

Engineering Report 2007 - 03

5 HK Closing Spring Support

192348K01
(Arrow Head Assembly)

Proprietary Class 3

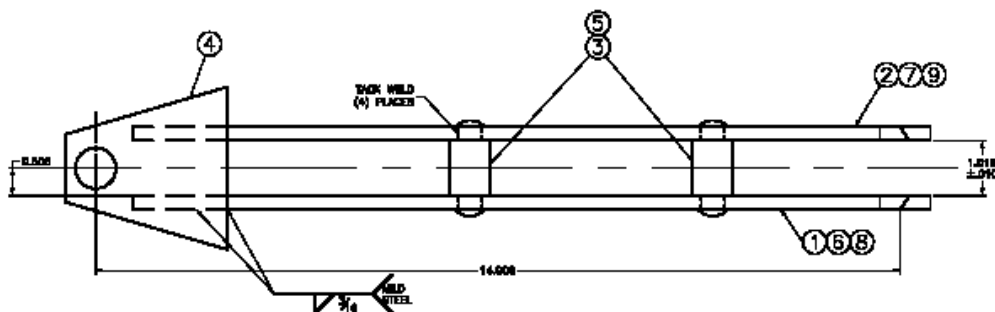
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Synopsis:

In the past it has been requested by several of ABB's customers that we evaluate the effect of broken welds on the inside of the rivets in the Arrow head assembly (items 3&5 below). There has always been some question whether the welds in the assembly contribute to the robustness of the assembly. This report is written to inform our customers of the findings of our investigation.



Arrow Head Assembly 192348K01

EVALUATION:

Three of the assemblies were tested to determine if the welds added significantly to the strength of the assembly. The assemblies were marked with T1, T2 and T3.

T1 This assembly was a welded assembly stressed in the Tenius Olsun test fixture until one of the welds broke. (This should perform similar to an assembly that has been returned with a broken weld in a breaker and found during the refurbishment process).

T2 This assembly was not welded. (This assembly should perform similar to an assembly that has been found to have all welds broken during the refurbishment process).

T3 This assembly was welded and installed just as they are supplied new in the breakers or as sold by the components

group. (This assembly will be used as the standard by which we can compare to the other assemblies that represent broken welds).

Testing:

A test fixture was manufactured to apply even and consistent pressure to the Arrow Head Assembly. (Shown with an Arrow Head Assembly in place).



The fixture was installed in the Tenius Olsen Testing equipment. Pressure was applied to the assemblies.



Data was captured from the pull test and graphed to demonstrate the differences found during the test. The tests were performed to capture data on the ability of the assembly to withstand a tensile force and the ultimate yield point at which the various assemblies failed.

On the 2 assemblies that had been welded you can see a sudden drop on the graph. This signifies the point on T1 and T3 at which the welds reach their failure point.

Test on Specimen T1

This test demonstrates one such failure since we started with 1 weld broken to simulate the cracked welds that our customers find during the refurbishment of breakers.

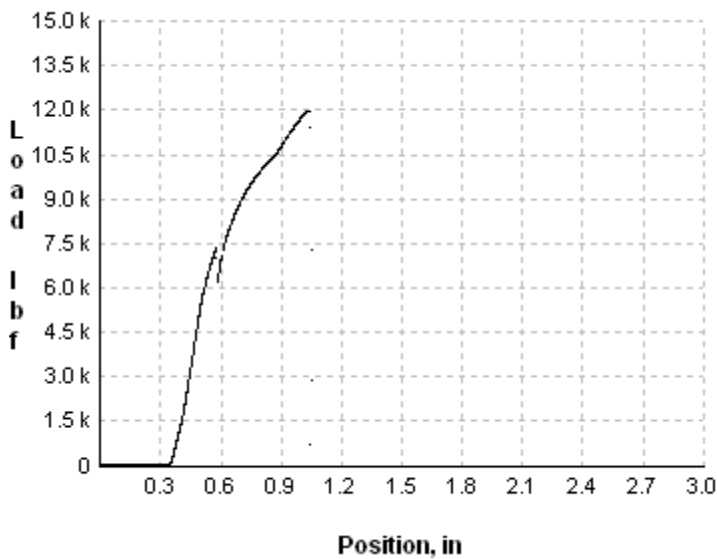
Test on Specimen T2 has no welds to demonstrate the performance of the assembly when it is found with both welds cracked.

Test on Specimen T3 has 2 welds and 2 district points that show weld failures.

T1

The weld reached its failure point at 7380 lbf.

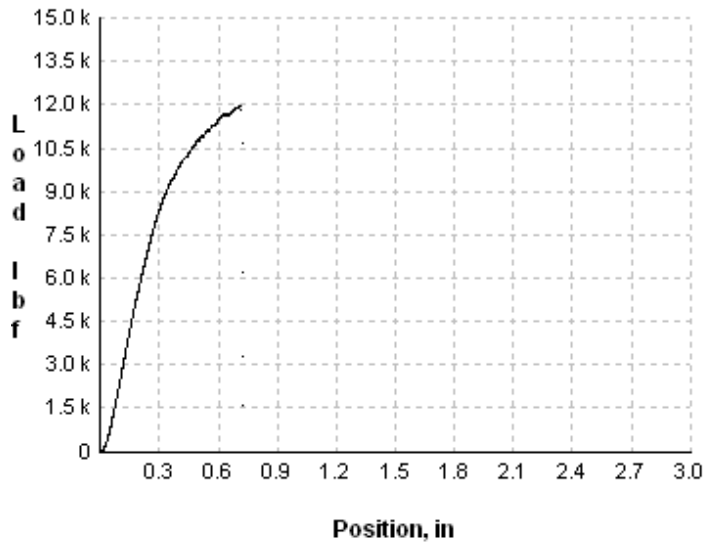
The ultimate yield strength of the assembly was reached at 11980 lbf.



T2

There was no weld on T2 so you see the normal stress strain profile that begins to reach the yield strength at approximately 8000 lbf.

The ultimate yield strength of the assembly was reached at 11970 lbf.



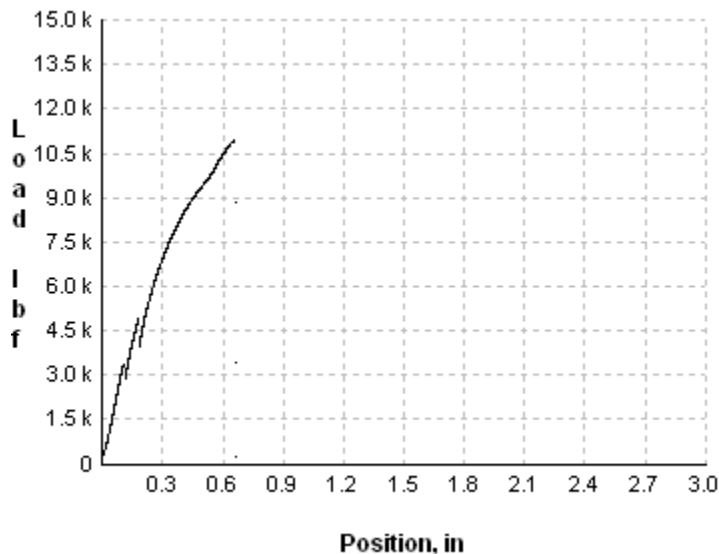
On Graph T3 there are 2 yield points that represent the point at which each of the wells reached their point of failure.

T3

The first weld reached its failure point at approximately 3390 lbf.

The second weld reached its failure point at approximately 4950 lbf.

The ultimate yield strength of the assembly was reached at 10950 lbf.



Conclusion:

The results of this test show plainly that the welding of the rivets on the inside of the Arrow Head assembly contributes very little to the overall strength of the component. Cracks in the spot welds on the rivets will not cause the failure of the assembly during its normal operating sequence.

It is therefore appropriate to continue to reuse the assemblies during refurbishment of the breaker as long as the end of the rivet has a well defined mushroom shape on the outside of the side plate and that there is no deformation to the side plates that could cause interference with the normal operation of the spring on the outside of the Arrow Head Assembly.

