MASTERDRIVE

## Installation

1. Clean sheaves/pulleys, and remove dust, dirt and oil.
2. Check for worn grooves using sheave gauge.
3. Use correct belt for sheave size
4. Never “roll” or “pry” the belts into the sheave grooves. Move the driver unit to allow belt to slip on easily.
5. Check alignment. Drive shafts must be parallel.
6. Rotate each sheave to check for wobble or bent drive shaft.
7. Tighten the belt take-up and then run the belt 10 minutes. Recheck and adjust tension, using tables on reverse.

## Warning

When servicing a drive, be certain machinery is SHUT OFF and properly prevented from accidentally starting. Do not wear loose clothing, jewelry, etc. Keep guards on machinery when it is operating.

## Rapid Belt Failure

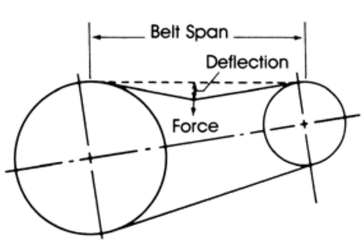
| SYMPTOM | CORRECTION |
|---|---|
| Belt cover wears rapidly | Replace sheaves |
| Slip burns-shiny sheave grooves | Increase tension |
| Belt hard and cracked | Heat condition; Ventilate drive; Check tension |
| Belt sticky or soft | Eliminate oil |

## Belt Tensioning

STEP 1: After measuring the belt span (see sketch) use a belt tension tester and apply perpendicular force to any ONE of the belts at the span mid-point. Measure the force required to deflect any of the belts 1/64 inch for every inch of span length. EXAMPLE: A 32" span deflection would be 1/64 inch x 32 or 1/2 inch.
Note: When new belts are installed on a drive, the tension will drop rapidly during the first few hours. Thus, for new belts, multiply the maximum deflection force shown in the tensioning tables by 1.33. Check tension frequently during the first 24 hours of operation. Subsequent retensioning should fall between the minimum and maximum forces shown in the tables.
STEP 2: Compare Step 1 deflection force reading with range of force in the following tensioning tables. If the force is below the minimum after any adjustment per above note, then the belts are too loose.

If the force is greater than the maximum after any adjustment per above note, then the belts are too tight.

Readjust measured drive tension until the deflection force is between the maximum and minimum values shown in or calculated from the respective tensioning tables.




## Classical V-Belt Tensioning Table

| Belt | Small Sheave Dia. Range (inches) | Small Sheave RPM Range | Speed Ratio Range | Belt Deflection Force in Lbs. Classical Min. | Classical Max. | Classical Cogged Min. | Classical Cogged Max. |
|---|---|---|---|---|---|---|---|
| | 2.2 | | | NR | NR | 3.8 | 5.4 |
| | 3.2 | 1750 | 2.0 | 3.1 | 4.5 | 3.9 | 5.6 |
| A* | 3.4-3.6 | to | to | 3.5 | 5.0 | 4.1 | 5.9 |
| | 3.8-4.2 | 3600 | 4.0 | 3.8 | 5.4 | 4.3 | 6.3 |
| | 4.6-7.0 | | | 4.6 | 6.6 | 4.9 | 7.1 |
| | 4.0 | | | NR | NR | 7.1 | 10 |
| | 5.0-5.2 | 1160 | 2.0 | NR | NR | 7.3 | 11 |
| B* | 5.4-5.6 | to | to | 6.0 | 8.8 | 7.4 | 11 |
| | 6.0-6.8 | 1800 | 4.0 | 6.6 | 9.6 | 7.7 | 11 |
| | 7.4-9.4 | | | 7.4 | 11 | 7.9 | 12 |
| | 6.8 | | | NR | NR | 12 | 18 |
| | 7.5 | 870 | 2.0 | NR | NR | 12 | 18 |
| C* | 8.0-8.5 | to | to | NR | NR | 13 | 18 |
| | 9.0-10.5 | 1800 | 4.0 | 12 | 17 | 13 | 19 |
| | 11.0-16.0 | | | 13 | 20 | 13 | 19 |
| | 13.0 | 690 | 2.0 | 20 | 29 | - | - |
| D* | 13.5-15.5 | to | to | 22 | 33 | - | - |
| | 16.0-22.0 | 1200 | 4.0 | 25 | 37 | - | - |
| | | 435 | 2.0 | | | | |
| E* | 21.6 | to | to | 33 | 48 | - | - |
| | 24.0 | 900 | 4.0 | 33 | 48 | - | - |

* For Classical banded belts multiply the force in the table by the number of belts in the band.

## Narrow V-Belt Tensioning Table

| Belt | Small Sheave Dia. Range (inches) | Small Sheave RPM Range | Speed Ratio Range | Belt Deflection Force in Lbs. Narrow Min. | Narrow Max. | Narrow Cogged Min. | Narrow Cogged Max. |
|---|---|---|---|---|---|---|---|
| | 2.20 | 1200-3600 | | NR | NR | 2.8 | 4.1 |
| | 2.35-2.50 | 1200-3600 | | NR | NR | 3.2 | 4.7 |
| 3V* | 2.65-2.80 | 1200-3600 | 2.00 | 3.2 | 4.7 | 3.5 | 5.1 |
| | 3.00-3.15 | 1200-3600 | to | 3.6 | 5.3 | 3.8 | 5.5 |
| | 3.35-3.65 | 1200-3600 | 4.00 | 4.1 | 5.9 | 4.1 | 6.0 |
| | 4.12-5.00 | 900-3600 | | 4.7 | 6.8 | 4.8 | 7.1 |
| | 5.30-6.90 | 900-3600 | | 5.2 | 7.6 | 5.8 | 8.6 |
| | 4.40-4.65 | 1200-3600 | | NR | NR | 9.0 | 13 |
| | 4.90-5.50 | 1200-3600 | | NR | NR | 10 | 15 |
| 5V* | 5.90-6.70 | 1200-3600 | 2.00 | NR | NR | 11 | 17 |
| | 7.10-8.00 | 600-1800 | to | 11 | 17 | 13 | 19 |
| | 8.50-10.90 | 600-1800 | 4.00 | 13 | 19 | 14 | 20 |
| | 11.80-16.00 | 400-1200 | | 15 | 22 | 15 | 23 |
| | | | 2.00 | | | | |
| 8V* | 12.50-17.00 | 600-1200 | to | 31 | 45 | - | - |
| | 18.00-24.00 | 400-900 | 4.00 | 36 | 53 | - | - |

NR - Not Recommended
* For Narrow banded belts, multiply the force in the table by the number of belts in the band.

The deflection forces in these tables apply only to the listed belts currently being manufactured.

MASTERDRIVE™

| To Find | Given | | Formula |
|---|---|---|---|
| **7. Belting** | | | |
| Effective Tension | $T_1$ and $T_2$ | Te = | $T_1 - T_2$ |
| Effective Tension | HP, RPM, Pulley Radius | Te = | $\frac{63025 \times HP}{RPM \times R}$ |
| Effective Tension | Torque, Pulley Radius | Te = | Torque / R |
| Effective Tension | Horsepower, Belt Velocity (FPM) | Te = | (HP x 33000) / FPM |
| Total Load | $T_1$ & $T_2$ | TL = | $T_1 + T_2$ |
| **8. Overhung Load** | | | |
| Overhung Load | Torque, Diameter | OHL = | (T x 2) / Diameter |
| Overhung Load | Effective Tension, Belt Factor<br>f = 1.50 V-Belts<br>f = 2.50 flat belts | OHL = | Te x f |
| Overhung Load | Horsepower, Speed (RPM)<br>Diameter, factor<br>f = 1.0 chain<br>f = 1.25 gear drives<br>f = 1.50 V-belts<br>f = 2.50 flat belts | OHL = | $\frac{126000 \times f \times HP}{Diameter \times RPM}$ |
| Overhung Load | Weight | OHL = | Weight |
| **9. Electricity** | | | |
| Motor Speed (RPM) | Number of Poles | RPM = | $\frac{120 \times HZ}{No.\ of\ Poles}$ |
| Horsepower Single Phase or Direct Current Motor | Volts, Amps, Power factor Efficiency | HP = | $\frac{Volts \times Amps \times Pf \times Eff.}{746}$ |
| Horsepower 3 Phase Motor | Volts, Amps, Power factor Efficiency | HP = | $\frac{Volts \times Amps \times 1.73 \times Pf \times Eff.}{746}$ |
| Horsepower | Watts | HP = | Watts / 746 |
| Horsepower | Kilowatts | HP = | KW / .746 |
| Motor Power (Watts), Single Phase | Volts, Amps, Pf, Eff. | Watts = | V x Amps x Pf x Eff. |
| Motor Power (Watts), 3 Phase | Volts, Amps, Pf, Eff. | Watts = | 1.73 x V x Amps x Pf x Eff. |
| **10. Temperature** | | | |
| Degrees Fahrenheit | Degrees Centigrade | °F = | (1.8 x ° C) + 32 |
| Degrees Centigrade | Degrees Fahrenheit | °C = | 5/9 (°F - 32) |

**11. Metric Conversions**

| | |
|---|---|
| Inches x 25.4 = Millimeters | Millimeter x .0394 = inches |
| Pounds x .455 = Kilograms | Kilogram x 2.2 = pounds |
| U.S. Gallons x 3.785 = Liters | Liter x .264 = U.S. Gallon |
| Pounds (Force ) x 4.448 = Newtons | Newtons x .2246 = Pounds (Force) |
| Pounds inches x .113 = Newton Meters | Newton Meters x 8.85 = Pound-ins. |
| Horsepower x .746 = Kilowatts | Kilowatts x 1.34 = Horsepower |
| Pounds/in$^2$ (psi) x .0069 = Newtons/mm$^2$ | Newton /mm$^2$ x 145 = Pounds/in$^2$ |
| BTU x .00029 = Kilowatt Hours | Kilowatt Hours x 3415 = BTU's |

# Engineering Calculations Quick Reference Guide

## Torque

$$\text{Horsepower} = \frac{(\text{Torque, Pound-inches})(\text{RPM})}{63{,}025}$$

$$\text{Horsepower} = \frac{(\text{Torque, Pound-feet})(\text{RPM})}{5{,}252}$$

## Flywheel Effect, $WR^2$

$$WR^2 = \frac{0.17773F\,(D_o^{\,4} - D_1^{\,4})}{1000} - \frac{NY\,(D_o - Z)^3}{1000} \text{ lb.-ft}^2$$

for gray iron. Multiply by 1.08 for steel.

Where: $D_0$ = Outside diameter of rim, inches.
$D_1$ = Inside diameter of rim, inches.
F = Face width of rim, inches
N = Number of grooves
Y = Groove constant from table
Z = Groove constant from table

## Torque Required to Accelerate or Decelerate a Flywheel

The torque required to uniformly accelerate or decelerate a sheave, pulley or flywheel can be calculated as follows:

$$\text{Torque (in. lbs.)} = \frac{.03908 \times N \times W \times R^2}{t}$$

$$\text{Torque (ft. lbs.)} = \frac{.003257 \times N \times W \times R^2}{t}$$

N = Difference between initial and final RPM.
W = Weight of rim in pounds.
R = Mean Radius of Sheave Rim, Pulley or Flywheel in feet.
t = Time required to effect speed change, in seconds.

## Data for $WR^2$ Calculations

| Groove | Pitch Diameter | Add to PD to find $D_o$ | Outside Diameter (in) | Outside Diameter ($D_0$) Minus Inside Diameter ($D_1$) for Standard Sheaves | Y | Z |
|---|---|---|---|---|---|---|
| 3V | - | - | up to 10.6 | 1.2 | .113 | .30 |
| | - | - | 10.7 to 25.0 | 1.3 | .113 | .30 |
| | - | - | 25.1 to 35.5 | 1.5 | .113 | .30 |
| 5V | - | - | up to 21.2 | 1.9 | .320 | .50 |
| | - | - | 21.2 to 31.5 | 2.0 | .320 | .50 |
| | - | - | 37.5 to 50.00 | 2.2 | .320 | .50 |
| 8V | - | - | up to 22.4 | 2.7 | .885 | .80 |
| | - | - | 22.5 to 53.0 | 2.9 | .885 | .80 |
| | - | - | 53.1 & up | 3.0 | .885 | .80 |
| A Multi-Duty | All | .75 | - | 1.6 | .377 | .50 |
| B Multi-Duty | All | .35 | - | 1.6 | .377 | .50 |
| A | All | .25 | - | 1.5 | .238 | .40 |
| B | All | .35 | - | 1.7 | .384 | .50 |
| C | Up to 18.0 | .40 | - | 2.1 | .696 | .65 |
| C | 20.1 to 50.0 | .40 | - | 2.2 | .696 | .68 |
| D | Up to 20.0 | .60 | - | 2.9 | 1.280 | .90 |
| D | 20.0 to 58.0 | .60 | - | 3.0 | 1.280 | .90 |
| E (Special) | | .80 | - | | 2.050 | 1.14 |