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Extending the fatigue life of oilfield drilling equipment

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The majority of drill pipe failures occur as a result of metal fatigue. Fatigue fractures propogate as a result of cyclic stresses that are often far lower than the static design stress for the component. The fatigue damage is cumulative and permanent with cracks propogating until the remaining section is unable to withstand the application of a single load.

The problem for the equipment operator is that accumulated fatigue damage is extremely difficult to detect during standard inspection. When the damage is at a stage where it can be picked up it is likely to be extensive with the part already in a critical condition.

Factors effecting fatigue life:

- Mean tensile stress
- Stress amplitude
- Corrosive nature of the mud system
- Fatigue strength of material
- Pipe geometry
- Residual tensile stresses from the manufacturing process

Tensile residual stresses that are often introduced during manufacture sit close to the material surface and are effectively added to the operating stresses. These tensile residual stresses attempt to pull or tear the material apart accelerating crack propagation.

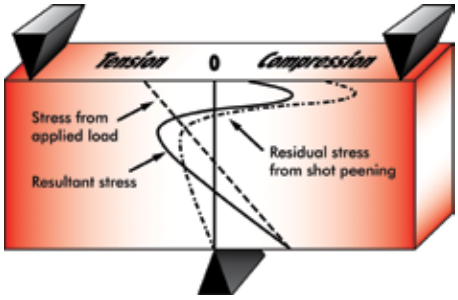
Extending Fatigue Life

The majority of failures have been found to occur around section changes, the postion and geometry of these should therefore be carefully considered at the design stage. Materials with high fatigue strength should also be selected.

It is of course possible to extend the fatigue life of the equipment by operating it at reduced loads however, this may not be desirable.

One cost effective method of extending fatigue life is to carry out a controlled shot peening operation. Shot peening involves firing spherical media at the component surface in a controlled manner. The impacts produce spherical dimples in the material surface causing elastic plastic deformation. The overlapping dimples replace the harmful tensile stresses with a layer of compressive residual stress. The compressive layer helps to prevent the initiation and propogation of fatigue cracks by effectively reducing the applied load at the surface and sub surface.

When properly specified and applied the compressive layer produced by controlled shot peening can be driven deep enough sub surface to sit below pre-existing and post-manufacturing initiation sites such as pits, scratches and notches.



Other fatigue failure modes such as stress corrosion cracking (SCC) and corrosion cracking can also addressed by removing tensile stresses with controlled shot peening.

In addition to controlled shot peening at new manufacture stage, it is also possible to carry out blasting and shot peening of in-service parts to restore fatigue life, particularly if parts have been operating in a corrosive environment.

Controlled shot peening is a very economical and well proven method of extending fatigue life in Oilfield Drilling Equipment, Welded Structures, Pumps and Valves.

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The Dublin Spire – a stunning example of our surface texturing technique showing the versatility of controlled shot peening

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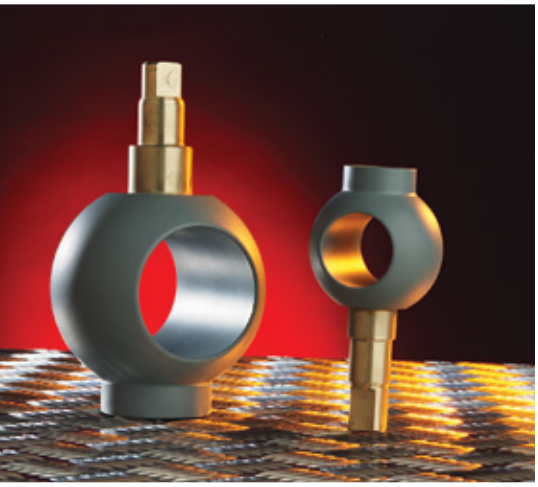

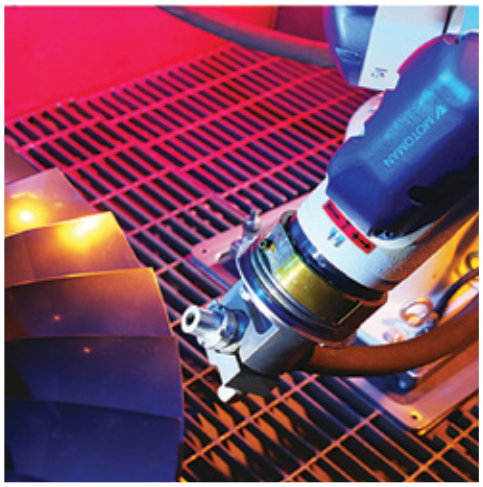

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