

# Synchronous Drive Installation

These instructions must be read thoroughly before installing or operating this product.

**WARNING: to ensure the drive is not unexpectedly started, turn off and lock-out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.**

## Sprocket Installation

1. Thoroughly inspect the bore of the sprocket and the tapered surface of the bushing. Any paint, dirt, oil or grease must be removed.
2. Assemble bushing into sprocket. Loosely insert the screws into assembly. At least one sprocket must have flanges.
3. With key in keyseat of shaft, slide sprocket to its desired position with screw heads to the outside. If it is hard to slide the bushing onto the shaft, check shaft for burrs, etc.
4. Line up assembly so as not to misalign belts and tighten screws evenly and progressively. Apply the recommended torque to screws.

## Sprocket Alignment

Synchronous sprocket alignment and parallelism of the shafts is very important. Proper alignment helps to equalize the load across the entire belt width, thereby reducing wear and extending belt life.

Place a straightedge against the outside edge of the sprockets and move sprockets until the straightedge touches the two outside and two inside edges of the sprockets. The straightedge should cross the sprockets as close to the shafts as possible. A string can be used if a straightedge is not available. Remember the string should contact at four points as explained above. An alternate method would be to use the precision laser alignment tool.

After aligning the sprockets, check the rigidity of the supporting framework. Shafts should be well supported to prevent distortion and a resulting change in the center distance under load. Do not use spring-loaded or weighted idlers. Idler sprockets or pulleys must be locked into position after adjusting belt tension.

## Drive Alignment

Good tracking of synchronous belts on the sprockets depends upon alignment to within 1/4 degree. This translates to a maximum "M" dimension, as shown in Figure 1, of 0.05" per foot center distance.

**WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.**

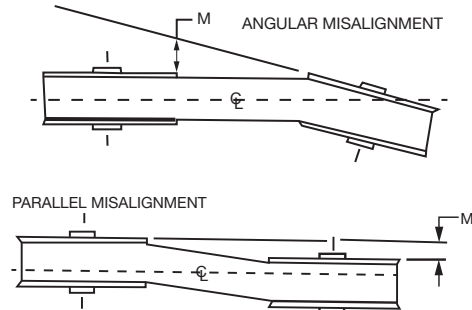


Figure 1 - Angular and Parallel Misalignment

## Belt Installation and Tensioning

Do not pry or otherwise force the belt onto the sprockets, as this can result in permanent damage to the belt. Reduce the center distance between the pulleys so that the belt can be easily installed.

Synchronous drives must be properly tensioned. If the belt is too loose, it may jump teeth when heavier loads are applied. If the belt is too tight, belt life will suffer, and bearings will be unnecessarily overloaded. Improper tension can result in excessive drive noise.

### Force/Deflection Tensioning Procedure

First, measure the span length and calculate the deflection distance of 1/64, per inch span (see Figure 2).

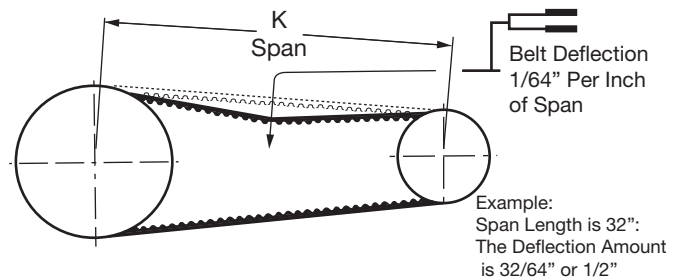


Figure 2 - Calculate Deflection Distance

Use the formula method to calculate recommended deflection forces.

Apply the calculated deflection force at the center of the span. Measure the deflection with this force applied. Move the center distance until the proper deflection is obtained.

### Sonic Tension Meter Method

The Sonic Tension Meter measures frequency in the belt upon an applied stimulus. The meter will then provide an output of both frequency and calculated static tension. The static tension is calculated based upon three user inputs: belt width, span (as measured in the above illustration) and the mass content of the belt. Variables for belt mass constants are provided in Table 1.

**Table 1 - Belt Mass Constants**

Belt		Adjusted Belt Weight (g/m)
HT200	5M	4.1
HT200	8M	5.5
HT200	14M	9.6
HT250	8M	5.8
HT250	14M	9.7
HTR	8M	5.7
HTR	14M	10.1
HTRC	8M	5.5
HTRC	14M	10.1
HTD	8M	6.2
HTD	14M	9.9
HTD	20M	12.8
HT500	14M	7.9
HT500	8M	4.7

**Measuring the span vibration of the belt**

1. Input parameters of span length, belt width and the belt mass constant into the meter.
2. Press the MEASURE button on the meter.
3. Thumb the belt at center span as if strumming a guitar string.
4. Hold the microphone 1/4 inch away from the back of the belt.
5. The tension meter will display static tension and frequency. Compare the static tension output to the T value calculated below or compare the frequency output to the formula below. Note that drive outputs of static tension and frequency are also provided on-line from the ViaSync selection program at [www.ptwizard.com](http://www.ptwizard.com).

$$T = 4 * M * W * S^2 * f^2 * 10^{-9}$$

Where: T = Belt span tension (Newtons)  
 M = Belt mass constant (g/m)  
 W = Belt width (mm)  
 S = Span length (mm)  
 f = Natural frequency of the belt at applied tension (Hz)

**Drive Tensioning**

**Formula Method**

The formula method for determining belt tension may be used for greater accuracy.

**\*NOTE: If the formula calculation for "T" is less than "Min T. Value" (Table 2) use the "Min T. Value" for T. Always use the greater T value; such as from T Formula 1 or Table 2.**

**Step 1.** Calculate Minimum Installation Tension:  
 Formula 1:

$$T = \frac{20 (HP)}{V} + mV^2$$

Where: HP = Horsepower  
 V = Belt Velocity/1000 (in FPM)  
 m = Value in Table 2  
 Belt Velocity = PD x RPM x 0.262  
 (PD = Pitch Diameter in inches)

**Step 2.** Calculate Deflection Forces:

Formula 2:

$$MinForce = \frac{1.0 * T + \left(\frac{K}{L}\right) Y}{16}$$

Note: Use 1.1\*T instead of 1.0\*T for HT500 Belts

Formula 3:

$$MaxForce = \frac{1.1 * T + \left(\frac{K}{L}\right) Y}{16}$$

Note: Use 1.2\*T instead of 1.1\*T for HT500 Belts

Note: For used belts, use 0.7\*T (HT500 use 0.8\*T) instead of 1.0\*T; and 0.8\*T (HT500 use 0.9\*T) instead of 1.1\*T. See notes above for HT500 new belt values.

T = Static tension, lbs  
 L = Belt length, inches  
 Y = Factor from Table 2  
 K = Span length, inches  
 CD = Center distance, inches  
 D = Large pulley diameter, inches  
 d = Small pulley diameter, inches

$$K = \sqrt{CD^2 - \frac{(D - d)^2}{4}}$$

**Step 3.** Adjust tension per procedure outlined in Belt Installation and Tensioning using the calculated deflection forces from Step 2, Formula 2.

**Table 2 - Drive Tensioning Calculations**

	Pitch	Width	m	Y	Min Ts (lb)
HT200	5 mm	15 mm	0.28	24.9	14
	5 mm	25 mm	0.47	41.5	23
	8 mm	20 mm	0.58	34.2	19
	8 mm	30 mm	0.88	51.3	30
	8 mm	50 mm	1.46	85.5	52
	8 mm	85 mm	2.45	145.3	95
	14 mm	40 mm	1.78	93.0	77
	14 mm	55 mm	2.44	127.9	120
	14 mm	85 mm	3.77	197.7	206
	14 mm	115 mm	5.11	267.5	291
HTR	14 mm	170 mm	7.55	395.4	447
	8 mm	20 mm	0.61	33.8	22
	8 mm	30 mm	0.91	50.8	33
	8 mm	50 mm	1.52	84.6	55
	8 mm	85 mm	2.58	143.8	94
	14 mm	20 mm	0.93	46.4	45
	14 mm	40 mm	1.87	92.9	89
	14 mm	85 mm	3.97	197.3	189
HTRC	14 mm	15 mm	5.37	267.0	256
	14 mm	170 mm	7.93	394.7	379
	8 mm	12 mm	0.30	56.9	25
	8 mm	22 mm	0.56	104.4	46
	8 mm	35 mm	0.89	166.1	73
	8 mm	60 mm	1.52	284.7	125
	14 mm	20 mm	0.94	221.2	82
	14 mm	42 mm	1.97	464.5	171
	14 mm	65 mm	3.04	718.9	265
	14 mm	90 mm	4.21	995.4	367
14 mm	120 mm	5.62	1327.2	489	

**Table 2 - Drive Tensioning Calculations**

	Pitch	Width	m	Y	Min Ts (lb)
HTD	20 mm	115 mm	7.24	367.0	392
	20 mm	170 mm	10.71	542.5	603
	20 mm	230 mm	14.49	734.0	834
	20 mm	290 mm	18.27	925.4	1065
	20 mm	340 mm	21.42	1085.0	1258
HT250	8 mm	20	0.54	42.29	19
	8 mm	30	0.81	63.44	30
	8 mm	50	1.35	105.7	52
	8 mm	85	2.29	179.7	95
	14 mm	40	1.80	93.04	77
	14 mm	55	2.48	127.9	120
	14 mm	85	3.83	197.7	206
	14 mm	115	2.18	267.5	291
HT500	8 mm	12 mm	0.33	65	28
	8 mm	21 mm	0.57	113	49
	8 mm	36 mm	0.97	194	84
	8 mm	62 mm	1.68	335	145
HT500	14 mm	20 mm	0.92	230	119
	14 mm	37 mm	1.69	4.26	220
	14 mm	68 mm	3.11	782	405
	14 mm	90 mm	4.12	1035	536
	14 mm	125 mm	5.72	1438	744

**Software: Via - SYNC**

Dodge VIA-SYNC can be accessed from [www.ptwizard.com](http://www.ptwizard.com). Additional troubleshooting and selection assistance is available by calling Dodge Engineering Support at 864-284-5700.

**Overhung Load Calculations**

Overhung load is an important consideration for drive design. Motor and reducer bearings are rated for specific load capacities to achieve calculated life. If the drive design is such that bearing loads are exceeded, life will be proportionally reduced. Likewise, if the drive exerts a lesser load on the bearings, life will be extended. Needless to say, drive design that keeps bearing loads below ratings can pay big dividends.

**BELT PULL:** The basis for overhung load calculation is belt pull. Belt pull is the result of torque being transmitted when the belt exerts a pull on the sprocket diameter.

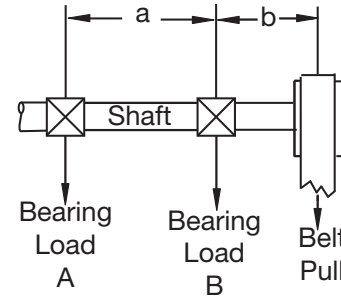
**EXAMPLE:** 5 hp at 200 RPM is 1,575 inch-pounds of torque. If a 6 inch diameter sprocket is used, (3 inch radius), 1,575/3 = 525 pounds effective belt pull is required. Note that if a larger diameter sprocket is used, belt pull is reduced accordingly.

Belt pull can be calculated using the following formula:

$$\text{Belt Pull (lbs)} = \frac{126,000 \times \text{HP} \times F}{\text{RPM} \times \text{PD}}$$

- Where: HP = Name plate horsepower of the motor or driver
- F = Drive Factor (1.3 for synchronous belt)
- RPM = Shaft RPM
- PD = Pitch Diameter of Sprocket

**BEARING LOAD:** Belt pull translates into bearing load and is greatly affected by the location of the sprocket on the shaft. Figure 3 shows an example of what happens as the distance between the center line of belt pull and the adjacent bearing is extended.



**Figure 3 - Overhung Sheave**

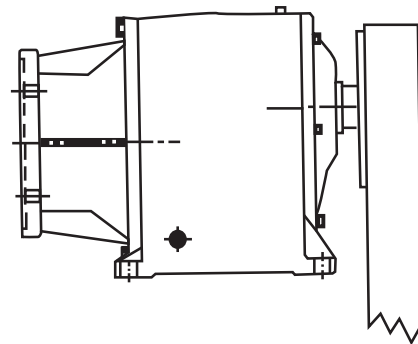
$$\text{Load at B, lbs.} = \frac{\text{Belt Pull} \times (a + b)}{a}$$

a	b	Belt Pull	Bearing Load "B"
10 in	1 in	500 lbs	550 lbs
10 in	5 in	500 lbs	750 lbs

$$\text{Load at A, lbs.} = \text{Belt Pull} \times \frac{b}{a}$$

In another example, consider the same situation for a motor or gearbox. Referring to Figure 4, note that the sprocket should be mounted as close as possible to the face of the gearbox.

As the distance between the gearbox face and sprocket increases, the bearing load is also increased, which leads to a reduction in bearing life.



**Figure 4 - Gearbox**

The center line of belt pull should not extend beyond the end of the shaft. Given a choice of a small diameter, wide face-width drive design, or a larger diameter, narrower face-width alternative, choosing the larger diameter, narrower face-width will provide a longer bearing life.

**Drive Design Considerations**

For each application there can be several drive alternatives. Contact Dodge Product Support for specific questions at 864-284-5700.

<b>Drive Troubleshooting</b>		
<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
<b>Unusual Noise</b>	Misaligned drive	Re-adjust alignment
	Hi or Low belt tension	Adjust to recommended value
	Backside idler	Use inside idler
	Worn sprocket	Replace sprocket
	Bent sprocket flange	Replace or repair
	Excessive belt speed	Redesign drive
	Incorrect belt profile	Replace with DODGE belt
	Subminimal sprocket diameter	Redesign with larger sprockets
	Excessive load	Use higher capacity drive
<b>Loss of Belt Tension</b>	Weak mounting structure	Reinforce mounting structure
	Excessive sprocket wear	Use wear-resistant sprockets
	Fixed center drive	Install inside idler
	Excessive debris	Install adequate drive guard.
	Excessive load	Use higher capacity drive
	Subminimal sprocket diameter	Redesign drive
	Drive running hot	Use heat fingers on hot shaft
<b>Belt Edge Wear</b>	Damaged flanges	Repair or replace sprocket
	Low belt tension	Adjust to recommended value
	Poor tracking	Correct alignment
	Guard interference	Remove obstruction, add idler
<b>Pre-mature Tooth Wear</b>	Improper tension	Correct drive tension
	Poor alignment	Correct drive alignment
	Wrong belt type	Use correct DODGE belt
	Worn sprocket	Replace
	Damaged sprocket	Replace
	Excessive load	Use higher capacity drive
	Dirt or debris	Install adequate drive guard
	Sprocket wobble	Correct bushing installation

<b>Drive Troubleshooting</b>		
<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
<b>Tooth Shear</b>	Shock loads	Use higher capacity drive
	Few teeth in mesh	Redesign drive
	Worn sprocket	Replace
	Backside idler	Use inside idler
	Wrong belt profile	Use correct DODGE belt
	Low belt tension	Adjust to recommended value
<b>Tensile Break</b>	Shock load	Use higher capacity drive
	Subminimal sprocket diameter	Redesign with larger sprockets
	Debris in drive	Install adequate drive guard
<b>Belt Cracking</b>	Improper belt handling, storage	Do not crimp belt or subject it to sharp bends
	Subminimal sprocket diameter	Redesign with larger sprockets
	Backside idler	Install inside idler
	Start-up temp below 180 degrees F	Preheat drive before start-up
<b>Bearing Failure</b>	Extended exposure to harsh chemicals	Protect drive
	Excessive belt tension	Adjust to recommended value
	Drive misalignment	Re-adjust alignment
<b>Vibration</b>	Subminimal sprocket diameter	Redesign with larger sprockets
	Wrong belt profile	Install correct DODGE belt
	Hi or Low belt tension	Adjust to recommended value
	Loose key or bushing	Install per instructions
<b>Belt not Tracking</b>	Loose mounting structure	Reinforce or tighten
	Misalignment	Re-adjust alignment
	Long center distance	Carefully adjust alignment
<b>Belt not Tracking</b>	Mounting structure bending	Reinforce mounting structure

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