

WP0306

Dodge® chain drives: selection guide

Dodge Customer/Order Engineering

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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.**

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

Table 1. Type of input power.

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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

Table 2. Class of Service for Driven Machine

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.

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SELECTION

Easy Selection Table RECOMMENDED SMALL SPROCKET

V-Drives
FHP Drives
Drive Component Accessories
DV/VA-SYNC
HT200/HTD Synchronous Drives
HT500 Synchronous Drives

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	
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 18	40 17	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 19	40 17	40 17	40 20	40 24	50 17
701-750	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 20	40 17	40 18	40 22	40 25	50 17
651-700	35 17	35 17	35 17	35 17	35 17	35 17	35 17	35 22	40 17	40 19	40 23	50 17	50 18
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
471-500	35 17	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 17	35 23	40 17	40 17	50 17	50 17	50 20	50 25
411-440	35 17	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	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	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	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	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	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	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	35 17	40 17	40 19	50 18	50 23	60 17	60 20	80 17
221-240	35 17	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	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	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	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	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 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 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 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 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	100 15
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	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	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	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	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 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 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	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	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	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	120 18
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	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	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	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	240 13

Notes:

- Apply Service Factor to obtain Design Horsepower. Select small sprocket based upon Design Horsepower and RPM on this chart.
- Sprocket selections are recommended minimum. Larger sizes may be selected if required to obtain desired ratio, etc.
- 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 3. Selection table

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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	
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
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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	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	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	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	120 18
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	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	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	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	240 13

Notes:

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

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.

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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: $5 \times 1.5 = 7.5$

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 $15 \times 3.21 = 48.15$ 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.

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

$L = 140.31$ (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 DodgeEngineering@abb.com.

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