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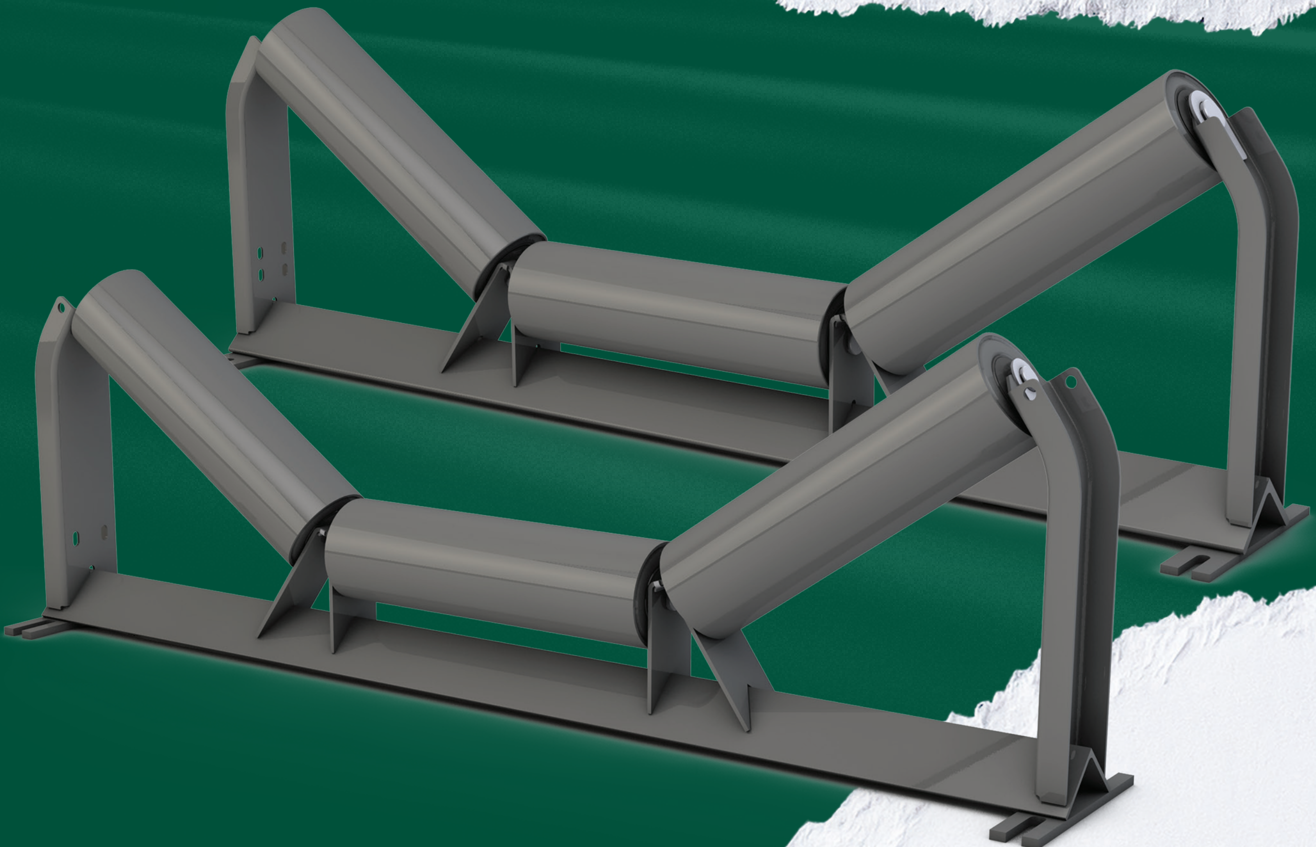

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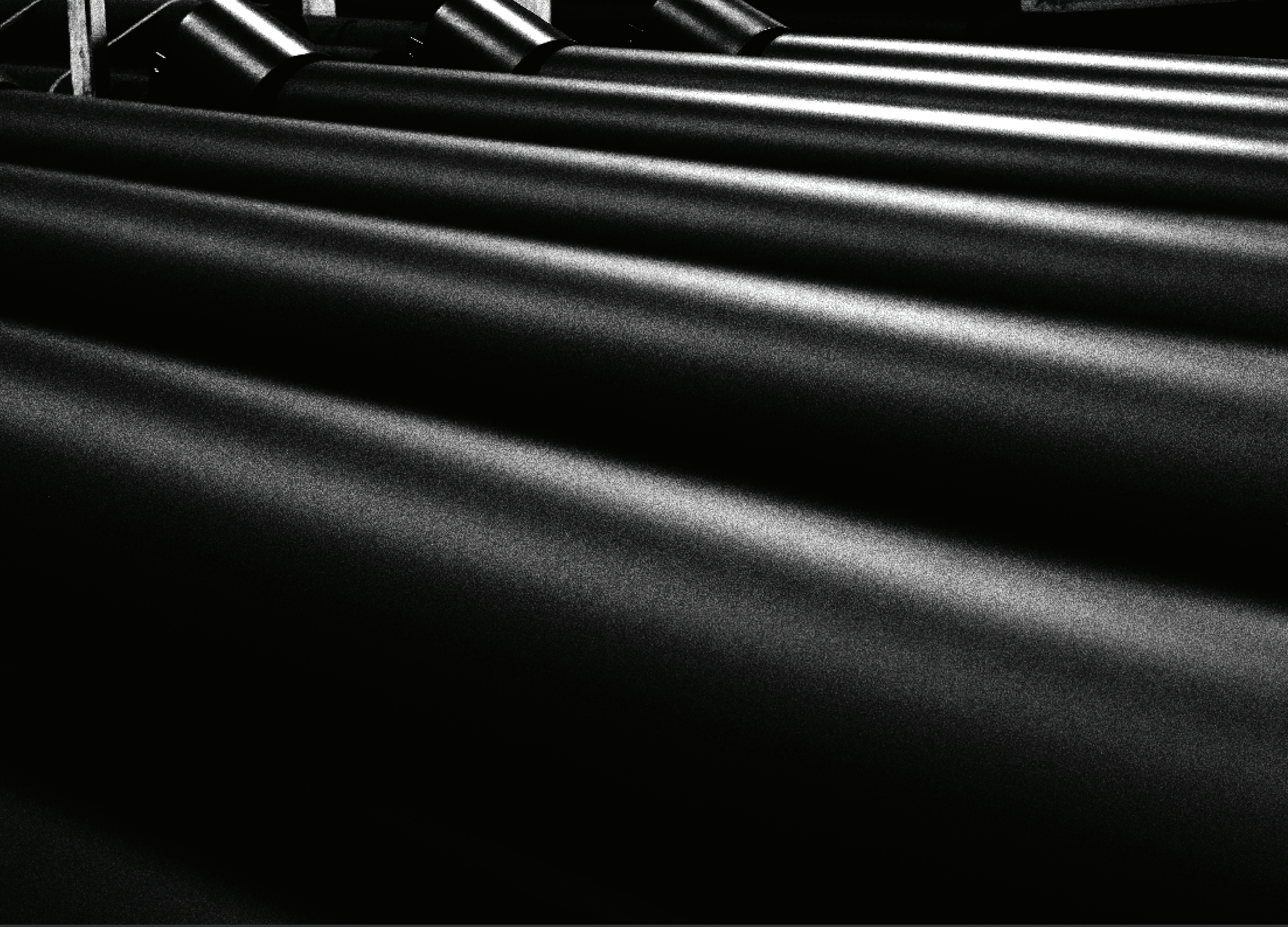
IDLER SELECTION GUIDE



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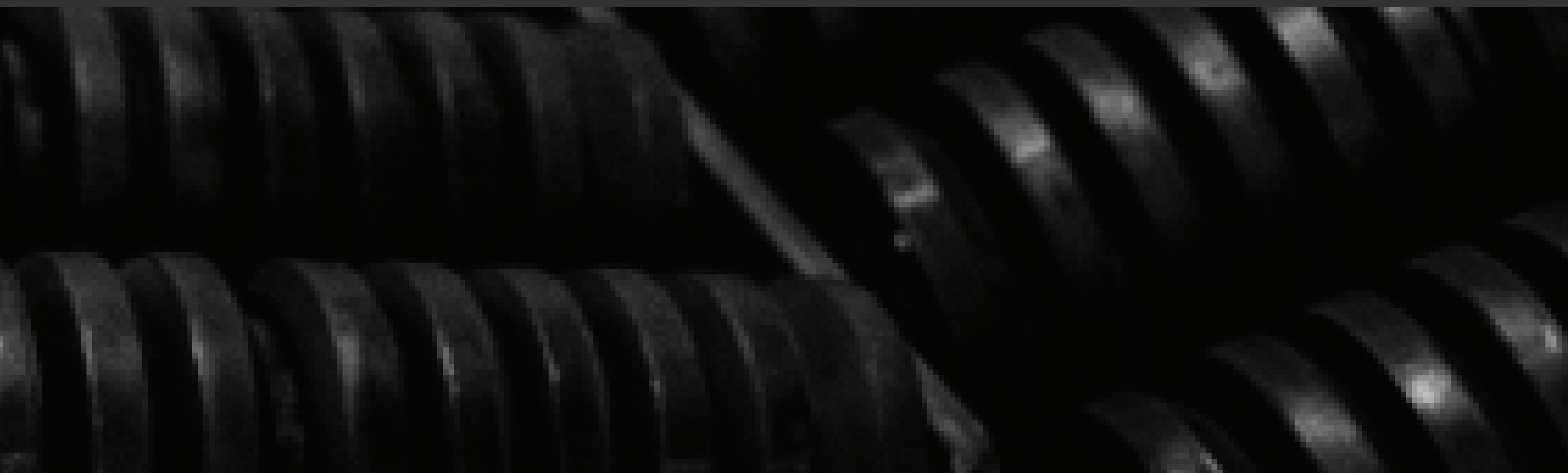
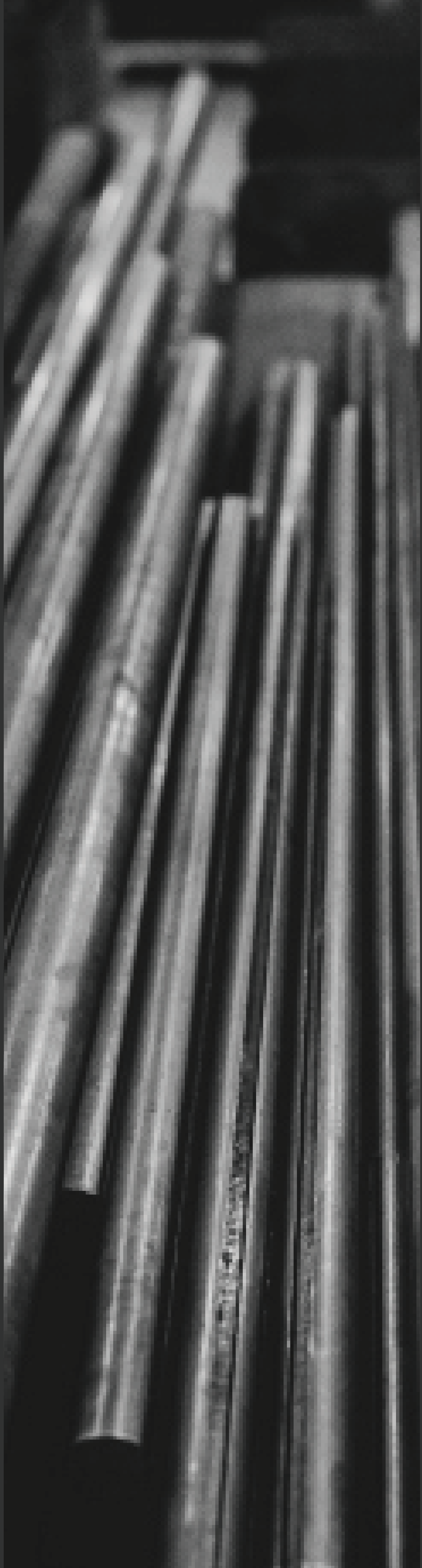


IDLER SELECTION GUIDE



APPENDIX

The charts included in this document represent a guide based on analysis of typical conveyors.

As each application is different, no warranty can be implied or given based on these charts alone.

GETTING STARTED

MATERIAL AND CONVEYOR DATA

PPI idlers meet or exceed CEMA requirements for load, life, and dimensions. Load limits shown in the following tables reflect CEMA methods. Basic calculations use bearing L10 requirements at 500 RPM in the table below.

Smaller idler rolls assist in reducing build up, larger idler rolls lower speed or Revolutions Per Minute (RPM) and therefore can extend bearing life. For this reason, the suggested maximum belt speed for different roll size exists. For instance, the 500 RPM rating for CEMA idlers translate into the following belt speeds:

CEMA	DESIGN L10 LIFE HOURS
B	30,000
C	30,000
D	60,000
E	60,000

CEMA	DESIGN LIMIT FPM
4"	534
5"	654
6"	758
7"	916

If the suggested maximums are exceeded there will be a reduction in bearing life. To overcome this may require a decreased rating or an increase in CEMA class. For more detailed conveyor design and idler selection consult CEMA's book, *Belt Conveyors For Bulk Materials*.

The following steps and tables will enable you to select belt speed and belt width for most applications. The experts at PPI are available to assist if you have special requirements, including specific bearing life expectations.

GETTING STARTED

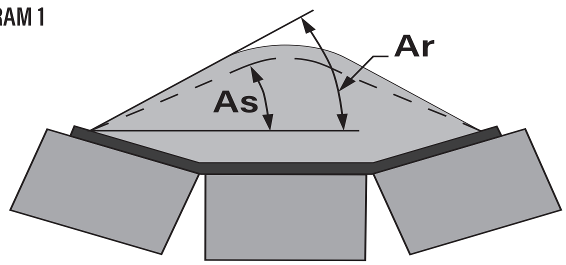
If you know belt tension, width and speed skip to step 5 on page 4.

What are you conveying? Do you know your material?

Information required: material density (weight per cubic foot), and the angle of repose.

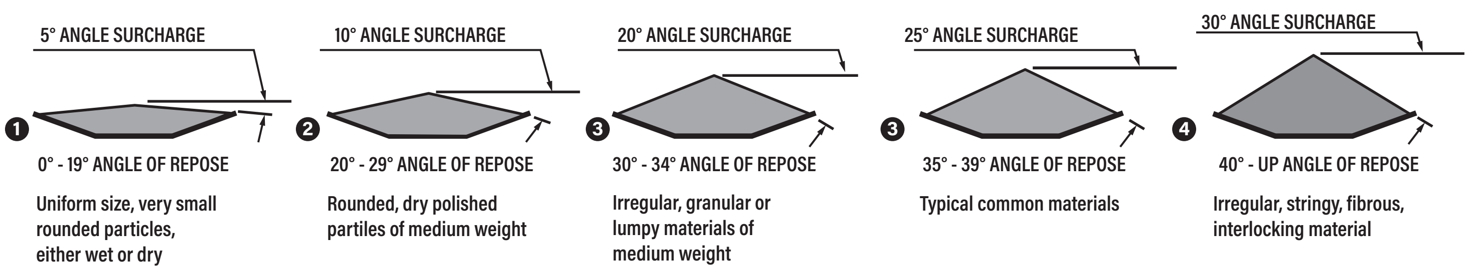
What is the angle of repose? There are two basic angles that describe the flow nature of material. One is the angle of repose (Ar); the other is the angle of surcharge (As). The angle of repose is the angle the material makes with the horizontal when dumped in a pile, such as a stockpile or a stationary belt. It is a direct measure of the static friction of the material.

DIAGRAM 1



The angle of surcharge (As) is the angle the material makes with the horizontal when the material is bumped or moving, such as on a moving conveyor belt. It is a direct measure of the kinetic friction. The higher the surcharge angle, the more material can be stacked on the belt. It is often the maximum incline of the conveyor. The angle of surcharge is normally 5° to 15° less than the Angle of Repose. To determine the Angle of Surcharge, look up angle of repose on the Material Properties tables and apply it to Diagram 2.

DIAGRAM 2 – TYPICAL As



STEP 1: Determine material characteristics; lump size, surcharge angle of material being conveyed, the desired or preferred trough angle, and cubic weight per foot of material.
The trough angle is the angle the wing roll of the trougher make with the horizontal. (See Table 13)

If you are unsure use 35° for standard troughing idlers, use 20° for CIT & unequal troughing idlers.

STEP 2: Calculate the volumetric capacity (C) required. This is calculated from the tons per hour (TPH), using the following formula:

$$C(ft^3/hr) = TPH * 2000 / \text{Material density } (lbs/ft^3)$$

STEP 3: Calculate the equivalent capacity, (Ceq): The charts list the capacity for various belt widths at the different troughing angle. These have been calculated at a belt speed of 100 FPM. To make it easier to pick out the right combination, calculate the Ceq using the following formula:

$$\text{Equivalent Capacity (Ceq)} = C * 100 / FPM$$

Conveyor speed is an important factor in conveyor design. Higher speeds will normally decrease capital equipment costs, but can increase idler costs, risk of damage during loading, etc. Suggested speeds and limits are listed for some bulk materials in Table 14.

Common conveyor speed is 500 FPM. The suggested minimum belt speed for proper discharge is 350 fpm.

TABLE 1 - 20° TROUGHED BELT - 3 EQUAL ROLLS

BELT WIDTH (INCHES)	CAPACITY AT 100 FPM (FT3 / HR) (C EQ)						
	SURCHARGE ANGLE						
	0°	5°	10°	15°	20°	25°	30°
18	537	653	769	886	1,005	1,128	1,254
24	1,041	1,258	1,477	1,698	1,924	2,155	2,394
30	1,708	2,060	2,414	2,772	3,137	3,511	3,897
36	2,538	3,057	3,579	4,107	4,645	5,196	5,765
42	3,533	4,250	4,972	5,703	6,447	7,210	7,997
48	4,691	5,640	6,594	7,560	8,544	9,552	10,592
54	6,013	7,225	8,444	9,678	10,935	12,223	13,552
60	7,498	9,006	10,522	12,057	13,621	15,223	16,876
72	10,961	13,155	15,364	17,599	19,876	22,210	24,617
84	15,078	18,089	21,119	24,186	27,310	30,511	33,814
96	18,596	22,304	26,035	29,811	33,568	37,601	41,667

TABLE 2 - 35° TROUGHED BELT - 3 EQUAL ROLLS

BELT WIDTH (INCHES)	CAPACITY AT 100 FPM (FT3 / HR) (C EQ)						
	SURCHARGE ANGLE						
	0°	5°	10°	15°	20°	25°	30°
18	864	964	1,066	1,169	1,274	1,381	1,492
24	1,668	1,857	2,048	2,241	2,438	2,640	2,847
30	2,733	3,039	3,346	3,658	3,975	4,300	4,636
36	4,058	4,508	4,961	5,419	5,886	6,364	6,857
42	5,644	6,266	6,891	7,524	8,169	8,830	9,511
48	7,491	8,312	9,138	9,974	10,825	11,698	12,598
54	9,598	10,646	11,700	12,768	13,855	14,969	16,118
60	11,966	13,269	14,580	15,906	17,257	18,642	21,058
72	17,484	19,378	21,285	23,215	25,182	27,196	29,275
84	24,043	26,642	29,256	31,902	34,598	37,361	40,210
96	29,647	32,846	36,064	39,321	42,639	46,040	49,548

TABLE 3 - 45° TROUGHED BELT - 3 EQUAL ROLLS

BELT WIDTH (INCHES)	CAPACITY AT 100 FPM (FT3 / HR) (C EQ)						
	SURCHARGE ANGLE						
	0°	5°	10°	15°	20°	25°	30°
18	1,021	1,109	1,198	1,289	1,380	1,475	1,572
24	1,967	2,132	2,299	2,467	2,638	2,814	2,996
30	3,218	3,484	3,752	4,023	4,299	4,581	4,873
36	4,775	5,165	5,558	5,955	6,360	6,775	7,204
42	6,636	7,175	7,717	8,265	8,824	9,397	9,987
48	8,803	9,514	10,229	10,953	11,690	12,445	13,224
54	11,276	12,182	13,094	14,017	14,957	15,921	16,915
60	14,053	15,179	16,312	17,458	18,626	19,823	21,059
72	20,524	22,160	23,807	25,473	27,171	28,910	30,705
84	28,216	30,458	32,714	34,997	37,323	39,706	42,165
96	34,786	37,545	40,320	43,130	45,991	48,924	51,950

TABLE 4 - FLAT BELT

BELT WIDTH (INCHES)	CAPACITY AT 100 FPM (FT3 / HR) (C EQ)						
	SURCHARGE ANGLE						
	0°	5°	10°	15°	20°	25°	30°
18	NA	123	246	372	498	630	762
24	NA	232	466	702	942	1,190	1,444
30	NA	376	756	1,137	1,527	1,928	2,340
36	NA	555	1,113	1,677	2,253	2,844	3,450
42	NA	768	1,540	2,322	3,120	3,936	4,776
48	NA	1,016	2,037	3,072	4,126	5,208	6,318
54	NA	1,298	2,604	3,927	5,273	6,654	8,076
60	NA	1,614	3,240	4,885	6,560	8,278	10,050
72	NA	2,353	4,720	7,116	9,558	12,060	14,640
84	NA	3,229	6,478	9,767	13,117	16,551	20,092
96	NA	3,977	7,979	12,029	16,155	20,384	24,746

STEP 4: Select the belt width using Tables 1 thru 4 and Ceq in Step 3.

Lump Size – The lump size influences the belt specifications and the choice of carrying idlers. There is an empirical relationship between lump size and belt width. For a 20° surcharge angle with 10% lumps and 90% fines, the recommended maximum lump size is one third of the belt width (BW/3). If it is all lumps, then the recommended maximum lump size is one fifth of the belt width (BW/5).

STEP 5: Determine the Calculated Idler Load (CIL)

$$CIL = ((Wb + (Wm * K1)) * Si) + IML$$

Wb = Weight of the belt (lb/ft) – use actual or estimate from Table 5

Wm = Weight of the material (lb/ft) = 33.3 * TPH / FPM

Si = Spacing of Idlers (ft)

K1 = Lump adjustment factor (see Table 6)

IML = Idler Misalignment Load (lb) = 1/6 * D * T / Si where:

D = Misalignment (in) – This is the deviation in height from one idler to the adjacent idler due to variations in framework.

T = Belt Tension (lb) & Si = Spacing of Idlers (ft)

Estimated CIL - when Tensions are not yet known for well aligned structures: CIL = 1.25* ((Wb + (Wm * K1)) * Si); for portable or not so well aligned structures: CIL = 1.5 *((Wb + (Wm * K1)) * Si)

While idler spacing can vary, many conveyors will use 4’ as the spacing for carrying idlers, one foot for impact idlers, and eight or ten ft. for return idlers. Commonly, 10’ is used but some instances use 8’ For example, double the carrying idler spacing, to simplify the framework. For more detailed information see Table 16, or CEMA’s Book *Belt Conveyors For Bulk Materials*.

STEP 6: Using the calculated value CIL, the belt width and the troughing angle, select the idler series from the tables on the following page.

For picking (unequals), and Live shaft idlers see Table 15. For flat carrying idlers, see Table 10.

There are numerous factors governing idler life, namely speed, dirt, water, maintenance, temperature, etc. For more information on how to calculate these factors, see CEMA’s Book *Belt Conveyors For Bulk Materials.*

TABLE 5 – AVERAGE BELT WEIGHT

BELT WIDTH	MATERIAL CARRIED LB/CU.FT.		
	30-74	75-129	130-200
18	3.5	4	4.5
24	4.5	5.5	6
30	6	7	8
36	9	10	12
42	11	12	14
48	14	15	17
54	16	17	19
60	18	20	22
72	21	24	26
84	25	30	33
96	30	35	38

TABLE 6 – K_1 LUMP ADJUSTMENT

MAXIMUM LUMP SIZE (Inches)	MATERIAL WEIGHT: LB/CU.FT.						
	50	75	100	125	150	175	200
4	1	1	1	1	1.1	1.1	1.1
6	1	1	1	1.1	1.1	1.1	1.1
8	1	1	1.1	1.1	1.1	1.2	1.2
10	1	1.1	1.1	1.2	1.2	1.2	1.2
12	1	1.1	1.1	1.2	1.2	1.2	1.3
14	1.1	1.1	1.1	1.2	1.2	1.3	1.3
16	1.1	1.1	1.2	1.2	1.3	1.3	1.4
18	1.1	1.1	1.2	1.2	1.3	1.3	1.4

IMPACT IDLER SELECTION

STEP 7: Determine the weight of the largest lump size using Table 8.

STEP 8: Check the impact of the largest lump and the maximum drop by using the top half of Table 9.

STEP 9: Check the material flow impact by using the bottom half of Table 9.

STEP 10: Select the appropriate impact system for your conveyor from Step 7 and/or 8 using the heaviest selected.

The EZ Slider series from PPI profides a variety of loading zone options:

- EZR- Impact slider with all rails
- EZS- Impact slider with steel rolls in the center
- EZI-Impact slider with impact rolls in the center

For impacts beyond what an impact roll can handle, the best choice is a True Impact System (TIS). For loads beyond this chart contact PPI.

TABLE 7 - TROUGHING IDLER RATINGS

BELT WIDTH	20° TROUGHING ANGLE RATINGS (lb)			
	B	C	D	E
18	410	900	1200	
24	410	900	1200	
30	410	900	1200	
36	410	900	1200	1800
42	390	850	1200	1800
48	390	800	1200	1800
54		750	1116	1800
60		700	1070	1800
66				1800
72			977	1800
84				1800
96				1750

BELT WIDTH	35° TROUGHING ANGLE RATINGS (lb)			
	B	C	D	E
18	410	900	1200	
24	410	900	1200	
30	410	900	1200	
36	410	837	1200	1800
42	363	791	1200	1800
48	353	744	1200	1800
54		698	1116	1800
60		650	1070	1800
66				1800
72			977	1800
84				1674
96				1628

BELT WIDTH	45° TROUGHING ANGLE RATINGS (lb)			
	B	C	D	E
18	410	900	1200	
24	410	900	1200	
30	410	900	1200	
36	369	810	1200	1800
42	351	765	1200	1800
48	342	720	1200	1800
54		675	1080	1800
60		630	1035	1800
66				1800
72			945	1800
84				1620
96				1575

TABLE 8 - MAXIMUM LUMP WEIGHT

DENSITY lb/ft^3	AVERAGE DIMENSION SIZE OF LUMP (IN)												
	2	3	4	5	6	7	8	9	10	12	14	16	18
50	0.4	1.3	3	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	20	28	41	59	81	140	199	296	421
125	0.9	3.2	7.4	14	25	35	52	74	101	175	248	371	527
150	1.1	3.8	9	17	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

TABLE 9 - IMPACT LOAD RATINGS

MAX LUMP SIZE (lb)	2 FOOT DROP	4 FOOT DROP	6 FOOT DROP	8 FOOT DROP	10 FOOT DROP
20	EZI	EZI	TIS - D	TIS - D	TIS - D
40					
60		TIS - D			
80					
100	TIS - D				
120					TIS - E
140					
160				TIS - E	
180					
200			TIS - E		
220					
240		TIS - E			
260					
280	TIS - E				
300					

TPH	2 FOOT DROP	4 FOOT DROP	6 FOOT DROP	8 FOOT DROP	10 FOOT DROP
200	EZI	EZI	EZI	EZI	TIS - D
400				TIS - D	
600			TIS - D		
800		TIS - D			
1000	TIS - D				
1200					
1400					TIS - E
1600					
1800				TIS - E	
2000					
2200			TIS - E		
2400					
2600		TIS - E			
2800					
3000	TIS - E				

RETURNS

RETURN IDLER SERIES SELECTION

In the selection of return belt idlers, only the belt is supported, so the unit weight for the belt (Wb) is multiplied by the idler spacing to obtain the load per return idler.

STEP 11: Determine the calculated idler load for returns (CILr)

CILr = (Wb * Sir) +IML

Wb = Weight of the belt (lb/ft) – use actual or estimate from Table 5

Sir = Spacing of return idlers (ft) (generally 10′ some at 8′ or twice the carrying spacing)

IML = Idler misalignment load (lb) = 1/6 * D * T / Sir where:

D = Misalignment (in) – This is the deviation in height from one idler to the adjacent idler

T = Belt tension (lb) & Si = Spacing of idlers (ft)

Estimated CIL - When tensions are not yet known for well aligned Structures: CIL = 1.25 * ((Wb + (Wm * K1)) * Si); for portable or poor Alignment: CIL = 1.5 * ((Wb + (Wm * K1)) * Si)

STEP 12: Using the calculated value CILr, belt width, and troughing angle, select the Idler Series from Table 10.

Appropriate diameter of return rolls for abrasion may be different from troughing size. Remember, the dirty side of the belt rests on the return idlers.

TABLE 10 - RETURN & FLAT RATINGS

BELT WIDTH	RETURN & FLAT CARRYING IDLERS RATINGS (lb)			
	B	C	D	E
18	220	475	600	
24	190	325	600	
30	165	250	600	
36	155	200	600	1000
42	140	150	500	1000
48	125	125	425	1000
54			375	925
60			280	850
66				775
72			155	700
78				625
84				550
90				475
96				400
102				250
TWO-ROLL V-RETURNS		500	850	1300

NUMBER OF IDLERS REQUIRED

STEP 13: Determine the number of Idlers:

Number of TROUGHING IDLERS: = ((C1 – Li) /Si) – 1

Number of IMPACT IDLERS: = (Li/Si_i) – 1

Number of RETURN IDLERS: = (C1/Si_r)-1

where

Si = Idler spacing (generally 4′)

Si_i = Impact idler spacing (generally 1′)

Si_r = Return idler spacing (generally 10′, sometimes 8′)

C1 = Conveyor length

Li = Length of impact area

If transitional idlers or trainers are used, adjust idler quantities accordingly.

Suggested number of self-aligners is one for every 25 carrying idlers, and one for every 10 return idlers.

TABLE 11 - LOADING

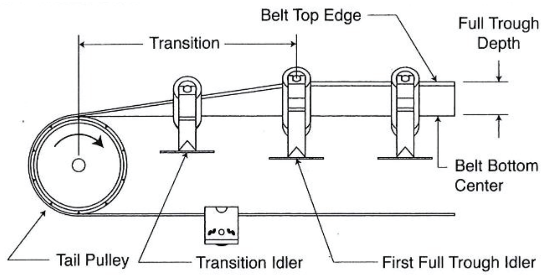
IDLER TROUGH ANGLE	% RATED BELT TENSION	RECOMMENDED TRANSITION DISTANCE = FACTOR x BELT WIDTH (BW)	
		FABRIC BELTS	STEEL CORD BELTS
20°	>90%	1.8	4.0
	60% - 90%	1.6	3.2
	<60%	1.2	2.8
35°	>90%	3.2	6.8
	60% - 90%	2.4	5.2
	<60%	1.8	3.6
45°	>90%	4.0	8.0
	60% - 90%	3.2	6.4
	<60%	2.4	4.4

Full trough CEMA recommended minimum transition distance ratios

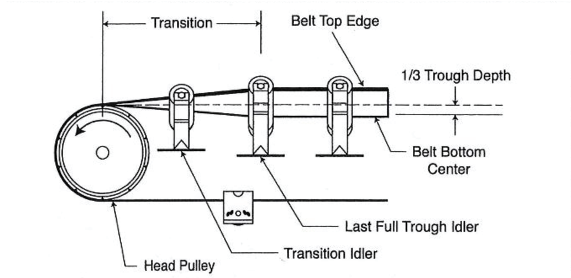
TABLE 12 - DISCHARGE

IDLER TROUGH ANGLE	% RATED BELT TENSION	TRANSITION DISTANCE = FACTOR x BELT WIDTH (BW)	
		FABRIC BELTS	STEEL CORD BELTS
20°	>90%	1.2	2.7
	60% - 90%	0.9	2.1
	<60%	0.6	1.3
35°	>90%	2.1	4.5
	60% - 90%	1.4	3.5
	<60%	1.2	2.4
45°	>90%	2.6	5.3
	60% - 90%	2.0	4.3
	<60%	1.6	3.1

One-third trough minimum transition distance ratios



Full trough transistion from tail pulley to first fully troughed idler



One-third trough transistion from last fully troughed idler to pulley

ROLLS & ROLL COVERINGS

While many conveyors use steel rolls everywhere except on impact idlers, some users will find they have build up problems on the return side. For example, material from the dirty side of the belt in contact with returns will build up on the return rolls.

The primary method of addressing build up on return rolls, in addition to belt scrapers, is to use Return Rubber Disc (RRD) on the return. This will help material fall off before it can build up.

In extreme cases, RRDs are not sufficient. In those cases there are other options available. For instance, Return Rubber Grooved (RRG) or Beater Bar Return (BBR). These options are only used after the RRD is tried in a particular application.

Because the return is in contact with the carrying, or dirty side of the belt, it can also be subject to abrasion. There are several options to address this issue. One option is HD Rolls, or rolls with ¼" thick tube/rim. Other options are to use lagging or a plastic sleeve over the roll.

EXAMPLE

Select idlers for a conveyor that is going to transport 1,000 tons per hour of mined bituminous coal a distance of 300 ft. with a lift of 50 ft.

STEP 1: From Table 12 we find coal, bituminous, mined, the table tells us that the 3" minus. Then we find that 8" minus for 50 lb/ft3 material has a K1 of 1 from Table 6.

We don't know tensions yet, so we can not determine IML, so we approximate it by calculating CIL without IML, and multiply it by 1.5 density is 50-54 lb/ft , angle of repose is 45°. for an IML service factor. While we don't know Si.

To determine angle of surcharge, we use this information and cross-reference it to Diagram 2. While this diagram might suggest a larger angle of surcharge, we select 20°, as it is more common, and will be a more conservative selection.

STEP 2: Determine the Volumetric Capacity

C = TPH * 2000 / material density

C = 1,000 * 2,000 / 50 = 40,000 ft3/hr

STEP 3: Determine the Equivalent Capacity Ceq = C * 100 / FPM. While we were not given a belt speed, the notes indicate a starting point of 500 fpm, and in looking in Table 13, we see the maximum belt speed listed of 500 to 700 fpm.

Ceq = 40,000 * 100 / 500 = 8,000

STEP 4: While we were not given the troughing angle, we assume 35°, as this is the common style for equal troughing idlers. Using this information, and Table 2, column for 20° surcharge angle we find that a 42" belt has a capacity of 8,169 ft3/hr at 100 fpm. Check lump size, i.e. max lump = BW / 5 or 42 / 5 = 8". If mostly fines then max lump = BW / 3 or 42/3 = 14".

STEP 5: Calculate the Idler Load.

CIL = ((Wb + (Wm * K1)) * Si) +IML

Looking in Table 5, we find the Wb = 11lb/ft

Wm = 33.3 * TPH / FPM = 33.3 * 1,000 / 500 =66.6

We don't know lump size, so we assume 8" minus, and state that our design is based on 8; most conveyors will use 4' for carrying idler spacing.

CIL = 1.5 * ((11 + (66.6 * 1)) * 4) = 416 lb

STEP 6: Determine Idler Series - Taking CIL and using Table 7, we find that a 35° troughing for 42" belt will have a rating of 791 lb for a C idler.

STEP 7: Using the 8" lump size we assumed earlier, we use Table 8 to find that the weight of this lump is approximately 21 lb.

STEP 8: While we don't know the drop yet, we can use Table 9 to find the check a possible drop of 6'. We find that a standard impact idler or EZI could handle a 6' drop with lump size of 20 lb.

STEP 9: However, it appears that the limiting factor for our conveyor will be material flow. Looking at 1,000 TPH on the bottom chart of Table 9, we find that even a 2' drop will require an impact system, unless the loading chute is designed to reduce the impact to the conveyor.

STEP 10: This system will need an impact system: D6-35TIS-42SB or D6-35TISL-42SB

STEP 11: Determine the return Idler

CILr = (Wb * Sir) +IML

Since we don't know IML, we will use a factor of 1.5.

CILr = 1.5 * (11 * 10) = 165 lb

STEP 12: This is over the 150 lb rating for a CEMA C return idler as shown in Table 10. Which means that we have several choices available.

1. Use CEMA D return idler.

2. Use 2 – roll V Return CEMA C return idler.

3. Use 8' for the spacing on return idlers.

4. Plan on using CEMA C returns at 10' spacing at this time, but perform an actual IML check once tensions are known, and upgrade later if necessary.

STEP 13: Calculate the number of idlers needed.

Number of Troughers = ((C1 – Li) /Si) – 1 = ((300 – 6)/4) –1 = 73

Number of 35° Troughers = 73 –2 = 71

Number of 20° Troughers (for transition) = 2

Number of Impact idlers = (Li/Sii) – 1 = (6/1) – 1 = 5
or 1 impact system

Number of Return Idlers: = (C1/Sir)-1 = (300/10) –1 = 29

C = TPH * 2000 / density =	**__________TPH * 2000 /________lb/ft³ =**	**A________ft³/hr**
Ceq = C * 100 / FPM =	**____ * 100 /____FPM =**	**B______**
Wm = 33.3 * TPH / FPM =	**33.3 *_____TPH /____FPM**	**C______lb**
IML = 1/6 * D * T / Si	**1/6 *______in *_____lb /______ft**	**D______lb**
CIL = ((Wb + (Wm * K1)) * Si) +IML	**((____lb + (_____lb *____)) *____ft) +____lb =**	**E______lb**
CEMA SERIES		
IML = 1/6 * D * T / Sir	**1/6 *______in *_____lb /______ft**	**F______lb**
CILr = (Wb * Sir) +IML	**(____lb *____ft) +____lb =**	**G______lb**
# of Troughers = ((C1 – Li) /Si) – 1 =	**((_____ft –_____ft) /____ft) –1 =**	**H_______**
# of____° Troughers (for transition) =		**I_______**
# of____° Troughers =	**H______– I______=**	**J_______**
# of Impact idlers = (Li/Sii) – 1 =	**(_____ft/_____ft) – 1 =**	**K_______**
# of Return Idlers: = (C1/Sir)-1 =	**(_____ft/_____ft) –1 =**	**L_______**

MATERIAL PROPERTIES

MATERIAL	AVERAGE WEIGHT/ CUBIC FOOT	MAXIMUM	REPOSE ANGLE	MATERIAL	AVERAGE WEIGHT/ CUBIC FOOT	MAXIMUM	REPOSE ANGLE
Alfalfa seed	10-15		29	Brewers grain, wet	55-60		45
Alum, fine	45-50		30-44	Brick, hard	125		
Alum, lumpy	50-60		30-44	Brick, soft	100		
Alumina	50-65	10-12	22	Bronze chips, dry	30-50		44-57
Aluminum chips	7-15		45	Buckwheat	37-42	11-13	25
Aluminum hydrate	18	20-24	34	Calcium carbide	70-80		30-44
Aluminum oxide	70-120		29	Calcium lactate	25-29		
Aluminum silicate	49		30-44	Carbon, dry, fine	8-20		20-29
Aluminum sulphate	54	17	32	Carbon black pellet	20-25		25
Ammonium chloride	45-52		30-44	Carbon black powder	4-7		30-44
Ammonium nitrate	45		30-44	Carborundum, 3″/less	120		20-29
Ammonium sulp. grain	45-58		44	Cast iron chips	90-200		45
Ash, black, ground	105	17	32	Cement, portland	72-99	20-23	30-44
Ash, coal, dry, 1″ less	35-40	20-25	45	Cement, portland aer.	60-75		
Ash, coal, dry, 3″ less	35-40		45	Cement, clinker	75-95	18-20	30-40
Ash, coal, wet 1″ less	45-50	23-27	45	Cement mortar	133		
Ash, coal, wet, 3″ less	45-50		45	Chalk, lumpy	75-85		45
Ashes, fly	40-45	20-25	42	Chalk 100 mesh	65-75		
Ash, gas, wet	78			Charcoal	18-25	20-25	35
Asphalt for paving	80-85			Chips, paper mill	20-25		
Asphalt, crushed 1″ less	45		30-44	Chips, pm, softwood	12-30		
Bagasse	7-10		45	Chips, hogged, fuel	15-25		
Barite	180		30-44	Chrome ore (chromite)	125-140		30-44
Barium carbonate	72		45	Cinders, blast furnace	57	18-20	35
Bark, wood, refuse	10-20	27	45	Cinders, coal	40	20	35
Barley	37-48	10-15	23	Clay calcined	80-100		
Basalt	80-103	20-28		Clay, dry, fines	100-120	20-22	35
Bauxite, mine run	80-90	17	31	Clay, dry, lumpy	60-75	18-20	35
Bauxite, crushed 3″ less	75-85		30-44	Coal, anthracite, river	60	18	35
Beans, castor, whole	36	8-10	20-29	Coal, anthracite, sized	55-60	16	27
Beans, castor, meal	35-40	8-10		Coal, bituminous, mined	50-54	24	45
Beans, navy, dry	48		29	Coal, bituminous, sized	45-55	16	35
Beans, navy, steeped	60		35-40	Coal, bituminous, run	45-55	18	38
Beet pulp, dry	12-15			Coal, bituminous, slack	43-50	22	40
Beet pulp, wet	25-45			Coal, bituminous, strip	50-60		
Beets, whole	48		50	Coal, lignite	40-45	22	38
Bentonite, crude	35-40	20	42-44	Coke, loose	23-35	18	30-44
Bentonite 100 mesh	50-60	20	42	Coke, petroleum calc.	35-45	20	30-44
Benzine hexachloride	56			Coke, breeze 1/4″ less	25-35	20-22	30-44
Bones	34-40		45	Concrete, cinder	90-100	12-30	
Boneblack, 100 mesh	20-25		20-29	Concrete, 2″ slump	110-150		24-26
Bonechar	27-40		30-44	Concrete, 4″ slump	110-150		20-22
Bonemeal	55-60		30-44	Concrete, 6″ slump	110-150		12
Borax, 2″-3″ lumps	60-70		30-44	Copper ore	120-150	20	30-44
Borax, 1″-2″ lumps	55-60		30-44	Copper ore, crushed	100-150		
Borax, fine	45-55	20-22		Copper sulfate	75-85	17	31
Boron	75			Corn, cracked	45-50		
Bran	10-20		30-44	Corn, ear	56		
Brewers grain, dry	25-30		45	Corn, shelled	45	10	21

MATERIAL	AVERAGE WEIGHT/ CUBIC FOOT	MAXIMUM	REPOSE ANGLE
Cornmeal	32-40	22	35
Cottonseed, cake, crack	40-45		30-44
Cottonseed hulls	12		45
Cottonseed meal	35-40	22	35
Cryolite, dust	75-90		30-44
Cryolite, lumpy	90-100		30-44
Cullet	80-120	20	30-44
Diatomaceous earth	11-14		30-44
Dicalcium phosphate	40-50		45
Disodium phosphate	25-31		30-44
Dolomite, lumpy	80-100	22	30-44
Earth, as excav. Dry	70-80	20	35
Earth, wet, w/clay	100-110	23	45
Ebonite, crushed 1/2″	65-70		30-44
Feed, cattle & fowl	45-50		
Feldspar, 1/2″ screenings	70-85	18	38
Feldspar, 1′-3″ lumps	90-110	17	34
Feldspar, 200 mesh	100		30-44
Ferrous sulphate	50-75		
Fish meal	35-40		
Flaxseed	45	12	21
Flaxseed meal	25		30-44
Flour, wheat	35-40	21	45
Flue dust, dry	35-40		20
Fluorspar 1/2″ screen	85-105		45
Fluorspar, 1″-3″ lumps	110-120		45
Foundry sand, loose	80-90		30-44
Foundry sand, old	70-100		30-44
Fullers earth, dry	30-35		23
Fullers earth, oily	60-65		20-29
Fullers earth, burned	40		20-29
Fullers earth, raw	35-40	20	35
Garbage, household	50		
Gilsonite	37		
Glass batch	80-100		0-10
Granite, 1/2″ screenings	80-90		20-29
Granite, 1″-3″ lumps	85-90		20-29
Granite, broken	95-100		30-44
Graphite, flake	40		30-44
Grass seed	10-12		30-44
Gravel, bank run	90-100	20	38
Gravel, pebbles	90-100	12	30
Gypsum, dust nonaera.	93		
Gypsum, dust aerated	60-70	23	
Gypsum, 1/2″ screening	70-80	21	40
Gypsum, 1″-3″ lumps	70-80	15	30
Guano, dry	70		20-29
Gunpowder	63		
Hay, loose	5		

MATERIAL	AVERAGE WEIGHT/ CUBIC FOOT	MAXIMUM	REPOSE ANGLE
Hominy	37-50		30-44
Ice, crushed	35-45		19
Iimenite ore	140-160		30-44
Iron borings	125		
Iron ore	100-200	18-20	35
Iron ore crushed	135-150	20-22	
Iron oxide pigment	25	25	
Kaolin clay 3″ under	63	19	35
Kaolin talc, 100 mesh	45-56	23	
Lead arsenate	72		45
Lead ores	200-270	15	30
Lead oxides	60-150		45
Lignite, air dried	45-55		30-44
Lime, ground 1/8″ less	60-65	23	43
Lime, hydrated 1/8″ less	40	21	40
Lime, pebble	53-56	17	30
Limestone, agi.1/8″ less	68	20	30-44
Limestone, crushed	85-90	18	38
Limestone, dust	80-85	20	
Linseed meal	27	20	34
Litharage, pulverized	200-270		
Magnesium chloride	33		40
Magnesium sulphate	40-50		30-44
Malt, dry gr.1/8″ less	22		30-44
Malt, dry whole	27-30		20-29
Malt, wet	60-65		45
Malt, meal	36-40		30-44
Manganese dioxide	80		
Manganese ore	125-140	20	39
Manganese sulphate	70		30-44
Marble, crushed 1/2″ less	80-95		30-44
Meat scraps	50-55		30-44
Mica, ground	13-15	23	34
Mica, pulverized	13-15		
Mica, flakes	17-22		19
Milo, maize	56		30-44
Molybdenite, powdered	107	25	40
Mortar, wet	150		
Muriate of potash	77		
Mustard seed	45-48		20-29
Nickel-cobalt sulphate	80-150		30-44
Oats	26-35	10	21
Oats, rolled	19-24		20-34
Oil cake	48-50		45
Oxalic acid crystals	60		30-44
Oyster shell 1/2″ less	50-60		30-44
Oyster shell, whole	80		30-44
Paper pulp stock	40-60		19
Peanuts, in shells	15-24		30-44

MATERIAL PROPERTIES

MATERIAL	AVERAGE WEIGHT/ CUBIC FOOT	MAXIMUM	REPOSE ANGLE
Peanuts, shelled	35-45		30-44
Peas, dried	45-50		
Phosphate, fertilizer	60	13	26
Phosphate triple super	50-55	30	45
Phosphate rock dry	75-85	12-15	25-29
Phosphate rock, crush	60	25	40
Plystyrene beads	35		23
Potash salts, sylvite	80		20-29
Potassium carbonate	51		20-29
Potassium chloride	120-130		30-44
Potassium nitrate	76-80		20-29
Potassium sulphate	42-48		45
Pumice 1/8″ less	40-45		45
Pyrites 2″-3″ lumps	135-145		20-29
Pyrites, pellets	120-130		30-44
Quartz 1/2″ screen	80-90		20-29
Quartz 1″-3″ lumps	85-95		20-29
Rice, hulled	45-48	8	19
Rice, rough	36		30-44
Rock, crushed	125-145		20-29
Rock, soft	100-110	22	30-44
Rubber pellets	50-55	22	35
Rubber, reclaim	25-30	18	32
Rye	42-46	8	23
Salicylic acid	29		
Salt, dry, coarse	40-55	18-22	
Salt, dry, fine	70-80	11	25
Salt cake, dry, coarse	85	21	36
Salt cake, dry pulv.	60-85		20-29
Sand, bank, damp	105-130	20-22	45
Sand, bank, dry	90-110	16-18	35
Sand, foundry, prepared	80-90	24	30-44
Sand, foundry, shakeout	90-100	22	39
Sand, silica, dry	90-100	10-15	20-29
Sand, core	65	26	41
Sandstone, broken	85-90		30-44
Sawdust	10-13	22	36
Sewage, sludge	40-50		20-29
Shale, broken	90-100		20-29
Shale, crushed	85-90	22	39
Sinter	100-135		35
Slag, crushed, furnace	80-90	10	25
Slag, granular, dry	60-65	13-16	25
Slag, granular, wet	90-100	20-22	45
Slate, 1/2″ less	80-90	15	28
Slate, 1″-3″ lumps	85-95		
Soap granules	15-25		30-44
Soap chips	15-25	18	
Soap detergents	15-50		
Soapstone, talc, fine	40-50		
Soda ash, briquettes	50	7	22
Soda ash, heavy	55-65	19	32
Soda ash, light	20-35	22	37
Sodium bicarbonate	41	23	
Sodium nitrate	70-80	11	24
Sodium phosphate	50-65		37
Sodium alum. sulphate	75		30-44
Sorghum seed	32-52		30-44
Soybeans, cracked	30-40	15-18	35
Soybeans, whole	45-50	12-16	21-28
Soybean cake, 1/2″ over	40-43	17	32
Soybean flakes, raw	20-26		30-44
Soybean meal, cold	40	16-20	32-37
Soybean meal, hot	40		30-44
Starch	25-50	12	24
Steel chips	100-150		30-44
Steel trimmings	75-150	18	35
Sugar, granulated	50-55		30-44
Sugar, powdered	50-60		
Sugar, raw, cane	55-65		45
Sugar, wet, beet	25-45		20-29
Sugar cane, knifed	15-18		45
Sulphate powdered	50-60	21	30-44
Sulphate, crushed 1/2″	50-60	20	30-44
Sulphate, 3″ less	80-85	18	30-44
Taconite, pellets	116-130	13-15	30-44
Talc, 1/2″ screen	80-90		20-29
Talc, 1″-3″ lumps	85-95		20-29
Talc, solid	165		
Tobacco leaves, dry	12-14		45
Tobacco stems	15		45
Traprock, 1/2″ screens	90-100		30-44
Traprock, 2″-3″ lumps	100-110		30-44
Trisodium phosphate	60		
Trisodium phos. gran.	60	11	30-44
Trisodium phos. Pulv.	50	25	40
Triple super phos.	50-55		
Vermiculite, expan.	16		45
Vermiculite ore	70-80	20	
Wheat	45-48	12	28
Wheat, cracked	35-45		30-44
Wood chips	10-30	27	45
Wood shavings	8-15		
Zinc concentrates	75-80		
Zinc ore, crushed	6-8	22	38
Zinc ore, roasted	110		38
Zinc oxide, heavy	30-35		45-55
Zinc oxide, light	10-15		45

BELT SPEED & MISC. IDLER RATING

MAXIMUM RECOMMENDED BELT SPEEDS

MATERIAL BEING CONVEYED	BELT SPEEDS (FPM)	BELT WIDTH
Grain or other free flowing non-abrasive materials	400	18
	600	24-30
	800	36-42
	1000	48-96
Coal, damp clay, soft ores, overburden and earth, fine crushed stone	600	18
	800	24-36
	1000	42-60
	1200	72-96
Foundry sand prepared or damp, shakeout sand with small cores with or without small castings not hot enough to harm the belt	350	Any width
Prepared foundry sand and similar damp (or dry abrasive) materials discharged from belt by plows	200	Any width
Non-abrasive materials discharged from belt by means of plows	200 Except for wood pulp where 300-400 is preferred	Any width
Feeder belts, flat or troughted, for feeding fine, non-abrasive or mildly abrasive materials from hoppers	50 - 100	Any width
Coal (bituminous, sub-bituminous), PBR coal, lignite, petroleum coke, gob, culm and silt	500 to 700 for belt conveyors, 380 to 500 for silo feed conveyors and tripper belt conveyors	Any width
Power generating plant applications	500 for belt conveyors 380 for silo feed conveyors and tripper belt conveyors	Any width

MISC IDLER LOAD RATINGS

BELT WIDTH	UNEQUAL TROUGHING IDLERLOAD RATING (LB)		
	C	D	E
24	475	600	
30	475	600	
36	325	600	1260
42	250	600	1200
48	200	530	1000
54	150	440	1000
60	125	400	1000
72		280	925
84			775
96			625

BELT WIDTH	LIVE SHAFT IDLER LOAD RATING (LB)		
	C	D	E
18	1200		
24	1200	1400	
30	1200	1400	
36	1200	1400	2100
42	1100	1400	2100
48	1000	1275	2100
54	875	1150	2100
60	780	1000	2100
72		850	2100
84			1825
96			1550

IDLER SPACING RECOMMENDATIONS

BELT WIDTH (IN)	TROUGHING IDLERS						RETURN IDLERS
	WEIGHT OF MATERIAL HANDLED: LBS PER CU. FT.						
	30	50	75	100	150	200	
18	5.5′	5.0′	5.0′	5.0′	4.5′	4.5′	10.0′
24	5.0′	4.5′	4.5′	4.0′	4.0′	4.0′	10.0′
30	5.0′	4.5′	4.5′	4.0′	4.0′	4.0′	10.0′
36	5.0′	4.5′	4.0′	4.0′	3.5′	3.5′	10.0′
42	4.5′	4.5′	4.0′	3.5′	3.0′	3.0′	10.0′
48	4.5′	4.0′	4.0′	3.5′	3.0′	3.0′	10.0′
54	4.5′	4.0′	3.5′	3.5′	3.0′	3.0′	10.0′
60	4.0′	4.0′	3.5′	3.0′	3.0′	3.0′	10.0′
72	4.0′	3.5′	3.5′	3.0′	2.5′	2.5′	8.0′
84	3.5′	3.5′	3.0′	2.5′	2.5′	2.0′	8.0′
96	3.5′	3.5′	3.0′	2.5′	2.0′	2.0′	8.0′

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