Design and Selection

Conveyor Chain Selection Procedures

Conveyor Classes

A consideration closely related to the type of conveyor chain is the conveyor class. Six conveyor classes have been established on the basis of friction factors involved with the movement of the chain (sliding or rolling) and the movement of the material (sliding or carried). These six classes are described in terms of chain and material movement in the following table:

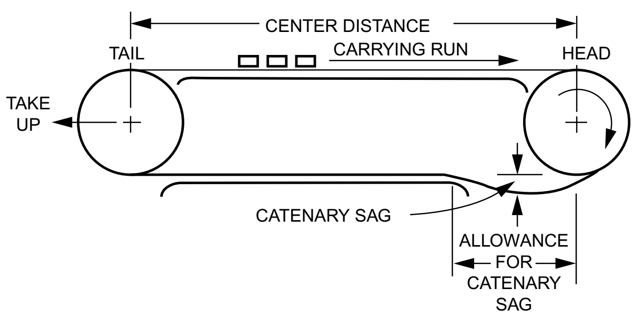
Conveyor Classes		
Class	**Chain**	**Material**
1	Sliding, with flights	Sliding
1A	Sliding, without flights	Sliding
2	Rolling	Sliding
3	Sliding	Carried
4	Rolling	Carried
4A	Supplemental Roller	Carried

Basic Conveyor Arrangements

There are several basic conveyor arrangements. The recommended arrangement (see illustration) is with the drive at the head end and with the carrying and return runs well supported. Note the catenary sag in the return run at the head end. In general, the catenary sag should be at least equal to 3% of the span over which the chain is hanging. The illustrated arrangement offers two advantages:

- The catenary force tends to keep the chain engaged on the drive sprocket.
- Wear at the chain joints is minimal because the return run is under minimum tension and flexure at the chain joints is reduced by the well-supported return line.

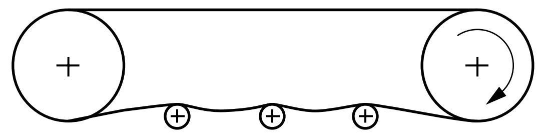
If a take-up is used to adjust the center distance and maintain the correct catenary sag, be extremely cautious not to impose excessive loads on the chain.



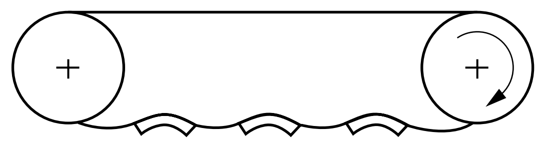
Other Arrangements

Other methods of supporting the return run are shown in the following illustrations.

These methods of support will result in faster chain wear because of the additional flexure at the joints in the return line and the higher pressure between the chain and the return support because of the small area of support.



Return Strand Supported by Rollers

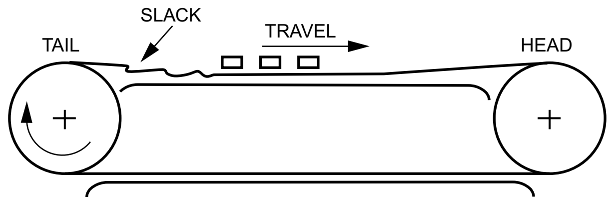


Return Strand Supported by Shoes

Conveyors sometimes are driven from the tail end as shown in the following illustration.

This arrangement is not recommended for two main reasons:

- Chain wear at the joints is greater because chain is flexing under load at both the head and tail sprockets.
- Excess chain tends to accumulate on the carrying run just after the tail sprocket and the resulting wedging action can cause the chain to jump the sprocket.

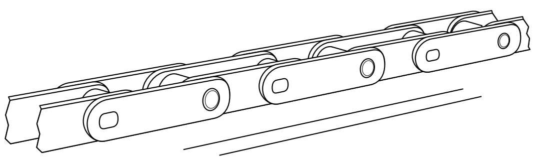


Design and Selection

Method of Chain Travel

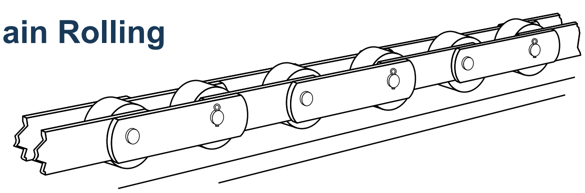
Another basic consideration is whether the chain will slide or roll. In deciding on the method of chain travel, the following points should be evaluated:

Chain Sliding



- Simple in construction, fewer moving parts and usually the lowest in cost for a given load.
- Most effective in “dirty” applications.
- Greater horsepower required.

Chain Rolling



- Smoother operation, less pulsation.
- Lower friction which permits longer centers, smaller motors, and lower operating costs.
- Not suited to “dirty” applications, foreign matter jams rollers.
- Less horsepower required.

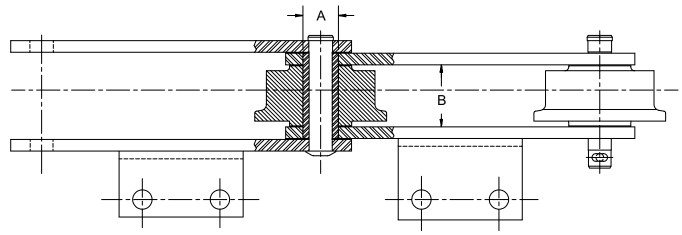
Conveyor Pulsation

Another consideration is the amount of pulsation that can be tolerated in the conveyor. This will vary from one installation to another and the permissible amount is a matter of judgement. When pulsation must be minimized, consider the possible causes and remedies listed in the following table:

Possible Cause	Remedy
Excessive friction	Clean and lubricate moving parts.
Conveyor too long	Use shorter conveyor sections.
Conveyor speed too low (10 FPM or less)	Increase conveyor speed, or use non-metallic bushed chain.
Velocity fluctuation caused by chordal action	Use drive sprocket with 12 or more teeth, or use compensating sprocket.

Carrying Loads of Rollers

A basic consideration on conveyors using chain with rollers is the load imposed on the chain. This load includes the weight of the slats or flights, and the weight of the material being carried. This load must be limited so that the pressure of the bushing on the roller is kept within permissible limits.



A = Roller-bore diameter } **Applies also to outboard rollers.**
B = Roller hub length
Roller-bearing area = A x B
The roller carrying pressure, per roller, is distributed over the roller-bearing area.

The table below lists allowable bearing pressures between bushings and roller. Note the method of determining the roller bearing area. The listed bearing pressures are for “ideal conditions”, i.e. slow speeds in non-gritty service with lubricated bearings. As any of these conditions become more severe, the allowable pressures must be reduced accordingly.

The allowable working bearing pressures, in pounds per square inch between rollers and bushings, are approximately as follows:

Roller and Bushing Materials in Contact	Allowable Bearing Pressure P.S.I.
Case-hardened steel against case-hardened steel	1400
Case-hardened steel against white iron	1400
Case-hardened steel against untreated steel	1200
Case-hardened steel against cast iron	1000 ①
Case-hardened steel against malleable iron	1000
Case-hardened steel against bronze	400
Gray iron against malleable iron	800
Malleable iron against malleable iron	800
Gray iron against bronze	800
Non-metallic against carburized steel or heat treated stainless steel (LF bushed rollers)	100

① Applies also to chill iron.

Design and Selection

Conveyor Chain Selection Procedures

Wear Strips and Ways

Generally, it is desirable that the chain wear slower than the wear strips or liner since it is the more critical and expensive part of the conveyor components. Therefore, the most compatible wear strip should be considered after the proper chain has been selected. Conveyor may experience wear even with the chain rolling instead of sliding. This wear is not a critical consideration but cold finished steel should be used for best operation.

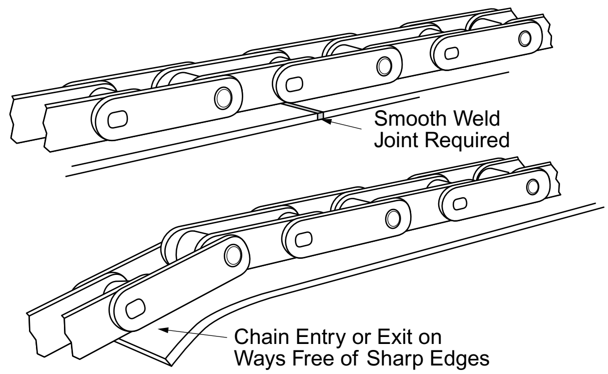
The subject of wear is extremely complicated and influenced by many factors. It is impossible to predict with accuracy the wear life of various chain – liner combinations. This is due to the effect of many variable and uncontrollable factors such as abrasion, corrosion, lubrication, load, speed, and break-in period. Thus, prior experience of a successful chain – liner combination for a specific application is the best guide to predict performance.

For new installations, where no previous experience can be applied as a guide, a metal liner should be used where chain is slightly harder than the liner. This will protect the chain by ensuring the liner wear first. The material should be at least comparable to the chain in surface finish or smoother.

Non-metallic materials such as wood and plastic are occasionally used as liner materials. These may result in wear strip economy, but should not be used where severe impacting loads exist or under extremely dirty conditions.

If wear is a problem, neglecting the effect of corrosion, experience has shown that generally by increasing the hardness of either the chain or the metallic wear strip in an abrasive environment should decrease the wear on both. Lubrication, even if only water will reduce wear. Some general comments to insure proper installation of liners in the conveyor and things to do before start-up are:

1. See that the joints on the liners and frame are smooth so that no sharp edges protrude.
2. Take reasonable care in eliminating welding slag, weld spatter, metal filings and/or mill scale from the conveyor.
3. Break in chain and liner by operating the conveyor without load, and with plenty of lubricant, for a short period of time (generally 8-24 hours) or until the mating wear surfaces are polished smooth.



Note: The above comments are guidelines that normally will increase or improve chain liner compatibility.

Abrasion Resistant Steel Alloys That May Be Used As Liner Material				
Name	Condition	Mechanical Properties		
		Hardness BHN	Yield 1000 PSI	Tensile 1000 PSI
SSS-321	Q & T	321	–	–
SSS-360	Q & T	360	–	–
SSS-400	Q & T	400	–	–
Sheffield AR	HR	225	–	–
AR-No. 235	HR	235	70	100
Abrasion Resisting, Med. Hard.	HR	235	–	–
Abrasion Resisting, Full Hard.	HR	270	–	–
Jalloy AR-280	Q & T	260	110	117
Jalloy AR-320	Q & T	300	135	142
Jalloy AR-360	Q & T	340	160	166
Jalloy AR-400	Q & T	400	184	190
Jalloy S-340	Q & T	320	149	157
Jalloy 3 (AR)	HR	225	90	104
T-1-A-360	Q & T	360	145	180
XAR-15	Q & T	360	165	180
XAR-30	Q & T	360	165	180
USS-AR	HR	235	–	100
T-1	Q & T	321	100	115
T-1-A	Q & T	321	100	115
T-1-A-321	Q & T	321	137	171
T-1-B-321	Q & T	321	137	171
T-1-321	Q & T	321	141	175
T-1-360	Q & T	360	145	180
Astralloy	N	440	141	228

Presented as a guide only. If additional information is required, contact the designated steel company.
Note: Q & T = quenched and tempered; HR = hot rolled; N = normalized. Typical values are enclosed in parentheses.
Mechanical properties are those of sheet or hot rolled plate up to 1/2" thick and are minimums unless typical is indicated by parentheses.

Design and Selection

This procedure is intended to serve primarily as a guide for selecting a general type, or class, of chain when a new conveyor is designed. When following the step-by-step instruction outlined, the user may find that more than one type of chain will fit the particular conveyor requirement. In such a case the final selection of the chain may be affected by such factors as allowable sprocket diameters, space limitations for chain, chain pitch, and many other environmental and design factors peculiar to the particular conveyor being designed. Contact your representative for assistance in selecting the best chain when a choice of more than one class is indicated.

Parts of this section will prove useful in determining whether the chain on existing installations is the most economical choice, and will also serve as a guide to upgrading existing installations where service life is not satisfactory.

Procedure

There are six basic steps in selecting the proper type of chain for a conveyor installation.

1. Determine the class of conveyor.
2. Estimate the total chain pull.
3. Determine the design working load.
4. Make a tentative chain selection.
5. Make tentative selection of attachment links.
6. Verify chain selection and re-check design working load.

Step 1. Determine the Class of Conveyor

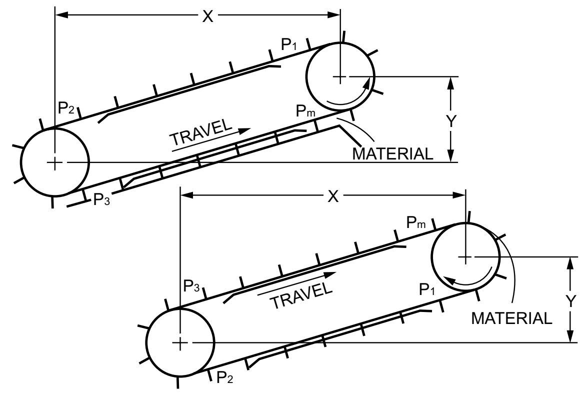
Check the sections on Conveyor Types,Conveyor Classes, and Method of Chain Travel in relation to your conveying problem. Make a tentative selection of a conveyor class required.

Step 2. Estimate the Total Chain Pull (Pm).

Use the formula which applies to the conveyor class tentatively selected and calculate total chain pull (Pm) which is total conveyor chain pull. For conveyors that are partly horizontal and partly inclined, calculate the chain pull for each section, and add to obtain total chain pull. Note: Calculations assume properly adjusted take up equipment. If take-up force is adjusted to exceed the calculated value (P_2 + P_3), excessive chain loading may result.

Class 1, 1A and 2 Conveyors

(Chain sliding or rolling; Material sliding)



Formulas for Calculating Total Chain Pull (Pm)

Horizontal: $\left(\frac{Y}{X} \text{ is less than } f_1\right)$

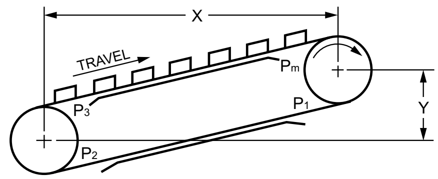
$$Pm = X\left(2f_1W + f_2M + \frac{h^2}{c}\right) + MY$$

Inclined: $\left(\frac{Y}{X} \text{ is greater than } f_1\right)$

$$Pm = X\left(f_1W + f_2M + \frac{h^2}{c}\right) + Y(W + M)$$

Class 3, 4 and 4A Conveyors

(Chain sliding, rolling or in tension; Material carried)



Formulas for Calculating Total Chain Pull (Pm)

Horizontal: $\left(\frac{Y}{X} \text{ is less than } f_1\right)$

$$Pm = f_1X(2W + M) + MY + \frac{h^2}{c}X$$

Inclined: $\left(\frac{Y}{X} \text{ is greater than } f_1\right)$

$$Pm = (M + W)(f_1X + Y) + \frac{h^2}{c}X$$

Formulas for Calculating Horsepower (HP)

Horizontal:

$$HP = \frac{1.15\,(S)(Pm)}{33{,}000}$$

Inclined:

$$HP = \frac{1.15\,(S)(Pm - P1)}{33{,}000}$$

$$P_1 = W(Y - f_1X)$$

$$P_2 = P_3 = 0$$

Design and Selection

Conveyor Chain Selection Procedures

Symbols

f1 = Coefficient of Friction – chain sliding or rolling on runway. See next column for specific value of the coefficient. If chain is supported by flights, etc., f1 should be coefficient for flights sliding on conveyor ways.

f2 = Coefficient of Friction – material sliding on trough. (See Table in next column).

M = Weight of material handled per foot of conveyor (lb./ft.)

$$M = \frac{(TPH)(33.3)}{S}$$

$$M = \frac{(CFH)\ (\text{Mat'l. Density in LB/FT3})}{60(S)}$$

W = Weight of moving conveyor parts – chains, flights, slats, etc., per foot of chain (lbs/ft). Depending on the method of chain travel, use the following factors for estimating approximate chain weight (lbs/ft) if actual chain weight is unknown.

Material or chain sliding – .0015 x Total weight of material on conveyor at any time (lbs.). (Classes 1, 1A, 2 or 3)

Material carried and chain rolling .0005 x Total weight of material on conveyor at any time (lbs.). (Classes 4 and 4A)

For example: If a Class 4 Conveyor is used and the total material weight is 40,000 pounds, then 40,000 x .0005 = 20.0

Use 20.0 Lbs/Ft. as an estimated chain weight for "W" in the above equation. Add the estimated Weight/Ft. on the flights or slats that will be used.

h = Height of material rubbing against side of conveyor trough (inches).

c = Trough side friction constant (see Table in next column).

Pm = Total Maximum chain pull (lbs)

P1
P2 = } Chain pull at point indicated (lbs)
P3

HP = Required horsepower at headshaft

S = Conveyor Speed (ft/min)

TPH = Capacity in Tons per Hour = $\frac{MS}{33.3}$

CFH = Capacity in cubic feet per hour

$$= \frac{TPH \times 2000}{(\text{Mat'l. Density in lb/ft3})}$$

X = Horizontal center distance (ft.)

Y = Vertical rise (ft.)

Chain Friction Factors (f1)

Chain Sliding

Chain Sliding on Steel Track – unlubricated 3-.5
Chain Sliding on Steel Track – lubricated 2
Chain Sliding on Hard Wood 5
Chain Sliding on Non-Metallic Wear Strips:
Chain Sliding on Ultra-High Molecular
Weight Polyethylene .... .15-.4

Chain Rolling

$$f_1 = f_r \frac{d_a}{d_r}$$

Where: d_a = axle diameter (inches)(usually bushing O.D.)
d_r = roller outside diameter (inches)

(Fr) For Metal Rollers			
Cast Rollers		Steel Rollers	
Dry	.5	Dry	.4
Lubricated	.4	Lubricated	.3

For LF (Low Friction material) Bushed Rollers, f_r =.25

Material Friction Factors

Materials	Friction Factor Mat'l Sliding on Steel Trough (f2)	Trough Side Friction Factor (c)
Aluminum	.40	27
Ashes, Coal, Dry	.50	36
Ashed, Coal, Wet	.60	55
Bagasse	.40	200
Cement, Portland	.65	12
Cement Clinker	.70	12
Coal, Anthracite, Sized	.40	25
Coal, Anthracite, Run of Mine	.45	20
Coal, Bituminous, Sized	.50	21
Coal, Bituminous, Run of Mine	.55	20
Coke, Mixed	.55	42
Coke, Breeze	.65	36
Grains	.40	23
Gravel, Dry	.45	12
Gravel, Run of Bank	.60	11
Ice, Crushed	.15	34
Lime, Pebble	.50	28
Sand, Dry	.60	7
Sand, Damp	.85	6
Stone, Screened	.60	9
Wood Chips, Pulp Logs	.40	48

Step 3. Determine the Design Working Load

The determination of chain pull (Pm) is for static conditions and does not include consideration of the following dynamic conditions:

a. Loading fluctuations that may exceed the static load condition. These fluctuations are provided for by the Service Factor. (See table below.)

b. The conveyor chain speed and the number of teeth in the sprockets used. These items are provided for by the Speed Factor (Fs). (See table below.)

Calculate the Design Working load by modifying **Pm** as follows:

For single strand conveyor:

Design Working Load = Pm x Service Factor x Speed Factor

For multiple strand conveyor:

$$\text{Design Working Load} = \text{Pm} \times \text{Service Factor} \times \text{Speed Factor} \times \frac{1.2}{\text{No. of Strands}}$$

The multiplier (1.2) is used to provide for possible overloads in one of the strands caused by unequal load sharing distribution.

Speed Factors (Fs)

No. of Teeth on Sprocket	50		100		150		200		300		400	
	Cast Chain	Engineered and Welded Steel Chain	Cast Chain	Engineered and Welded Steel Chain	Cast Chain	Engineered and Welded Steel Chain	Cast Chain	Engineered and Welded Steel Chain	Cast Chain	Engineered and Welded Steel Chain	Cast Chain	Engineered and Welded Steel Chain
6	1.6	1.4	2.3	2.0	2.3	2.9	5.0	4.4	–	–	–	–
7	1.3	1.1	1.6	1.4	2.0	1.8	2.6	2.3	4.5	4.0	–	–
8	1.2	1.0	1.4	1.3	1.7	1.5	2.0	1.8	2.9	2.5	4.2	3.6
9	1.1	1.0	1.3	1.2	1.6	1.4	1.8	1.6	2.3	2.0	2.9	2.6
10	1.0	0.9	1.3	1.1	1.4	1.2	1.6	1.4	1.9	1.7	2.3	2.0
11	1.0	0.9	1.2	1.0	1.3	1.2	1.5	1.3	1.7	1.5	2.1	1.8
12	1.0	0.9	1.1	1.0	1.3	1.1	1.4	1.2	1.6	1.4	1.9	1.6
14	1.0	0.8	1.1	0.9	1.2	1.0	1.3	1.1	1.5	1.3	1.7	1.4
16	0.9	0.8	1.0	0.9	1.1	1.0	1.2	1.0	1.4	1.2	1.5	1.3
18	0.9	0.8	1.0	0.9	1.0	0.9	1.2	1.0	1.3	1.1	1.5	1.3
20	0.9	0.8	1.0	0.9	1.0	0.9	1.1	1.0	1.3	1.1	1.5	1.2
24	0.9	0.8	0.9	0.8	1.0	0.9	1.1	0.9	1.2	1.0	1.3	1.2

Note: If sprocket size has not yet been determined, use a speed factor for a 12-tooth sprocket. Refer to sprocket selection beginning on page 75.

Service Factor

Type of Load	Operating Conditions ①		Daily Operated Period	
	Start Stop Frequency Under Load	% Load Added At a Time	8-10 Hrs.	24 Hrs.
Uniform	Less Than 5/Day	Less Than 5%	1.0	1.2
Moderate Peaks	5/Day to 2/Hr.	5-20%	1.2	1.4
High Peaks	2/Hr. to 10/Hr.	20% to 40%	1.5	1.8
Temperature	Operating Conditions		Service Factors	
	Up to 200°F (93°C)		1.0	
	200°F to 350°F (93°C to 177°C)		1.1	
	350°F to 500°F (177°C to 260°C)		1.2	
	Above 500°F (260°C)		Contact Us	

① Reversing under load can be damaging and requires special consideration. Contact Us for selection assistance.

Determination of Speed Factor for Traction Wheels

1. Determine effective pitch diameter (PDeff):
   (PDeff) =Traction wheel O.D. + barrel O.D. (chain)
2. Compare (PDeff) to pitch diameters of standard engineering sprockets. If (PDeff) falls between two standard pitch diameters, go to the lower value.
3. The standard pitch diameter chosen from No. 2 above will give the number of teeth.
4. Knowing the number of teeth and chain speed, speed factor (Fs) can be determined.

The "Start-Stop" and "% loaded" parameters are intended to guide you in classifying the severity of loading for your conveyor. If these two parameters fall into different categories (ex. start-stop less than 5/Day, % loaded at a time 5-20%) use the more severe classification (moderate).

Step 4. Make Tentative Chain Selection

To aid in making the selection, consider the following:

a. The wear life and relative cost of each type.

b. Short conveyor centers and high chain speeds produce rapid joint wear and chain elongation. These conditions suggest a chain with a high (A or B) wear rating.

c. Heavy loads produce rapid sliding and rolling wear. These conditions suggest a chain with a high (A or B) sliding or rolling wear rating.

d. Conveyors operating in highly abrasive surroundings require hard bearing surfaces. This condition would suggest a steel chain.

e. Mildly abrasive or moderately corrosive conditions may indicate that a cast chain is the economical choice.

f. Corrosive atmospheres reduce the fatigue strength of component parts. In this case, chain with armor cased pins are recommended.

g. The chain pitch may be dictated by the required spacing of attachment links. A longer pitch is more economical while a shorter pitch requires less room for sprockets. In many cases a 4” to 6” pitch chain is considered a good compromise.

h. The selection procedure outlined is applicable only if temperatures of the chain will remain within -40°F and +350°F. Special lubricants may be needed above 250°F. If these temperature limits will be exceeded, contact us.

Additional factors such as sprocket availability and price, chain delivery lead time and chain price should also be considered in making the final choice.

In making the final selection reliability should be a primary consideration. Cast chains, in general, do a good job in sliding applications and have excellent corrosion resistance. However, in critical applications where overloads may be encountered, Engineered Steel and Welded Steel chains will usually provide longer and more dependable service. It is recommended, therefore, that the final selection be made from the listings of Engineered Steel and Welded Steel chains. Refer to the detail listings for the type of chain selected and select a specific chain that has a working load at least equal to the design working load and meets the pitch and space requirements.

IT IS NOT RECOMMENDED TO USE CAST, CAST COMBINATION NOR WELDED STEEL CHAINS FOR ELEVATOR SERVICE.

Step 5. Make Tentative Selection of Attachment Links

Refer to the section on attachments. On the basis of the information here and on the basis of the chain selected, tentatively select the desired attachment links.

Step 6. Verify Chain Selection and Re-Check Design Working Load

Recalculate total chain pull (Pm) and design working load using the exact chain and attachment weight as given in the listings to verify that the selected chain will meet the requirements.

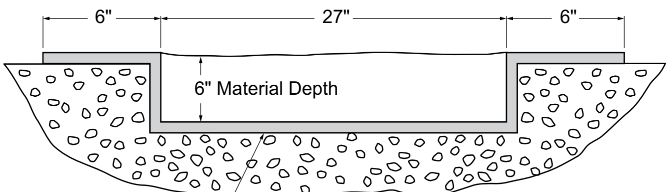
Selection Procedure for Double Flex Chains

This procedure is the same as that for standard chains except that the “Chain Pull” as determined must be modified. The modification is necessary because the chain is flexing around curves and additional tension is developed because of the friction between the sides of the chain and curves. The chain pull must be calculated on a cumulative basis, with the “Turn Factor” for each curve taken into account. Contact Us for assistance in applying the proper “Turn Factor” for your conveyor.

Design and Selection

Conveyor Chain Selection

A horizontal scraper flight conveyor has been tentatively designed to handle Bituminous coals, and will feed an incinerator from a coal storage hopper. The coal is to be conveyed in an existing trough which is approximately 100 feet long and has a cross section as shown in the sketch below.



Conveyor Data

Material Handled:	*Bituminous Coal*
	(1/2" maximum lump size)
Material Density:	*50 Lbs. per cubic foot*
Conveyor Centers:	*100 Feet*
Conveyor Capacity:	*170 Tons per hour*
Conveyor Speed:	*100 Feet per minute*

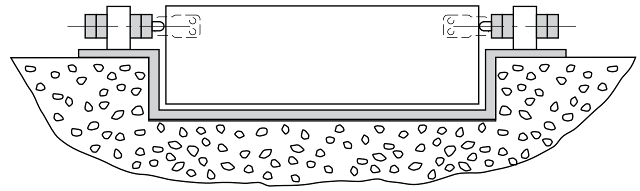
Other Considerations

1. Approximately 100 steel plates (1/4" x 10" x 27"; Weight 10 Lbs.) are left over from another project, complete with attachment wings. It is desired to use these as flights if possible. Attachment wings are available to suit chain.
2. No space restrictions.
3. Conveyor to operate 16 hours per day/5 days per week.
4. Drive will be selected to suit conveyor.

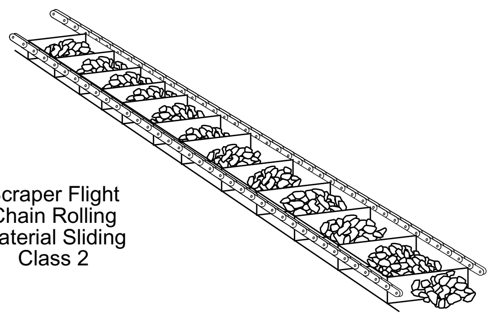
Select Suitable Chain

Step 1. Determine Conveyor Class

In the basic considerations section of this procedure, it was pointed out that a conveyor using a chain that rolled would result in smoother operation. Since a rolling chain also has less friction, smaller drive units could be used, at lower operating costs. Therefore, tentatively pick a chain with rollers to run on the existing trough. Also tentatively figure on using the available 10" x 27" steel flights and attachment wings. The basic conveyor cross section might become a two-chain conveyor with scraper flights connected between the chains as shown in the following sketch.

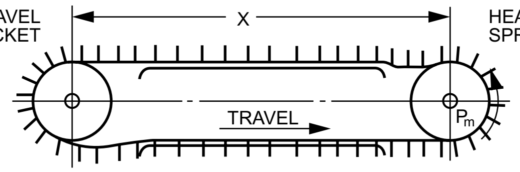


The unit becomes a scraper flight conveyor, similar to that indicated as a basic type of conveyor.



Scraper Flight
Chain Rolling
Material Sliding
Class 2

Step 2. Estimate Total Chain Pull



$$P_m = X\left(2f_1W + f_2M + \underline{b}^2\right) + MY$$

Where:

Pm	= Maximum chain pull (Lbs.)
X	= Conveyor centers (100 Ft.)
f_1	= Coefficient of friction – chain rolling on runway
f_1	$= f_r \frac{d_a}{d_r}$ (See Table, page 123)
f_1	= 0.20 (This factor will range from 0.10 to 0.20, depending upon the chain roller-bushing proportions. Since the chain pull is only being estimated at this point, use the highest range 0.20 in the first calculation.)
M	= Weight of material handled per foot of conveyor
M	$= \frac{TPH \times 33.3}{S} = \frac{170 \times 33.3}{100} = 56.6$ Lbs./Ft.
W	= Weight per foot of moving conveyor parts
S	= Conveyor speed (feet/minute)

Design and Selection

Design And Selection Conveyor Chain Selection Procedures

Since the weight of the chain and attachment links has not yet been determined, use the empirical factor given on page 107 to establish chain weight.

W = .0015 x 56.6 Lbs./Ft. x 100 Ft. = 8.49 Lbs./Ft.
Add to this the weight of the flights.

(There are approximately 100 flights available; assume a flight spacing of every 2 feet)

10 Lbs./ Flight x 1 Flight/2 Ft. = 5 Lbs./Ft.

W = 8.49 Lbs./Ft. + 5 Lbs./Ft. = 13.49 Lbs./Ft.
f_2 = Coefficient of friction of material
f_2 = 0.50 (Material friction factor table, page 107)
h = Height of material (see sketch of trough)
h = 6 inches
c = Trough side friction factor
c = 21 (Material friction factor table, page 107)
y = Vertical rise = 0 (Horizontal Conveyor)

Substitute Values in Formula:

$$Pm = X\left(2f_1W + f_2M + \frac{h_2}{c}\right) + MY$$

$$= 100\left[2(.20)(13.49) + .50(56.6) + \frac{62}{21}\right] + 56.6 \times 0$$

$$= 100(5.4 + 28.3 + 1.7)$$

Pm = 3540 Lbs.

Step 3. Determine Design Working Load

$$\text{Design W.L.} = Pm \times \text{Service Factor} \times \text{Speed Factor} \times \frac{1.2}{\text{No. of Strands}}$$

$$= 3540 \times 1.2 \times 1.0 \times \frac{1.2}{2}$$

$$= 2545 \text{ Lbs.}$$

The Service Factor was picked from the table on page 108 for uniform loading since the conveyor is being fed from a hopper. A factor of 1.2 was selected because the conveyor will be in operation for more than 10 hours per day.

The speed factor was picked for a 12 tooth sprocket, although final sprocket selection has not been made.

Step 4. Make Tentative Chain Selection

Refer to the chain selection chart and note that an engineered steel roller type chain is recommended for a Class 2 Conveyor.

Refer to pages 10-15 of the chain listing section and note that these chains all have rollers. For the conveyor arrangement tentatively selected, a Style "R" chain, whose rollers are larger than the sidebars, should be used. As indicated in the selection procedure, Step 4-g. (Page 109), a 4- to 6-inch pitch chain is good first choice. Also, from the calculation of Design Working Load, a chain having a working load rating of 2548 pounds or greater will be required.

Checking the chain listings, you will note a number of Style "R" chains in the desired pitch range. SR196 would be selected as the chain that most closely matches the desired working load. Chains such as 2188 and 1604 have working loads substantially higher and would not be economical choices. SR196 would be the tentative selection.

Step 5. Make Tentative Selection of Attachment Links

From the basic conveyor arrangement decided upon, an attachment lug which projects on one side of the chain only is required. Also, it is desired to select an attachment link to which the available flight wings can be adapted, if possible. This suggests a single - attachment lug such as the "A" attachment. The A1 (single hole) attachment is available for the SR196 chain. Make this the tentative selection.

Step 6. Verify Chain Selection & Recheck Design

Working Load

The exact chain and attachment link weight per ft. can now be used to calculate the Design Working Load. Also, the chain roller and bushing diameters can be used to determine the chain friction factor (f_1).

Chain Weight

SR196 Plain Chain = 5.0 Lbs./Ft.
SR196 A1 Attachment Link = 6.6 Lbs./Ft.

The weight per foot for the attachment link is based on a link interspersed every pitch. For the conveyor arrangement to be used, an attachment link will be required every 2 feet, or every 4th pitch (6 inch pitch chain).

3 plain links at 5.0 Lbs./Ft.	= 15.0 Lbs.
1 Attachment link at 6.6 Lbs./Ft.	= 6.6 Lbs.
	21.6 Lbs.

21.6 4 = 5.4 Lbs./Ft.

SR196 A1 every 4th link	= 5.4 Lbs./Ft.
2 strands of chain x 5.4 Lbs./Ft.	=10.8 Lbs./Ft.
Flight Weight	= 5.0 Lbs./Ft.
	15.8 Lbs./Ft.

15.8 Lbs./Ft. = W = Total weight of moving conveyor parts.