

Fitting Durability Study

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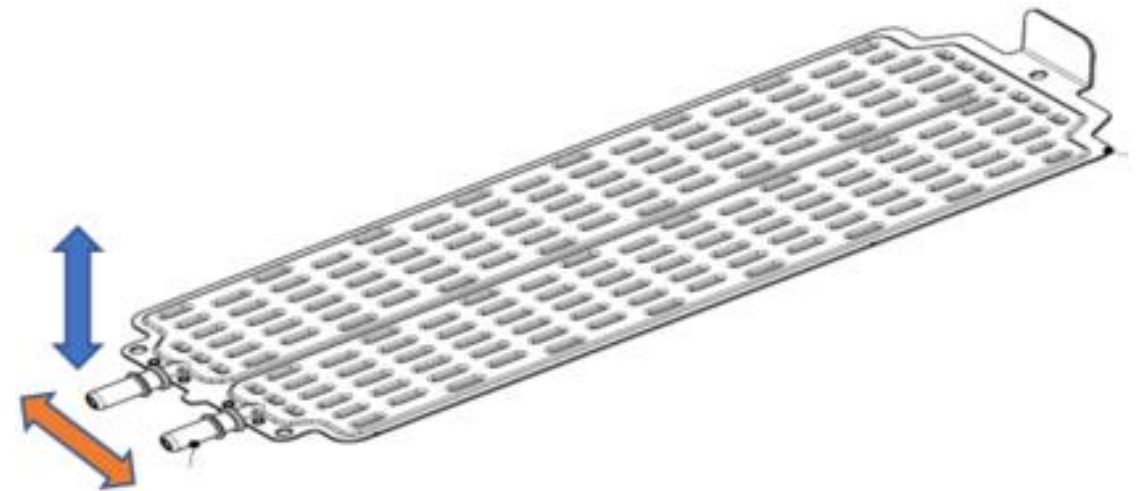
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Part Validation

- Quality assurance in the automotive industry is essential
- Durability of parts is assessed for validation
- Fittings of a cooler are a risk area for the part
- Dana's customer was concerned that the fill of the braze was not sufficient enough to ensure durability
- Ideally, parts will have a braze fill larger than 7 mm
- Insufficiently brazed parts were found with fills from 1 – 5 mm

Cooler Testing

- 25 battery coolers were tested by applying a cyclical bending moment to the fittings on the cooler
- All plates are leak tested with a nitrogen-air mixture to ensure no leaks are present before or after the cyclical loading
 - If a part exhibits a leak rate greater than 0.4 CCMs, it will have failed
- After applying 2000 cycles in both the blue and orange directions on both fittings of all 25 plates, no failures were found to occur



Instron Data

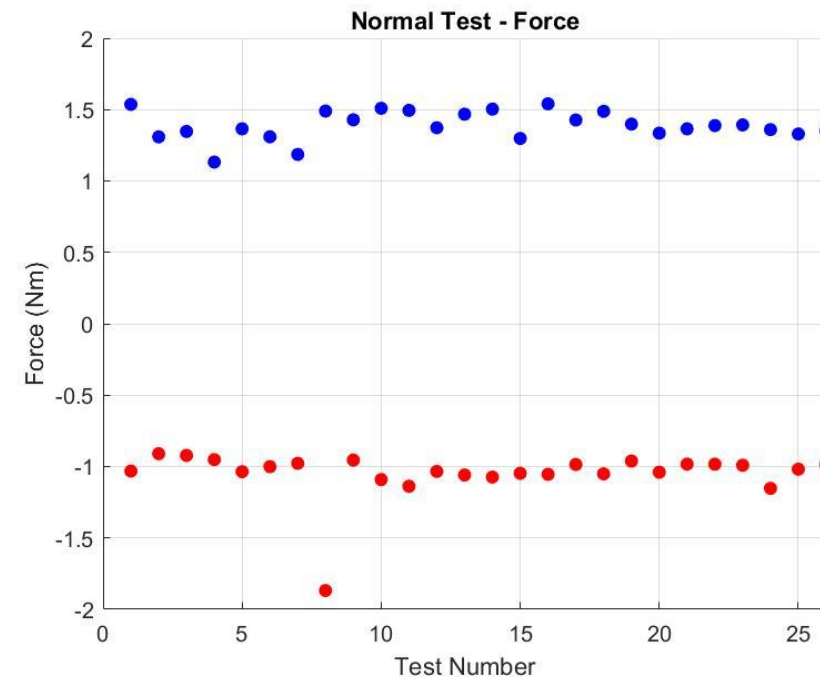
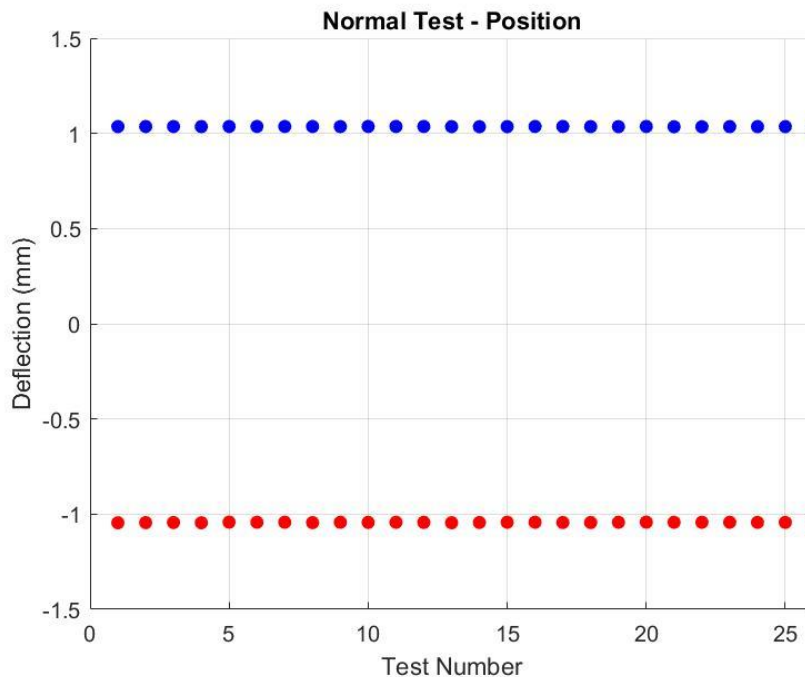
- Cyclical deflection data was generated by the Instron machine in a standard format
- For ease of use, a program was created to expedite the analysis of the Instron data for report generation
- Matlab was used to generate a data file
- Graphs can be used to show the customer
- Data handling and data processing was executed

Matlab File

- The Matlab file reads in the relevant columns of the Instron files
- It then converts the signs of the force column, since the Instron records force as opposite to the defined sign convention
- Normalization was also performed on the force column
- Imperial units of the Instron file are converted to SI units
- Files are sorted into normal and parallel tests
- Plots of the maximum/minimum deflection and forces encountered during testing were generated for normal and parallel tests

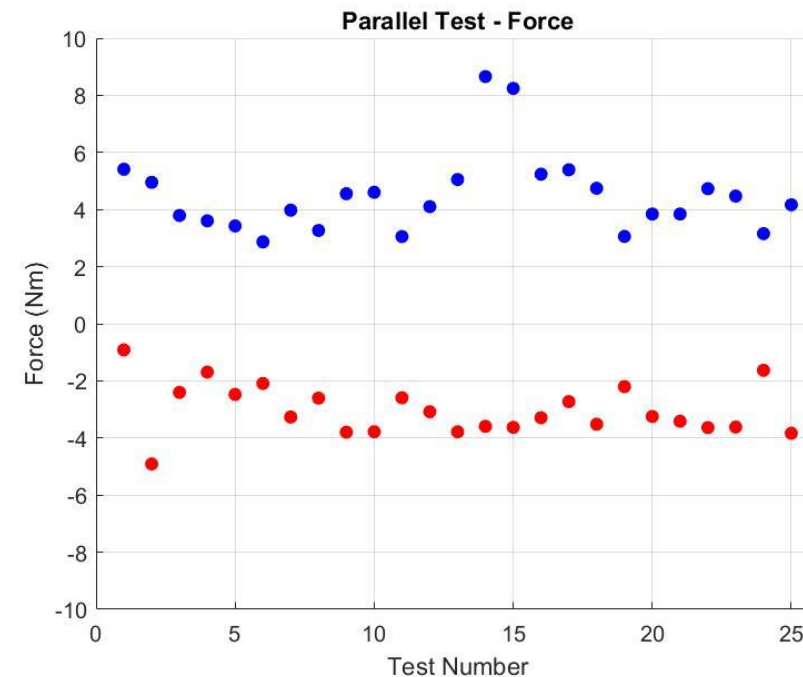
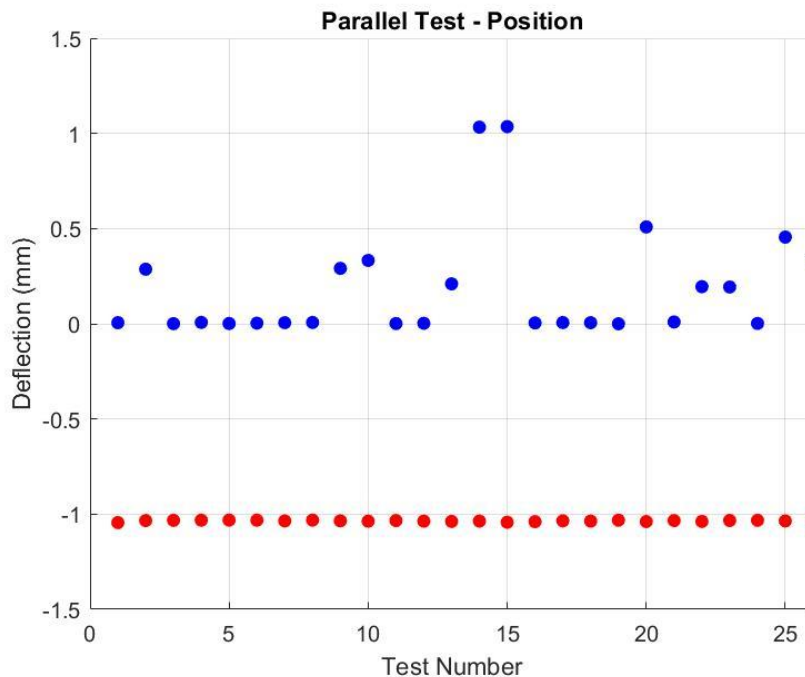
Normal Tests

- Testing in the normal direction was easy, since fittings are less rigid
- Achieved the specification of $\pm 1\text{mm}$ deflection and over 1Nm force
- Results can be seen below



Parallel Tests

- Fittings were more rigid in the parallel direction
- Large forces were required to achieve 1mm, with a preference for negative deflection. Specification of 1Nm was overshoot.



Conclusion

- The customer was satisfied with the durability of parts, despite lower than desired braze fill
- Additional validation testing was performed (vacuum testing, shock and vibration testing) to ensure durability
- Steps were taken to ensure that the number of parts with low braze fill would be reduced in final production

Acknowledgements

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