

IT & Production

9/2021 · November 2021

UNOFFICIAL ENGLISH TRANSLATION

The original article was published in German in IT & Production, a trade magazine published in Germany. Prepared for CRETEC. The German original remains the reference.



Turbocharger assemblies inspected at high speed

The conference advertisement remains unchanged. Original publisher artwork, logos and advertisements are retained in their original language.

Industrial machine vision

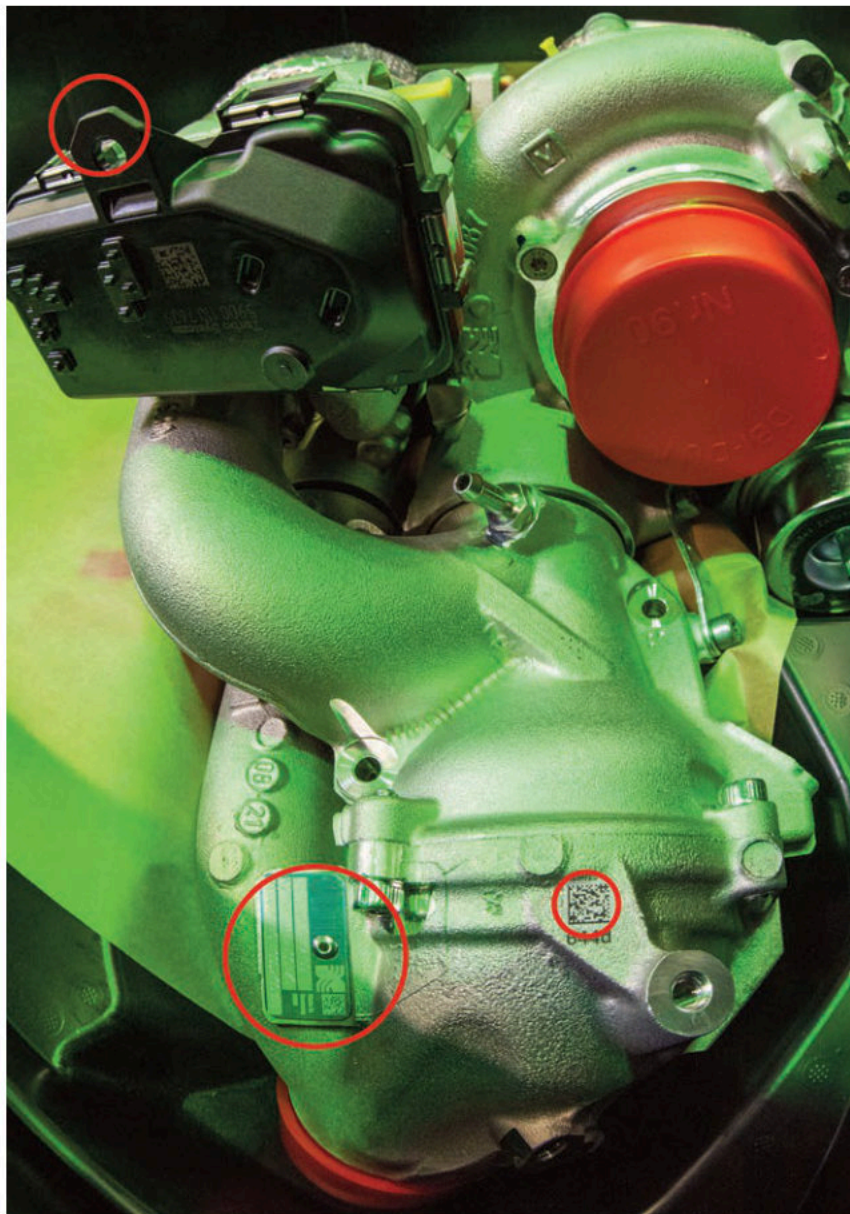
Turbocharger assemblies inspected at high speed

Using a PC-based automation platform, Cretec has significantly reduced inspection cycle times for turbocharger assemblies at a German automotive supplier, including complete product traceability.

Applications and parameter changes can be checked and modified centrally at any time, independently of the current settings. High-end industrial PCs based on Windows 10 IoT allow the inspection system to be adapted at any time, even without a system integrator. Cretec and the customer integrated HALCON into the TurboPCS system. Various vision applications for an entire production line were then commissioned step by step in the factory, fully integrated into the customer's system.

From eight seconds to 0.021 seconds

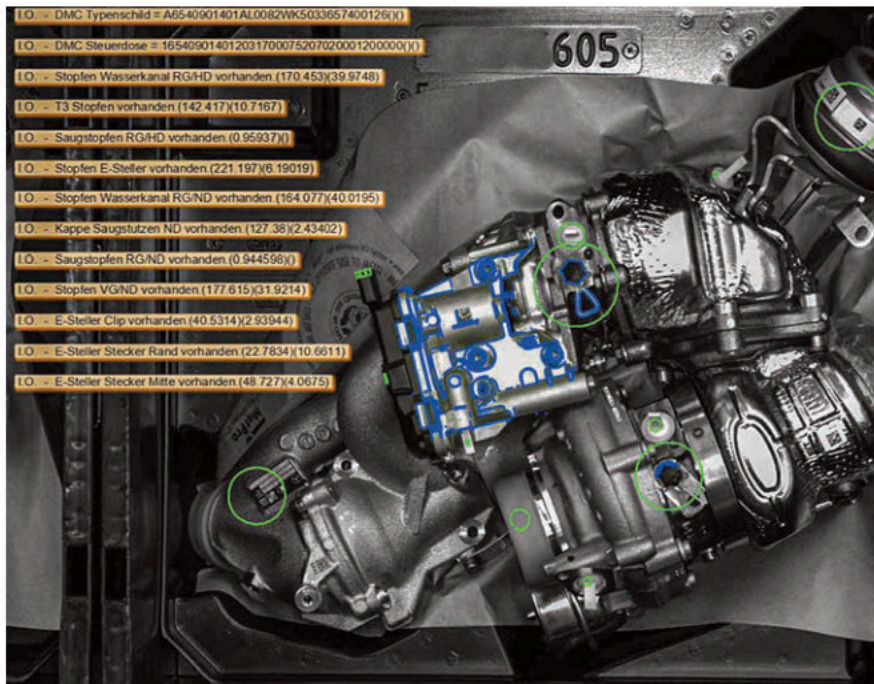
The automotive supplier receives products from different suppliers, marked using different lasers. The smart camera previously used could read only one supplier's DataMatrix codes. By contrast, Cretec's PC system reads every supplier's codes in a fraction of the previous cycle time. In the former installation, a smart camera read 2D codes on a rotating component and output its rotational position. Some markings were labelled and



Twelve features of a turbocharger assembly are inspected from 3.5 m above. Circled in red are a 3 mm-wide plastic web, the assembly's nameplate and a small 5 mm × 5 mm DataMatrix code.

others laser-marked. The new solution reduced the reading/cycle time from eight seconds to 0.021 seconds. A

camera mounted on the dome controls the dome lighting for code and plain-text reading. A combination of dome and



Up to twelve features are inspected during final inspection in the packaged state.

dark-field lighting achieved significantly better reading performance.

The machine-vision system was integrated into the station, and a high-resolution GigE camera connected to the station computer, so that the vision system sends data directly to the customer's system. This enables reliable analysis of code quality, classification into the appropriate quality grades, storage of the results and integration into internal or external corporate communication. Verification complies with common international standards for 1D codes (ISO 15416) and 2D codes (ISO 15415, ISO 29158, AIM/DPM). DataMatrix-code data, verification classification and plain text are stored in the customer's system. The solution has already been running reliably for more than three years in weekly three-shift operation without a problem.

Frank Sperling, the customer's vision specialist, says: "The total investment associated with the new machine-vision project was only about half that of the former

individual vision solutions using smart cameras." Stability at the assembly stations and throughput were also significantly improved.

Completeness inspection from 3.5 m above

Automotive customers are interested only in absolutely

defect-free products. After production, complete turbocharger assemblies are placed in boxes with shaped plastic trays for shipping and stay there until they reach the end customer. Four boxes form one layer and three layers fit on a pallet. In theory, plugs might not have been installed or the connector housings might be damaged, so final documentation of inspections is necessary. The vision solution had to cope automatically with the approximately 1 m height difference between the first and third layers while checking different features. The system also had to be outside the handling and crane area, requiring a minimum height of 3.5 m.

The task was solved with a high-end industrial PC and complete integration into the customer's software environment. Four LED ring-lighting modules with integrated cameras were installed below the factory ceiling, each centrally above a box position. The cameras also synchronise control of the strobe lighting. The high resolution of the four 20 MP zoom cameras with autofocus lenses ensures



The Z-ring of the turbocharger assembly is checked for presence and 3D height using an LED projector and a 20 MP zoom camera.

reliable detection of a plastic web only 3 mm thick on the turbocharger assembly from up to 3.5 m above. The small DataMatrix code (5 mm × 5 mm) and the nameplate with customer data are also read with absolute reliability. The twelve features inspected include checking that plugs are present and correctly positioned.

To extend this task with colour evaluation, images from the 20 MP monochrome camera can be combined into an RGB colour image by sequentially switching the red, green and blue lighting channels. This reliably detects differently coloured plugs and other features. The physical resolution of the combined image corresponds to that of a comparable 60 MP colour camera.

Traceability for complaints

If a feature of the turbocharger assembly in its packed tray is faulty, it is marked red on the monitor image. At the same time, the boxes are illuminated green or red, giving the worker an immediate local fault indication without having to look at the monitor. Data and images from every box are also stored. This ensures that every turbocharger assembly is defect-free when sent to the customer in its tray. For example, a customer complaint about a delivery of 24 supposedly faulty assemblies was rejected on the basis of 100% traceability, with images of the defect-free components and correct packaging. The system has been running since January 2021 and had already saved several times its investment cost

within six months.

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