Propeller shaft straightening reduces costs and downtime

Using specialised companies for shaft straightening processes can significantly reduce downtime and represent an attractive commercial option for operators.

As ship sizes have increased, so have the lengths of propeller shafts and classification societies are reporting more instances of propeller shaft damage due to alignment problems. Lead times for replacement shafts can be significant, so techniques have been developed to recover damaged shafts by using processes such as cold straightening.

The principles were first established more than 40 years ago and can be equally applied to propeller shafts and rudders stocks. Bureau Veritas was the first classification society to approve the technique in 1972 and since that time others have followed with approvals as the principles and processes have been improved and validated. These recoveries are not regarded as temporary measures but are now accepted as fully acceptable for continued service use.

Danish company MarineShaft Hirtshals specialises in cold straightening of shafts with diameters from as small as 20mm to more than 1,000mm. Equipment is purpose-built and press capacities can deliver up to 6,000 tonnes of force. A range of 18 lathes are capable of managing components up to 5m in diameter and 25m long, allowing large shafts and rudder stocks of up to 100 tonnes in weight to be handled.

The company has approval from all leading classification societies and work is done in close association with these, with full certification provided on an individual basis for each repair. Weld repairs are also undertaken and MarineShaft maintains a team of fully qualified and certified welders.

MarineShaft claims that many of its repairs can be completed within 48 hours of the arrival of a shaft at its workshops. In order to achieve these times, the company will operate 24 hours a day when urgent repairs are required to limit the downtime of vessels. It also claims that recovered shafts can, in some cases, be straightened to tighter tolerances than when new, achieving figures of within 0.05 mm or better, even on large shafts.

Vessels operating with propeller shafts straightened by MarineShaft include the 74,927 dwt products tanker Stena Poseidon and the 13,200 dwt ice strengthened bulk cargo carrier Tali, which suffered damage to both its rudder and propeller shaft when it grounded in rough seas off the Norwegian coast. The straightened propeller shaft and its repaired rudder and rudder stock were certified by Lloyd's Register.

The use of shaft straightening techniques is not limited to independent manufacturers or service companies; major OEMs such as MAN Diesel & Turbo andwartsila also offer straightening services. The MAN Service Centre at Frederikshavn in Denmark has hydraulic press facilities to carry out the operation and quotes examples of repairs being carried out in as little as three days, stating that cold straightening can be both quick and cost-effective.

Work is class-approved and non-destructive testing can be carried out to confirm that no surface cracking has taken place or there are no sub-surface defects present, caused by the initial bending or the straightening process. Press capacity also enables rudders stocks and other shafts of up to 500mm diameter to be cold straightened.

Wartsila supports the same business principles, pointing out that bent propeller shafts can not only result in wear of bearings and damage to other components but, in the worst case, can disable a vessel with resultant safety implications. The company also has a facility in Denmark and can complete many recovery projects within 48 hours of arrival of the parts at its workshop. Repairs are fully approved and certified by classification societies and considered as a permanent solution.

Cold straightening is carried out with a numerically-controlled hydraulic press and the operation does not adversely impact material properties. Shaft geometry is restored and welded with superlative accuracy. According to the company, results are well within the same limits as those of a new shaft.

OSV Gamleby, which suffered damage to its rudder and shaft when it hit a whale while underway off the Norwegian coast, is another example of successful cold straightening and welding of shafts and rudders. The operator’s recovery vessel, Bunkerman, has the capability to retrieve damaged parts of up to 530mm diameter and remove the damaged section. Cold straightening and welding of shafts and rudders can be completed within four days of arrival and the operation does not adversely impact material properties. Re-work and welding is also possible.

Wartsila claims that finished tolerances are within the same limits as those of a new shaft.

Damaged bearing journals can also be built up by plasma spray methods or weld build-up techniques. Metalock Engineering is one such company that quotes examples of shafts that have been recovered following bearing failure causing surface damage to the shaft bearing area. After machining down to remove the damage and preparation by sand blasting, an arc-spray coating can be applied to build up the shaft diameter prior to re-machining. The coating materials used are both hard and self-bonding, making them suitable for repairs on heavy duty shafts.

A further technique for recovery of damaged shaft surfaces is laser welding. The principle involves the use of a high-energy laser beam employed to heat and bond new material to a prepared surface. Although it is suited to high volume automated processes, Swedish company Hoganas has developed the process for applications such as propeller shaft repair, successfully depositing material at rates of up to 8 kg/hour and thickness up to 4mm.

One example quoted is the repair of a shaft of 11.5m length where the damaged section was recovered by laser cladding with 300kg of new material, the full process being classification society supervised. Evidence from preceding trials and the repair itself demonstrated that the filler material used provided superior characteristics to the base material and the repair was accepted as being a permanent solution.

Source: Marine Propulsion - Feb/March 2014