

Team 515 JTEKT Bearing Painter - Operation Manual

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Project Overview

Our sponsor, JTEKT North America, manufactures an array of needle roller bearings for companies like Caterpillar and Allison to use in their transmissions. For identification purposes JTEKT paints a colored stripe around the retainer of the bearing with a metal etching paint called Dykem. This is a tedious and timely endeavor that is currently done by hand. JTEKT has sponsored our team to automate the process of painting these needle bearing retainers and make this a much quicker and effective task for a JTEKT employee. The bearing painting machine accepts a wide range of bearing sizes and successfully paints a stripe of Dykem around each retainer. The frame of the machine is constructed out of 80/20 aluminum extrusion and is sized to fit in JTEKT's current fume hood.

Component Description

Note that the bill of materials that includes all purchased items for this project is in Appendix A.

Part Intake

The part intake section of the design consists of aluminum and 3D printed PLA that is assembled as a ramp that is tilted down into the part painting track.

Part Painting

The part painting system consists of a conveyor, motor, pipe, rubber tube, ramp, and track. The conveyor belt is a QC conveyors IS125 given by JTEKT, which is run by a NEMA 23 Stepper Motor. The ramp and track made of aluminum are assembled to hold bearing retainers up to the spinning conveyor belt. A bottle of Dykem feeds paint into the rubber tube that runs into an aluminum pipe. The 1/8 of an inch pipe is made of aluminum with capillary holes drilled horizontally to add Dykem to the felt strip.

Part Dispensing

As for the dispensing section, a PLA 3D printed ramp and track are used to catch the bearings off the part painting track.

Electrical

The electrical components of this design consist of a AC to DC power converter, with a toggle switch, and a RexQualis Uno R3 board that controls the speed of the conveyor belt.

Integration

The part intake ramp, painting track, and part dispensing track are all very similarly designed to guide the bearings through the machine in a safe and effective manner. These systems work together to negotiate the bearings from the waiting area after being loaded, into the

conveyor, and out to the dispensing track where they will finish their drying process. This device uses a microcontroller, motor driver, toggle switch, AC to DC Power Supply, and stepper motor in cohesion to spin the conveyor belt. When the operator flips the toggle switch to the ON position the conveyor will start to spin and suck bearings that were loaded into the intake system through the painting system and out to dispensing.

Operation

Setup/ adjusting for different size bearings:

Begin by ensuring the Dykem tube valve is turned to the OFF position. Using an Allen wrench, loosen the screws that control the intake X and Y axis adjustment as well as the 4 screws that hold the paint track to the conveyor. Place the desired size bearing retainer on the paint track and lift up until the bearing has firm contact with the bottom of the conveyor (if a smaller bearing is needed, use provided adapters to the painting track). Tighten the 4 screws on the conveyor to hold the track in place. Next, hold the bearing retainer on the edge of the conveyor and press the intake track up to it, ensuring that the X and Y adjustment is correct. Tighten the intake axis adjustment screws, beginning with the 2 for the Y axis and the thumb screw for the X axis. The machine is now adjusted and ready to operate.

Loading and running the machine:

Begin by loading the desired size bearings sequentially onto the intake track, which should also already be adjusted according to the previous section. Ensure the Dykem tube valve is turned to the off position. Using the provided painting felt, cut an 8 inch strip of the felt. Remove the painting tube from the track and attach the felt to the tube. Place the painting tube with the attached felt back onto the painting track. Turn the Dykem tube valve to the ON position for 10 seconds (3 seconds if felt has already been used) to allow the Dykem to saturate the felt, then return to the OFF position. Turn the toggle switch to the ON position to start the conveyor and begin the painting process.

Once all the bearings are painted, turn the toggle switch to the OFF position to stop the conveyor. Ensure the last dispensed bearing is adequately painted and dry and then remove the completed bearings.

Troubleshooting

Insufficient Dykem Flow

First check the supply of Dykem and check if there is still a plentiful reservoir. If there is ample Dykem, then there is blockage in the line and the painting line and tube needs to be removed from the device and flushed with acetone.

Bearings Not Rolling

If the bearings are not rolling through the machine this is because there is not enough friction between the painting track and the conveyer belt, and the U brackets that hold the conveyer need to be adjusted. To do this go to the “*Setup/ adjusting for different size bearings*” section shown previously in the operation manual.

Conveyer Stalling

If the conveyer stalls turn the toggle switch off and on a couple of times. If it continues to stall, make sure the machine is off and manually spin the motor shaft 180 degrees. If it is still stalling when bearings are running through it, it is because there is too much friction between the bearing and the painting track, and the painting track needs to be readjusted. To do this go to the “*Setup/ adjusting for different size bearings*” section shown previously in the operation manual.

Appendix A

BLUE = PAINTING SYSTEM
GOLD = CHASSIS
RED = CONVEYOR SYSTEM
GREEN = TRACK

