Laser Tracker-Alignment & Inspection of a Tire Machine

Figure 1

Application Description

This method sheet describes one method to align, inspect, and setup a tire machine consisting of 2 spindles and a transfer ring.

Setup

- Setup the tracker in an ideal location where you can see all your features, or as many features as possible.
- Setup up some Leap Frog pucks.

a) Clean the spot on the machine where you want to hot glue the SMR puck. **Note**-It is better to put the pucks on the machine rather than the floor, especially if you have a floor that can float a little with traffic/machine movement.

b) Hot glue the pucks in the clean locations. **Note**-It is best to spread them out as much as possible to provide the most stable re-alignment. Think of each puck as legs of a table the further apart they are the harder it is to tip the table over. Also be sure to put several extra pucks on (6-8) in case one gets knocked off the machine or you can't get to one for a measurement.

Alignment

- We will be aligning to some measure features that includes the direction of transfer ring movement and the zero point of the material feed, i.e. a midpoint of the rails for the conveyor system that feeds the material onto the drum/spindle. Lastly this machine has 2 pads on the underside of the transfer ring carriage that we will use to see the rotation of our coordinate system.
- First we will measure the Transfer Ring Movement as a 2D line.

a) Glue another puck to the transfer ring in a location that is open, can be easily seen, and is a flat/clean surface so the puck sticks well.

b) Go to **Measure>Line>3D Line**.

c) With the transfer ring at one end of the machine measure a point with the Insert button, move the transfer ring, measure another, and so on until you reach the other end of the machine. Then compensate with the Home button. I will call this line M_Transfer_Ring_Direction_Line but you can name it as you like. Then hit OK.

- Now we will find the Zero Midpoint of the material feed. We will find this by measuring the rails this machine sits on as circles and then constructing the midpoint of the two circles.

a) Go to **Measure>Circle**.

b) Select a Plane = Define. Offset = 0. Click OK.

c) Measure the plane on the end of the rails, 2-3 points per rail and compensate after you have measured **BOTH** ends not after each. See Figure 1.

d) Measure each rail as a circle take 4-7 points around rail #1 then compensate. Accept your results. Repeat for the second rail. Accept your results.

e) Go to **Construct>Point>Midpoint**.

f) Select First Point = M_Circle001. Select Second Points = M_Circle002. Check Constructed. Click OK. I will call this C_Transfer_Ring_Zero_Position_Point. Click OK.

g) Go to **Construct>Plane>Perpendicular.**

h) Select a Point = C_Transfer_Ring_Zero_Position_Point. Select a Line = M_Transfer_Ring_Direction_Line. Check Constructed. Click OK. I will call this C_Z_Zero_Plane. Click OK.

- Now we will measure the two machined pads on the underside of the Transfer Ring Carriage. We will use these to set the rotation of our coordinate system, clocking the directions of our X-axis and Y-axis.

a) Go to **Measure>Line>2D Line**.

b) Select a Plane = C_Z_Zero_Plane. Offset = 0. Click OK.
c) Measure a point on the first pad. Measure a second point on the second pad and compensate.

Note-The direction that you measure your line (1st to 2nd point) will be used to set your positive X-axis directions. I will call this M_X_Axis_Rotation_Line. Click OK. See Figure 2.

Figure 2

- Now that we have measured our alignment features we will construct our coordinate system and set our alignment.

a) Go to **Construct>Coordinate System>Bore**.
b) Select a Plane = C_Z_Zero_Plane. Line Defined X-axis = M_X_Axis_Rotation_Line. Select a Line = M_Transfer_Ring_Direction_Line. Check Constructed. Click OK twice.
c) Go to **Alignment>CAD=Part**.
d) Measured Coordinate System = C_Coordsys001. Nominal Coordinate System = *World*. Scale Option is checked as None. Click OK.

- Save the File. **File>Save As**.

Measurements

- Now that we have our alignment we are ready to start measuring the rest of the machine, but before we get too far along let us measure our Leap Frog Pucks in case anything gets moved or bumped. **Note**-You can also measure the pucks at the very beginning, before the measurement of the alignment features.

a) Go to **Measure>Point>Comp Off**.
b) Place the SMR in the 1st puck measure & compensate. Repeat for each of your puck positions. If you want you might want to mark the order of the pucks with a white marker.

- Save the File. **File>Save**. If anything happens you can now re-open the file and realign to the machine using the **Devices>Move Device Position** command. This will be discussed at the end of the Method Sheet. This command is used if your setup gets disturbed or if you need to move the Laser Tracker to complete the machine measurement.
- Now we want to measure spindle/drum #1. We want to check if it is Parallel to the Transfer Ring Direction Line.

a) Go to **GD&T>Parallelism**.
b) Tolerance = *Your tolerance*. Datum = A. Select a Feature = Measure as a Cylinder. Now you can either do the parallelism over the length of the entire cylinder you measure or you can choose key in length to restrict in to a certain length (i.e. 12”). Click OK. Select a Datum = _Transfer_Ring_Direction_Line. Click OK.
c) Measure Spindle/Drum #1. Measure 3-4 points around one end of the cylinder, 3-4 around the middle, and 3-4 around the other end then compensate. Your cylinder results will appear. I will call this M_Spindle_1. Click OK. Then your parallelism results will appear. Click OK.

- Now we want to measure spindle/drum #2. We want to check if it is Concentric to Spindle 1.

a) Go to **GD&T>Concentricity**.
b) Tolerance = *Your tolerance*. Datum = B. Select a Feature = Measure as a Cylinder. Now you can either do the Concentricity over the length of the entire cylinder you measure or you can choose key in length to restrict in to a certain length (i.e. 12”). Click OK. Select a Datum = M_Spindle_1. Click OK.
c) Measure Spindle/Drum #2. Measure 3-4 points around one end of the cylinder, 3-4 around the middle, & 3-4 around the other end then compensate. Your cylinder results will appear. I will call this M_Spindle_2. Click OK. Then your concentricity results will appear. Click OK.

- Now we want to measure the transfer ring inner cylinder. We will do this in its 2 positions (Position #1 for Spindle #1, Position #2 for Spindle #2). We will do this to check to see how concentric the Transfer Ring is to each Spindle.

a) Move the Transfer Ring into Position #1 around Spindle #1.
b) Go to **GD&T>Concentricity**.

c) Tolerance = *Your tolerance*. Datum = B. Select a Feature = Measure as a Cylinder. Now you can either do the Concentricity over the length of the entire cylinder you measure or you can choose key in length to restrict into a certain length (i.e. 12”). Click OK.
d) Measure the cylinder inside the Transfer Ring. Take 5-7 points around one end of the inside cylinder and 5-7 points around the other end of the cylinder. Compensate inside the ring.
e) Your cylinder results will appear. I will call this M_Transfer_Ring_Spindle_1. Click OK. Then your concentricity results will appear. Click OK. See Figure 3.
f) Move the Transfer Ring into Position #2 around Spindle #2.
g) Go to **GD&T>Concentricity**.
h) Tolerance = *Your tolerance*. Datum = C. Select a Feature = Measure as a Cylinder. Now you can either do the Concentricity over the length of the entire cylinder you measure or you can choose key in length to restrict in to a certain length (i.e. 12”). Click OK. Select a Datum = M_Spindle_2. Click OK.
i) Measure the cylinder inside the Transfer Ring. Take 5-7 points around one end of the inside cylinder and 5-7 points around the other end of the cylinder. Compensate inside the ring. Your cylinder results will appear. I will call this M_Transfer_Ring_Spindle_2. Click OK. Then your concentricity results will appear. Click OK.

- Save the File. **File>Save**.

Figure 3

Constructions

- Now that we have inspected the machine we need to find out how much we need to move the spindles/drums position them directly across from & facing each other.
- First we need to measure points to mark the positions on the spindles where we want to check our cylinders for position (X & Y) to ensure your spindles are aligned.

a) Go to **Measure>Point>Comp Off**.
b) Measure a position on one end of spindle #1, where you measured your cylinder and compensate. I will call this M_End_A_Spindle_1. See Figure 4.
c) Repeat for the other end of the cylinder you measured for spindle #1. Call this M_End_B_Spindle_1.
d) Repeat on spindle #2 and change names of points accordingly.

- Now we want to take those points and project them to the centerline of their respective cylinders to find the XY location of the cylinder at that location.

a) Go to **Construct>Point>Line Project**.
b) Select a Point = M_End_A_Spindle_1. Select a Line = M_Spindle_1. Check Constructed. Click OK. I will call this C_End_A_Spindle_1.
c) Go to the Tolerances tab. Check the X&Y tolerances and enter your X&Y positive & negative tolerances. Uncheck all the rest of the tolerances. Then click the Save to Preferences button. Click OK.
d) Go to **Construct>Point>Line Project**.
e) Select a Point = M_End_B_Spindle_1. Select a Line = M_Spindle_1. Check Constructed. Click OK.
f) Go to the Nominals tab. Next to the Select Nominal use the pull down box to choose C_End_A_Spindle_1. This will do the comparisons to the other end of the spindle to see which way X&Y you need to adjust the spindle to make it parallel to the Transfer Ring’s movement. Click OK.
g) Repeat for the spindle on the other end.

- If you want to check how much you need to adjust to line up the spindle & the transfer ring we will dimension the length from the above points to their respective Transfer Ring Centerline.

a) Go to **Dimension>Length>Point/Line**.
b) Select a Point = C_End_A_Spindle_1. Select a Line = M_Transfer_Ring_Spindle_1.
c) Go to the Tolerances tab. Check the X&Y tolerances and enter your X&Y positive & negative tolerances. Uncheck all the rest of the tolerances. Then click the Save to Preferences button. Click OK.

d) Repeat for each of the points = C_End_(AorB)_Spindle_(1or2) and choosing the appropriate line = M_Transfer_Ring_Spindle(1or2).
Note-Ideally these X & Y values will equal zero.

Figure 4

Reporting

- Now we want to put together a nice report that will allow us to easily see what need to be moved and in which direction.

a) Go to **File>Review Features**.
b) Click on the **Print** button.
c) Type in the Operator's name, Name of the Part, & Serial number of the current part. Click OK.
d) Header = Header. Format = Tabular. Lists = *DEFAULT LIST*. Then on the left side of the screen you will see a list of everything you have measured and constructed on this machine. Make sure there is a check in the box of everything you want to print and no check in the box of everything you do not want to print. Click OK.
e) Click **Save**. Find the desired folder to place the report and name the report accordingly. Click Save.
f) Click OK twice.

- Save the File. **File>Save**.

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