Exercise E201-S11-EXR-RV1.wpd

Alignment and Tensioning of Wedge (Narrow V) Belts

Objective

- Using the IPT Industrial Trades Manual, the DAC Belt Drive Trainer, a belt tension gauge, selected tools, and knowledge of belt drive components and terminology, properly install, align, and tension a wedge belt on a belt drive.

Performance Standard

- Align belt drive sheaves within 1/64" and tension the belt according to the manufacturer’s recommendations.

Foundation Competencies

- Use of hand tools.
- Knowledge of belt drive terminology. (Exercise E201-S01)
- Knowledge of belt types. (Exercise E201-S02)
- Knowledge of sheave terminology. (Exercise E201-S04)
- Ability to install sheave bushings. (Exercise E201-S06)
- Ability to perform belt drive pre-checks. (Exercise E201-S07)

Required Background Reading

- IPT’s Industrial Trades Training Manual, pgs. 294-297, 302-304. (DAC #510-MAN)

Tools Required

- Combination wrench set.
- Hex wrench set.
- Sheave inspection gauge set.
- Belt tension gauge.
- Straightedge.
Components Required

- DAC Belt Drive Trainer, #201 and associated components.

Introductory Discussion

Wedge belt is the name given to the most efficient type of V-belt available in industry. The wedge belt is taller and thinner than a conventional V-belt. This construction allows the belts to sit deeper in the sheave groove, generating a greater amount of friction and allowing for higher tension. The increased friction created by high belt tension and increased sheave contact allows a wedge belt to transmit three times the horsepower of conventional V-belts in the same space, or the same horsepower in ½ to ⅓ the space.

Because of the high tension of wedge belts, it is always necessary to use a belt tension gauge to adjust the belt to the proper tension. Properly tightened wedge belts are very taught and have little give. In fact, the tension of a wedge belt is so high that many mechanics hesitate to correctly tighten them, for fear that they may be overly tight. With the exception of high belt tension, wedge belts are installed and aligned like all other belts.

Wedge belts should always be aligned and tensioned according to manufacturer's specifications. When the proper tools are used and the proper procedures are followed, belts and sheaves will have a long life, and the belt drive will operate efficiently.

Performance Steps

- **Warning:** When working on machinery in the field, always remember to lock out and tag out the power source to eliminate the risk of electric shock and/or injury due to moving parts.

**Step 1.** Prepare the DAC Belt Drive Trainer for use.

- Using the Belt Drive Trainer Arrangement Drawing, install the motor element at position #3, using the jacking bar and jacking bolts.

- The jacking bar should be mounted in the baseplate mounting holes between the motor feet and the driven element.
Step 2. Perform a preliminary alignment of shafts in the vertical plane.

- Prior to mounting sheaves, check for angular misalignment of shafts in the vertical plane. To do so, use the magnetic angle indicator to measure the angle of the driven element’s shaft off horizontal. Then measure the angle of the motor shaft off horizontal.

- Using shims from the shim kit, correct the motor element to make its shaft equal in angle with the driven element’s shaft relative to horizontal. It is not necessary that both shafts be perfectly level.

- While both shafts could be leveled, it is not necessary in order to align sheaves. Should both elements be greatly out of level, level both shafts.

Step 3. Install the 3V narrow sheaves on the DAC Belt Drive Trainer.

- Install the 3V narrow sheaves included with the training aid.
These sheaves require the installation of bushings. Mount the sheaves with the bushing flange facing the motor and driven elements. Refer to exercise E201-S06, if necessary.

- Mount the smaller of the two sheaves on the driver shaft. Mount the larger on the driven shaft. Lightly tighten the sheave setscrews.

**Step 4.** Perform belt drive pre-checks.

- To obtain accurate alignment and tensioning, it is important to perform a standard set of equipment pre-checks. These pre-checks are performed to rule out any external factors causing belt drive malfunction. Use exercise E201-S07 as a guide if necessary. At a minimum, perform a sheave run-out check.

**Step 5.** Install the 3V wedge belt on the sheaves.

- Shorten the span length by loosening the bolt on the sub-base. The motor element should be pushed toward the driven element allowing the belt to slip over the sheaves easily.

- Place the shorter of the two wedge belts provided with the training aid into the sheave grooves without forcing or prying them on.

- Remember that forcing a belt on or off of a sheave could damage the tensile member. Once the tensile member is damaged the belt will no longer perform as designed.

- As a general rule, a belt should not seat more than 1/16th of an inch below the top of a fixed-pitch sheave. If the belt sits much lower, the sheave should be checked for wear. New belts will extend slightly above the top of the sheave.
While the belt is loose on the drive, rotate the drive manually until the slack is evenly distributed above and below the sheaves.

Increase the span length by tightening the bolt on the motor sub-base. Once some tension has been established and the belts are snug in their sheave grooves, you are ready to perform the next step.

Step 6. Align sheaves.

Using a straightedge, align the two sheaves. Hold the straightedge across both sheaves while checking for space between the straightedge and the sheave rims. When aligned, the straightedge will contact each sheave at two points across the face, four times in all. A gap at one point indicates a degree of angular misalignment in the horizontal plane. A gap at two points on one sheave indicates either parallel misalignment, extreme angular misalignment, or a combination of parallel and angular misalignment.
Assuming some misalignment, use the adjustable sub-base bolt, and a soft face mallet, to adjust motor position in order to correct for angular misalignment in the horizontal plane. Once angular misalignment of sheaves has been corrected, the straightedge should touch at two points on one sheave and be parallel to, or touching at two points, on the other sheave.

Note that parallelism of shafts in the horizontal plane can be adjusted by accurately measuring between the shafts at each end, or by creating a gauge and inserting it between the shafts at both ends. These methods are more efficient than relying on trial and error.

Should parallel misalignment of sheaves be present (axial misalignment of shafts) measure the sheave face offset using a straightedge and a 6" rule.

Use sheave location on the shaft to adjust for parallel misalignment (axial misalignment of shafts). Loosen one setscrew and shift the sheave until the straightedge touches each sheave at two points.
Once the sheaves are aligned within 1/64", anchor them to the shafts by tightening their set screws. Tighten the motor hold-down bolts to keep the motor from shifting. The slightest shift of the motor element will cause misalignment.

Step 7. Tension the belt to the proper specification.

For belt tensioning procedures using a tension gauge refer to pages 294-295 in IPT, and the belt tension guide included with the Gates belt tension gauge.

Tension the 3V530 wedge belt using the following procedure:

1. Measure the belt “span length”. This is the distance between the points where the belt last touches the sheaves. Make a note of your findings.

2. Mark the center of the span. At the center apply force with the tension gauge perpendicular to the span, sufficient to deflect the belt 1/64th of an inch per one inch of span length in the belt’s normal position. A calculation will be required.

3. Apply force until the amount of calculated deflection distance on the lower linear scale of the tension gauge visually matches a straight line across the top of the sheaves. Using a straightedge across the top of the sheaves will make the process more accurate, but it may require an assistant.
4. Find the amount of deflection force on the upper scale of the tester. The sliding rubber O-ring collar slides down the scale as the gauge compresses. The collar stays at the point of maximum force when pressure is released.

- Deflection force can also be established by pulling down the upper length of the belt using a spring scale. Note that deflection force is always measured on the tight side of the sheaves.

5. Compare the deflection force reading with the general range of forces listed in the guide provided with the Gates tension gauge for a type 3V530 belt, or refer to table #23 on page 295 of IPT. Assume a deflection force of 9 lbs. for new 3V belts. If less than normal recommended deflection force exists, belts should be tightened. If the deflection force is found to be greater than the maximum limit specified, the belt should be loosened.

- Always establish deflection force based on the specific manufacturer's recommendations, if possible.

☐ Use the motor sub-base adjusting bolt to increase or decrease the span length. These adjustments will increase or decrease belt tension respectively.
Belt tension is not a one time adjustment. It should be checked periodically as part of routine maintenance. When a new belt is installed, tension should be checked frequently during the first 48 hours of operation.

**Step 8.** Re-check alignment.

- Because the motor tends to shift slightly at its feet when tightened, it is important to re-check alignment. If misalignment is present, perform the necessary steps to correct it.

- The total allowable misalignment recommended for V-belts is ½ deg, or 1/10-in. offset per foot.

**Step 9.** Re-tension as necessary.

- New belts require a “run-in” period. During this time, the belt elongates and becomes more flexible. Because of this, belts must be re-tensioned frequently during the first 48 hours of operation. Tension should also be checked periodically as a part of regular maintenance.

- Over tightening of belts can lead to reduced belt and bearing life.

**Step 10.** Remove the belts from the drive.

- To remove the belts, shorten the distance between the motor element and driven element by loosening the motor hold down bolts and the adjustable sub-base bolt. The belt should be
loose enough to lift off of the sheave.

levator> Attempting to pry or roll the belts off by rotating the sheaves may cause serious injury and damage to the belt.

**Step 11.** Return the DAC Belt Drive Trainer to its standard configuration.

- Remove shims, if any, from beneath motor feet.

**Summary**

You have just successfully aligned and tensioned a wedge belt on the DAC Belt Drive Trainer. The procedure of tensioning and aligning a belt is the most important task a mechanic must perform in order to maintain a belt drive. Because of high tension requirements, it is of great importance that wedge belts be tensioned to the manufacturer’s specifications.

All wedge belts, whether used in a set or singularly, should be tensioned using a consistent procedure, the proper tools, and the manufacturer's tensioning recommendations. Following standard procedures will maximize the efficiency of a belt drive and reduce downtime in an industrial setting.

**Optional Tasks**

- Move the motor element and sub-base to position #1.

- Repeat the procedures described in this exercise to align and tension the 3VX530 belt provided with the training aid.

**Resources**