Rudder Overhaul

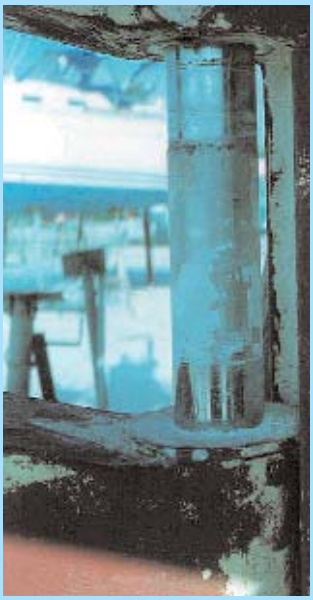
by Chris Haire

Even trouble free and simply engineered components will one day require serious attention. Unless water is pouring through at a furious rate it's easy to put off a major overhaul on the rudder assembly for another day, even though this is one of the most vital systems on a boat.

This was my attitude and even when the rudder shaft started to drip very slightly my reaction was to apply a 'stop gap' solution which would deal with the problem in the easiest way with the minimum disturbance to the rudder assembly and with the boat remaining afloat. The leak was abated by extending the rudder tube within the hull above the waterline by fixing with jubilee clips a rubber hose and a metal top bearing liberally stuffed with grease. All this involved was to disconnect the quadrant, which came apart without difficulty and slide the rubber over the shaft and tighten the clips. The repair was satisfactory and the leak stopped but a little more effort was now required with the steering. As time passed the wheel became harder to turn. The steering, which had previously been very light – two fingers on a spoke now required two hands on the wheel rim. With the boat out of the water I decided to investigate.

My first discovery revealed that the quadrant was now in contact with the aluminium angle that formed part of the steering assembly. There was a lot of wear on the angle from the contact with the quadrant – metal fragments were deposited on the grease lubricating cables and pulley sheaves

Dismantling the quadrant was very difficult – the four stainless steel bolts securing the quadrant to the shaft had become completely stuck into the threaded aluminium of the quadrant. The only way to separate the two components of the quadrant was to cut the bolts with a very slim cutting disc at the join by the rudder shaft. This was achieved without damage to the quadrant or the rudder shaft. A machine shop was able to drill out the seized bolts and recut the thread within the aluminium. Extensive corrosion to the underside of the quadrant was revealed, which had been caused by contact with the brass bearing fitted at the time of the temporary repair. However, with the removal of the rubber extension piece and bearing, the rudder still remained very stiff to turn with a great deal of pressure being required on the edge of the blade to get the rudder to swing.



Above left: Lowered rudder shafts showing oxide deposits
Above right: Rudder held in position prior to fitting new rivets

Extended rudder tube and additional o rings prior to glassing to hull

Existing rudder shaft hub with o rings

The cause for the original seepage of water through the top of the rudder tube could be ascribed to the failure of the neoprene O-rings located within a hub bonded to the hull. These had been fitted as a postproduction modification by the manufacturer as a replacement for the original stuffing box, which had been deemed unsatisfactory. To change the O-rings would require dismantling the rudder bearings and taking the rudder out . The cause of the corrosion to the quadrant was the result of the contact of 2 dissimilar metals lubricated by salt water from the defective seals. Contact had occurred due to the rudder shaft dropping 5mm when a nylon spacer located in the heel fitting disintegrated. Although the rudder assembly was wired to the anodes, the aluminium of the quadrant was more vulnerable than the zinc on the anodes.

With a semi-balanced rudder and skeg design it should have been possible to remove the rudder by dismantling the bronze bearing which is fixed to the base of the skeg. As the four slotted head bolts were seized to the shoe fitting, the only way to remove the rudder was to take off the shoe from the skeg by grinding off the face of the copper rivets holding the shoe to the base of the skeg. This was done with the base of the rudder supported on blocks and an extended hydraulic jack. Once the rivets had been removed, the jack was lowered allowing the rudder shaft to be gently withdrawn from the hull. Although heavy, the rudder had to be 'worked' loose before it would drop down under its own weight. The corrosion from the aluminium quadrant had resulted in deposits on the shaft between the O-rings. This combined with the contact of the quadrant with the frame was the reason for the increased effort at the steering wheel.

Rudder Overhaul (continued)

by Chris Haire

The rudder was manhandled into the back of an estate car and taken to the machine shop so that the bronze heel fitting could be separated and the deposits polished off the shaft. It was necessary to dismantle the heel bearing as it was the only way to replace the nylon spacers – these were split so that they could be folded around the exposed lower section of the rudder shaft which was otherwise encapsulated within the fibreglass structure of the rudder. The slotted head bolts, once removed, were too badly damaged to be reused. The original Whitworth thread could not be matched, so the threads in the heel were drilled out and remade to receive 16mm socket head bolts. The split nylon spacers were remade using Delrin which is more resistant to water absorption.

Before offering back the rudder for re-assembly, the O-rings in the hub were replaced.

To forestall a repeat occurrence of O-ring failure the rudder tube within the hull was extended above the waterline to finish just below the underside of the quadrant. An oversized piece of stainless steel tube containing 2 Delrin bushes each holding an additional O-ring was slid over the rudder shaft – now refitted to the hull. The stainless steel tube was covered in a thin plastic slip-sheet to which glass fibre and resin was applied moulding it to the inside of the hull. The tube is held in place to prevent rotation by self taping screws taken through the fibreglass into the metal. Should the lower O-rings need replacing it should be possible to separate the extension tube from its supporting GRP surround.

With the rudder back in position, there just remained the refixing of the heel to the skeg using 12mm copper rods with the ends beaten over – a job requiring two persons and extra heavy club hammers. To assist in burring over the rod ends, a strong punch was held at the end of the rod and then hammered. Finally, the quadrant was refixed and the steering cables reattached and greased. The steering is now as it was when I first bought the boat - as light as a feather.

Exhaust/cooling water injection elbow

by Laurence Gandar

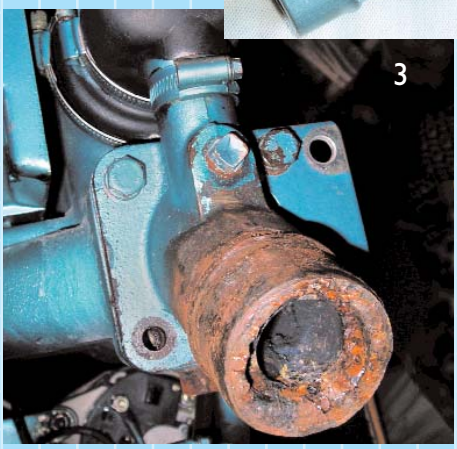
This was not the job that I had intended to do when I started. The item of winter maintenance was to replace the domestic water pump and fit an accumulator to smooth out the water flow and stop the pump cycling. This was easily achieved.

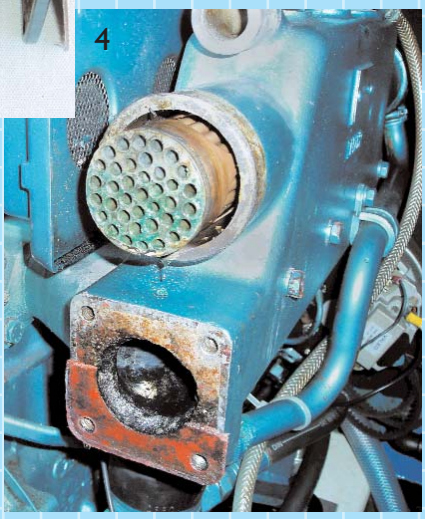
However, to get at the water pump satisfactorily I needed to remove the engine exhaust pipe. Having got the old exhaust hose disconnected I happened to inspect the exhaust elbow where the cooling water is injected into the engine exhaust. From the photograph (pic 3) it is evident that there was very little clearance remaining between the water injection pipe and the exhaust pipe itself.

The engine is a Thorneycroft T 98 and although this is the second time I have removed the exhaust pipe it was the first time that I had inspected this particular part of the engine system. The engine hours are about 1500 although the engine is now 14 years old We are not experiencing any apparent overheating or lack of cooling water throughput, but in the previous season the salt water pump shaft seal had failed, and in hindsight this could have been partly attributed to increased pressure as a result of the constriction in the exhaust pipe.

Removal of the exhaust elbow was not complicated, but on inspecting the amounts of very hard deposits in the exhaust pipe I decided that a replacement unit was better than trying to clean up the old one. All the parts were obtained from Thornycroft Engines who provided an excellent service, even supplying new bolts and gaskets, in addition to the elbow and water connection parts and of course the rubber bellows.

As I said at the beginning this was not intended to be routine maintenance, but I would suggest that other owners check it from time to time!





1. Shows correct clearance between exhaust pipe and water injection elbow
2. Exhaust pie (right part) and water outlet pipe
3. Corrosion in exhaust outlet
4. Heat exchanger (top) and exhaust outlet