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ABOUT THE EVOLUTION OF THE LEICA LASER TRACKER/3D CMM METROLOGY

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Abstract

Keyword: ***Leica Laser Tracker***

Leica Geosystems Laser Trackers have been at the forefront of laser tracking technology for more than 15 years. These portable coordinate measuring machines have enabled companies around the world to deliver innovative products, achieve unheard-of tolerances, substantially lower manufacturing costs and increase productivity well beyond their expectations. Leica Geosystems continues to set the standards by making metrology truly mobile, truly flexible, and truly innovative with the new Portable CMM solution, consisting of a Leica Laser Tracker and the unique arm-and wireless Leica T-Probe and hand-held Leica T-Scan laser scanner.

INTRODUCTION

The authors of this work present general aspects of the 3D measuring procedure of the positioning and assembling units of bodyworks of cars using the laser *Leica Laser Tracker*. Leica Geosystems is a global supplier of complete hardware and software packages for the metrology market. The Leica Tracker system for 3D measuring is used by the main producers and suppliers of utilities from the airspatial, naval , car sector etc., the Metrolog XG soft being the best tool for the control of the components leaving from their 3D CAD model.

CONTENT

The execution and assembling precision of the units (fig. 3) is verified through check points (for Block-s, pins*)* and check holes (for Bases, Frames etc.).

The tooling projector must always have in view the access with the measuring devices for the check points, no matter if they are materialized only by surfaces and holes precisely realized, or if they are jacks for the assembling of the sight vanes (Icky Bolts) etc. The measurements have two stages: certification (it is realized at the supplier) and a recertification (at the client).

In order to have the same measurements it is compulsory to fulfill the same conditions for the fixing of the stations. This way, according to the station type (straight with adjustable legs, rotative, inclined with adjustable legs) one must try to place the station in the working position:

- straight station with adjustable legs - this must be adjusted with the air bubble so that the maximum deviation from the plane is ±0.1[mm], (fig.4);

- inclined station with adjustable legs - the altimetry calibre are used and the adjusting of the station is made according to the quotas from the documentation, using the air bubble;

- rotative station - this is placed and blocked in such a way, so that there should be no possibility of movement.

The 3D measuring implies at first the realization of an alignment. There are lots of alignment types used according to the necessary measuring precision or the measuring possibility.

The alignment is the zero car correlation (center car front) with zero measuring machine (Leica Laser Tracker). The alignment implies the cancellation of all degrees of liberty so that the component (3D), related to the system of coordinates from the soft Metrolog, should be oriented.

There are more possibilities for the realization of the alignments: six points surface (fig.1), three points, two points and a plane, two circles and a plane.

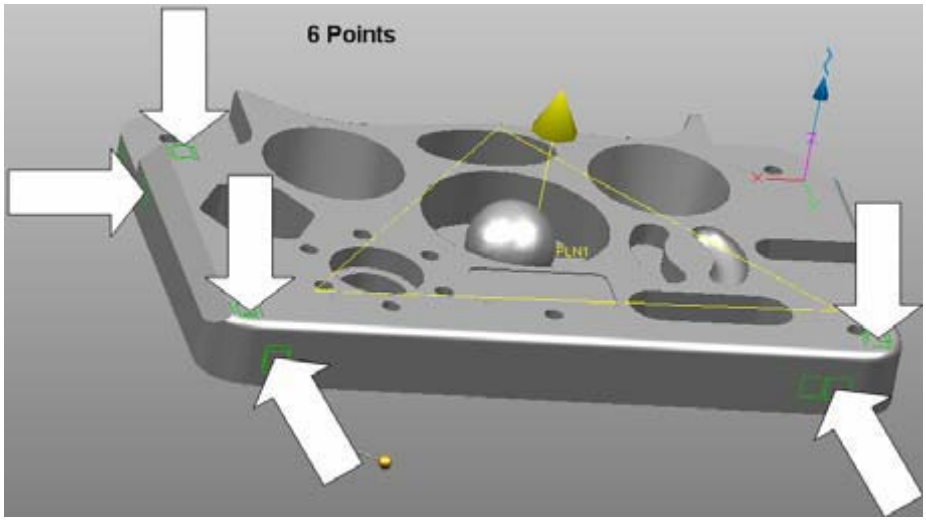

Fig.1 . The alignment six points surface

All six points must be defined using the object to be measured and afterwards should they be measured. After the realization of the alignment the surface of the component (the mould) can be easily verified by means of measuring of points on surfaces, of distances etc.

For the alignment (three points), (fig.2), the sight vane holes are used most of the time. The sight vane holes are tolerated holes of H7 precision, which must be placed as much as possible in the extremities of the measuring station, so that they can comprise all the references, their coordinates being given by the projector, related to the car system of 3D coordinates. The minimum number of sight vane holes is 4.

The alignment is made while blocking the axes XYZ on the sight vane holes. The sight vane holes are chosen in such a way, so that the longest axe should be chosen. The sight vanes 1, 2, 3 for alignment are to be used as example in the case below, while the blocking of the axes is made as follows:

-on sight vane 1 the axes XYZ should be blocked;

-on sight vane 2 the axes YZ should be blocked- the plane axe should be chosen (Z) and the axe which makes no connection between 1 and 2 (in this case Y); the measurement indicates axe Y;

-on sight vane 3 only axe Z should be blocked (independent of the raising direction of axe Z);

-after the alignment, the sight vanes left should be measured (sight vane 4 in the present case).

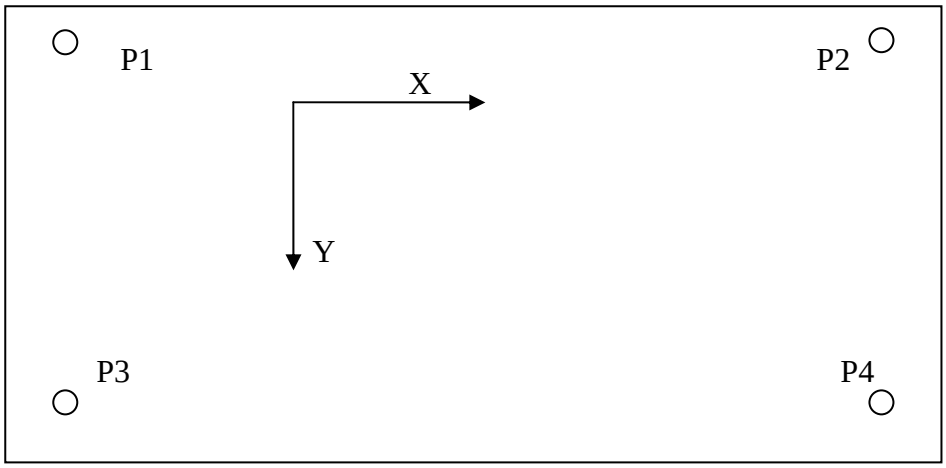

Fig. 2. The alignment three points

The measuring of the sight vanes can be realized with:

- the ball stand; in this case a point is measured, but the height of the stand in reference to the table plane should be taken into consideration (10, 15, 20 [mm]);
- the sight vane; in this case a sphere is measured; the height of the sight vane in reference to the table plane is to be considered (10, 15, 20 [mm]);
- pegs in this case a circle is to be measured, so the height must also be measured (this can be realized with a plane or with a circle projected on a plane).

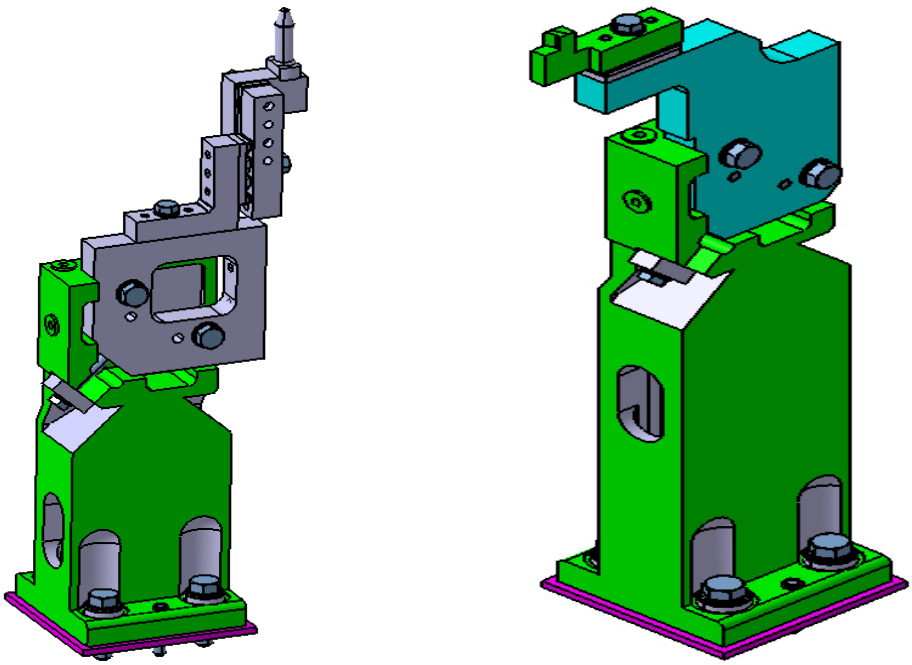

Fig. 3. Units

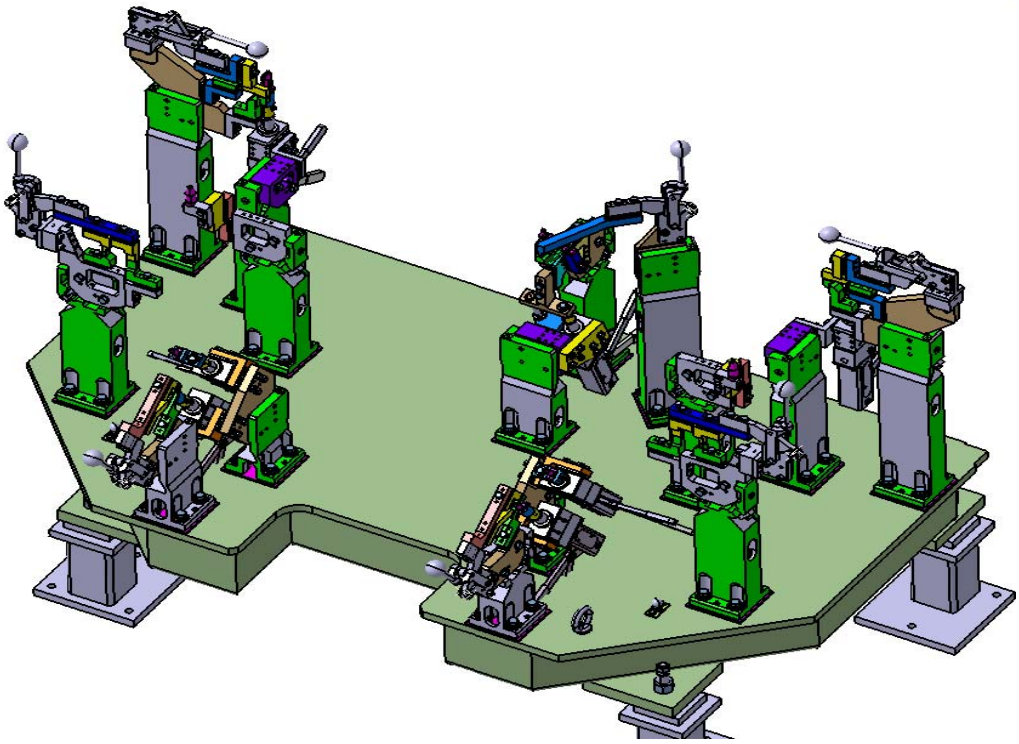

Fig. 4. Straight station with adjustable legs

CONCLUSIONS:

In addition, many leading firms in a variety of industries also find Leica measurement and inspection solutions indispensable. Practically all renowned car manufacturers depend on Leica measuring systems to obtain extremely tight tolerances (0.01 [mm] maximal eroor) mandated by today's designs. BMW, DaimlerChrysler, Ford Motor Company, MAN Commercial Vehicles AG, Renault, Toyota, Volvo and VW are just a few of our standard bearers.

REFERENCES:

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[2] – www.leica-geosystems.com