



*Technical Report #54*

*Dimensional study on AJUSA oil pipes*

## Technical Report

### Purpose

*The aim of this technical report is to show the importance of dimensional control during design and manufacturing stages of AJUSA turbocharger oil pipes.*

### Description

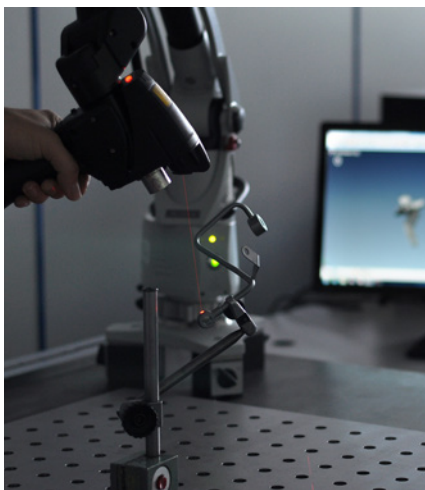
*AJUSA oil pipes undergo exhaustive quality controls that are carried out making use of the most advanced equipment in the market. Among other controls on this concrete product, such as leakages measurement or corrosion level test, a dimensional verification is done both in the design and development stage and during the manufacturing process.*

*Dimensional control on an oil pipe is a critical feature and sometimes it is extremely complex. Because of its geometry, using traditional methods turns out to be an uphill struggle and therefore it is almost essential to make use of three-dimensional tools in order to obtain precise data.*

*These oil pipes must supply oil from the block way out to the turbocharger core inlet, which many times turns the pipe into a twisting path with more than ten different curves which connect straight parts in different planes.*



*Picture 1. AJUSA Oil Pipe.*

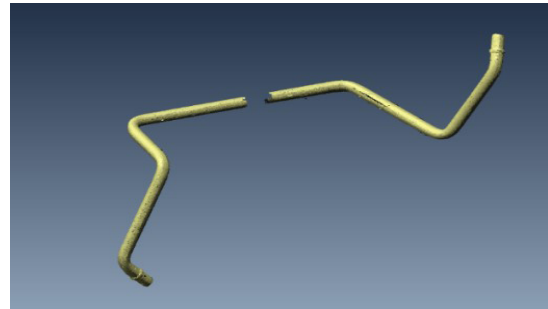


*Picture 2. Oil Pipe 3D Scanning.*

*For these sort of verifications, designing processes or reverse engineering, Ajusa uses a 7 axes three-dimensional arm equipped with an RS3 laser. Its purpose is to capture data of spatial position X, Y, Z from the surface of the pipe, obtaining this image directly in digital form so that it can be processed later.*

*The scanning precision is under 0.09 mm and its capture ratio can reach up to 460.000 points per second.*

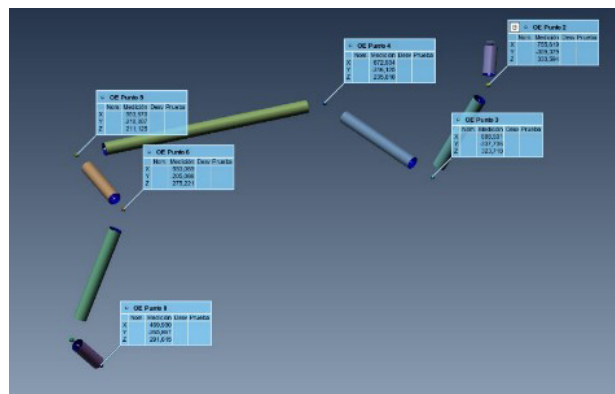
*With this measurement method it is not necessary to make contact with the pipe during the process because it is scanned from a few centimetres distance. The image is digitalised in real time in the form of a point cloud, thanks to the associated software.*



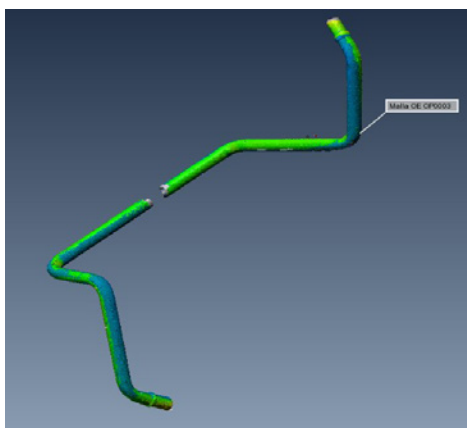
Picture 3. Point cloud of an oil pipe.

*The use of this tool in the design and manufacture of oil pipes and other Ajusa products is therefore of utmost importance as it ensures a precise product development, meeting all the required technical specifications.*

*The next step consists on carrying out different operations in order to turn the point cloud into parts with a precise geometry. For example, coordinates of the intersection between straight cylinders are obtained, as they are necessary for the curving process.*



Picture 4. Point cloud processing.



Picture 5. Deviations between two oil pipes.

*With respect to dimensional verification and technical control, manufactured pipes are analysed in order to identify the deviations between different production batches or between the pipe and the CAD design.*

*A colour map defining the tolerances is done, and it is adjusted according to them. Furthermore, data and numerical reports are obtained with the aim of validating the pipe dimensionally. Those reports and data are used later for quality statistical studies.*