherwise intertwining to form a textile fabric. It may comprise (1) a number of fibers twisted together (2) a number of filaments laid together without a twist (a zero-twist yarn) (3) a number of filaments laid together with more or less twist or (4) a single filament with or without twist (a mono-filament).

Yarn number: The number of hanks in a pound of spun yarn.

Yield point: The stress in a material at which a substantial increase in strain occurs with a minimum increase in stress.

Yield strength: The stress at which a material exhibits a specified limiting permanent set. Determined by a measurable value of plastic yielding of the material, above which the material is considered to be damaged and below which the damaging effects are considered to be negligible.

Young's modulus: Stress per unit strain for perfectly elastic material.

Z

Zero load: A reference load applied in taking an initial reading and prior to determining compressibility or extensibility.