Paper E Rudder Blade Change

First published c1979, updated by John Ingleby A95 2007

Atalanta type folding rudder blades, over about 15 years old could be near the end of their fatigue lives and so be suspect. So mentioned an article in the 1979 newsletter following the failure of T12's blade the previous year. An investigation was organised and the following report was published. We are indebted to our Hon. Member Maurice Donovan for this report made in 1979. (updated 2007)

A metallurgical examination of part of a the blade which broke off while T12 was rounding Beachy Head in 1978, showed the failure was caused by corrosion fatigue. When a folding blade flexes from side to side in a seaway, fatigue stresses are produced where the blade enters the stock. Then as time goes by microscopic fatigue cracks, invisible to the naked eye, begin to develop in the surface and gradually grow inwards, especially from areas where stress tends to concentrate, such as the bottom of the corrosion pits. Eventually not enough sound metal is left to withstand the loads on the blade, cracks suddenly propagate and the blade breaks. This is what happened to T12 and Al 24's blade was on the way to the same fate. *(It is possible that both these blades were Type 1 or 2, therefore only 3/8 thick and with a narrow neck. Hon Sec. 2007)*

All structural metals and alloys can be susceptible to fatigue; some more than others. Generally, the lower the stress the greater number of reversals a given material will stand and the longer it will last. Thus, it follows that protecting a rudder blade from corrosion by fitting sacrificial anodes should help to prolong its life. *(The blade in A95 is Type 3. In 1985 it was shot blasted and two pot sprayed professionally. I check each year, but no problem yet. Watch this space Hon. Sec. 2007).*

Unfortunately, it is not possible predict how long a given rudder blade will last as usage and conditions vary from boat to boat. From the evidence we have, it is apparent that 3/8" thick blades (this includes Fulmar blades) over 15 years old, that show extensive pitting corrosion e.g. 1/16" deep, are more than suspect and almost certainly should be replaced. Later type 3 Atalanta blades are 7/16" thick and about 2" wider at the critical zone and perhaps should last a bit longer, though by how much is difficult to speculate. Any blade, which has been bent accidentally and re-straightened, should be regarded with suspicion.

It is suggested that owners should also examine the condition of the blade swivel bolt for signs of deep corrosion and replace if more than about 1/16" deep. This component serves to hold the cheeks of the rudderstocks in line, so it is obviously important that this is in a sound condition as well. As will be seen under the section on materials, the nut and bolt are made from different aluminium than the rest of the rudder.

TYPES OF RUDDERS

The Atalanta, Titania, Fulmar and 31ft all use aluminium alloy folding rudders. Drawings of all parts of these rudders are available from the Drawing Master. BLADE DRAWINGS ARE AS FOLLOWS: -

BOAT	DESCRIPTION OF BLADE	THICKNESS	Drg. No.
A26	Type 1 Dinghy shape	3/8" - 10mm	A 24261
A26, Titania	Type 2 Semi elliptical	3/8" - 10mm	A 24536
A26	Type 3 Tapered	7/16" - 11mm	B 24788
Fulmar	One type Dinghy shape	3/8" - 10mm	A 2076
A31	One type Tapered	1/2" - 12mm	A 31038
	Pivot nut and bolt drawing number for A26 only		024779

NOTES: 1. A26 type 2 blade superseded type 1 for use in type 1 stock
2. A26 type 3 was used with all boats with welded stock

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MATERIALS — RUDDER BLADES
All rudders were made from aluminium alloy designated N 5/6 at that time, then changed to Alloy NS 8 for marine use to British Standard 1470. The nominal composition of this alloy is with, 4.5% Magnesium, 0.7% Manganese. Current Code specification is 5083 in the soft or 1/4 hard condition.

When ordering ask for Aluminium Alloy 5083 in the soft or 1/4 hard condition. This alloy may be obtained from Aluminium Stockists (see Yellow Pages or consult the Aluminium Federation 0121 6016363). Some stockists may not be prepared to supply cut lengths from standard 6' x 3' or 8' x 4' sheets or their metric equivalent.

MATERIALS — PIVOT NUT AND BOLT (D24779)
The pivot nuts and bolts were made from a stronger aluminium alloy. The present day standard is 6082 T6. The composition of this alloy is nominally Aluminium with 1% Magnesium, 1% Silicon and 0.7% Manganese. It should be used in the strong or heat-treated state and it can be purchased from most stockists in this form.

MAKING NEW BLADE
If you propose contracting the job to a local engineering firm, it might help to supply a drawing as well as the old blade for a pattern.
If it is to be a DIY job, then it may be worth hiring a powered jig saw, with metal blade, to cut out the shape and a powered routing tool to spindle out the downhaul groove. After cutting to shape the edges will need rounding off. Finally drill the hole for the swivel bolt using a suitable tank cutter.

FINISHING
Fairey Marine anodised all parts of aluminium rudders. This treatment is the same as that used to anodise metal spars. Your nearest electro-plating service (see Yellow Pages) should be able to advise you who can supply this service near you. Whilst anodising is not essential, it does provide some measure of protection and a very good key for painting.
It is strongly recommended that two sacrificial zinc anodes are bolted to the rudder blade, one on either side about 4" below the stock to inhibit corrosion. The anodes should weigh c1 lb.
It is essential that the surface of the blade under the anodes is scraped back to bare metal, before the anodes are bolted on.
Before fitting the blade prime it with a self-etching metal primer, (especially if the blade has been anodised). Make sure that any anti-fouling does not cover anodes. On no account should any bronze or brass fastenings be used in contact with the aluminium.
If the stock cheeks have become wider, it may be possible to have a 1/2" blade on an Atalanta.

NOTE ON OTHER MATERIALS
One owner has tried a mild steel blade, which caused severe corrosion of the stock. If the blade had been hot dip galvanised this would not have happened, though if continually immersed in salt water, it would corrode in about three years. The rudder was very heavy (3 times the weight) and he would probably need some sort of outrigger or a winch on the up-haul to assist in raising the rudder.

A laminated wooden rudder was placed on A48 about 1995, beautifully fashioned but quite thick. I have no reference of performance, or if it still exists.
Several boats have had a drop rudder installed and acceptable performances reported. Twin Rudders have been built on at least two Atalantas. No reports on performance.

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