



Residual Stress Experts



- Aerospace
- Conventional Power Generation
- Manufacturing
- Maritime
- Nuclear Power Generation
- Oil and Gas
- Rail and Transport

VEQTER is an engineering company providing excellence in the measurement, analysis and management of residual stresses. We are world leaders in our field and offer expertise on any aspect related to residual stresses in engineering components and structures.

Deep-Hole Drilling Technique

The deep-hole drilling residual stress measurement technique is a semi-invasive, mechanical strain relief technique (i.e. the strain of the component is measured during stress relief from the removal of a small amount of material). The technique has been successfully applied to a wide range of components.

The deep-hole drilling technique has been developed exclusively at the University of Bristol since 1992 with heavy funding and support from the UK nuclear industry. To that end the UK nuclear industry has been using extensive deep-hole drilling residual stress measurements to help demonstrate plant safety for many years.

VEQTER has a number of dedicated machines for carrying out the deep-hole drilling technique anywhere in the World. At our laboratory facilities or on-site, we measure residual stresses up to depths of 750mm.

To find out how VEQTER can help you please contact us on +44 (0) 117 987 8015 or using experts@veqter.co.uk

Deep-Hole Drilling Process:

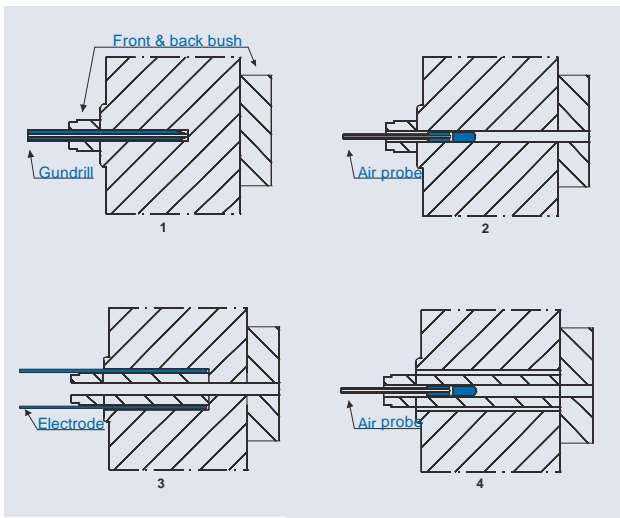
The procedure used for the deep hole drilling technique can be divided into 4 basic:

Stage 1 – a small diameter reference hole is gun drilled through the component and attached reference bushes.

Stage 2 – the diameter, ϕ_0 , of the reference hole is measured through the entire thickness of the component and reference bushes.

Stage 3 – a cylinder of material containing the reference hole along its axis is cut from the component, using an electro discharge machining process.

Stage 4 – the diameter, ϕ , of the reference hole is re-measured through the entire thickness of the cylinder and reference bushes.



Stages in the DHD technique

The diameter, ϕ_0 , of the reference hole measured in Stage 2 is the diameter when residual stresses are present. During Stage 3 the residual stresses are relieved, hence the diameter, ϕ , of the reference hole measured in Stage 4 is the diameter when residual stresses are not present. The differences between the measured diameters in Stages 2 and 4 enable the original residual stresses to be calculated.

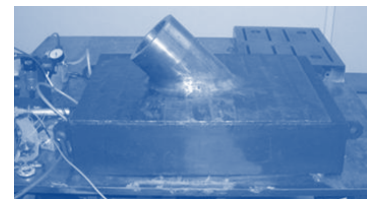
VEQTER Ltd performs the deep-hole drilling technique using three different sizes of reference hole diameter (i.e. 1.5mm, 3mm and 5mm) depending on geometry of the component and the expected residual stress profile.

Benefits of the DHD technique:

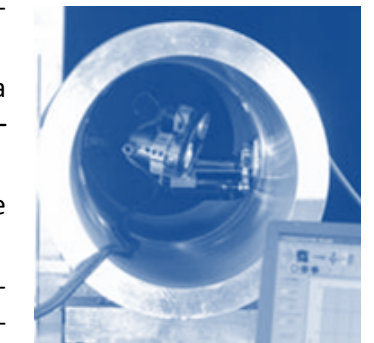
- Residual stresses can be measured at depths up to 750mm
- Laboratory or “on-site” measurement capability
- Bi-axial residual stress distribution measured (including stress gradients)
- Applicable to a wide range of materials, both metallic and non-metallic
- Applicable to both simple and complex component shapes
- Nominal accuracy: 10MPa – Aluminium, 30MPa – Steel, 15MPa – Titanium
- Indifferent to surface finish of component
- Indifferent to grain structure/texture of component material
- Semi-invasive – enabling repeated residual stress measurements at many different stages in component life
- Extracted cylinder of material provides stress-free sample for further material tests and validations
- Fast process in relation to quantity of stress information produced.



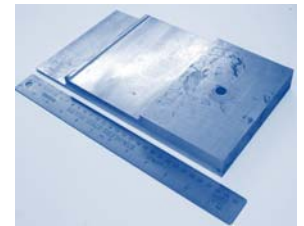
BWR shroud support mock-up



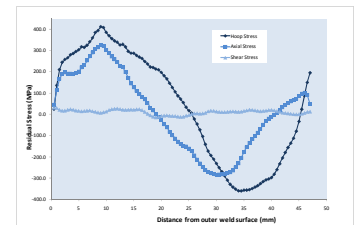
CRD mock-up



“Mini” machine deployed within a pipe



Rollled aluminium stepped plate



Deep-hole drilling residual stress measurement results

Limitations of the DHD technique:

- Not applicable through components of less than 10mm thickness
- Semi-invasive – the resultant hole might need to be re-filled or a mock-up be provided