



## How to select a chain drive

C.O. Engineering – Bearings and PT Components

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A question that is quite frequently asked is how a chain drive is selected. This paper details the inputs required and methods that can be used to select a chain drive.

There are two methods that can be used to select a chain drive.

1. Easy selection method
2. Using horsepower (HP) rating tables

The easy selection method will be discussed here.

Inputs that are required to start designing a chain drive are as follows:

1. HP
2. Driver and driven speeds (RPM) and shaft sizes
3. The surrounding conditions

**Easy selection method:** Follow these steps while using this method.

1. Determine class of service  
**Class A:** Fairly-uniform load  
**Class B:** Variable running load  
**Class C:** Heavy starting loads

2. Select the service factor (SF) using Table 1.

Table 1: Type of input power.

Class of Service	Type of Input Power		
	Internal Combustion Engine with Hydraulic Drive	Electric or Turbine	Internal Combustion Engine with Mechanical Drive
A	1.0	1.0	1.2
B	1.2	1.3	1.4
C	1.4	1.5	1.7

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Table 2: Class of Service for Driven Machine

Class of Service for Driven Machine			
Driven Machine	Class	Driven Machine	Class
Agitators, liquid or semi-liquid stock, paddle or propeller .....	A	Line Shafts:	
Bakery Machinery .....	B	Light or normal service .....	A
Beaters .....	B	Unevenly loaded .....	B
Blowers, Centrifugal .....	A	Machines, Non-Reversing:	
Boat Paddle Wheels or Propellers .....	C	Even load .....	A
Centrifuges .....	C	Pulsating load .....	
Clay Working Machinery:		Impact load .....	C
Extruders, Granulators, Mixers, Pug Mills, Rolls .....	B	Mills:	
Briquette Machine, Presses .....	C	Ball, Pebble, Rod, Tube .....	B
Compressors:		Blooming, Hammer, Hardinge, Rolling .....	C
Centrifugal, Rotary .....	B	Paper Machinery:	
Reciprocating .....	C	Agitators, Calenders, Dryers, Jordan Engines, Paper .....	
Conveyors:		Machines, Pulp Grinders .....	B
Uniformly or loaded .....	A	Beaters, Chippers, Nash Pumps, Washers, Winder .....	
Irregularly fed or loaded .....	B	Drums, Yankee Dryers .....	C
Reciprocating .....	C	Presses .....	C
Cookers, Cereal .....	A	Printing Machinery .....	B
Cranes .....	B	Pumps:	
Crushers .....	C	Centrifugal, Gear, Rotary .....	A
Elevators:		Dredge .....	C
Uniformly fed or loaded .....	A	Reciprocating, 1 or 2 cylinder .....	C
Irregularly fed or loaded .....	B	Reciprocating, 3 or more cylinder .....	B
Fans:		Rubber Plant Machinery:	
Centrifugal .....	A	Banbury Mills, Calenders, Mixers .....	C
Mine, Positive Blowers, Propeller .....	C	Screens:	
Feeders, Reciprocating .....	C	Air Washing, Water .....	A
Flour, Feed or Cereal Mill Machinery .....	B	Rotary (Stone or Gravel), Vibrating .....	B
Generators .....	A	Textile Machinery:	
Hogs for Refuse .....	C	Batcher, Calender, Dry Can, Dyeing Machinery .....	
Kettles, Brew .....	A	Loom, Mangel, Napper, Soaper, Spinner, Tentor .....	
Kilns and Dryers, rotary .....	B	Frame .....	B
Laundry Machinery .....	B	Card Machine .....	C
		Woodworking Machinery .....	B

3. Calculate the design HP (DHP): Driver HP X SF or normal running HP X SF.
4. Determine chain size and smaller sprocket (normally driver) number of teeth. Refer to Table 3.

Table 3: Selection table

## SELECTION

### Easy Selection Table RECOMMENDED SMALL SPROCKET

	RPM of small Sprocket	Chain Size and No. of Teeth for Design HP												
		1/4	1/3	1/2	3/4	1	1-1/2	2	3	4	5	6	7-1/2	
V-Drives	951-1000	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 23	40 17	40 17	40 20	40 24
	901-950	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 24	40 17	40 18	40 21	40 25
	851-900	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 24	40 17	40 18	40 22	50 17
	801-850	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 18	40 17	40 19	40 23	50 17
	751-800	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 19	40 17	40 17	40 20	40 24
	701-750	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 20	40 17	40 17	40 18	40 22	40 25
	651-700	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 22	40 17	40 19	40 19	40 23	50 17
	601-650	35 17	35 17	35 17	35 17	35 17	35 17	35 18	35 23	40 17	40 20	40 24	50 17	50 19
	551-600	35 17	35 17	35 17	35 17	35 17	35 17	35 19	40 17	40 17	40 21	50 17	50 17	50 21
	501-550	35 17	35 17	35 17	35 17	35 17	35 17	35 21	40 17	40 17	40 23	50 17	50 18	50 22
FHP Drives	471-500	35 17	35 17	35 17	35 17	35 17	35 22	40 17	40 17	40 24	50 17	50 19	50 24	
	441-470	35 17	35 17	35 17	35 17	35 17	35 23	40 17	40 17	40 17	50 17	50 20	50 25	
	411-440	35 17	35 17	35 17	35 17	35 17	40 17	40 17	40 21	50 17	50 18	50 22	60 17	
	381-410	35 17	35 17	35 17	35 17	35 17	40 17	40 17	40 22	50 17	50 19	50 23	60 17	
	351-380	35 17	35 17	35 17	35 17	35 17	40 17	40 17	40 24	50 17	50 21	50 24	60 18	
	321-350	35 17	35 17	35 17	35 17	35 17	40 17	40 18	50 17	50 18	50 22	60 17	60 20	
	301-320	35 17	35 17	35 17	35 17	35 17	40 17	40 19	50 17	50 19	50 23	60 17	60 21	
	281-300	35 17	35 17	35 17	35 17	35 17	40 17	40 19	50 17	50 20	50 25	60 18	60 22	
	261-280	35 17	35 17	35 17	35 17	35 17	40 17	40 19	50 17	50 22	60 17	60 19	60 23	
	241-260	35 17	35 17	35 17	35 17	35 17	40 17	40 19	50 18	50 23	60 17	60 20	80 17	
Drive Component Accessories	221-240	35 17	35 17	35 17	35 17	35 17	40 19	40 24	50 19	50 25	60 19	60 22	80 17	
	201-220	35 17	35 17	35 17	35 17	35 17	40 20	50 17	50 21	60 17	60 20	60 24	80 17	
	181-200	35 17	35 17	35 18	35 17	35 17	40 22	50 17	50 23	60 18	60 22	60 26	80 17	
	161-180	35 17	35 17	35 20	40 18	35 17	40 24	50 17	50 25	60 20	60 24	80 17	80 17	
	151-160	35 17	35 17	35 21	40 18	35 17	50 17	50 18	60 17	60 21	60 25	80 17	80 17	
	141-150	35 15	35 15	35 22	40 18	40 15	50 17	50 19	60 17	60 22	80 17	80 17	80 18	
	131-140	35 15	35 15	35 23	40 18	40 15	50 17	50 20	60 18	60 23	80 17	80 17	80 19	
	121-130	35 15	35 15	40 13	40 18	40 15	50 17	50 22	60 19	60 25	80 17	80 17	80 20	
	111-120	35 15	35 15	40 13	40 18	40 15	50 18	50 22	60 20	80 15	80 17	80 18	80 22	
	101-110	35 15	35 15	40 15	40 18	50 15	50 19	60 15	80 15	80 15	80 16	80 19	100 15	
DYNA-SYNC	91-100	35 15	35 15	40 15	40 15	40 17	50 15	50 18	60 17	80 15	80 18	100 15	100 15	
	81-90	35 15	35 15	40 15	40 15	50 15	50 15	50 18	60 18	80 15	80 15	80 16	100 15	
	71-80	35 15	35 17	40 15	40 16	50 15	50 18	60 14	80 15	80 15	80 16	100 15	100 15	
	61-70	35 15	35 19	40 15	40 19	50 15	60 15	60 16	80 15	80 15	80 18	100 15	100 15	
	51-60	35 17	40 13	40 15	50 13	50 15	60 15	60 19	80 15	80 17	100 15	100 15	100 16	
	46-50	40 13	40 13	40 16	50 13	50 16	60 14	80 13	80 13	100 13	100 13	100 14	100 17	
	41-45	40 13	40 13	40 18	50 16	60 13	60 16	80 13	80 14	100 13	100 13	100 16	120 13	
	35-40	40 13	40 14	50 13	50 16	60 13	60 19	80 13	80 17	100 13	100 14	100 18	120 14	
	30-35	40 13	40 16	50 13	50 18	60 15	80 13	80 13	80 19	100 13	100 16	120 13	120 14	
	23-29	40 14	50 13	50 16	60 14	60 19	80 13	80 17	100 13	100 16	120 14	120 15	120 18	
HT2000/HTD Synchronous Drives	17-22	50 13	50 14	60 13	60 19	80 13	80 17	100 13	100 17	120 13	120 16	140 13	140 16	
	12-16	50 15	60 13	60 18	80 13	80 16	100 13	100 16	120 14	120 18	140 15	140 17	160 15	
	8-11	60 14	60 18	80 13	80 18	100 13	100 17	120 14	140 13	140 17	160 15	160 18	180 18	
	5-7	80 13	80 13	100 13	100 13	100 18	120 17	140 14	180 15	180 14	200 13	200 15	240 13	
	HT500 Synchronous Drives	<b>Notes:</b>												
1. Apply Service Factor to obtain Design Horsepower. Select small sprocket based upon Design Horsepower and RPM on this chart.														
2. Sprocket selections are recommended minimum. Larger sizes may be selected if required to obtain desired ratio, etc.														
3. To use this chart for double or triple strand chain, divide the design horsepower by the following factors: Double strand: 1.9, Triple strand: 2.9														

Table 4: Selection table



**SELECTION**

**Easy Selection Table**  
RECOMMENDED SMALL SPROCKET

RPM of small Sprocket	Chain Size and No. of Teeth for Design HP													
	9	10	12	15	20	25	30	40	50	60	70	80	90	100
951-1000	50 17	50 17	50 20	60 17	60 20	60 24	80 17	80 18						
901-950	50 17	50 18	50 21	60 17	60 21	80 17	80 17	80 18						
851-900	50 17	50 19	50 22	60 17	60 22	80 17	80 17	80 19						
801-850	50 18	50 20	50 23	60 17	60 23	80 17	80 17	80 20						
751-800	50 19	50 21	60 16	60 18	60 24	80 17	80 17	80 21						
701-750	50 20	50 22	60 17	60 19	60 25	80 17	80 17	80 22	100 17					
651-700	50 21	50 24	60 17	60 21	80 17	80 17	80 18	80 23	100 17					
601-650	50 23	60 16	60 18	60 22	80 17	80 17	80 19	100 17	100 17					
551-600	50 24	60 17	60 19	60 24	80 17	80 18	80 21	100 17	100 18					
501-550	60 17	60 18	60 21	80 17	80 17	80 19	80 22	100 17	100 20					
471-500	60 17	60 19	60 22	80 17	80 17	80 20	80 23	100 17	100 21	100 24	120 17			
441-470	60 18	60 20	60 23	80 17	80 17	80 21	100 17	100 18	100 22	120 17	120 18			
411-440	60 19	60 21	80 16	80 17	80 18	80 22	100 17	100 19	120 17	120 17	120 21			
381-410	60 20	60 22	80 17	80 17	80 19	80 24	100 17	100 20	120 17	120 18	120 21			
351-380	60 22	60 24	80 17	80 17	80 21	100 17	100 17	100 21	120 18	120 19	140 17			
321-350	60 23	80 17	80 17	80 17	80 22	100 17	100 18	100 24	120 19	120 21	140 17	140 18	140 21	
301-320	80 17	80 17	80 17	80 18	80 23	100 17	100 19	100 24	120 21	140 17	140 17	140 19	140 21	
281-300	80 17	80 17	80 17	80 19	100 17	100 17	100 20	120 17	120 21	140 17	140 18	140 21	160 17	
261-280	80 17	80 17	80 17	80 20	100 17	100 18	100 21	120 17	120 21	140 17	140 19	160 17	160 17	
241-260	80 17	80 17	80 18	80 22	100 17	100 19	100 22	120 18	140 17	140 17	140 21	160 18	160 18	160 20
221-240	80 17	80 17	80 19	80 23	100 17	100 20	100 24	120 21	140 17	140 19	160 17	160 18	160 20	160 22
201-220	80 17	80 17	80 20	100 17	100 18	100 22	120 17	120 21	140 17	160 17	160 17	160 19	180 17	160 23
181-200	80 17	80 19	80 22	100 17	100 20	100 24	120 18	140 17	140 19	160 18	160 18	160 20	180 18	180 18
161-180	80 19	80 21	80 25	100 17	100 22	120 17	120 21	140 17	140 21	160 19	160 21	180 17	180 19	180 21
151-160	80 20	80 22	100 17	100 18	100 24	120 17	120 21	140 18	160 19	160 19	160 21	180 18	180 20	200 17
141-150	80 21	100 15	100 17	100 19	100 24	120 18	140 16	140 19	160 19	160 21	180 17	180 19	200 16	200 17
131-140	80 22	100 15	100 17	100 20	120 17	120 21	140 17	140 21	160 19	160 21	180 18	180 19	200 18	200 19
121-130	80 24	100 16	100 17	100 21	120 18	120 21	140 17	140 21	160 19	180 17	180 19	200 17	200 19	200 21
111-120	100 15	100 17	100 18	100 24	120 19	120 21	140 18	160 17	160 21	180 18	180 21	200 18	200 20	200 23
101-110	100 15	100 17	120 15	120 15	140 15	140 16	140 19	160 17	180 16	180 19	200 17	200 19	200 21	240 18
91-100	100 17	100 20	120 15	120 18	140 16	140 19	160 16	160 19	180 19	200 16	200 18	200 21	240 15	240 18
81-90	100 18	100 15	120 16	120 18	140 17	140 19	160 17	160 21	200 15	200 18	200 21	200 23	240 18	240 18
71-80	100 15	120 15	120 18	120 18	140 18	160 15	160 18	180 17	200 17	200 19	240 15	240 16	240 19	240 20
61-70	100 16	120 18	120 19	140 15	160 15	160 19	180 15	200 15	200 19	240 15	240 17	240 19	240 21	240 23
51-60	100 19	120 15	120 15	140 18	160 16	180 15	180 18	200 18	240 15	240 17	240 19	240 22	240 25	240 26
46-50	120 13	120 14	120 16	140 13	160 13	180 16	200 15	200 19	240 15	240 18	240 20	240 24	....	....
41-45	120 14	120 15	120 18	140 15	160 14	180 14	200 16	200 21	240 17	240 20	240 23	240 26	....	....
35-40	120 16	120 18	140 14	140 17	160 16	180 13	180 15	240 15	240 19	240 23	240 26	....	....	....
30-35	120 19	140 13	140 16	160 14	160 18	180 15	180 18	240 13	240 21	240 25	....	....	....	....
23-29	140 14	140 15	160 13	160 18	180 16	200 15	200 17	240 14	240 18	240 27	....	....	....	....
17-22	160 13	160 15	180 13	180 16	200 16	240 13	240 13	240 15	240 24	....	....	....	....	....
12-16	160 18	180 13	180 16	200 15	240 13	240 15	240 21	240 27	....	....	....	....	....	....
8-11	200 13	200 15	200 18	240 14	240 18	240 23	....	....	....	....	....	....	....	....
5-7	240 13	240 15	240 17	240 22	240 29	....	....	....	....	....	....	....	....	....

4. Sprocket selections above the bold line are based upon ANSI horsepower ratings. Selections below the bold line are based upon the chain pull formula for slow speed drives.  
 5. To achieve design life keep chain free of dirt and contaminants, and apply appropriate lubrication.

V-Drives  
 FHP Drives  
 Drive Component Accessories  
 DYNA-SYNC  
 HT 200/HTD Synchronous Drives  
 HT500 Synchronous Drives  
 Sprockets

Start at the column that is equal to or above the calculated DHP and trace down to the row that includes the faster shaft (normally driver). The chain pitch and sprocket number of teeth are listed at the intersection. Please refer to Table 3.

- 5. Calculate drive ratio: Faster shaft RPM divided by slower shaft RPM.

6. Calculate the size of the larger sprocket: Multiply the smaller sprocket number of teeth by the calculated ratio. Select the sprocket which is closest to this and has a stock part number.

7. Calculate the chain length (L):

$$L = 2c + 1.57 (D + d) + \frac{(D-d)^2}{4c}$$

Where: D = Pitch dia. large sprocket,  
d = Pitch dia. small sprocket,  
c = Proposed center distance

8. Divide chain length (inches) by chain pitch to determine number of pitches in the chain. It is best to use an even number of pitches.

Here is a selection example.

HP: 5, electric motor on a gear box

Driver RPM: 77

Driven RPM: 24

Center distance: 50 in.

Application: Tumbling barrel (heavy starting loads, peak loads & frequent shock loads)

The class of services table (Table 2) does not list this application, but looking at application above, it is class C. Therefore, SF should be 1.5 from Table 2.

DHP: 5 X 1.5=7.5

Chain and smaller sprocket: Referring to Table 3, look at the column for 7.5HP. Go down to the RPM of 71-80 for smaller sprocket. This shows a chain size of 100 with 15 teeth.

Drive ratio: 77/24=3.21:1

Larger sprocket: This sprocket should have 15 X 3.21 = 48.15 teeth. Since we cannot have 48.15 teeth, select a sprocket with 48 teeth (100 chain).

Chain length: This is calculated based on equation as given in 7 above.

$$L = 2(50) + 1.57(19.113 + 6.013) + \frac{(19.113-6.013)^2}{(4 \times 50)}$$

L=140.31 (No. 100 chain has 1.25 pitch), therefore length in pitches is  
L=140.31/1.25=112.48 pitches. Choose 112 or 114 pitches.

Verify that the sprockets fit the shaft sizes.

For any questions on mechanical drives, or any other mechanical power transmission products, please call us at 864-284-5700 or e-mail us at [brgpttechsupport@abb.com](mailto:brgpttechsupport@abb.com).