HTS DRIVE SELECTION BASED ON RPP® and RPP® PLUS BELT RATINGS

The selection of a stock RPP® and RPP® PLUS Belt Drive involves these simple steps:

Step 1. Determine service factor and calculate design horsepower.

Step 2. Select pitch using belt pitch selection guide.

Step 3. Select drive using pre-engineered drive tables.

Step 4. Determine drive width.

Step 5. Specify drive components: sprockets, bushings and belts.

To illustrate the design procedure, the following sample problem will be solved simultaneously with the instructions for each step.

Sample Problem

A gear pump is to be driven by 40 HP NEMA, Type B, electric motor with an output speed of 1160 rpm. The gear pump is to be driven at 580 rpm +5%. The center distance is desired to approximately 30 inches, but can be altered +3 inches, if necessary. The motor shaft is 2 3/8 inches and the pump shaft is 3 inches. The pump will operate 2 shifts per day, 5 days per week. The pump sprocket is limited to 18 inches OD. There are no unusual drive conditions.

STEP 1. Determine Design Horsepower

PROCEDURE

To calculate the design HP, it is necessary to determine a service factor based on the power source, driven machine and the type duty required. To choose the service factor, first determine the driver classification for the prime mover. Now find the driven machine type for the application. If your specific application is not listed, choose one with similar load characteristics.

For speed-up drives, an additional service factor must be applied. This add-on factor is dependent upon drive ratio. Refer to table 1c for additional service factors.

To find the design HP, multiply the service factor by the motor nameplate rating or by the brake horsepower developed if an engine is being used.

EXAMPLE

Using Table 1a on page K-90, we find the 1160 rpm 40 HP, NEMA B, motor fall in Class II. Referring to the Class II column in Table Ib, it will be noted that the gear pump has a service factor of 1.4.

Since the pump will run 2 shifts a day, we then add 0.2 from Table 1c to 1.4 for a total service factor of 1.6.

Rated HP x Service factor = Design HP

40 x 1.6 = 64HP

STEP 2. Select Belt Pitch

PROCEDURE

Using the design HP calculated above and the rpm of the smaller sprocket; select from the “Belt Pitch Selection Guide” on page K-91 the belt pitch best suited for the application. If the drive falls into two pitches it is usually a good idea to check both pitches, starting with the lighter one.

EXAMPLE

Find 1160 rpm on the horizontal scale and move up to 64 design HP on the vertical scale. The intersection falls into the 14mm pitch area.

Basic Service Factors

To find a basic service factor: First, determine the class of the driveR (prime mover) in table 1a. Then, determine the basic service factor for the application in table 1b - in the same class as the driveR.

1a: driveR (prime mover)

Class of driveR	Class I	Class II	Class III
Momentary Peak Load, % of Rated Load	**149%**	**150 to 249%**	**250 to 400%**
AC Electric Motors: Single Phase Squirrel Cage			all
NEMA design A			
3600 rpm	40 HP up	1-1/2 thru 30 HP	
1800 rpm	100 HP up	5 thru 75 HP	1 thru 3 HP
1200 rpm	15 HP up	3/4 thru 10HP	
900 rpm	5 HP up	1/2 thru 3 HP	
NEMA design B			
3600 rpm		5 HP up	1 1/2 thru 3 HP
1800 rpm		5 HP up	1 thru 3 HP
1200 rpm		5 HP up	3/4 thru 3 HP
900 rpm		2 HP up	1 1/2 thru 1 1/2 HP
NEMA design C			
1800 rpm		15 HP up	5 thru 10 HP
1200 rpm		7-1/2 HP up	3 and 5 HP
900 rpm		all	
NEMA design D			all
NEMA design F	all		
Wound Rotor			
1800 rpm		20 HP	2 to 15 HP
1200 rpm		15 HP	2 to 10HP
900 rpm		7-1/2 HP	1 to 5HP
Synchronous		normal torque	high torque
DC Electric Motors	shunt	compound	series
Engines — int combust	8 cyl up	6 cyl	4 cyl or less
Hydraulic Motors, Line Shafts			all

1b: Basic Service factors of driveN Machines

driveN Machines	Class I	Class II	Class III
Agitators, Mixers liquid	1.2	1.4	1.6
(paddle or propeller) semi-liquid	1.3	1.5	1.7
Bakery Machinery, Dough Mixers	1.2	1.4	1.6
Brick and Clay Machinery			
augers, mixers, granulators	1.4	1.6	1.8
pug mills	1.6	1.8	2.0
Centrifuges	1.5	1.7	—
Compressors reciprocating*	1.6	1.8	2.0
centrifugal	1.4	1.5	1.6
Conveyors			
belt, light package, oven	1.1	1.2	1.3
belt: ore, coal, sand	1.2	1.4	1.6
apron, bucket, elevator, pan	1.4	1.6	1.8
flight, screw	1.4	1.6	1.8
Fans, blowers Centrifugal, induced draft exhausters	1.4	1.6	1.8
propeller, mine fans, positive blowers	1.6	1.8	2.0
Generators and Exciters	1.4	1.6	1.8
Hammer Mills	1.5	1.7	1.9
Hoists, Elevators	1.4	1.6	1.8
Laundry Machinery general	1.2	1.4	1.6
extractors, washers	1.4	1.6	1.8
Line Shafts	1.2	1.4	1.6
Machine Tools drill presses, lathes, screw machines	1.2	1.4	1.6
boring mills, grinders	1.3	1.5	1.7
milling machines, shapers	1.3	1.5	1.7
Mills ball, rod, pebble, etc.	—	1.9	2.1
Paper Machinery			
agitators, calendars, dryers	1.2	1.4	1.6
beaters, jordans, Nash pumps pulpers	1.4	1.6	1.8
Printing Machinery			
presses, newspaper, rotary, embossing, flat bed, magazine; linotype machines; cutters; folders	1.2	1.4	1.6
Pumps			
centrifugal, gear, rotary, pipeline	1.2	1.4	1.6
reciprocating*	1.7	1.9	2.1
Rubber Plant Machinery	1.4	1.6	1.8
Saw Mill Machinery	1.4	1.6	1.8
Screens vibrating (shakers)	1.3	1.5	—
drum, conical	1.2	1.4	—
Textile Machinery			
looms, spinning frames, twisters	1.3	1.5	1.7
warpers, reels	1.2	1.4	—
Woodworking Machinery			
lathes, band saws	1.2	1.3	—
jointer, circular saws, planers	1.2	1.4	—

***Note:** When the driveN sprocket is used as a flywheel to reduce speed fluctuations, a specially constructed sprocket may be required. Consult Martin with the WR2 of the unit.

1c: Additional Service Factors

Operating Conditions

Intermittent or Seasonal	Sub 0.1
Add for 10-16 hr. service	Add 0.2
Add for 16-24 hr. service	Add 0.4
Add for each idler	Add 0.2

Speed-Up Drives

For speed-up drives, add to the basic service factor the additional factor given below.

Speed-up Ratio range	Additional Factor	Speed-up Ratio Range	Additional Factor
1 to 1.24	none	2.50 to 3.49	.30
1.25 to 1.74	.10	3.50 & over	.40
1.75 to 2.49	.20		

Unusual Conditions

Additional service factors are required for unusual conditions - such as load reversal, heavy shock, plugged motor stop, electric brake. These should be determined by a transmission specialist.

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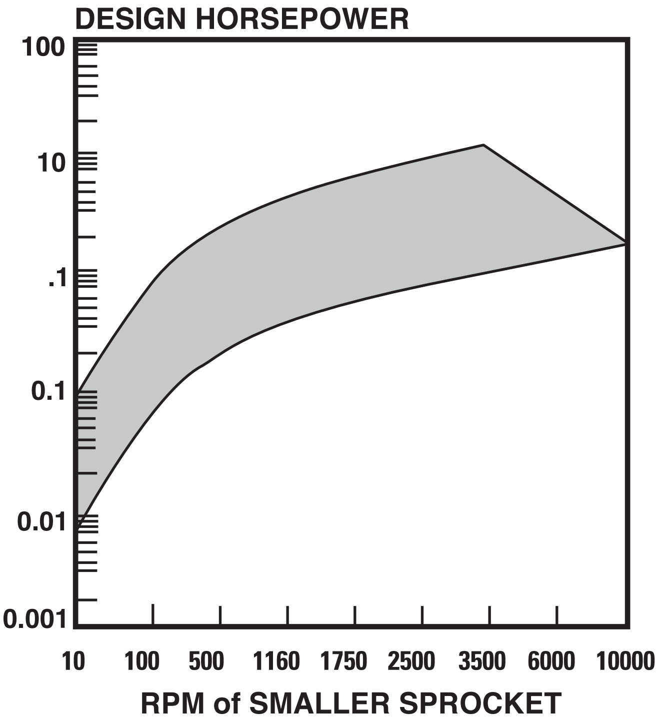
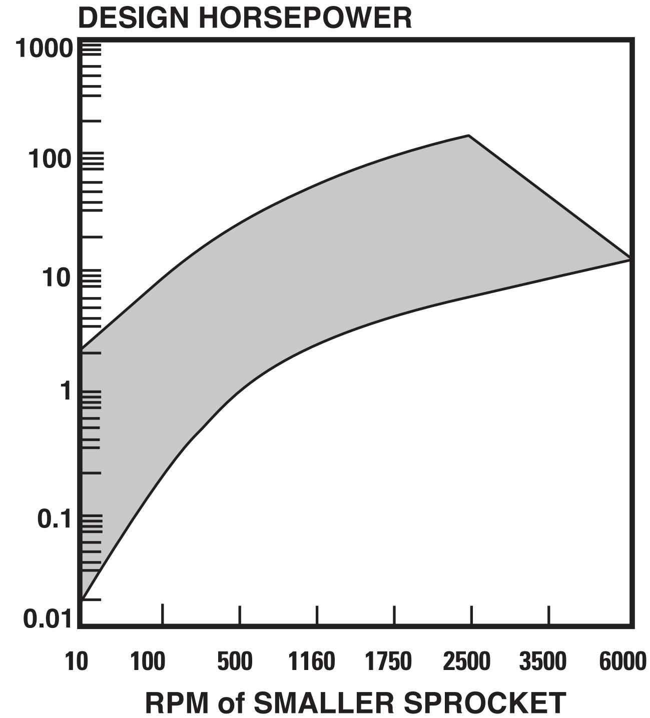
Belt Pitch Selection Guide

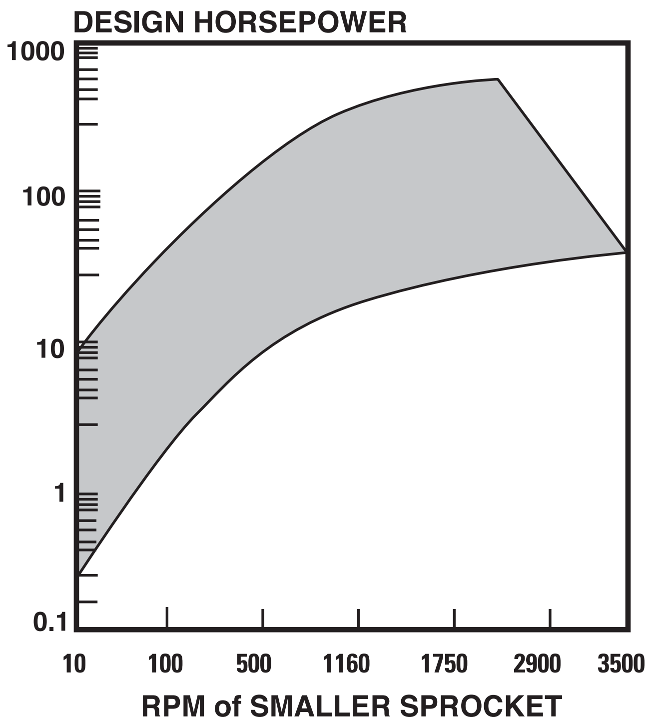
5MM PITCH



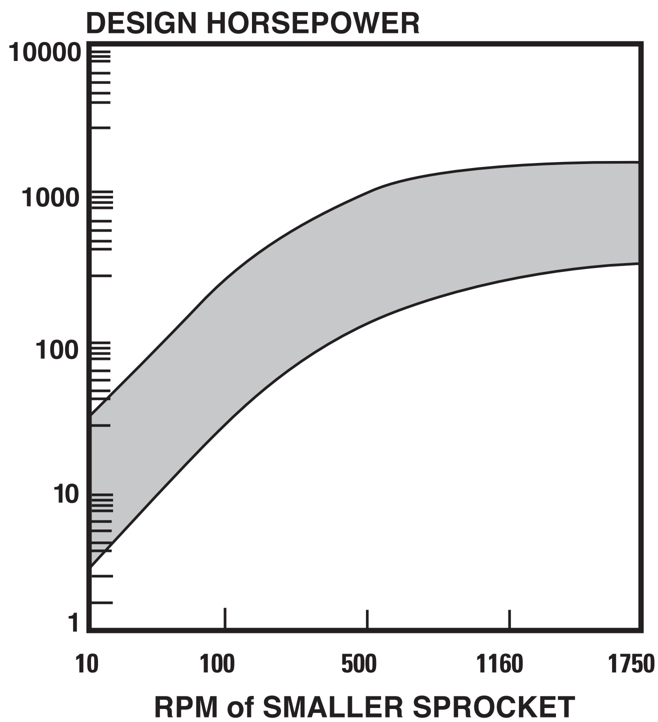
8MM PITCH



14MM PITCH



20MM PITCH



HTS® Drive Selection Procedure

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STEP 3. Select Sprocket and Belt Length

PROCEDURE

a. Determine speed ratio:
The speed ratio can be determined by any of the following methods.

1. Divide the rpm of the faster shaft by the slower shaft.
2. Divide the large sprocket diameter by the small sprocket diameter.
3. Divide the number of teeth of the large sprocket by the number of teeth of the small sprocket.

b. Select sprocket combination: turn to the Stock Drive Selection Tables (pages K-94 to K-149) and run down the left hand margin. Moving over within the selected speed ratio block we find the stock sprocket combinations available within this speed ratio. Selection will depend on the center distance required as well as the recommended minimum sprocket diameter for electric motors (see table below).

c. After selecting possible sprocket combinations which meet the center distance requirements, select the belt length required by proceeding up the column containing the center distance selected. At the top of the column will be the belt length code designation that will produce that center distance on that particular sprocket combination. Record the length factor given at the top or bottom of the table.

EXAMPLE

a. $\frac{\text{rpm of faster shaft}}{\text{rpm of slower shaft}} = \frac{1160}{580} = 2.0$

Desired ratio if 2.0 to 1

b. Using the Stock Drive Selection Tables for 14mm pitch and 1160 rpm drivers on pages K-132 to K-141, locate the drive ratio of 2.0. Eight combinations are shown on page K-126, all of which will meet the 30 + in. center distance desired. The maximum OD limit of 18 in. on the driveN sprocket and the minimum motor diameter of 6.1 eliminates four of the combinations; and the preference for as close to the 30 in. center distance as possible would favor the 36 to 72. The choice becomes a matter of economics or space. Larger sprockets require a smaller belt width for a given horsepower rating and also means less shaft loading. Although this usually gives a longer belt flex life the drive may have a higher initial cost.

c. Moving up the column in which the center distance appears, we find the 36 to 72 drive will use a 2310mm belt. The length factor in this case is 1.0.

Minimum Recommended Sprocket Pitch Diameters for General Purpose Electric Motors Synchronous Belts

	Motor Rpm (60 Cycle and 50 Cycle Electric Motors)					
Motor Horsepower	575 485*	690 575*	870 725*	1160 950*	1750 1425*	3450 2850*
1/2	—	—	2.0	—	—	—
3/4	—	—	2.2	2.0	—	—
1	2.7	2.3	2.2	2.2	2.0	—
1 1/2	2.7	2.7	2.2	2.2	2.2	2.0
2	3.4	2.7	2.7	2.2	2.2	2.2
3	4.1	3.4	2.7	2.7	2.2	2.2
5	4.1	4.1	3.4	2.7	2.7	2.2
7 1/2	4.7	4.1	4.0	3.4	2.7	2.7
10	5.4	4.7	4.0	4.0	3.4	2.7
15	6.1	5.4	4.7	4.0	4.0	3.4
20	7.4	6.1	5.4	4.7	4.0	4.0
25	8.1	7.4	6.1	5.4	4.0	4.0
30	9.0	8.1	6.1	6.1	4.7	—
40	9.0	9.0	7.4	6.1	5.4	—
50	9.9	9.0	7.6	7.4	6.1	—
60	10.8	9.9	9.0	7.2	6.7	—
75	12.6	11.7	8.6	9.0	7.7	—
100	16.2	13.5	10.8	9.0	7.7	—
125	18.0	16.2	13.5	10.8	9.5	—
150	19.8	18.0	16.2	11.7	9.5	—
200	19.8	19.8	19.8	—	11.9	—
250	19.8	19.8	—	—	—	—
300	24.3	24.3	—	—-	—	—

*Indicates 50 cycle RPM electric motors. #Frame 444T use 8.6
Data in the white area is from NEMA Standard MG-1-14-42 of June 1972 and MG-1-14-43 of January, 1968.
The data in the shaded area is a composite of various motor manufacturers data. They are usually conservative, and a smaller sprocket may be permitted. Consult the motor manufacturer data.

STEP 4. Select Belt Width

PROCEDURE

The stock drive selection tables on pages K-94 to K-149 list the horsepower ratings for the various stock belt widths.
To select the proper belt width, find the drive ratio required in the left-hand column. Read across to the appropriate motor rpm (1160 or 1750) and find a horsepower rating equal to or larger than the design horsepower of the drive. Keep in mind that the indicated horsepower rating must be corrected by multiplying it by the length factor, which is in the screened band above and below the center distances (length factors under 1.0 reduce the belt capacity while length factors over 1.0 increase the belt capacity). If the corrected horsepower capacity is equal to or exceeds the design hp, that belt width can be used. If it doesn't exceed the design horsepower, the next larger belt should be used.

Where there are several choices, as in this sample problem, drive limitations will generally control the choice. In addition, the following rules should be followed.

1. The larger the sprocket, the less belt width required.
2. Larger sprockets allow less strenuous flexing and, therefore, give better service life.
3. Avoid drives where the belt widths exceed sprocket diameter.
4. Larger sprockets mean lower shaft pull.

EXAMPLE

Refer to the 14mm belt selection tables and locate the 2.00 drive ratio line. According to step 3c, the 36 to 72 tooth combination could be used. Read across the 36 to 72 combination until you reach 88 hp (RPP-85). This horsepower which exceeds the design hp of the drive is located in the 85mm belt width column.

The recommended drive would be as follows:

DriveR sprocket:	P3614M85-(SF or 3020)
DriveN sprocket:	P7214M85-(F or 3535)
Belt:	2310-14M-85

STEP 5. Check and Specify Stock Drive Components

PROCEDURE

a. Check Sprockets Selected:
Check the sprockets selected in steps 3 and 4 against the design requirements using the dimensions given in the Sprocket Specification Tables on pages K-73 to K-84. Use flange diameter in checking against maximum diameter requirements.

b. Determine Bushing Type and Check Bore Sizes.
Using the Sprocket Specification Tables, find the bushings to be used with the required sprockets.

c. Specify stock drive components.

EXAMPLE

From the table on page K80, we find the P7214M85 (QD or TB)driveN sprocket, to have a maximum diameter over the flanges of 13.19 in. This is less than the 18 in. maximum specified.

And, from the table on page K-82, we find that there is no sprocket P2814M170 available, so the final choice will be the 36 to 72 speed ratio sprockets.

DriveR- Either P3614M85-SF or P3614M85-3020

Both choices will satisfy the 2-3/8" bore requirement.

DriveN-P7214M85-F or P7214M85-3535

Again, both choices will satisfy the 3" bore requirement. Choosing a QD bushed drive,

Stock drive components are as follows:

1 - 2310-14M-85-R RPPtm Belt
1 - P3614M85-SF Sprocket
1 - SF bushing with 2 3/8-inch bore
1 - P7214M85-F Sprocket
1 - F bushing with 3-inch bore

Safety Note ⚠ **WARNING!**

FAILURE TO FOLLOW RECOMMENDED APPLICATION INFORMATION AND RECOMMENDED PROCEDURES FOR INSTALLATION, CARE, MAINTENANCE AND STORAGE OF BELTS MAY RESULT IN FAILURE TO PERFORM PROPERLY AND MAY RESULT IN DAMAGE TO PROPERTY AND SERIOUS BODILY INJURY. MAKE SURE THAT BELTS SELECTED FOR ANY APPLICATION ARE RECOMMENDED FOR THAT SERVICE.