# Snap Ring Verification

In-Process Test & Monitoring Solutions

sciemetric

## Manufacturer uses Sciemetric system to add reliable, automated measurement and verification to axle snap ring installation processes, reducing downtime and rework costs during vehicle assembly

When inconsistent snap ring installations were causing major problems with axles down the assembly line, this automotive vehicle manufacturer required a solution to provide reliable pass/fail reporting at the station. Sciemetric's solution provided objective, accurate measurement of the processes, allowing the manufacturer to catch faulty processes before the part moved further down the line into assembly, where they were more time-consuming and costly to fix.

Snap ring installation is an important part of axle function in vehicles. If the snap rings on an axle assembly are improperly seated, it can cause vibration issues or even the disconnection of the axle shaft during operation.

The reason why problems with snap ring applications often go unnoticed until the end of the line or the vehicle assembly floor is that the conditions and function of the installation are challenging to monitor without the right tools. Many manufacturers rely on manual methods of quality control during the snap ring application process, but the conditions of the process can make it very difficult to get a reliable pass/fail result using manual methods.

## The manufacturer's problem: Manual verification methods proving unreliable

This manufacturer's snap ring installation station had two phases of operation. In the first phase, a snap ring was seated into a machined groove of the inner axle shaft. This application was being monitored using a machine vision camera for confirmation of correct placement. The second phase was a press operation wherein this shaft was secured into a bearing. This required the first inner snap ring to engage a groove within the inner rings of the bearing and then quickly after another outer ring to snap on the outside securing the housing.

The manufacturer was using a combination of machine vision and manual operator monitoring. The first phase of the station was externally visible and often (though not 100% of the time) able to be monitored using a machine vision camera to confirm correct placement. However, the second phase included snap rings securing the inner bearing race to the axle shaft and the outer race to the housing. In both cases it is impossible to insert a camera, making machine vision unusable. Instead, they had a human operator manually listening to confirm the two 'click' events as each snap ring was seated into place.

Unfortunately, what makes this particularly hard to reliably monitor with the human ear is that **these two snap events were happening within a tenth of a second of each other**. In a properly anechoic environment, events more than 40 ms can usually be detected. But add in the surrounding noise on the manufacturing floor, and these two distinct but necessary 'click' events of the snap rings seating into place become almost impossible for a human operator to reliably detect—made evident by the warranty claims and downtime/rework costs the manufacturer was experiencing.

When the manufacturer started discovering many faulty axles during vehicle assembly, they realized they needed a solution to measure these processes more accurately and deliver a reliable pass/fail result at the station before the parts moved further down production.

In applications like this, NVH (Noise, Vibration, Harshness) monitoring, or sound monitoring, provides a deeper level of insight and accuracy that machine vision can't match.

**Some manufacturers may also do a functional pull test,** either machined or manual, to confirm properly seated snap rings. Unfortunately, this can also be subjective or inaccurate, as too much or too little force could lead to incorrect pass/fail results, and ultimately a waste of time and unnecessary scraping of good parts. **Automated, precise measurement of the application events themselves will always yield the most reliable results.**

## Sciemetric's automated measurement and analysis system to achieve consistent, reliable pass/fail results during snap ring installation processes

To fix the manufacturer's problem, Sciemetric designed a way to take out the guesswork for the second phase of the operation, where the mechanics of the test were happening quickly and out of sight, and manual methods of defect detection were proving unreliable.

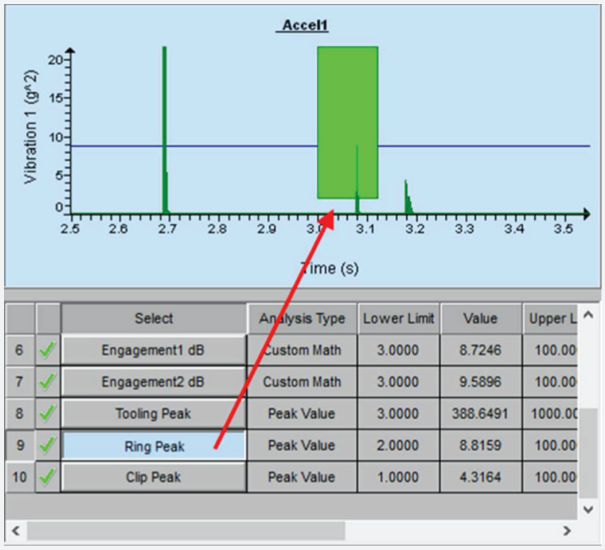
Sciemetric's solution was to measure press and vibration during the snap ring application processes, allowing the manufacturer to reliably detect the audible 'clicks' as each snap ring engaged into their proper seated position. Sciemetric used a draw-wire distance sensor and mounted accelerometer to measure the events. Using Sciemetric software, this data was then processed into signature waveforms for simple visual analysis (see screens below).

By comparing signature waveforms of known bad parts to those of good parts, it became possible to match up the precise timing of good vibration events. Essentially, seeing the right waveform spike ('click') at the right place/time during the process confirmed it was a properly seated snap ring—an accuracy that manual verification methods couldn't deliver.

## Use signature waveforms to identify specific, common problems during snap ring application

Identifying your exact problem(s) is integral to preventing it from happening again. The accuracy of signature waveforms helps you identify the precise problem in your failed snap ring application, which could include:

- Snap ring placed in the wrong groove
- A problem with the seating groove
- Missing snap ring
- Out-of-shape snap ring
- Non-confirming snap ring (too big, too small)
- Burred snap ring



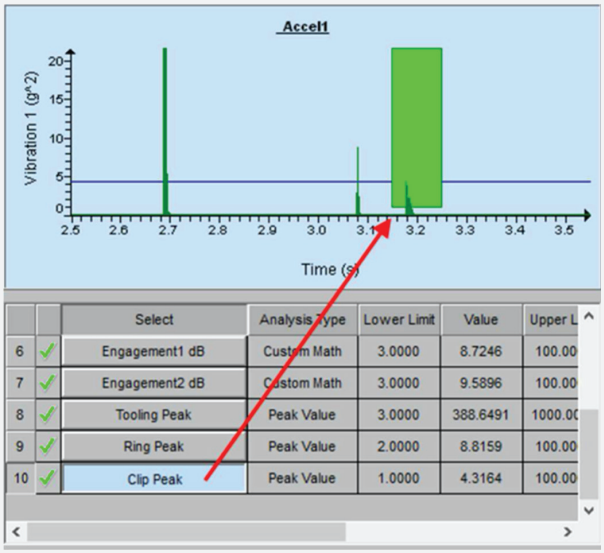




**Figure 1 & 2:** The two screens above show how clear it is to identify each of the required "click" events using signature waveform analysis. The screen on the left highlights the first click, and the screen on the right highlights the second click. These screens also illustrate how close together the two separate click events occur (within a tenth of a second), making manual analysis very difficult or unreliable.

## The result? Manufacturer achieves reliable snap ring verification, reduces downtime and rework costs during vehicle assembly

Sciemetric's solution enabled a consistent, reliable pass/fail reading at the station and offered the additional ability to better identify and solve future problems that could arise. By using distance and vibration measurements for snap ring verification, the manufacturer became accurately able to identify improperly seated snap rings that they had been missing through manual monitoring methods. These improvements to their line resulted in reduced downtime and rework costs during vehicle assembly—improving overall line efficiency and the bottom line.

## Compare and analyze problems across multiple stations with QualityWorX and Sciemetric Studio

Sciemetric's QualityWorX database and Sciemetric Studio analytics suite allow you to feed in data from nearly any process on your line for better insight into product quality issues. Analyze and compare processes at one station, or across different stations to identify anomalies and solve your problems.

Learn more at **www.sciemetric.com/studio**

Contact Sciemetric to see how our systems could help you achieve reliable defect detection during your operations, saving you time and money!

**For more information, visit www.sciemetric.com or email inquiries@sciemetric.com**

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