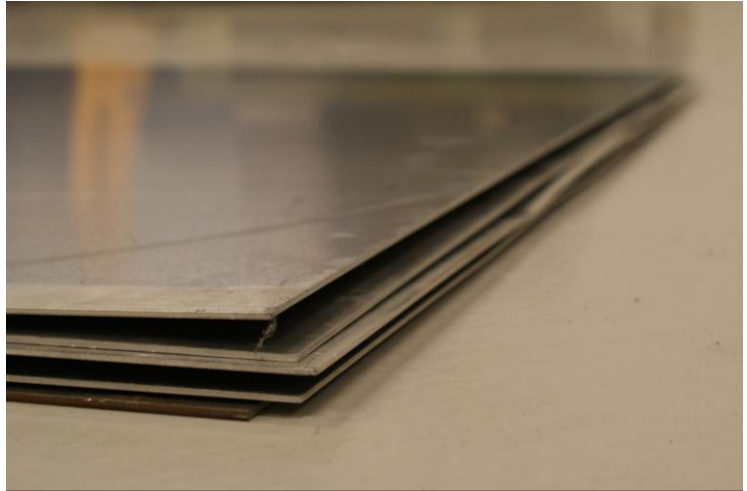


## **Aluminium plate flatness measurement**

Quality standards for Aluminium plates are increasing with the main players in the aircraft industry putting higher and higher requirements on flatness as well as demanding quality assurance of plate flatness.

To meet these demands, Shapeline has developed solutions which have already been supplied to customers manufacturing such flat aluminium products.



The benefits in time and cost savings are substantial since the material can be inspected in-line at production speed with automatic choice of quality alarm thresholds and norms depending on the product to provide 100 % quality assurance.

Our solution consists of several parts;

- Guidelines for the plate transportation (on the roller table) that ensures reliable and accurate measurement using Shapeline Double Line optical sensor technology. The measurement accuracy is also favourably compared with alternative high-precision traceable off-line methods.
- Sensor geometry suitable for measuring varying plate thicknesses over a wide thickness and width range.
- Evaluation methods suitable for aircraft and other industries.
- Presentation of measurement data suitable for the application utilizing the tools provided in the new Shapeline Generation 3 software.

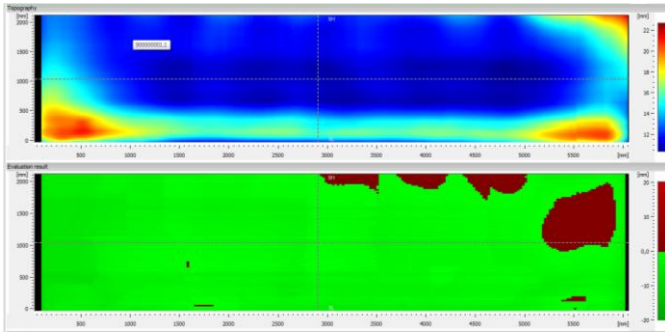
Shapeline provides powerful software and sensor technology which effectively removes the influence of vibrations. However, to ensure accurate measurement under real production conditions, elastic material deformations must be limited and controlled. Where modification of the roller table is necessary, Shapeline has this experience over many years. Now, for aluminium plates of a wide thickness range, a new concept has been tried and tested with good results.

For plates of varying thickness and high flatness demands, the system must be capable of measuring over a wide range with the same accuracy. This also puts special demands on the calibration procedure. Geometrical flexibility is a part of the Shapeline product concept and that is also true for our calibration solution. The system can be calibrated over a wide topographical range, ensuring the same precision measurement on all plates.

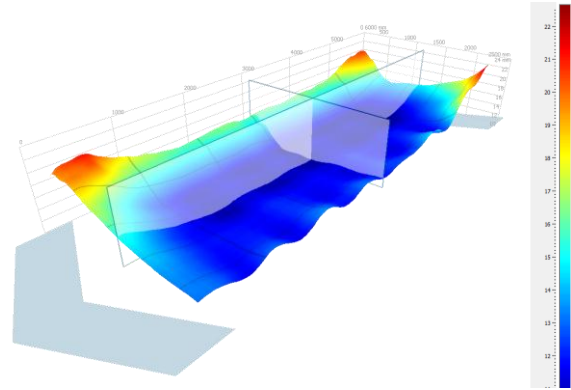
Aluminium plates often have many different applications and end-user types. Due to this, the measurement data must be checked against a number of different flatness norms. Shapeline has therefore developed a series of evaluation tools and a plate can be evaluated according to one or more norms. Norm thresholds can be changed or specified for individual plates. In addition, the evaluation can be data dependent in areas where certain flatness characteristics are separately

evaluated. The user interface is one of the high-lights of Shapsoft Generation 3. Special tools are available for crossbow, length bow, evaluation and plate history.

The software can also receive nominal width and length values in a plate measurement order and then check the plate measurement against those values. Where the difference is bigger than a set level this discrepancy can be reported in the measurement results.



*Topographical and defect maps*



*Topographical 3D-map*

### **Technical specifications**

#### **Measurement performance (example)**

Measurement accuracy ( $2\sigma$ ): 0,1-0,4 mm (0.004 – 0.016”) depending on plate speed

Width accuracy ( $2\sigma$ ): 1 - 2 mm (0.04 – 0.08”)

Length accuracy ( $2\sigma$ ): Depends on requirement and equipment

Measurement range in thickness direction: Up to 400 mm

Max plate width: No limit.

#### **Plate/sheet flatness evaluation**

According to internal standards e.g. Boeing, Airbus.

ASTM and EN-standards.

Customer specific.

#### **User interfaces (examples)**

- Topographical maps of plates/sheets
- Defect maps showing location and size of out-of-tolerance areas according to multiple standards
- Key numbers, defined by customer
- Control data such as steepness and I-unit maps and graphs
- History of several plates showing flatness trends and systematic flatness problems
- Information for maintenance and calibration
- Width- and length information

#### **Other software functions (examples)**

- Functions for vibration elimination
- Multi-user interfaces
- Real-time data output for process control
- Data export functions

Environmental conditions: 0-40° C, Humidity: 10-90%, non-condensing. The temperature range can be extended significantly using water cooling.