

Engine Assembly Inspection

Machine Vision Inspection — V-Rod Engine Assembly

- ✓ Machine Vision
- ✓ featured in
A-B Journal
DVT Vision in Action

Harley-Davidson Motor Co.
Kansas City, MO

Dan Bruyn
Sr. Manufacturing Engineer
816.270.8045

Frank Long
Dir. of Bus. Development
DVT Corporation
630.293.9377

When I first learned of this project, I knew it would require more creativity and resourcefulness than a standard application. This kind of challenge is exciting to me because it can potentially open doors for other applications.

Chris Davison
Branch Manager
Bachelor Controls, Inc.



Bachelor Controls, Inc.

Systems Integration for Manufacturing

Project Summary

Celebrating its 100th Anniversary in 2003, Harley-Davidson Motor Company is one of the most popular motorcycle manufacturers in the world. Harley manufactures/assembles a variety of motorcycles at its Kansas City facility, including the new V-Rod Engine. The V-Rod is a joint venture between Harley-Davidson and Porsche AG. Porsche designed the engine and Harley developed the rest of the bike. Bachelor Controls (BCI), a DVT Certified Integrator, was called on to develop a snap-ring installation inspection application.



Photo by Connor, DVT

Objectives / Requirements

Multiple manual operations were required in the assembly of the lower crank case. The operator has multiple operations to perform, including putting together some sub-assemblies. The BCI system needed to confirm the proper placement of snap rings that hold in the bearings supporting the balancer shaft. If a snap ring did not exist, or was not placed in the slot properly, it could fail inside the engine once sold to a customer. This could be dangerous and is very expensive to fix after the engine is assembled.

Results / Benefits

Working within a 10-inch space, the camera had to make three different inspections, moving to different locations to inspect each individual part. The limited space required BCI to be creative. The solution was to place a mirror at a 45-degree angle to the bearing location on the part. The mirror was mounted on a pneumatic track to place the mirror into position between cycles of the press. The press would insert the first snap ring/bearing and exit in time to move the mirror into position to acquire and process an image and then retract within seconds. This process was repeated for three different steps. The depth of field varied, so a camera was mounted to a Linear Actuator, enabling the camera to move to specific locations matching the locations in the depth of field of the lower crank case. Using heavy scripting — including the conversion of spherical coordinates to Cartesian coordinates — BCI engineers measured the gap between the edges of the snap ring to determine if it was seated correctly.



BCI's creative solution provides a reliable, consistent, accurate method for verifying the installation of the snap rings, reducing the risk of failure and expensive repairs. The inspection system also runs without creating any additional cycle time, allowing the operator to continue with their task at the workstation.

Bachelor Controls worked with us to create an innovative solution to a critical inspection in the assembly of the V-Rod engine. The result is a robust and precise application that does not add any additional cycle time to the process.

Dan Bruyn
Senior Manufacturing Engineer
Harley-Davidson Motor Company



Photo by Connor, DVT