



Internal Newsletter From

MTPNO864, Hull Ships in operation Technical Information

Technical Information Newsletter No. 3/2007

Distribution: Internal

Welding of cracks in rudder blades.

In many cases cracks in rudder blades and flaps on flap rudders are welded up since it is considered too much work to insert new plates, and the blade normally needs dismantling for proper access etc.

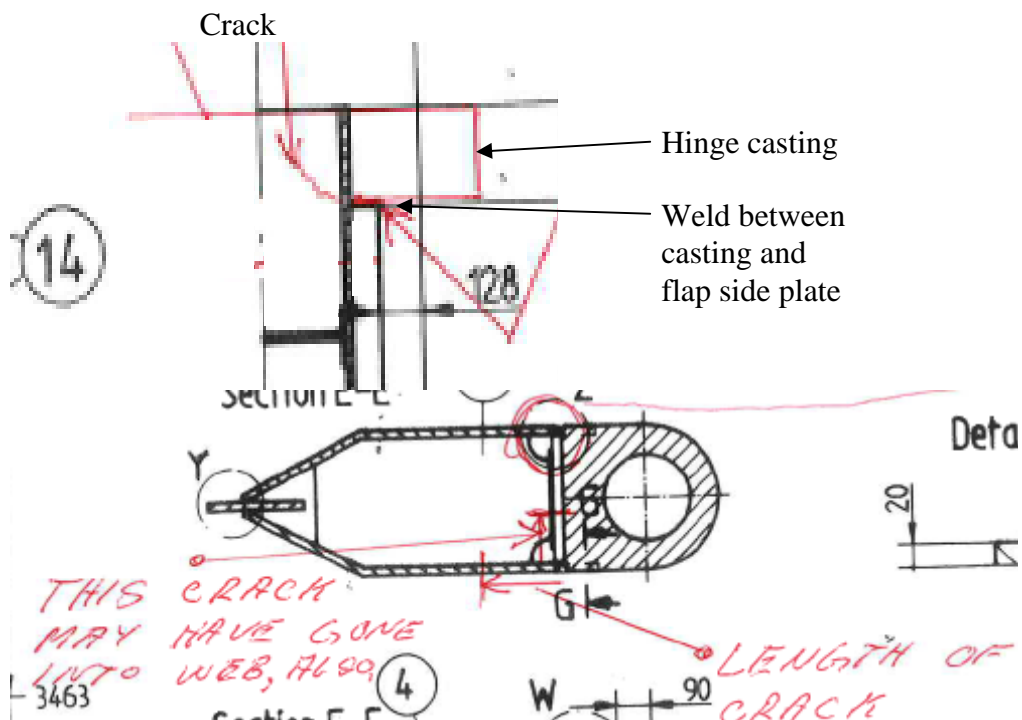
A resent case goes as follows:

Managers of a vessel reported that the upper part of the flap of a Becker type rudder was missing. Diving survey revealed that the upper half of the flap had broken off just above the middle hinge. The lower half was still intact but just hanging loose without any function.

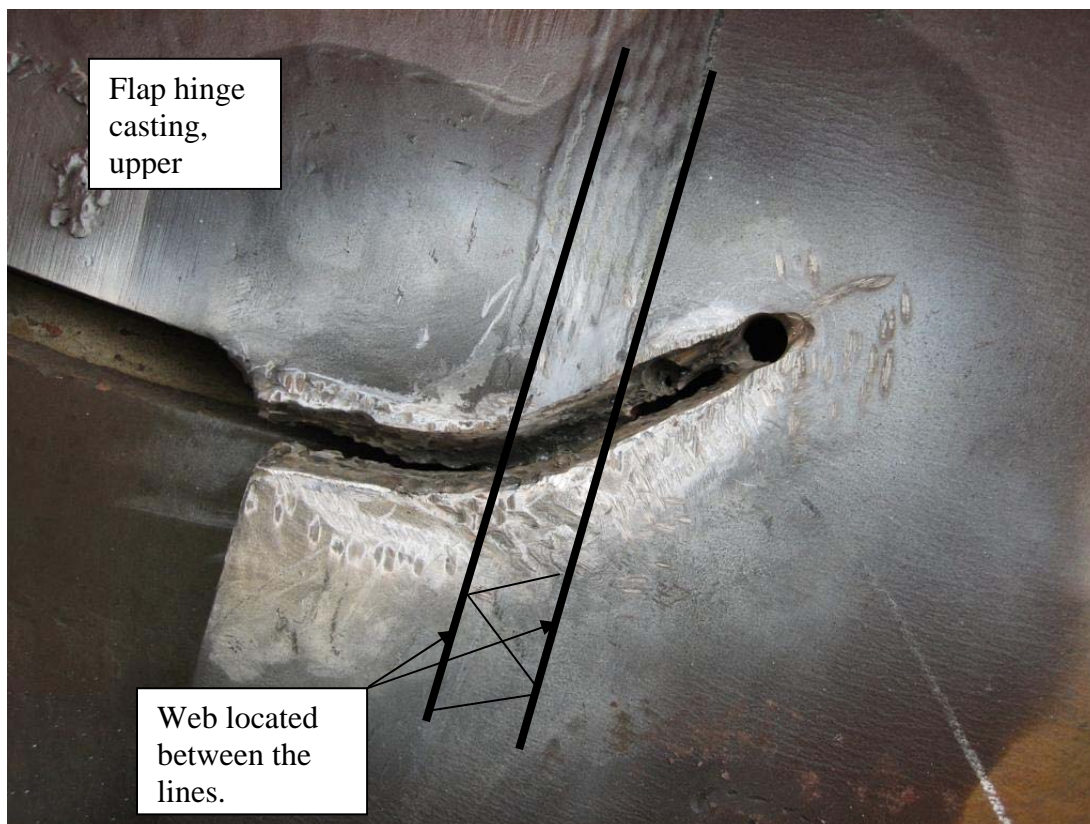
The vessel proceeded with tug assistance to port where temporary repairs were carried out consisting of welding flat bars across the remaining part of the flap and the blade, thus locking the flap so that the rudder would temporarily function as a normal rudder. CC for max 3 months given and a steering test was carried out before departure to assure adequate rudder function.

6 months earlier several cracks in the flap had been welded up by gouging and re-welding. Parts of the cracks were accessible from the back side where a ceramic backing was used during welding. One crack at the top of the flap was a bit longer and the welding was against a hinge bearing casting, thus making it difficult to fit a ceramic backing at this point. Also the end of the crack was extending past the vertical web making it impossible to back weld or inspect the root of the weld.

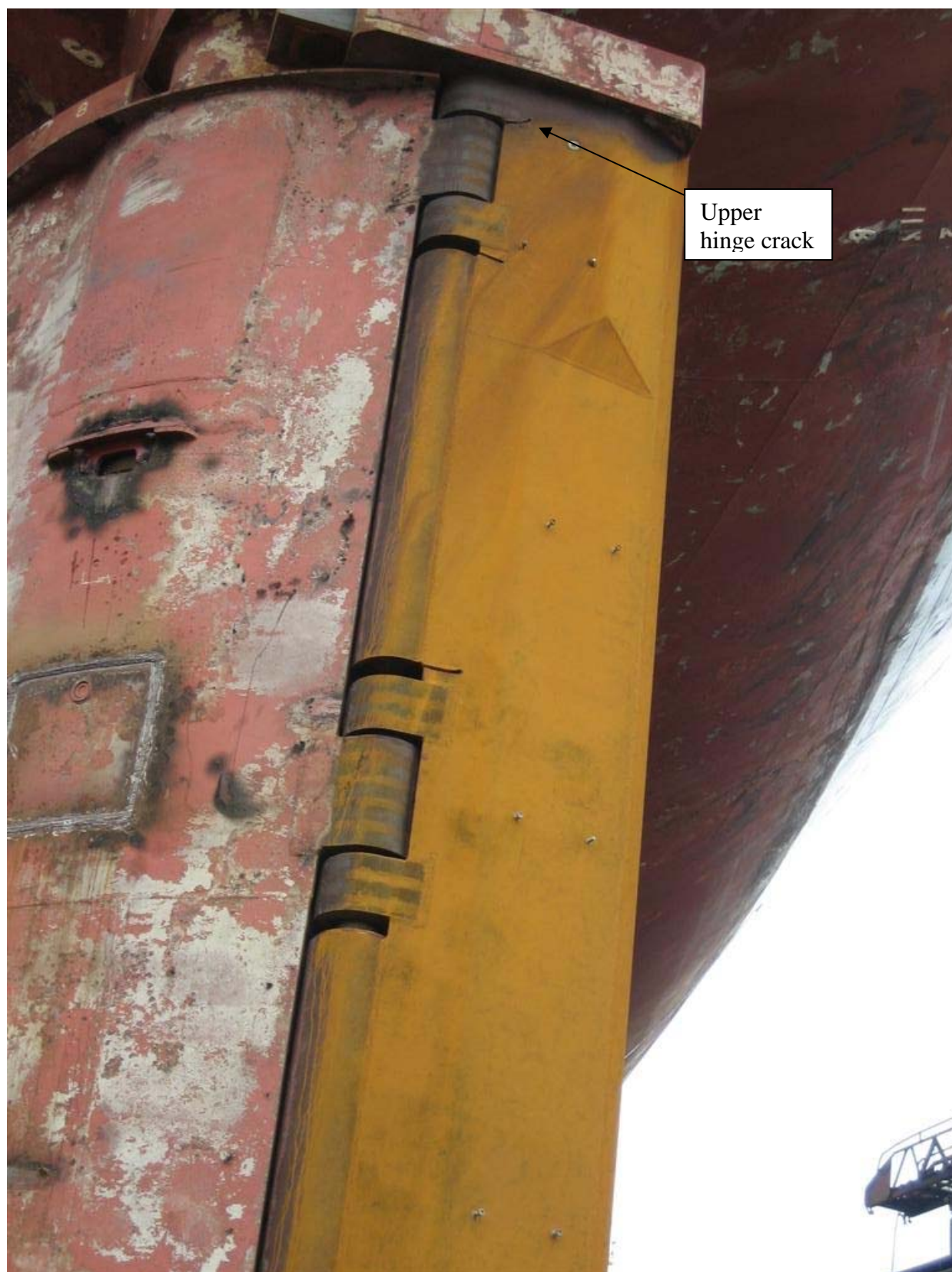
It is possible that, when this weld was re-welded, the crack had also propagated in the vertical web. (See sketches below) This crack could then easily propagate back out towards the repaired weld and cause it to crack again very quickly.



Picture below shows the crack after it had been gouged out. The web plate as can be seen on sketch above is behind the vertical weld in the picture below.



Picture below shows the flap with the crack, which may be seen right at the top. Two more, slightly shorter cracks may be seen further down.



A second recent case was picked up during report review at MTP. In this case a 500 mm long crack in the rudder blade in way of the recess for lower pintle bearing of a semi spade rudder was welded up using underwater welding and given a CC till next docking, 2.5 years into the future.

This is not the way to do it!

First of all underwater welding is only acceptable as temporary repairs for a short time, maximum 3 months.

Secondly, a temporary repair of highly stressed areas of a rudder should not be given 2.5 years in any case. Max 3 to 6 months, depending on the severity and length of cracks, would be the most we should normally grant.

This case also shows that the crack in the rudder side plate was welded (since it is clearly visible) but the internal web, which in this case was 40 mm thick, was not considered.

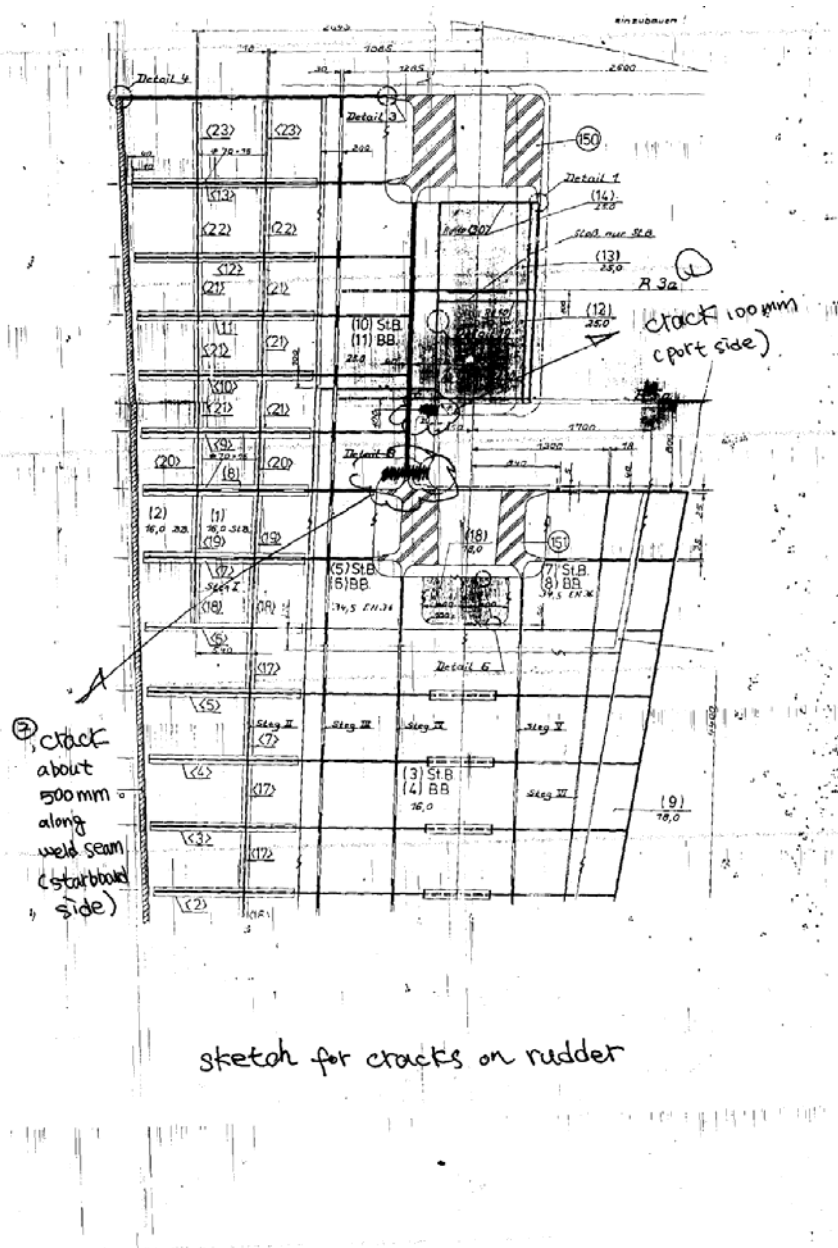
The owners were talked in to docking the vessel, and it turned out that the vertical web was also cracked, by approx 200 mm. The underwater welds had cracked again after only less than 3 months.

This case also illustrates the importance of considering internal structure and in particular vertical webs. Also underwater welding of high stressed areas is not acceptable as a permanent repair.

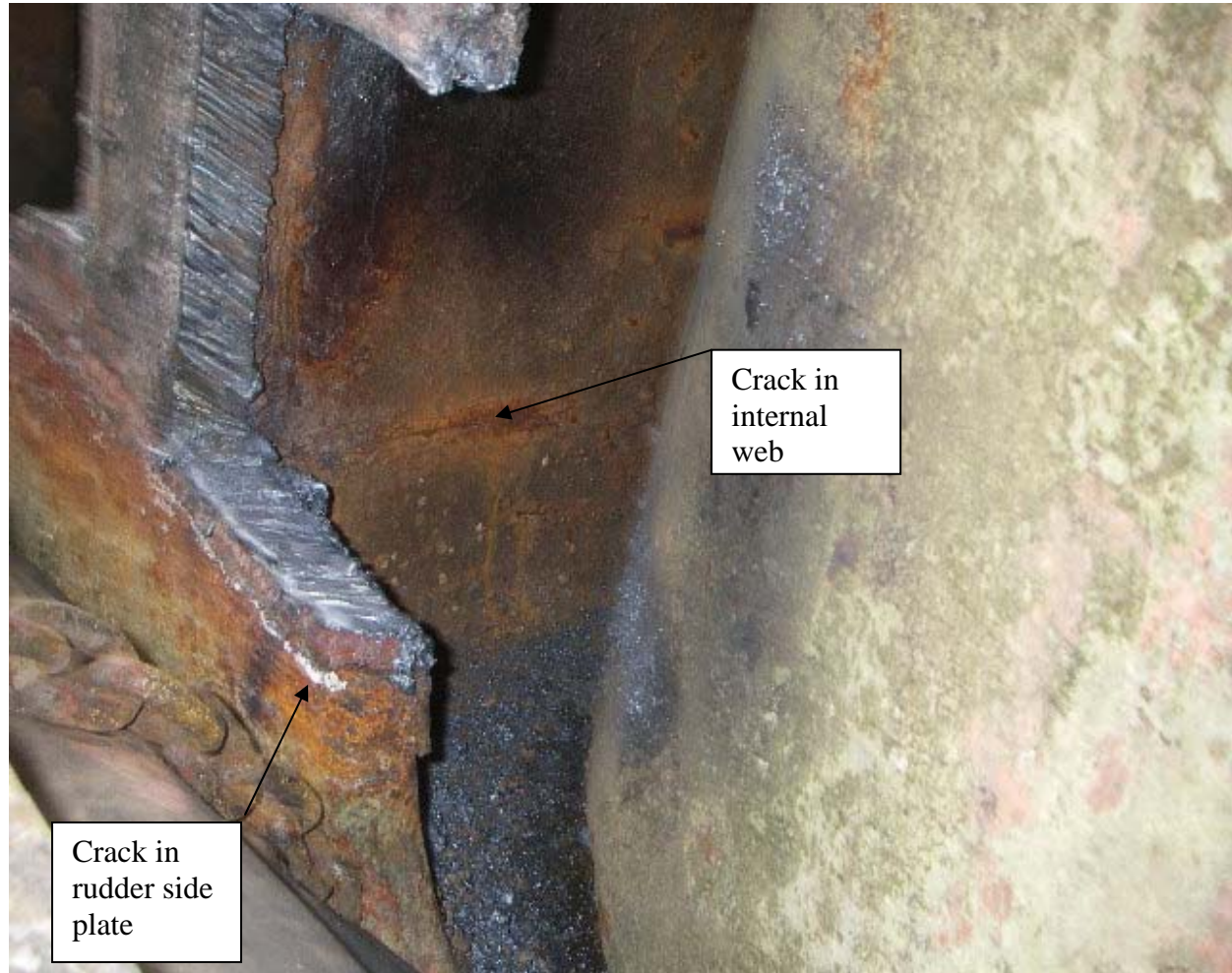
Appearance of under water welding of the crack



Position of cracks



Crack in rudder side plate and web



Crack in web after gouging and grinding (from both sides)



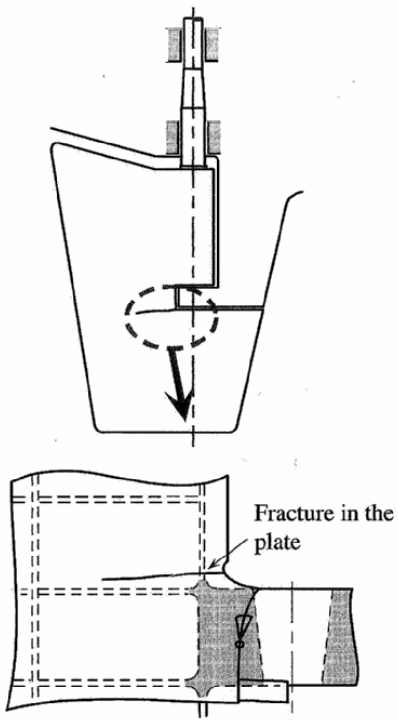
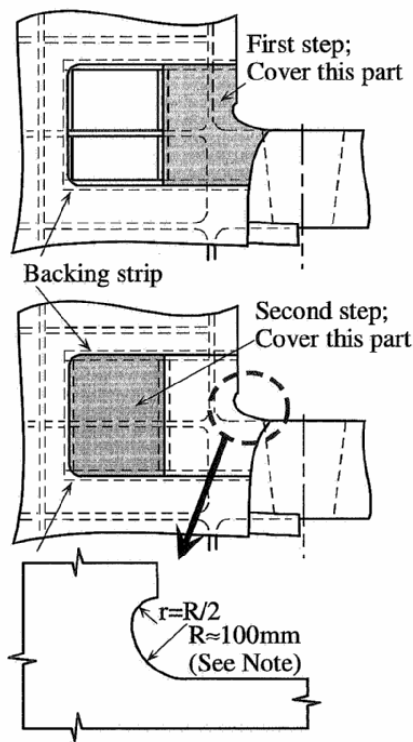
Rudder side plate after plates inserted



Conclusion:

When welding up cracks in rudder blade or rudder flaps, it is important to consider if the crack has propagated into internal structure and in particular the vertical webs.

If the cracks have occurred more than once, it is advisable to insert a new plate and to gain access to the internal structure to weld any cracks that may have occurred here. See attached repair proposal from IACS repair guideline for rudders.

PART 2	Fore and aft end regions	EXAMPLE No.
AREA 3	Stern frame, rudder arrangement and propeller shaft support	5
Detail of damage	Fractures in the rudder plating of the semi-spade rudder extending beyond the vertical web	
Sketch of damage	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Fracture in the plate</p> </div> <div style="text-align: center;">  <p>First step; Cover this part</p> <p>Backing strip</p> <p>Second step; Cover this part</p> <p>$r=R/2$ $R \approx 100\text{mm}$ (See Note)</p> <p>Note: R should be considered according to local detail</p> </div> </div>	
Notes on possible cause of damage	<p>1. Stress concentration due to inadequate local design and/or fabrication notches in way of the butt weld between cast piece and plating.</p>	
Notes on repairs	<ol style="list-style-type: none"> 1. Fractured plating is to be cut-out. 2. Internal structures are to be checked. 3. Cut-out is to be closed by an insert plating according to the sketch (welding only from one side is demonstrated). 4. Modification of the radius. 5. In case of a new cast piece, connection with the plating is to be removed outside the high stress area. 	