

Application Note: PortableRL

Measurement of tooling Edges on
Rotary Embossing, Folding and
Cutting Dies



Bruker alicona

Bruker Alicona is a leading global supplier of optical metrology solutions based on the principle of Focus Variation.

Focus Variation works on the basis of moving a focal plane over a surface and collecting robust 3D data which can then be used to measure geometric form and surface finish from a single optical sensor.

Measurement processes can be fully automated and provide GD&T measurement capabilities across all industrial & medical sectors.

The systems are in use in Industry, Industrial Research, Universities and production facilities globally.

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Introduction

In this issue, we explain how a portable optical 3D measurement system can be used to accurately measure the cutting and folding edges on die rolls. Using the Bruker Alicona PortableRL measurement system, the sharpness, profile, edge break and surface finish on these cutters can be measured. This can be carried out on machine to ensure cutting, folding or embossing quality is maintained.

Measurement Task

Rotary machines used in the packaging industry run at very high speeds and the finished product relies on the high quality of the dies used, a blunt or damaged edge/face will result in a bad part or scrappage of the whole run. Therefore, the timing of when to replace a roller is critical and the ability to predict when a roller needs replacement is essential.

Using the PortableRL measurement system provides the solution to this problem as it provides metric data on the quality of the edges to assess wear and damage allowing rollers to be replaced before they produce faulty products.



Using the Bruker Alicona PortableRL it is possible to measure directly on the roller when it is mounted on the die cutting machine. This avoids roller removal and speeds up the time required for maintenance and quality assurance checks.

If we look closely at the edges that produce patterns similar to the illustration above, we can see there are a number of key parameters.

The quality of an edge or surface depends on the application, for example for a tool designed for cutting the cutting edge is clearly the most important factor, as illustrated below. Using Optical Metrology, it is possible to display and measure the edge parameters, including edge radius as illustrated below in figure 1

Bruker Alicona is an expert in the area of cutting tool measurement with a deep range of knowledge on edge quality and chipping (see page 9) which are the key parameters needed to assess the effectiveness of a cutting edge. As part of this it is possible to measure EdgeQuality and Chipping.

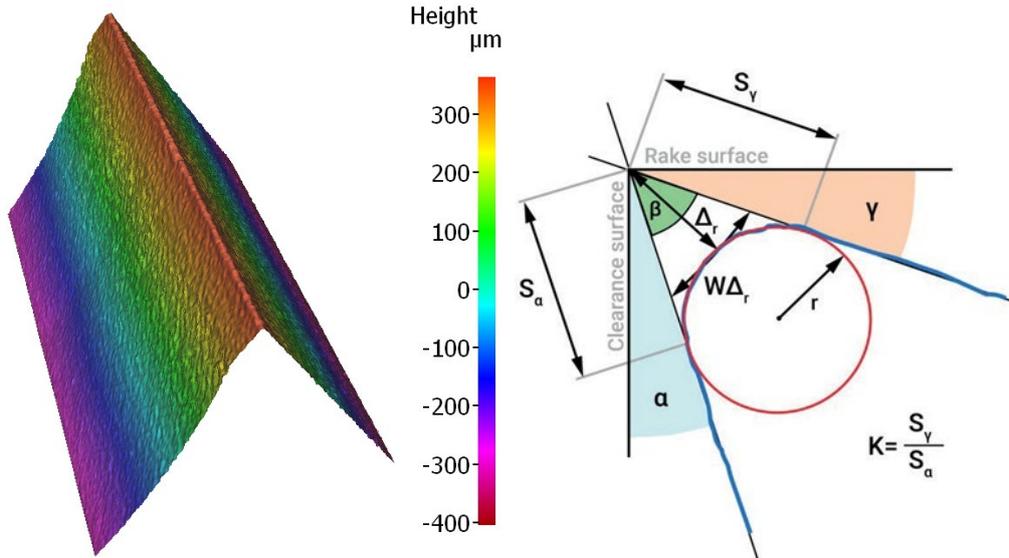


Figure 1

Using the edge chipping module, it is also possible to measure edge chipping providing quality assurance data, shown in figure 2

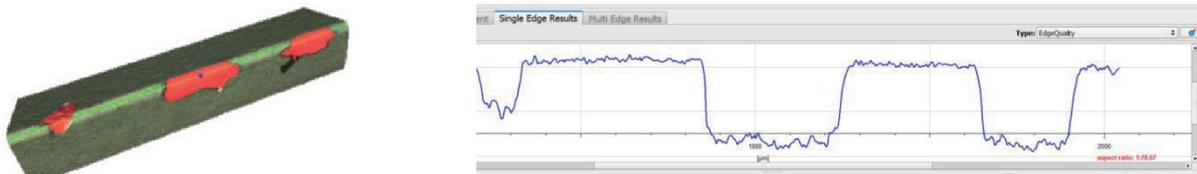


Figure 2

For embossing the form and quality and finish of the surface would be the most critical factor as shown in figure 3.

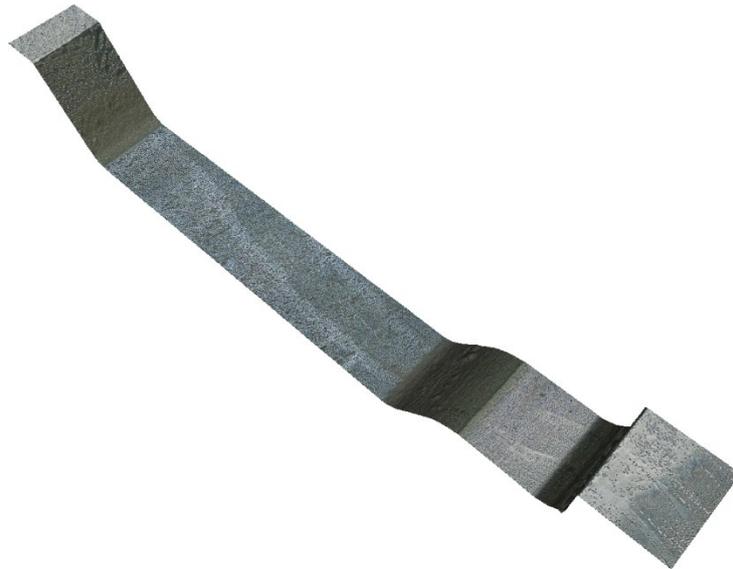


Figure 3

It is then possible to extract measurement data as illustrated in figure 4.

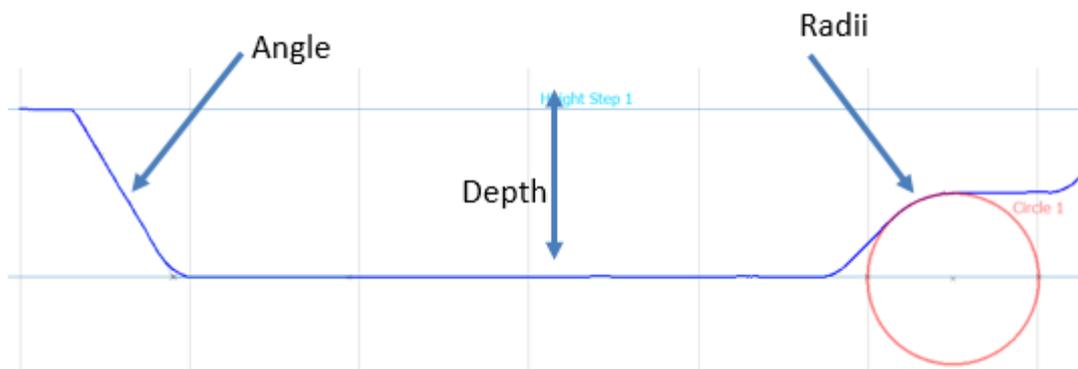


Figure 4

For folding the quality of the surface of the die, width, height and edges would be the most critical. This data can be easily captured and measured as illustrated in figure 5 below.

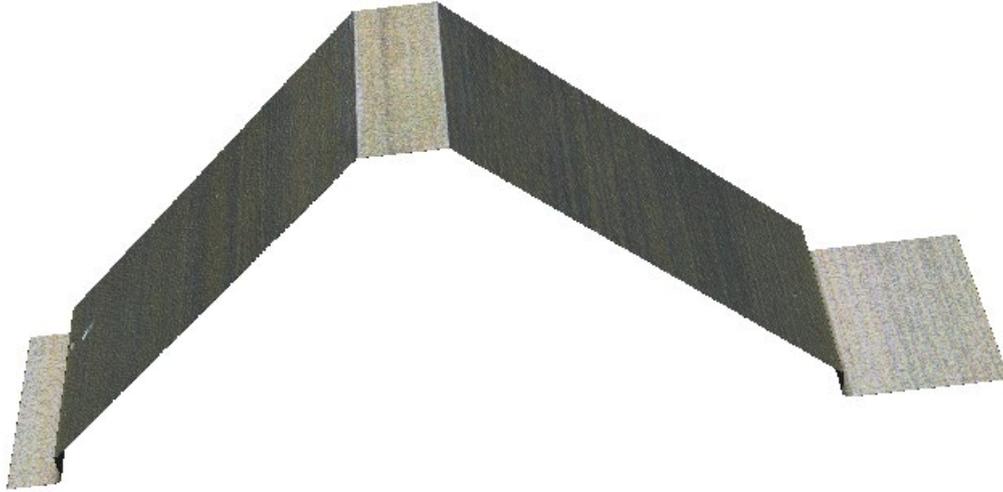


Figure 5

Metric data is then easy to extract as shown below in figure 6

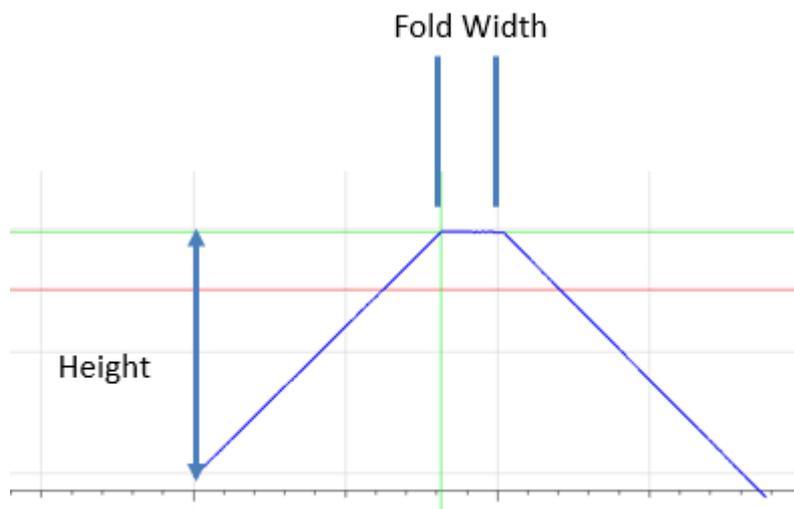


Figure 6

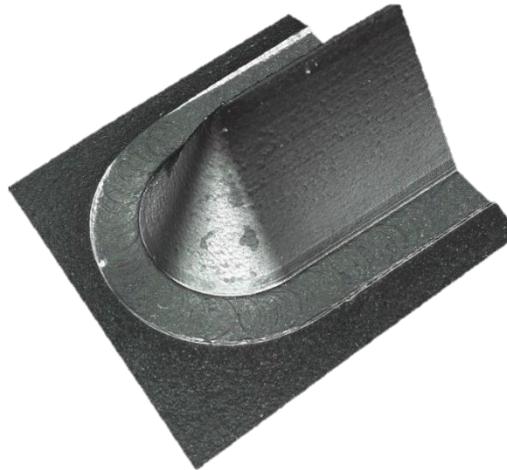


Figure 7

The above illustration, figure 7 is showing a 3D data set of a simple form of a cutting edge that is produced by Optical Metrology, but it is likely that the shapes will be more complex in nature as in the following examples.

In this triple intersection, figure 8, there is a requirement to measure the cutting edge in several positions.

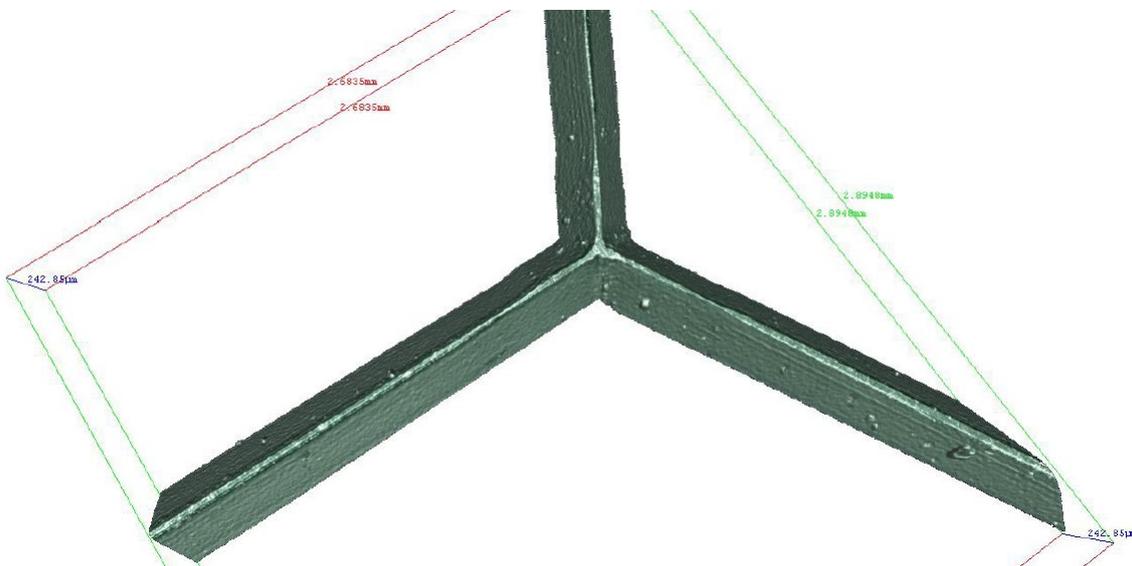


Figure 8

It is easily possible using the profile measurement built into the system to accurately measure in multiple positions as in figure 9

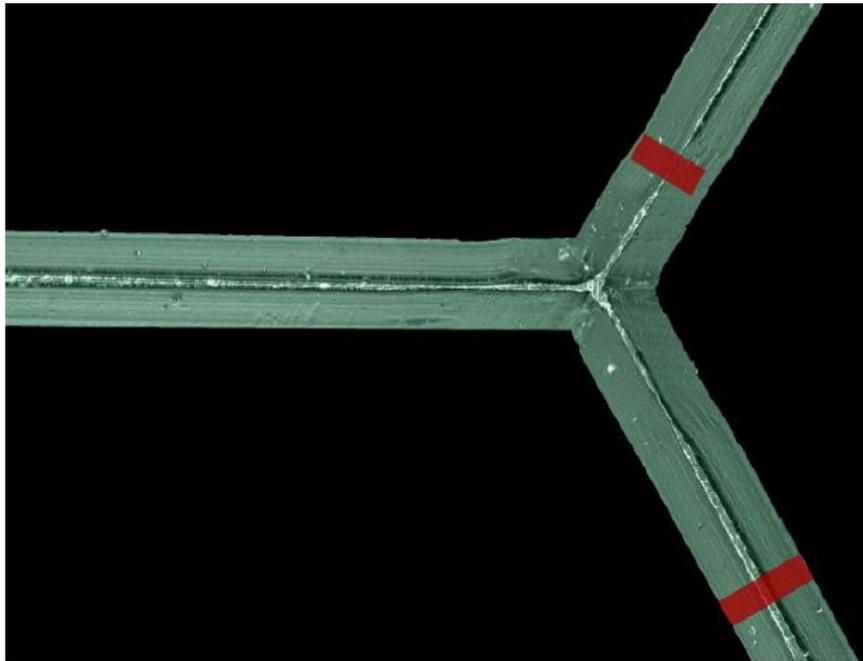


Figure 9

This provides an accurate measurement of the cutting edge radii and as can be seen the radii are different with one at $142\mu\text{m}$ and the other at $108\mu\text{m}$. This shows that wear or damage has occurred and will create a faulty product.

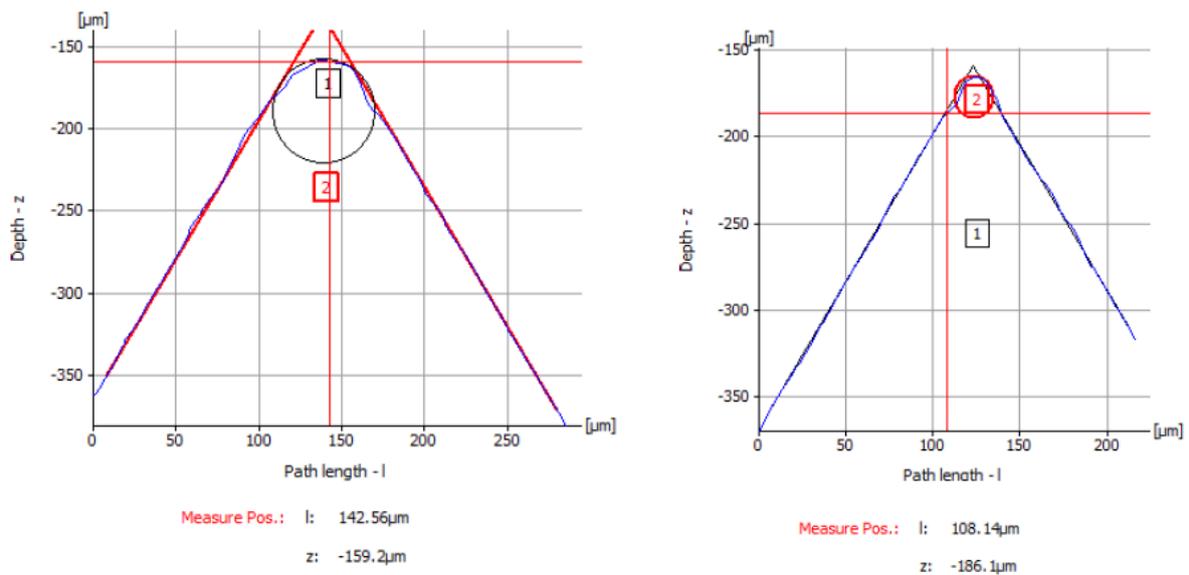


Figure 10

The technique of Focus Variation used by Bruker Alicona allows the measurement of very complex features with steep walls as illustrated below in figure 11 providing a unique solution for die users and manufacturers.

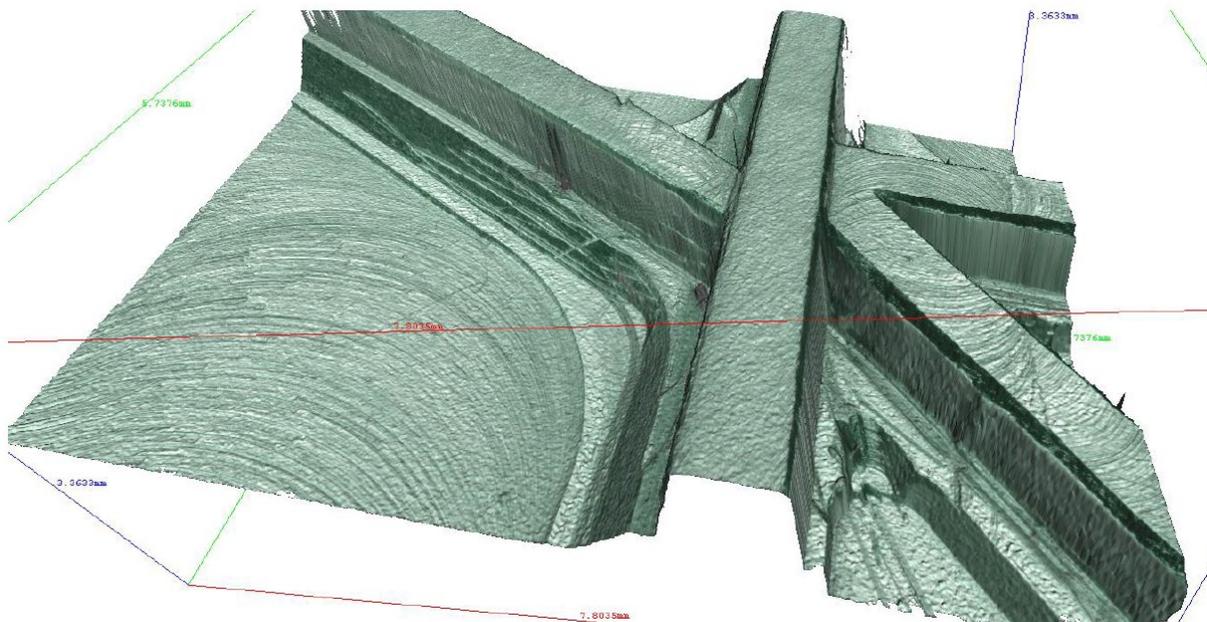
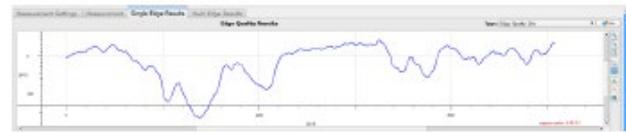


Figure 11

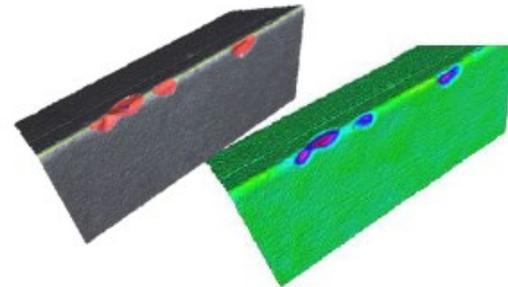
EdgeQuality offers fully automatic chipping measurement, depth, length and volume for edge quality verification.



Extracted surface profile along the edge

Users can measure:

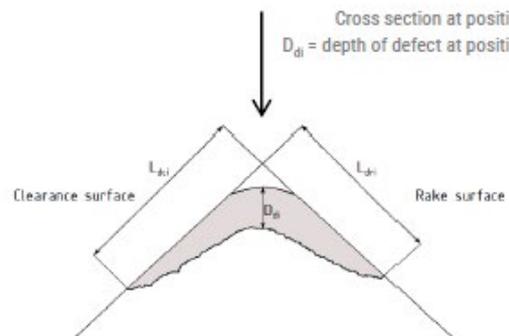
- The quality of the cutting edge
- Edges with or without radius
- A defect depth along the edge
- The finish on the edge



3D dataset with marked defects (true and pseudo color)

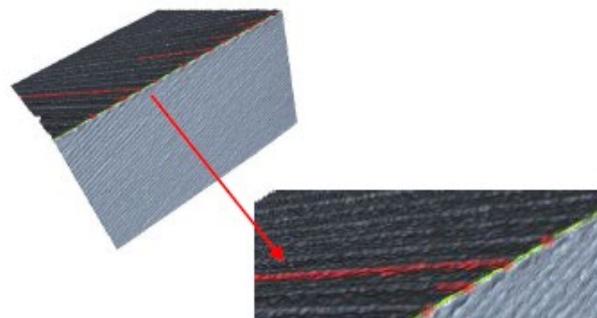


Cross section at position i
 D_{di} = depth of defect at position i



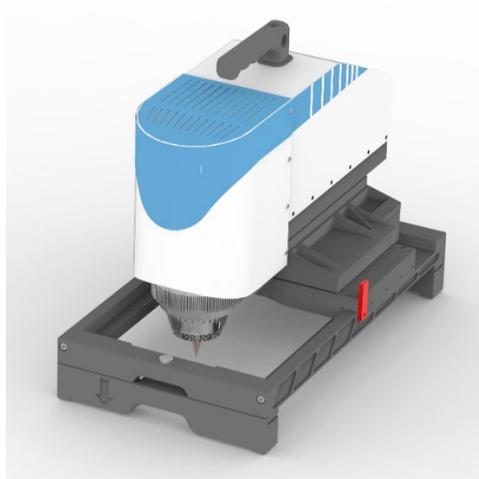
Typical measurable Parameters:

- Percentage of edge length with defects
- Max defect length along the profile
- Robust radius in the areas without defects



Warning options: If roughness on rake/clearance surface is higher than specified average R_v value, a warning can be displayed.

The PortableRL is available with custom mounts to fit onto or into rotary cutting machines.



It is available with a mobility case and also can be used powered by a battery pack



Summary

Using the PortableRL optical metrology system, it is possible to measure the critical cutting edge on rotary dies directly on machine providing in process quality assurance.

This technique offers many advantages to the user:

- The measurements are visualised and stored in a database that can be readily retrieved in the event of product issues.
- There is no potential for surface damage that can be caused by stylus-based instruments.
- The instrument user does not require any knowledge of metrology to make the measurements.
- All measurements are fully traceable to international standards