'Cold straightening' of bent shafts may save time and money

Class-approved cold straightening of bent shafts may save time and money compared to replacement with new shafts.

Published 02 September 2024

Written by Siddharth Mahajan

Some casualties involve damage to machinery parts which are considered very difficult to repair or deemed irreparable. This includes various types of shafts, such as propeller shafts and rudderstock. Large diameter shafts are subject to bending, which can occur during manufacturing, processing or in subsequent use. Such bending can occur in the rough forging of the shaft and when machining to final dimensions. In lively forgings the final cut for a keyway or similar can create bends. In some circumstances, the shafts will become bent after a period of use, or for example if a propeller strikes an obstruction.

Whether or not a shaft is reparable can sometimes give rise to disagreement between shipowners, manufacturers, repairers, classification societies and underwriters, and will require all parties to consider closely the various methods of repair available. For more than a decade Gard has had experience with a particular repair method for shafts known as "cold straightening", which has saved shipowners and underwriters substantial time and money.

The "cold straightening" method The cold straightening technique is more than 50 years old and has developed and improved over time. The latest technology allows straightening of shafts of all sizes - from 20mm to more than 1, 500mm in diameter and more than 25 metres in length - as well as straightening the shaft within very narrow tolerances, even more precise than when the shaft was manufactured in the first place. Cold straightening equipment consists basically of hydraulic presses equipped with numerical control and sensors for dimensional inspection of parts.

An example a bent propellar shaft before and after cold straightening.

Cold straightening does not affect the metallurgy of the shaft, as it actually releases stress from the material. This differs from other straightening methods, such as the hot-spot method which uses heat and puts stress on the material, affecting the metallurgy of the shaft.

The cold straightening method is favoured because of its accuracy and quick delivery time. The most common shafts can be straightened within 24 to 48 hours and for only a fraction of the cost of a replacement.

A bent propellar shaft 1 meter out of line, and after repair.

Advantages associated with the cold straightening method include the following:

- It is fully approved by all major classification societies.
- It is considered to be a permanent repair.
- The result is equivalent to a new shaft.
- It is fast and cost effective.
- The metallurgy of the shaft material is not adversely affected.

An example of successful "cold straightening" repairs In one case, a vessel grounded and the propeller shaft was bent substantially, being considered irreparable in the first instance. However, the parties agreed to forward the propeller shaft to a company specialising in cold straightening, in order to consider the possibility of repairing the shaft before deciding to replace it with a new one.

Bent rudderstock before and after cold straightening.

The bent propeller shaft The vessel had suffered extensive propeller shaft and rudder damage when it hit a rock off the Norwegian coast. The propeller shaft had only turned half around

when it was blocked and pulled approximately one metre out of the stern tube. The vessel suffered water ingress, but was safely towed into a quay. Subsequent examination showed that the propeller shaft had suffered massive damage and was heavily bent The manufacturing of a new propeller shaft would require more than four months, Cold straightening was proposed and found to be much cheaper and faster than commissioning a new shaft. The propeller shaft was transported to the repair company in Denmark and within one week the cold straightening repairs had resulted in a 0.01mm deflection from centre line, being successfully completed to full class approval as permanent repairs without any recommendation. Later, the shaft surface was machined 1mm off and executed within the demands of class.

This incident illustrates the importance of considering alternative repair methods, such as cold straightening, when shafts are heavily bent.

We wish to thank MarineShaft, Hirtshals, Denmark, for their contribution in the preparation of this article.