INEA INSPECT

Product Description

inSpect CAT/DPF

version 2.1

Non-destructive inspection

Highly specialized vision inspection technology with in-house designed machines and algorithms conducts thorough non-destructive inspection of all products within the production line.

All perspectives covered

The inspection process covers every angle, from internal assessments for plugged cells, light leaks, and coating depths, to surface examinations for edge chips, face gauges, and surface cracks.

Unparalleled speed and accuracy

inSpect can be optimized to match production cycle speeds by controlling various elements, including the handling system speed, image acquisition and processing times, data analysis, and reporting.

inSpect is an industrial vision system for catalytic converters and diesel particulate filters (DPFs) inspection, integrated into production lines. The system configuration supports parts from under 3x2 inches up to 15x20 inches.

The core working principle of inSpect is a 100% in-line visual part inspection. The camera scans the parts passing through, which are illuminated from below. Algorithms then process the image and calculate if a part is inside the designated tolerances. The algorithms are searching for blocked cells when inspecting catalytic converters or optical leaks when inspecting diesel particulate filters.

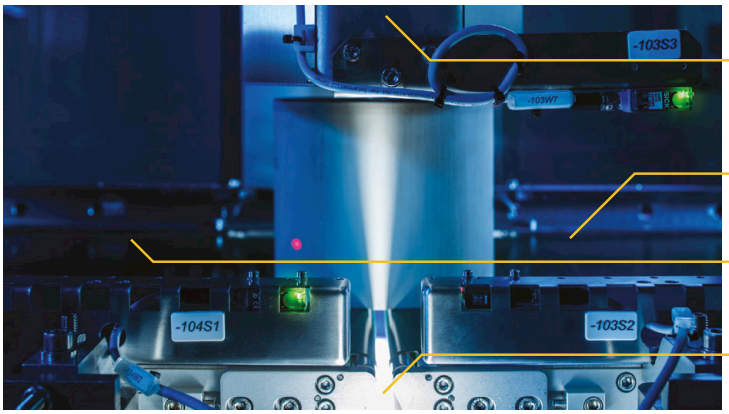
The machine works as an in-line configuration and can be installed on the existing line or as an addition to the quality check station with manual loading and unloading. The external conveyors are typically connected to the infeed and outfeed conveyors. On the infeed conveyor, parts are fed in the machine from the upstream stations. Outfeed conveyor transfers the inspected parts downstream to the diverter where the parts assigned with the OK flag are continuing to the pass conveyor and the parts assigned with the NOK flag are diverted to the reject conveyors.

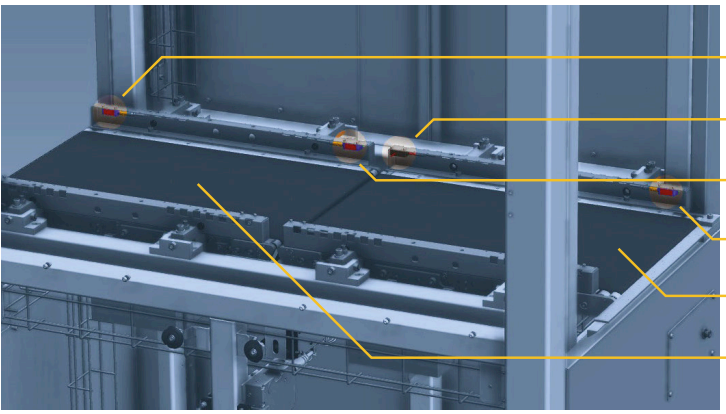
The system is constructed from the following elements:

- Inspection module used for inspecting substrates
- Electrical cabinet containing control electronics
- Operator station for visualisation and control of application parameters
- Diverter for separating parts that do not pass the necessary quality benchmark (optional)
- External conveyors (optional)

Basic elements

The system comprises infeed and outfeed conveyors that transfer substrates from one stage to the next; positioning registration sensors to accurately detect the location and dimensions of the substrates; a camera module equipped with a camera, lens, and an adjustable linear module for accommodating various part heights; and a lamp module which illuminates parts from below.



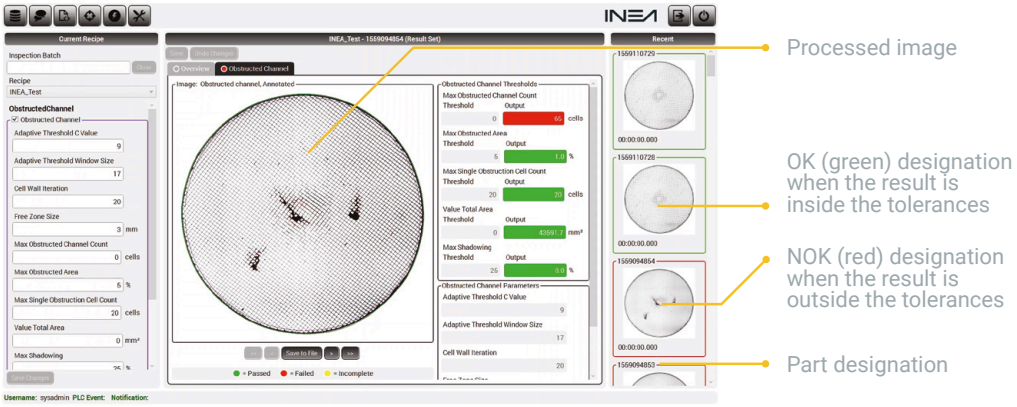


Conveyors and sensors

Conveyors operate at high speeds without negatively affecting the production cycle times. Despite the high throughput, the entire inspection process — data acquisition, analysis, saving raw data, and communication — is completed before the next part arrives.

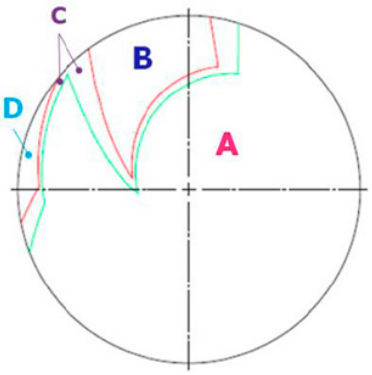
Part processing

Surface parameter analysis and detection of anomalies are executed with image processing directly on the line. Accounting for variations in light transmission or reflection, inSpect pinpoints irregularities within the structure according to set parameters. Once a part enters the system, a triggering sequence assigns each part a unique number, which, along with its designation, may be used elsewhere in the production line.

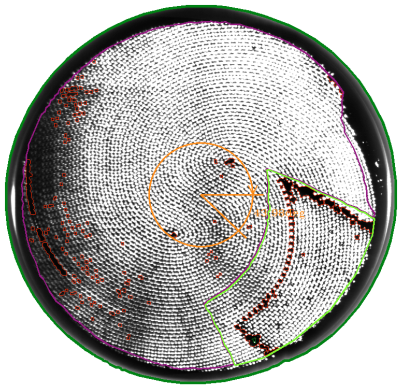


Multiple region control algorithm

The multiple region control algorithm detects obstructed channels in multiple regions of substrates, even with sensor hole cutouts. Leveraging AI technology, the algorithm accurately determines the part's orientation and positions masks to inspect different regions with tailored parameters, while excluding zones where inspection is not feasible. This advanced masking technique allows separate inspection of regions without any loss in processing time. This technology can be retrofitted to existing inSpect systems.

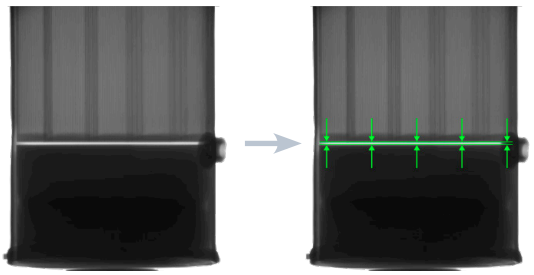


Map of multiple regions with varying characteristics caused by sensor hole cutouts within a single metallic substrate.

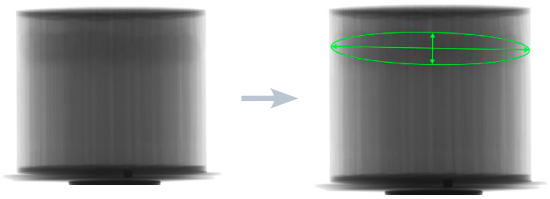


Honeycomb substrate image with multi-region analysis for detecting obstructed channels according to preset parameters.

Gap inspection between catalytic converter and DPF substrates after canning, confirming it meets predefined tolerances.



AI-driven analysis of washcoat application highlighting areas with excessive or insufficient washcoat dosing.

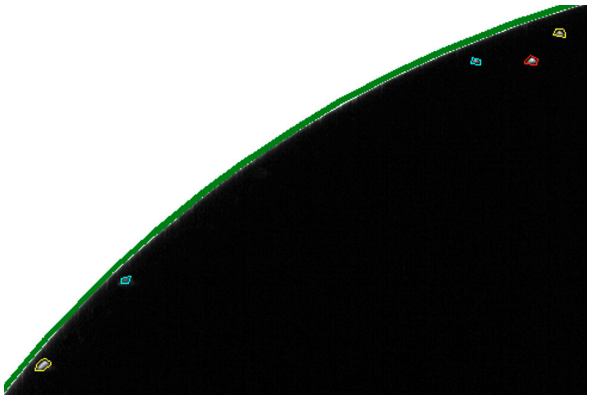


X-ray for non-destructive subsurface inspection

X-ray technology is employed for in-line, non-destructive quality checks on 100% of parts, with a cycle time of 5 seconds. Its real-time monitoring capability enables operators to make immediate process adjustments. The system inspects the positions of CATs and DPFs post-canning by measuring distances and uses AI to evaluate the coating depth of catalysts. Leveraging medical-grade X-ray technology, the inspection system adheres to stringent safety standards.

Partially open cell detection in DPFs

Edge cells in DPFs allow for greater tolerance regarding light leakage, as they are less critical to overall functionality. The inspection system has been upgraded to distinguish between the edge zone with partial cells and the interior zone with full cells. The enhanced system not only detects leaks in the edge zone but also measures each leak's size, calculates the total leak area, and provides separate results for edge cells, ensuring more precise and comprehensive quality control.



DPF optical leak detection shows higher tolerances for edge cells, allowing for greater variability in light leakage compared to interior cells.