# Damage to part.

After all processes were finished, we were notified of a small indication of damage that was observed upon receiving inspection at the customer. This document is to outline our process in handling the part and to provide insight on possible areas in processing where the part could be damaged and how to prevent this from happening in the future.

## Our process

**Receiving Inspection** – At the time of inspection, the part was inspected carefully and no damage was noted.

**Cleaning** – During hand wiping and cleaning of the part, no damage was observed on the weld joint or anywhere around it. The parts are measured then sent out for Chemical Etching

**Assembly and Tacking** – We assemble each part specific to one another, and each part is thoroughly inspected for damage or other anomalies before we install the pieces in the tooling and tack them together.

**Final Weld** – The part is cleaned and inspected by the welder before permanently joining the 2 pieces together. No damage was observed before and after welding.

**Final Inspection** – The parts are inspected and measured before being sent to Radiographic and Penetrant Testing.

**Final Ship** – Once all outside processes are complete, we take one final look at the part and send it to the customer.

# The process at  Inspection (NDT House)

**Receiving Inspection** – At the time of inspection, the part was inspected carefully and no damage was noted.

**Chemical Cleaning** – The parts are processed for Chemical Etching and sent back to us
No damage was noted.

**Radiographic Inspection** – The parts are received by inspection again, and undergo Radiographic X-Ray inspection. No damage or indications were noted. The part is free standing during this process with no clamps or electrical connectors.

**Penetrant Inspection** –  The parts undergo Penetrant inspection. No damage or indications were noted. The part is free standing during this process with no clamps or electrical connectors. Penetrant inspection would have definitely caught this damage indication if it was present during the process, this however was not the case. No damage was indicated on Penetrant Testing reports.

**Final Ship** – Once all outside processes are complete, It is sent back to us
for final packing and shipping.

# Location of damage

The pictures below show where the damage indication is in relation to the whole assembly (Figure A)

As well as having a surface indication on the outside of the part (Figure B) damage was noted on the back side of the indication as well (Figure C)

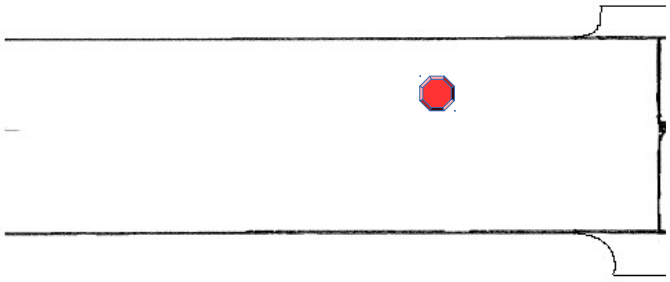


Figure A

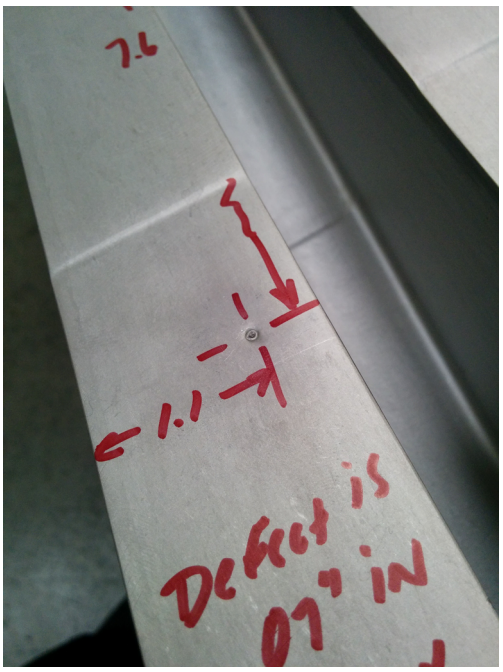
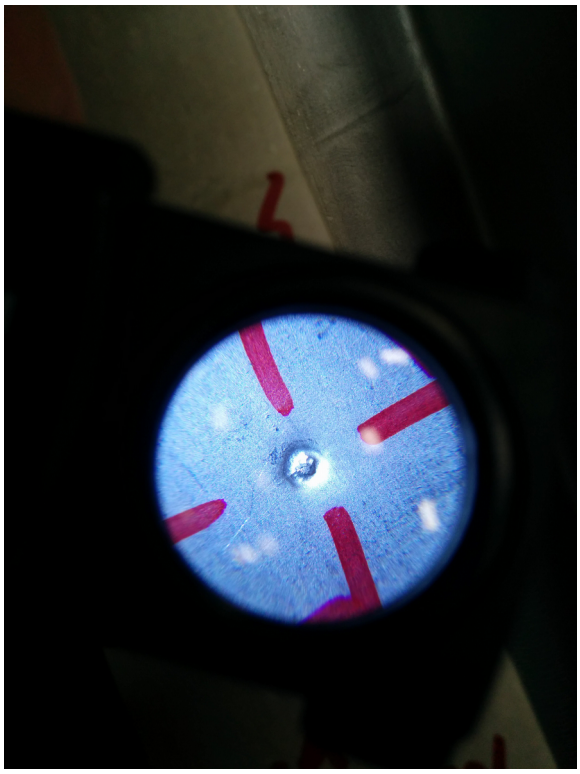
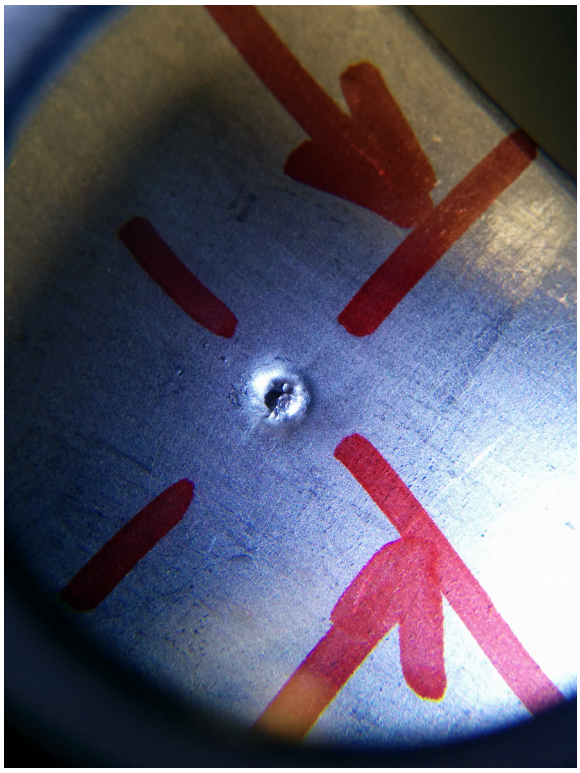



Figure B

Figure C

# Additional Photos of the Damage





# Damage Analysis

Upon notification of the present damage, a representative  was sent to the customer to visually inspect the damage. Here is a detailed analysis of the damage.

**Concavity** – The damage shows on both sides of the part, as if something was clamped down onto the assembly. The nature of the ding is concave on both sides, indicating that a considerable amount of force was exerted down onto the part from both ends, causing the damage. There is no process from us or the inspection house that involves clamping. See Figure D

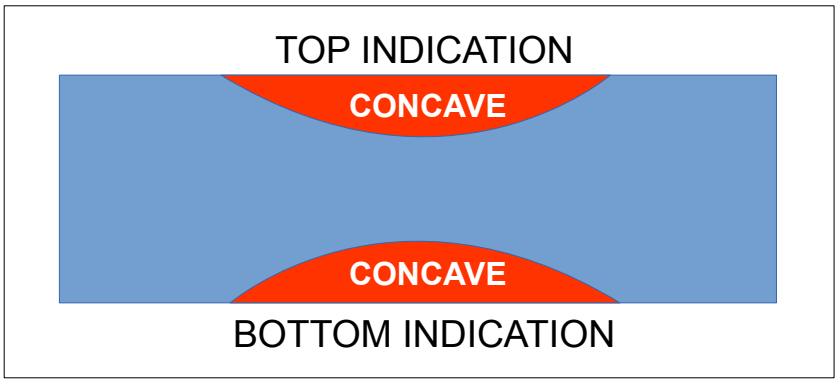



Figure D

**Recast** – The damage appears to have happened from an electrical source, connector, or clamp of some kind. There is a recast on the top edge of the damage, which is very suspicious of heat applied to the part. There is no process from us or the inspection house that involves electrical connectors being hard attached to the part. See Figure E

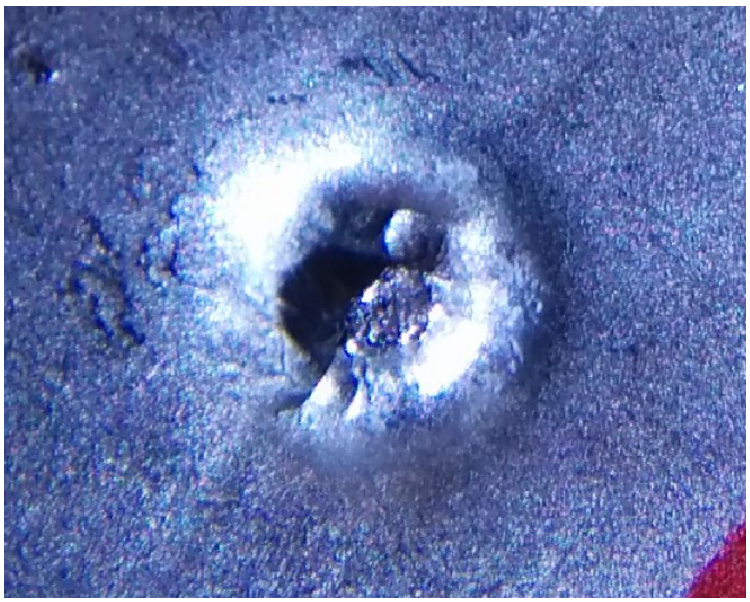


Figure E

# Processing Observations

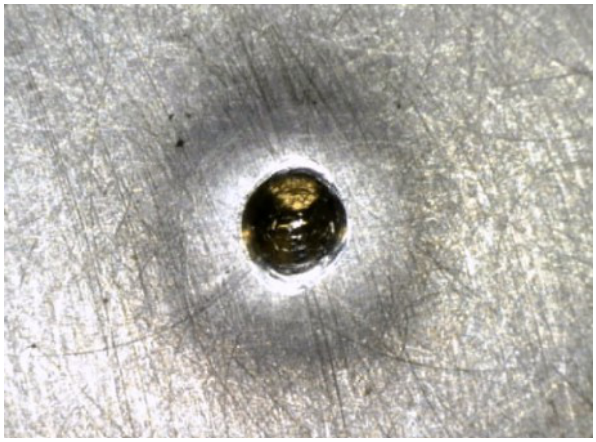
The following will outline observations made by us in regards to the handling process. The customer supplied tooling, as well modeling an accidental beam strike will be shown in depth, elaborating on possible damage points and alleviating the thought of damage by these processes.

**Tooling** – During pre-weld tacking and assembly, we use customer supplied tooling to assemble the parts. The tooling uses rubber stops to secure the part in place, ensuring no movement happens during welding. Contact between the tooling and the part was the first thought in where the damage could have happened; however, the securing points on the tooling only contact the outer surface of the part. The damage noted is not in any of zones where there is intimate contact between the tool and the part. See Pictures Below

**Electron Beam Grounding** – During Electron beam welding, there is no active ground attached to the part. The whole inside of the Electron Beam chamber acts as the ground, as it is under a vaccuum. There is no possible way for a ground to connect onto the part and damage it, as the part is laying flat on a table inside of the machine. There are no electrical clamps, or other devices attached to the part to accommodate for a proper ground. See Figure F

# Processing Observations

**Electron Beam Strike** – In order to show what an accidental Electron Beam Welding strike on parent material looks like, we have taken a sample part which was taken from a previous qualification for the customer. As you can clearly see, by comparison- the Weld Beam looks vastly different from the indicated damage on the part. The actual beam strike is a very clean indication, unlike the damage in question. The opposite end of the strike shows a convex nature rather than a concave indication like the damage in question. The customers weld schedule was used to fire upon the sample material, ensuring the power and other variables are exactly as they would be during the welding of a production part. See Figure G, H and next page



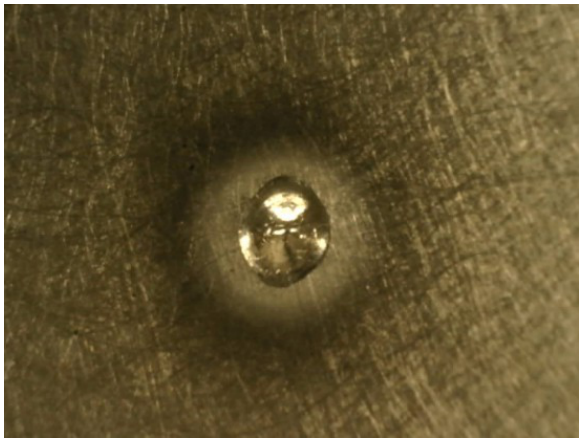
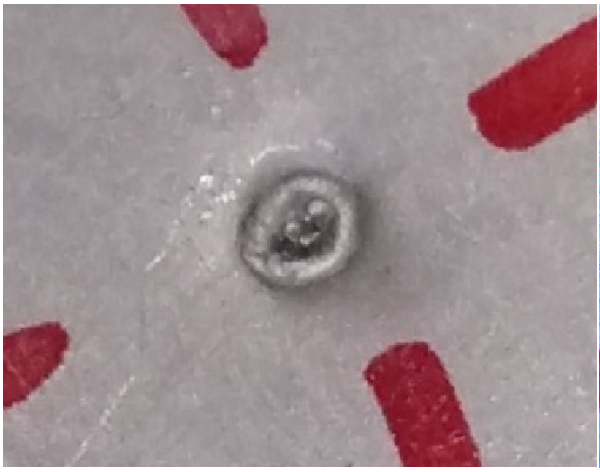


Figure G
Electron Beam Strike



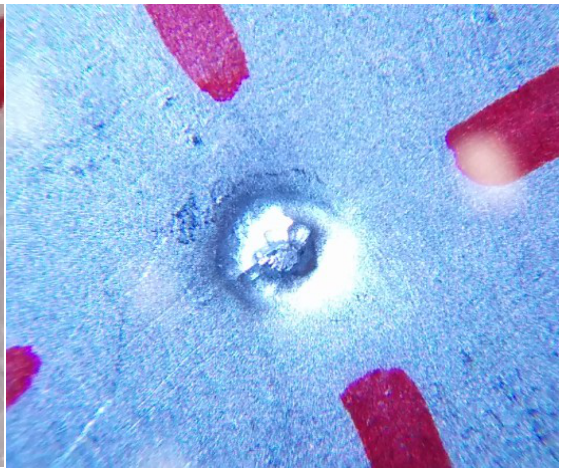
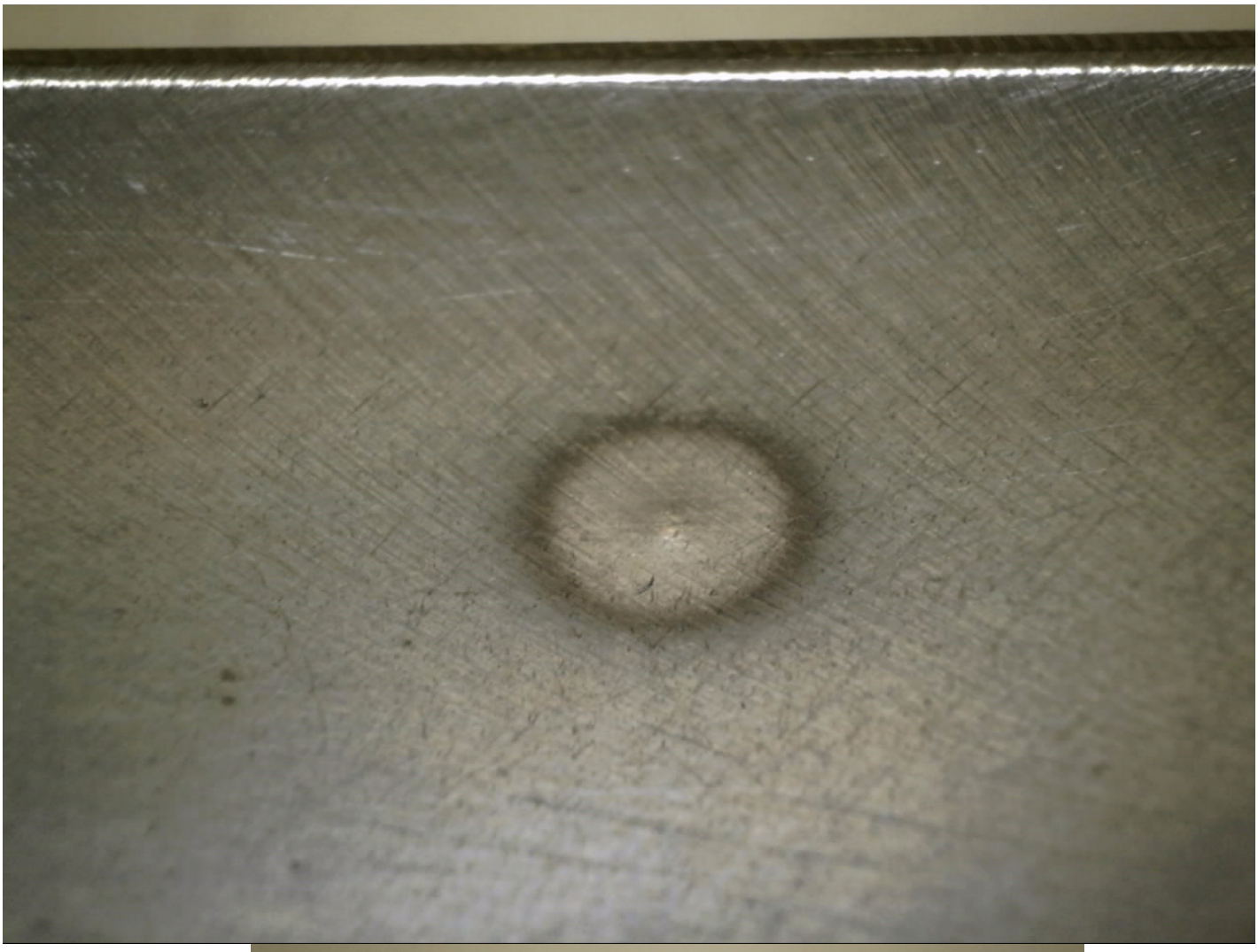
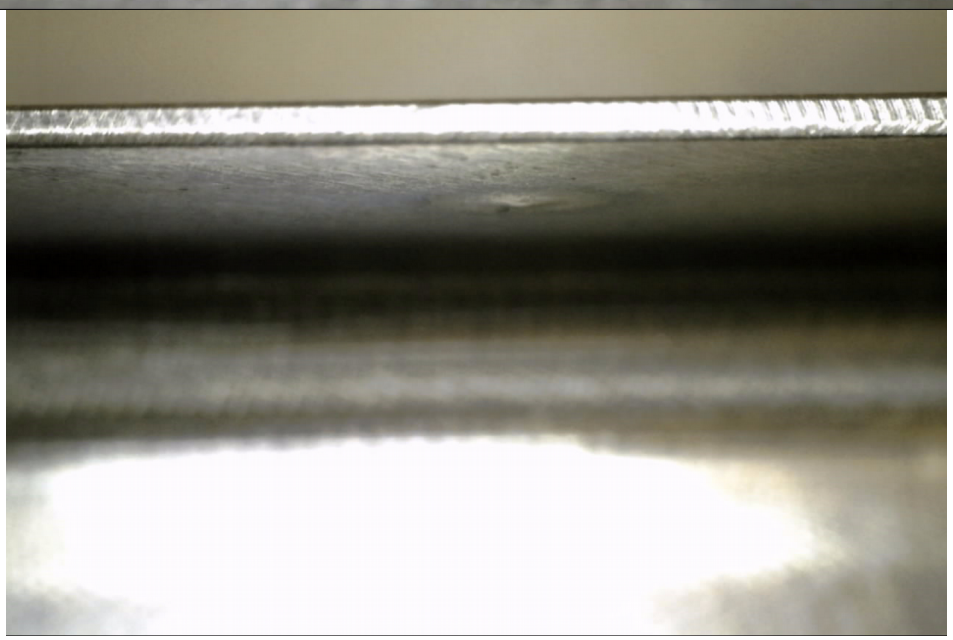


Figure H
Actual Part Damage

# Additional Photos of Electron Beam Strike

These photos show the back side of the strike, giving visual confirmation that the opposite end of the strike is convex.





## Conclusion

Upon detailed observation of the damage in question, we have come to the conclusion that this damage occurred by means of a clamp that was applied down onto the part with a considerable amount of pressure. The material was dimpled on the outer and inner surface, leaving concave indications. The clamp used must have been hot, or live with electricity to cause the recast on the part. The processes at our company involve no such type of clamps or anything that could cause this damage. Upon discussion with the outside vendor, their process does not involve anything like this either.

The damage on the Spar Assembly has most definitely not been caused by an accidental beam strike, or grounding problem as the indication looks vastly different as well as being concave on both ends of the damage. There will be a considerable change in processing to scour every inch of the part during all steps of processing to ensure something like this does not slip through the processing and make it all the way back to the customer.

## Action

The damage done to the Spar Assembly is unacceptable, and there will be a change in processing both at our company and the inspection house for careful monitoring of the part.

A representative from our company will be visiting the outside vendor for close monitoring of their processing. If any process shows potential for damage happening to the part, there will be a corrective action and a full resolution to this problem.