

# T.T.S.

**Topping Test Services Ltd.**

**Report:**                    **Ultrasonic Inspection of Welding  
on 10-Banded Fuel Tanker.**

**Prepared by:**            H.Topping MinstNDT.

**Issued by:**            T.T.S. Ltd.  
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**Prepared for:**        TWI Limited,  
Granta Park,  
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CB1 6AL

**FAO:**                    Mr. Alan Day.

**Date:**                    24<sup>th</sup> April 2014

**Report No:**            14/1946/TTS

### Introduction:

Our inspector visited the Pullman Fleet Services depot at West -Thurrock on the 24<sup>th</sup> April 2014.

The purpose of the visit was to conduct ultrasonic inspections of the internal fillet welds between adjoining sections of a 10-banded fuel tanker.

The objective of the inspections was to provide information of the fillet weld geometry and location in order that strain gauges could be attached at specific locations throughout the tanker structure.

Please refer to the appended ultrasonic inspection report and photographs for full details of the inspection results:

### Inspections:

The tanker was identified as a 45000 litre capacity aluminium shell fuel tanker, manufactured in South Africa by GRW Engineering on 26-10-2010.  
VIN No. AC 9433AA60CCU1857.

All 10 seams were ultrasonically inspected and identified as M-10 A/10 to M-1 MJ/10 as per the tanker band naming convention – (copy appended).

### Results:

It was noted that bands C, D, E, F & G were continuously welded on the outer edge on the internal side of the joining band in the lower half of the tank – positions 3 to 9 o'clock – and 'stitched' (typically 100mm weld 600mm gap) over the upper – 9 to 3 o'clock – portion of the tank.

Bands A, B, H, I & J were noted to be 'stitched' over their full circumference.

Note: The 100mm weld, 600mm gap weld pattern was noted to be irregular and varied considerably throughout the 10 bands of the tanker.


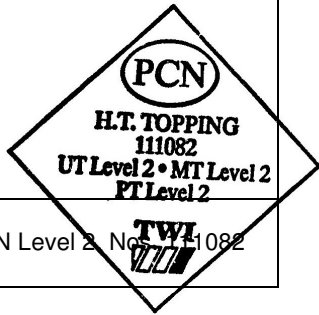
The location and toes of each internal fillet weld were marked with indelible ink on the outer face of the tanker shell to facilitate the accurate positioning of the strain gauges relative to the weld toes.

Each band was then photographed for reference – refer to photographs for further information.

## ULTRASONIC INSPECTION REPORT

CLIENT: TWI Ltd.  
Report No. 14-1946

PROJECT: Tanker internal weld inspection  
Sheet 3 of 5

DATE OF TEST(S) 24 <sup>th</sup> April 2014		TEST VENUE: Pullman Fleet Services Depot, West – Thurrock, Essex.		
COMPONENT IDENTIFICATION: Fuel tanker No. 5587.		SURFACE CONDITION AND WELD DETAILS: As welded MIG fillet welds.		
MATERIAL: Aluminium.		STAGE OF MANUFACTURE: On completion of welding + 48 Hrs.		
TEMPERATURE 0 - 40 C [ ✓ ]				
FLAW DETECTOR(S): SITESCAN D10+ SERIAL NO:1007527		PROBES USED (TYPE)	ANGLE	FREQUENCY (MHz)
CALIBRATION/REFERENCE BLOCKS: TYPE SERIAL NO. A2 44558 A4 77403 DAC PF001		Twin CD 10	0	5
				10
COUPLANT: UCA-7 Dry Powder Couplant.				
INSPECTION STANDARD: BSEN 1714		ACCEPTANCE STANDARD: Report findings.		
EXAMINATION LEVEL: B				
TECHNIQUE/PROCEDURE: BSEN1714 section 12		TIME BASE RANGE: 0 – 100mm		
TEST SENSITIVITY: COMPRESSION: DAC +14db SHEAR: DAC +14db ATTENUATION/TRANSFER: +2dBs			TEST RESTRICTIONS: Yes [ ] No [ ✓ ] If yes state details	
CALIBRATION: Equipment calibrated in accordance with BS EN 12668-1:2000				
<p><u>AREA TESTED AND RESULTS:</u></p> <p>The internal fillet welds in the identified bands were inspected to determine their geometry and location</p> <p><u>RESULTS:</u> The weld dimensions were marked on the out shell of the tanker and each band photographed.</p> <p>Please refer to the attached photographs for further information on the internal fillet weld locations.</p>				
Signed: 				
INSPECTOR(S) : H.Topping				
		CERTIFICATION STATUS: PCN Level 2 No. 111082		

## Photographs of Tanker.



Figure No.1 – Showing general view of Tanker with inspected band locations arrowed.

VEHICLE INFORMATION PLATE				
MANUFACTURER: GRW ENGINEERING (PTY) LTD P.O. BOX 5102 WORCESTER 6850 SOUTH AFRICA TEL No. +27 (0) 23 3486300		FAX No. +27 (0) 23 3473895		WEB SITE: www.grw.co.za
MANUFACTURERS VIN No. AC9433AA60CCU1857		JOB No. J9337	DATE OF MANUFACTURE 26-10-2010	
<b>DIMENSION INFORMATION</b>				
OVERALL LENGTH	12450mm			
COUPLING CENTRE TO REAR MOST AXLE	9119mm			
COUPLING CENTRE TO END OF TRAILER	10560mm			
AXLE SPACING	12410mm			
SUSPENSION RIDE HEIGHT	915mm			
<b>WEIGHTS</b>				
MAX. GVM	41000KG			
MAX. GVM IN U.K.	35000KG			
MAX. IMPOSED COUPLING LOAD (GKM)	10500KG			
NUMBER OF AXLES				
	AXLE 1	AXLE 2	AXLE 3	AXLE 4
MAX. AXLE LOAD - GA	9000	9000	9000	
MAX. AXLE LOAD - A	8000	8000	8000	
MAX. AXLE LOAD IN U.K. - A	8000	8000	8000	
<b>BRAKE INFORMATION</b>				
MAKE OF BRAKE 13 LINE SERVICE				
ANTILOCK				
BRAKE ACTUATOR SIZE/LENGTH, SERIAL No. & MAX. TYRE PRESSURE				
AXLE 1	AXLE 2	AXLE 3	AXLE 4	
T162				
10325081				
800KPa				
UNLADEN TARE WEIGHT 5342KG				
MAX. LIQUID LOAD				
MAX. LOAD RATE & UNLOAD RATE				
MAX. LOAD PRESSURE				

Figure No.2 – showing tanker ID plate.



# Tanker band naming convention

- Mistras naming convention (M-X) goes from *back-to-front*
- HSL/DfT/TWI/TRL consortium naming convention is alphanumeric and goes from *front-to-back*. The "/10" indicates a 10-banded tanker
- (B) stands for baffle and (BH) stands for bulkhead: these vary tanker-to-tanker
- Each band comprises two sides: a "+" end towards the front and a "-" end towards the back.

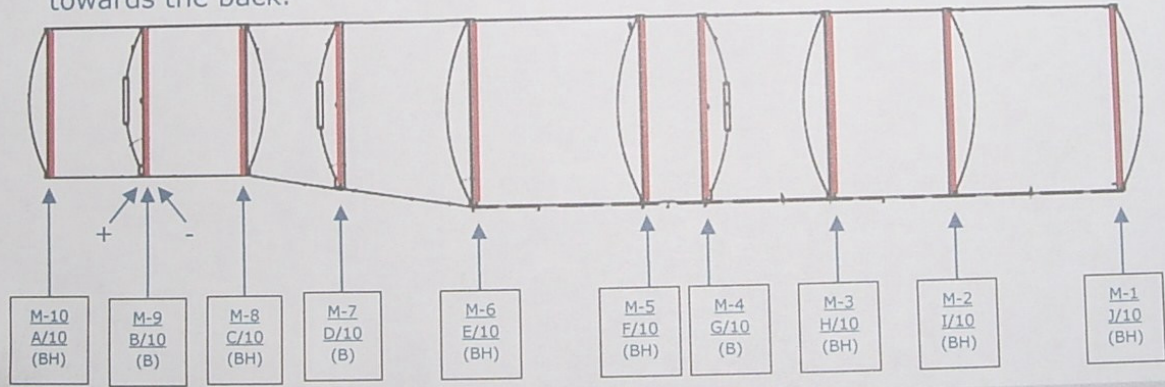
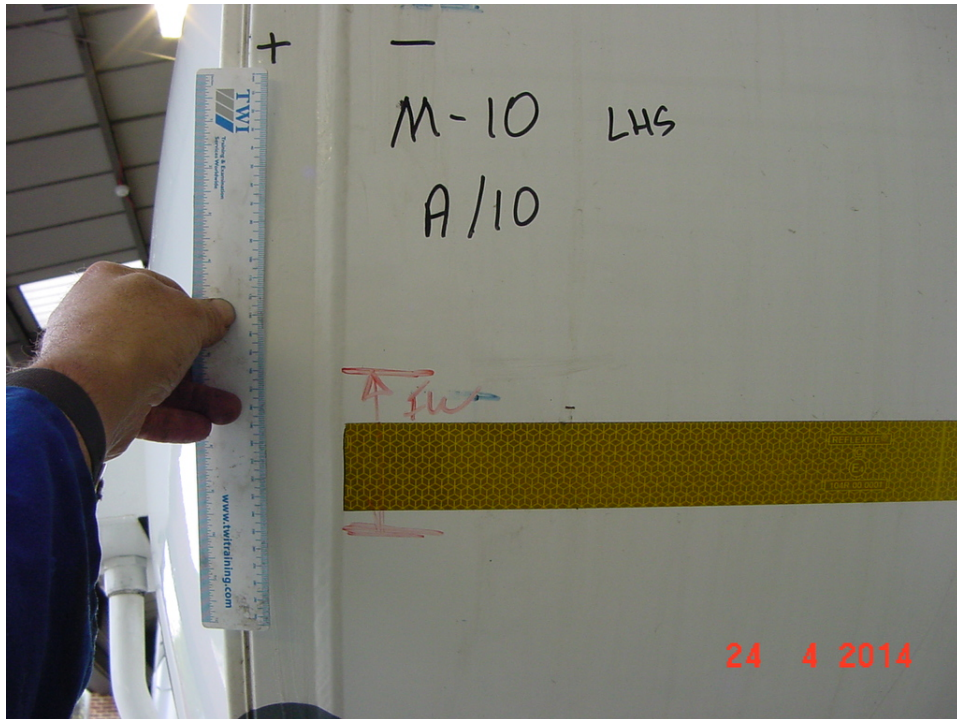


Figure No.3 – showing tanker band naming convention.

The main objective of the UT inspection of the tanker was to determine the position and extent of internal fillet welds between the extrusion band toe and the tanker shell inner surface to ensure the appropriate placement of the strain gauges. For this reason, the tanker was marked up with approximate positions of the internal fillet welds for each band and each side of the band (ie positive side and negative side). Below, Figures A1-A20 are taken of the nearside and Figures A21-A40 are taken of the offside. Figures A41-A50 are 'fillet weld map' diagrams. Each figure represents an idealised cross-section of a tanker band. The left hand side shows the negative side of the band and the right hand side shows the positive side of the band. Based on the images provided by the UT inspector, informative lengths (dark, bold lines) have been drawn on the cross-section diagrams to indicate the positions of the fillet welds. As noted previously, the objective during this phase of work was not to exactly map the fillet welds, but was to ensure that strain gauges were not placed on top of fillet welds, thereby resulting in inaccurate or unrepresentative readings. Therefore, the lengths of the dark lines on the fillet weld map diagrams should be taken to be indicative and not precise. Moreover, locations that were not necessarily fully inspected (ie underneath the tanker) are not marked up with dark bold lines to indicate fillet welds, but this does not mean that they may not be present.



**Figure A1** Nearside (labelled left-hand side, LHS), Band A.



**Figure A2** Nearside (labelled left-hand side, LHS), Band A.





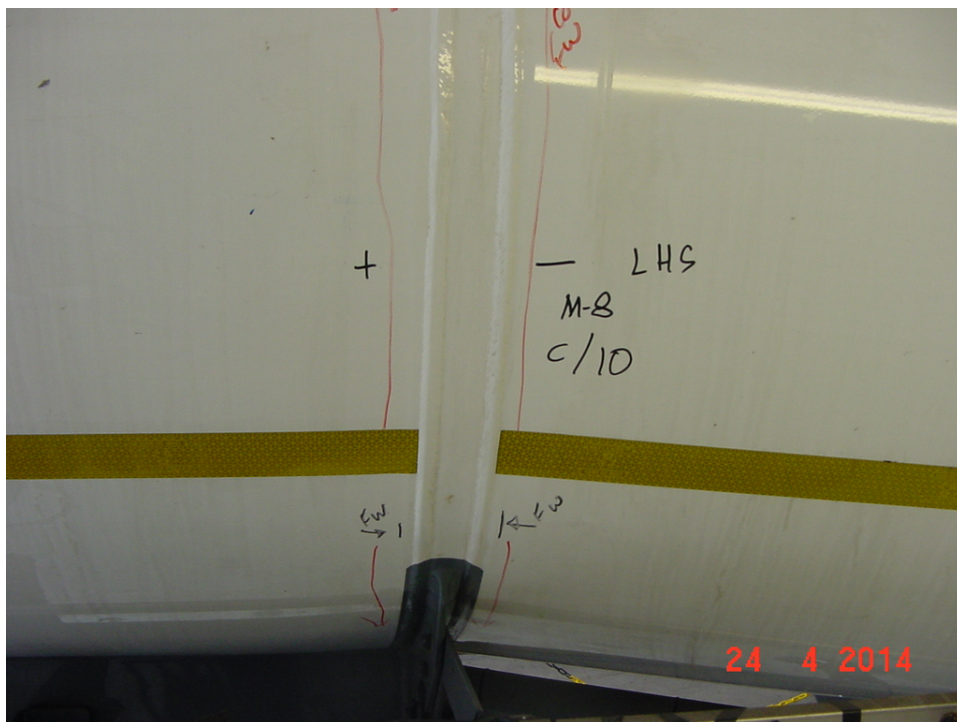
**Figure A3** Nearside (labelled left-hand side, LHS), Band A.



**Figure A4** Nearside (labelled left-hand side, LHS), Band B.

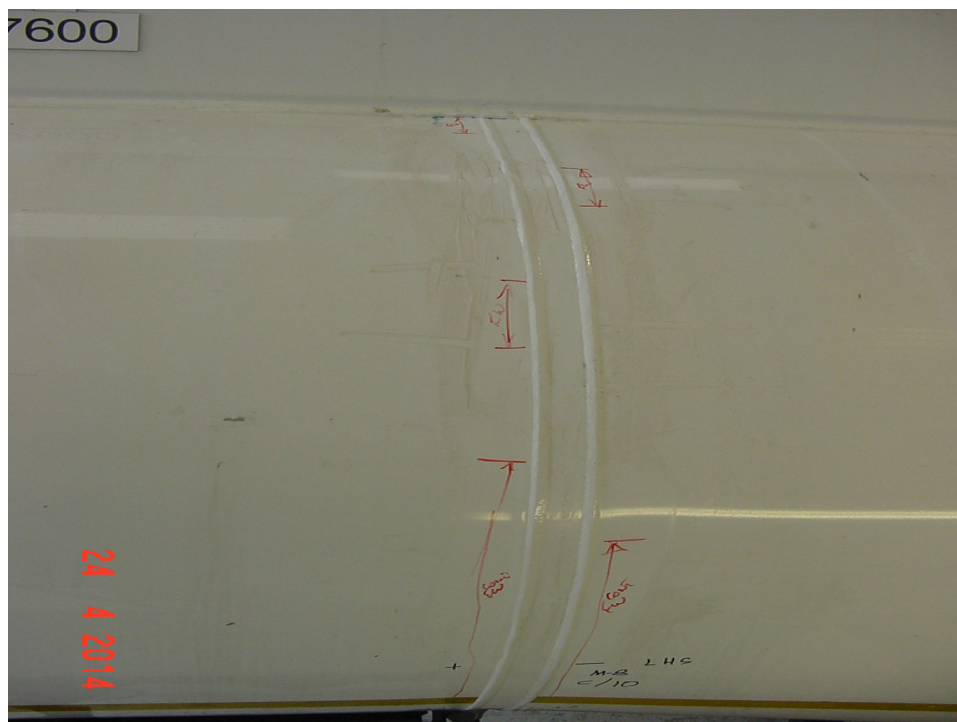


**Figure A5** Nearside (labelled left-hand side, LHS), Band B.



**Figure A6** Nearside (labelled left-hand side, LHS), Band C.





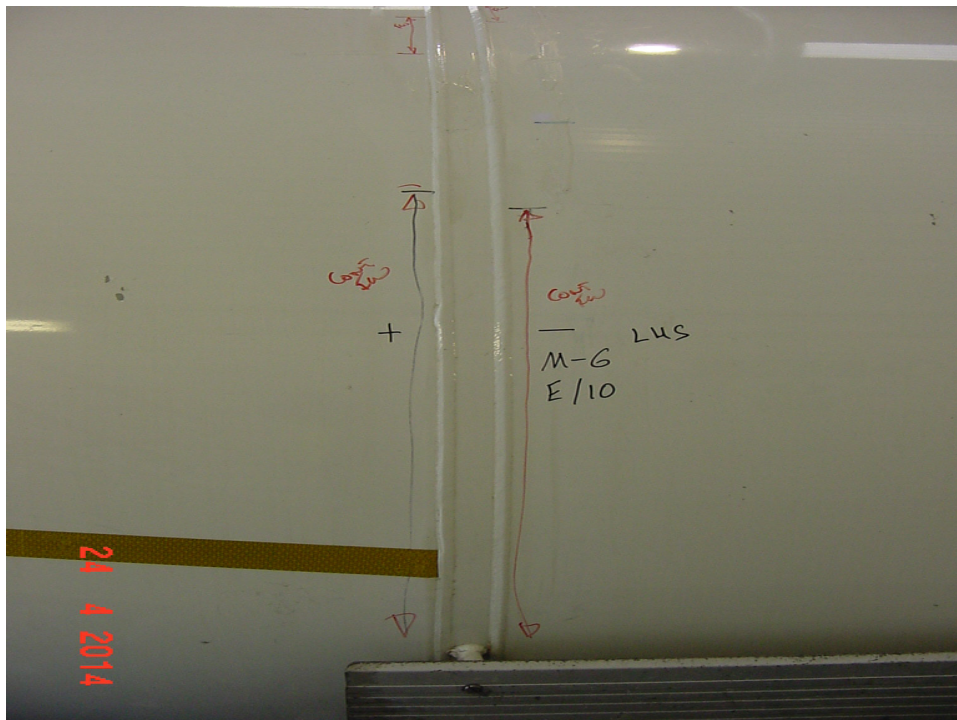
**Figure A7** Nearside (labelled left-hand side, LHS), Band C.



**Figure A8** Nearside (labelled left-hand side, LHS), Band D.

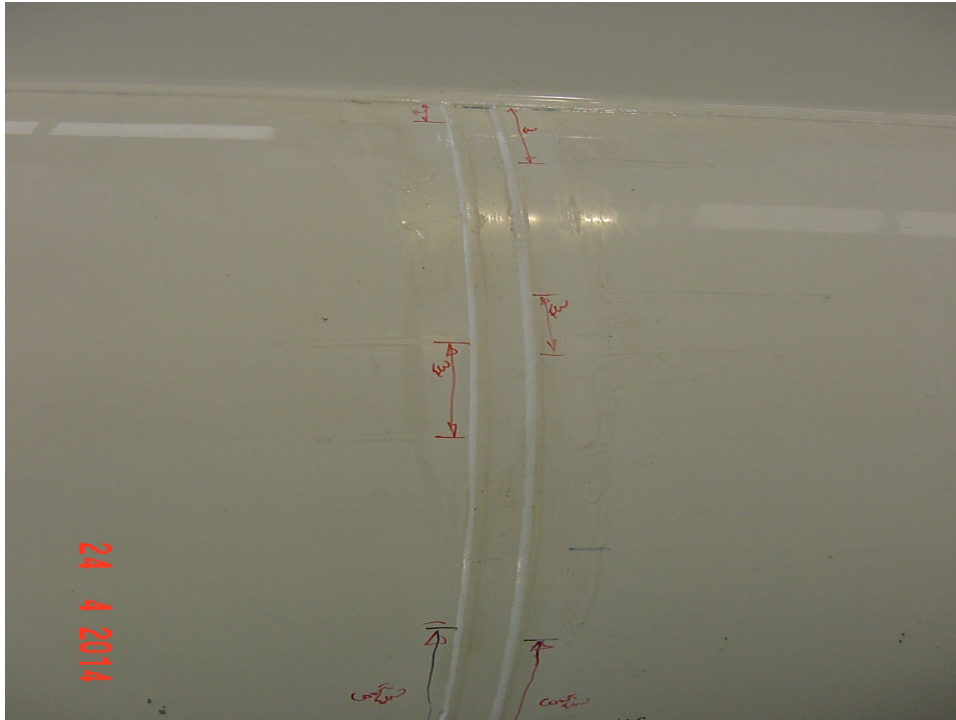


**Figure A9** Nearside (labelled left-hand side, LHS), Band D.

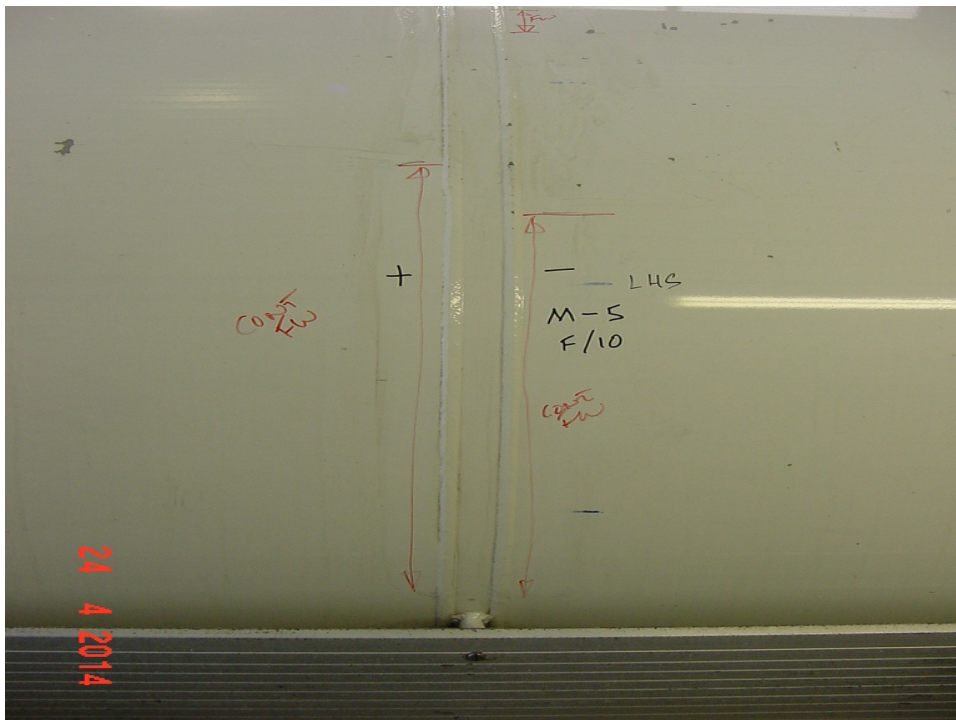


**Figure A10** Nearside (labelled left-hand side, LHS), Band E.

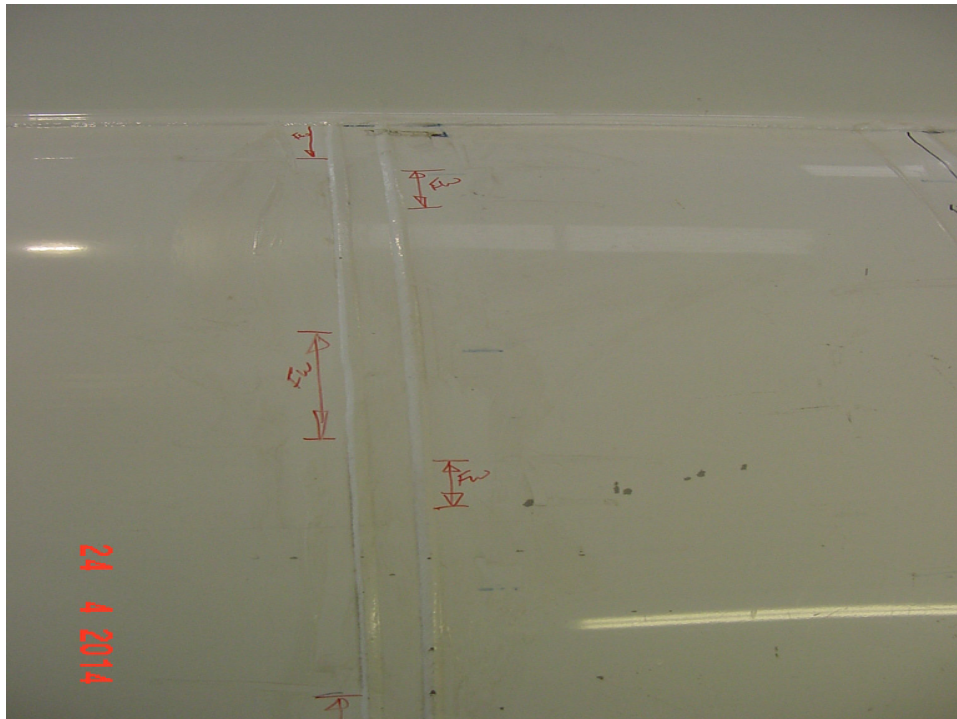




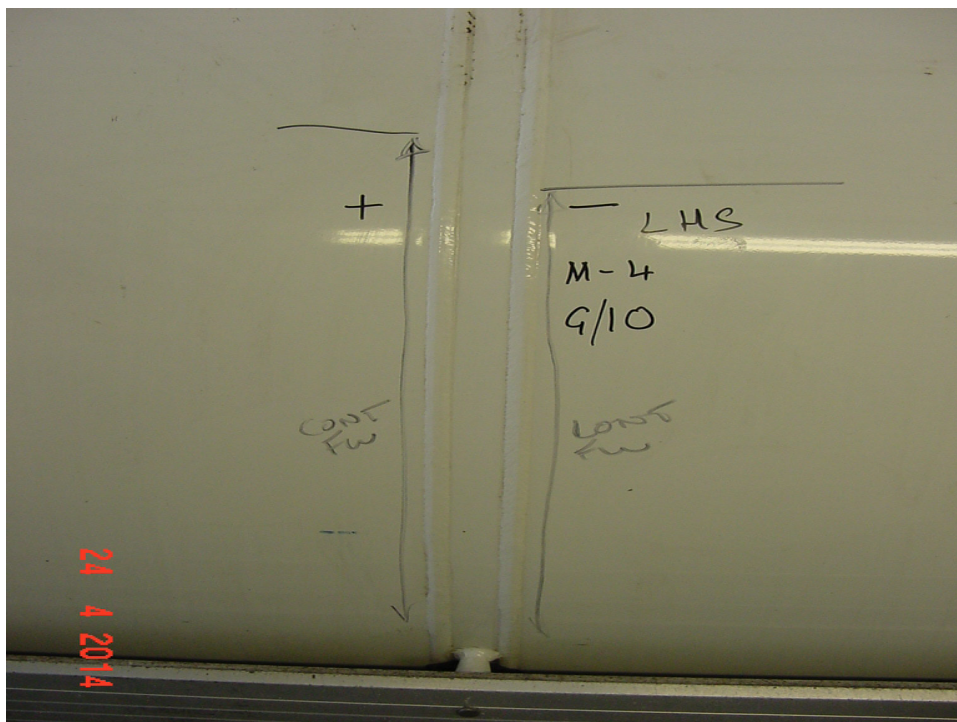
**Figure A11** Nearside (labelled left-hand side, LHS), Band E.



**Figure A12** Nearside (labelled left-hand side, LHS), Band F.

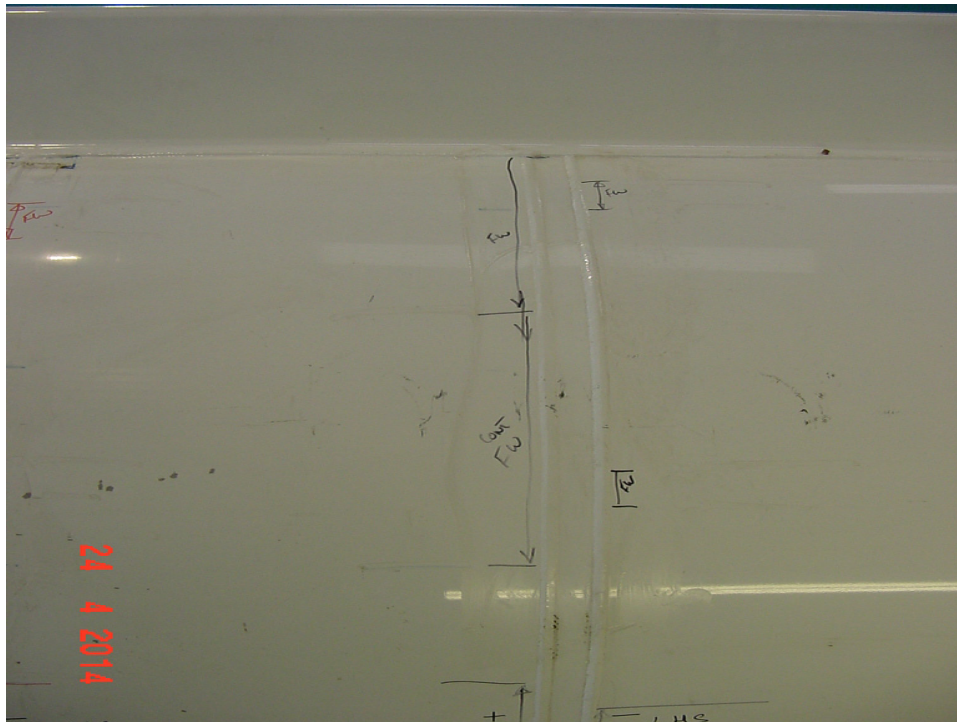


**Figure A13** Nearside (labelled left-hand side, LHS), Band F.

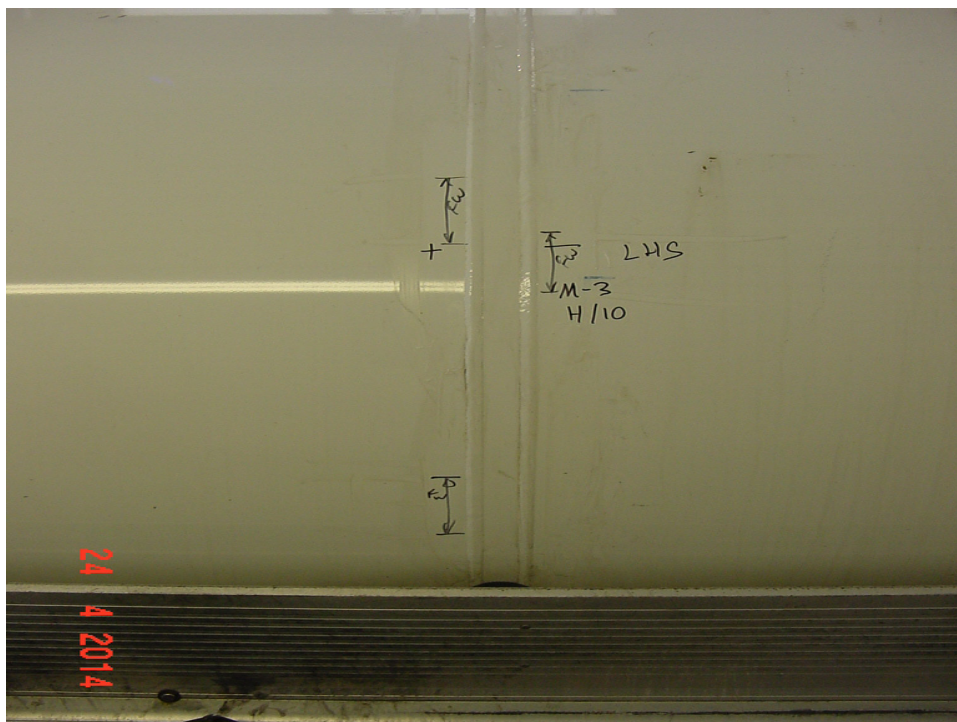


**Figure A14** Nearside (labelled left-hand side, LHS), Band G.





**Figure A15** Nearside (labelled left-hand side, LHS), Band G.



**Figure A16** Nearside (labelled left-hand side, LHS), Band H.





**Figure A17** Nearside (labelled left-hand side, LHS), Band H.



**Figure A18** Nearside (labelled left-hand side, LHS), Band I.

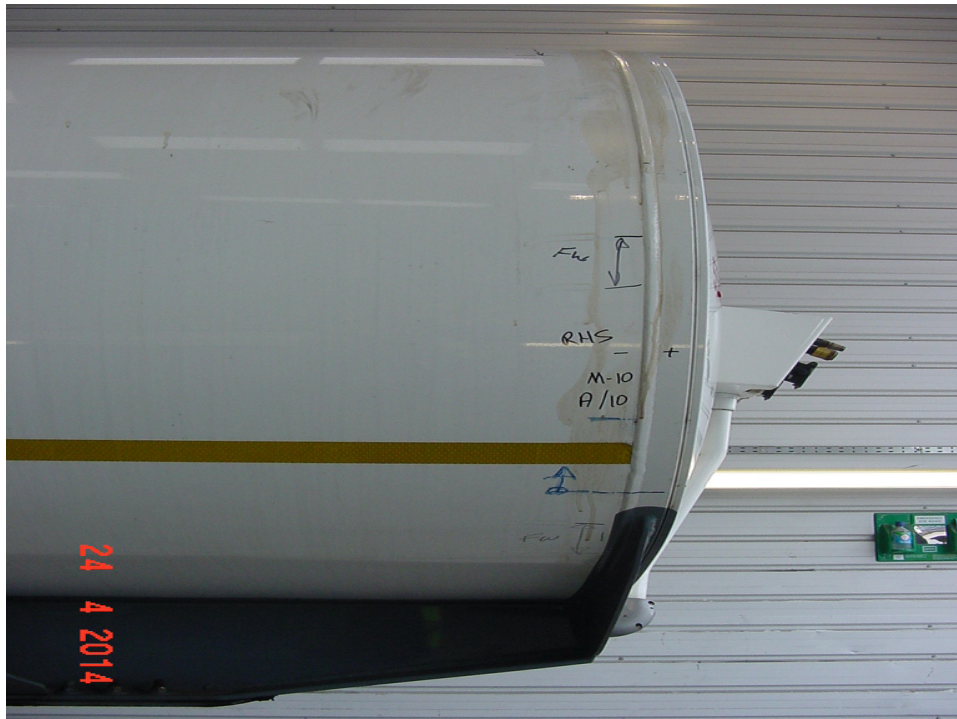


**Figure A19** Nearside (labelled left-hand side, LHS), Band I.



**Figure A20** Nearside (labelled left-hand side, LHS), Band J.





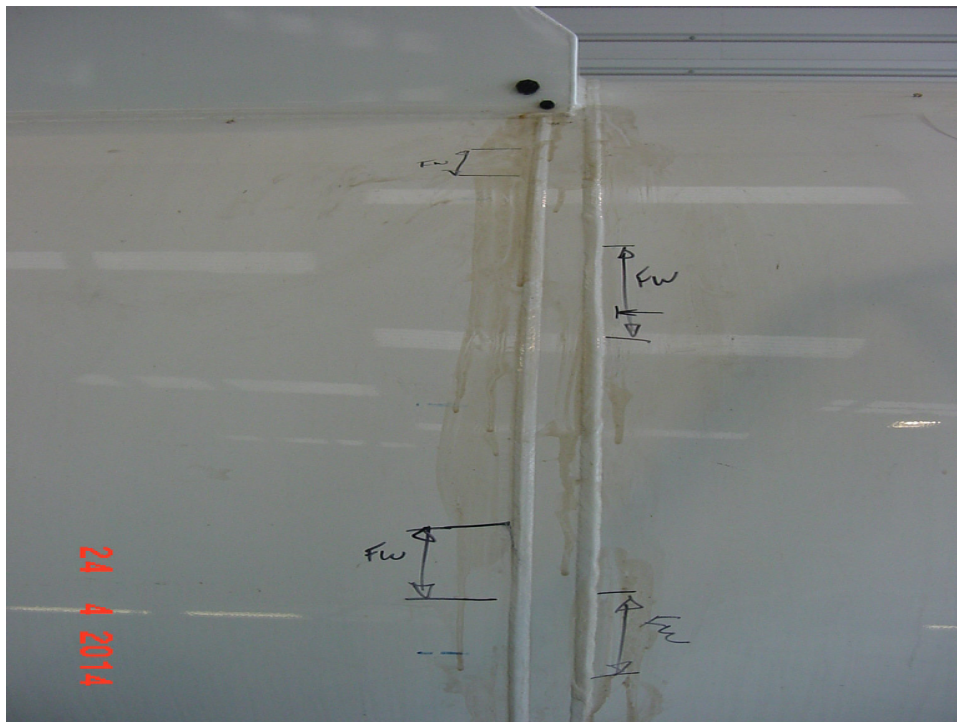
**Figure A21** Offside (labelled right-hand side, RHS), Band A.



**Figure A22** Offside (labelled right-hand side, RHS), Band A.



**Figure A23** Offside (labelled right-hand side, RHS), Band B.



**Figure A24** Offside (labelled right-hand side, RHS), Band B.



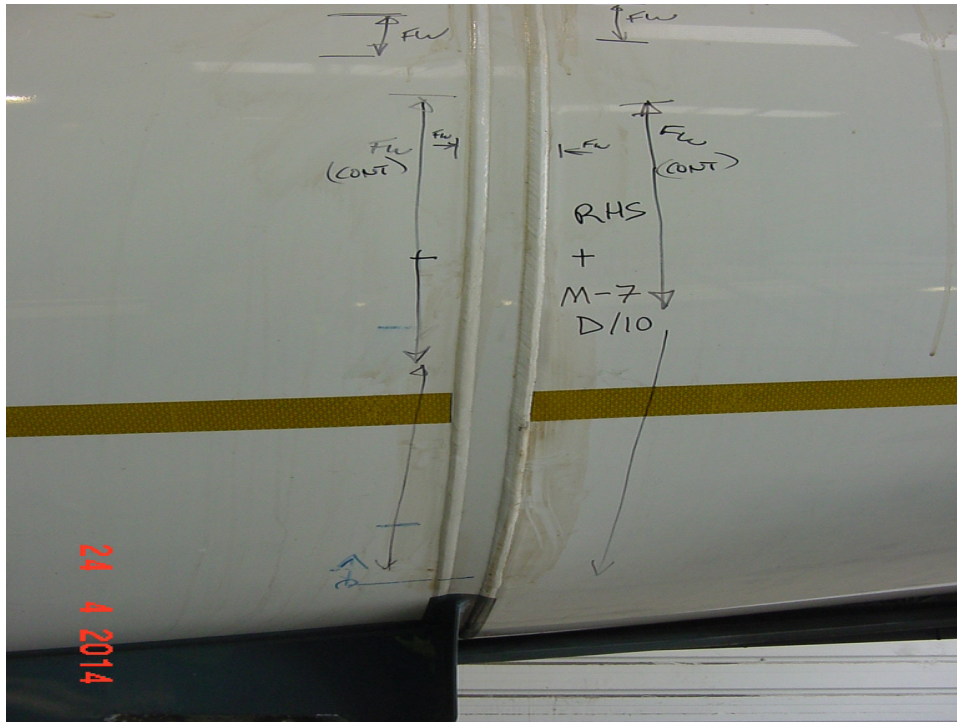


**Figure A25** Offside (labelled right-hand side, RHS), Band C.

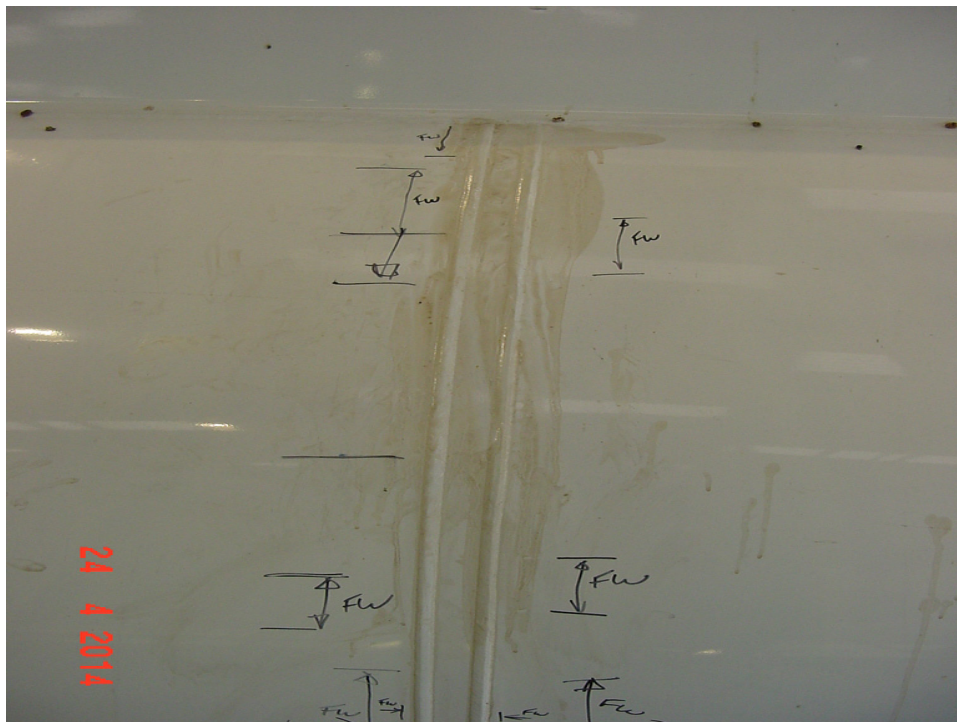


**Figure A26** Offside (labelled right-hand side, RHS), Band C.





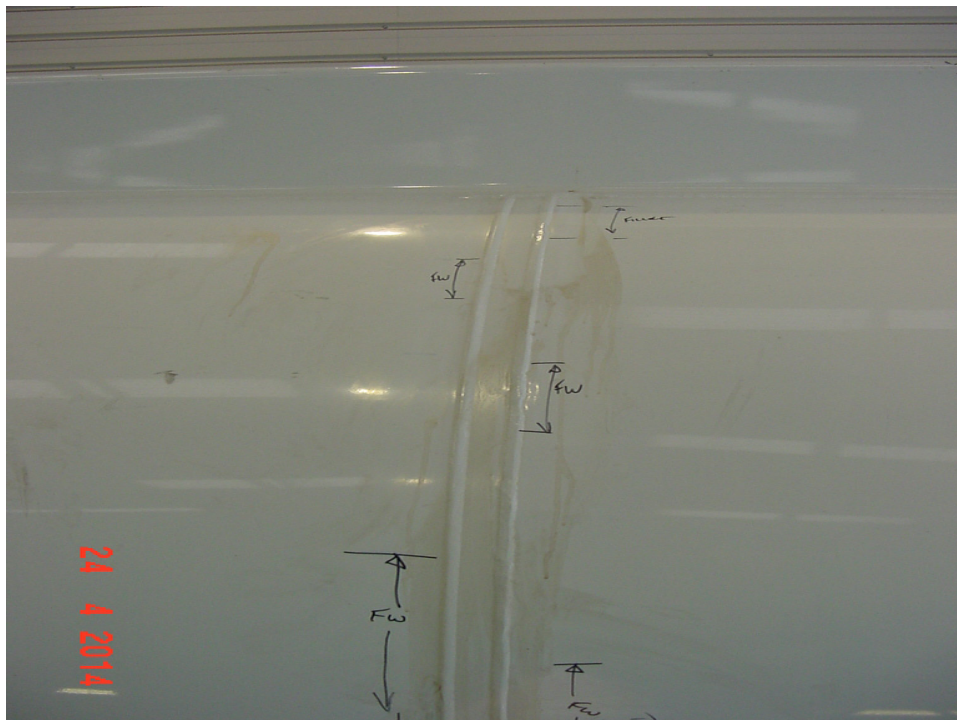
**Figure A27** Offside (labelled right-hand side, RHS), Band D.



**Figure A28** Offside (labelled right-hand side, RHS), Band D.

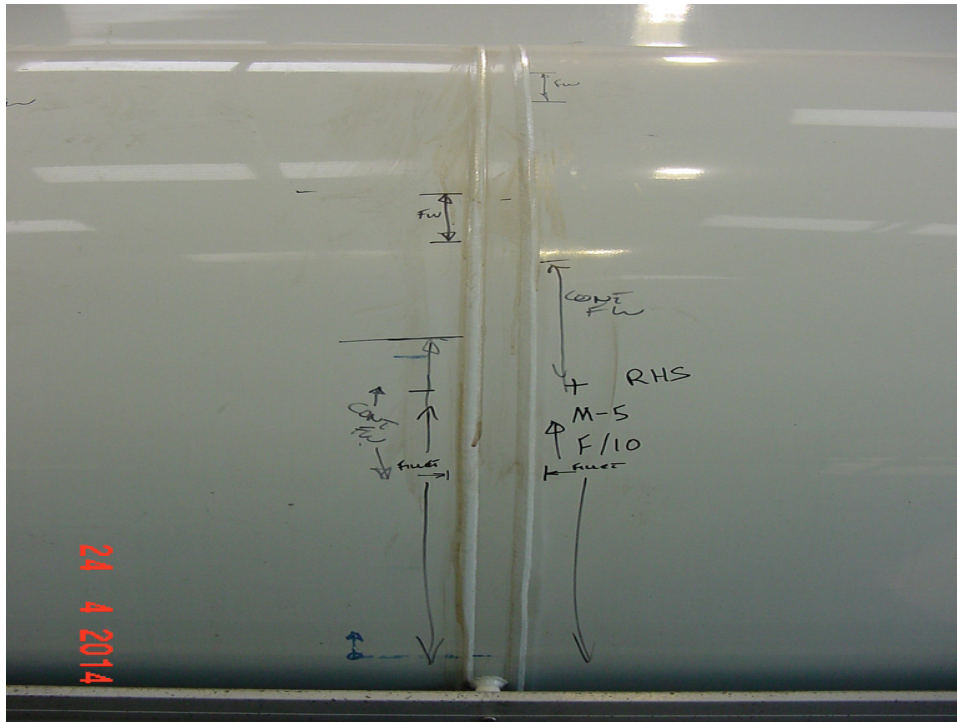


**Figure A29** Offside (labelled right-hand side, RHS), Band E.

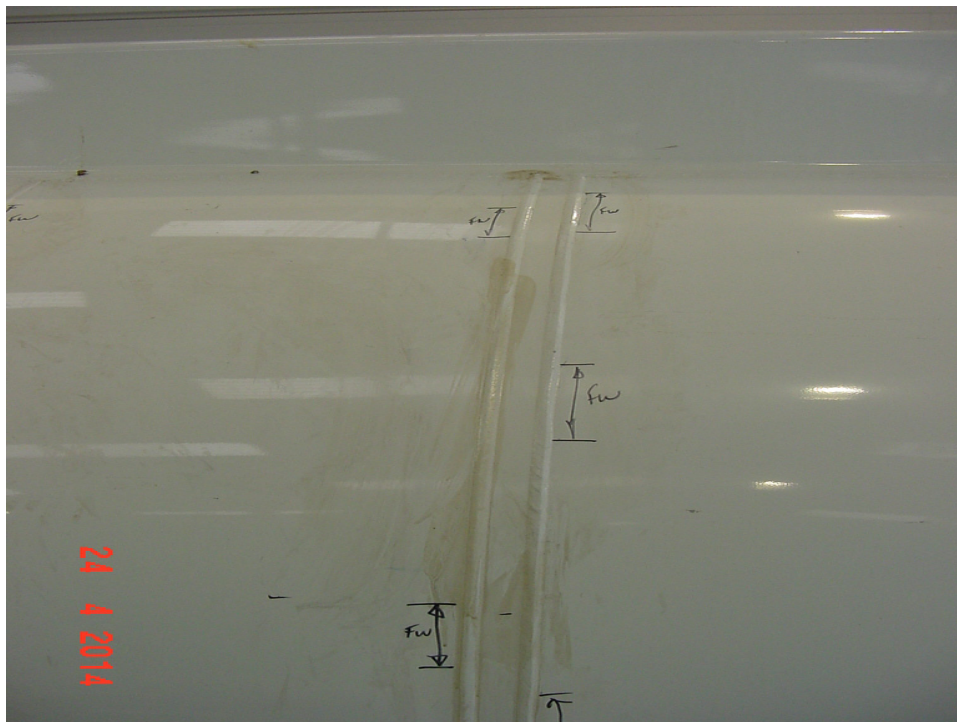


**Figure A30** Offside (labelled right-hand side, RHS), Band E.





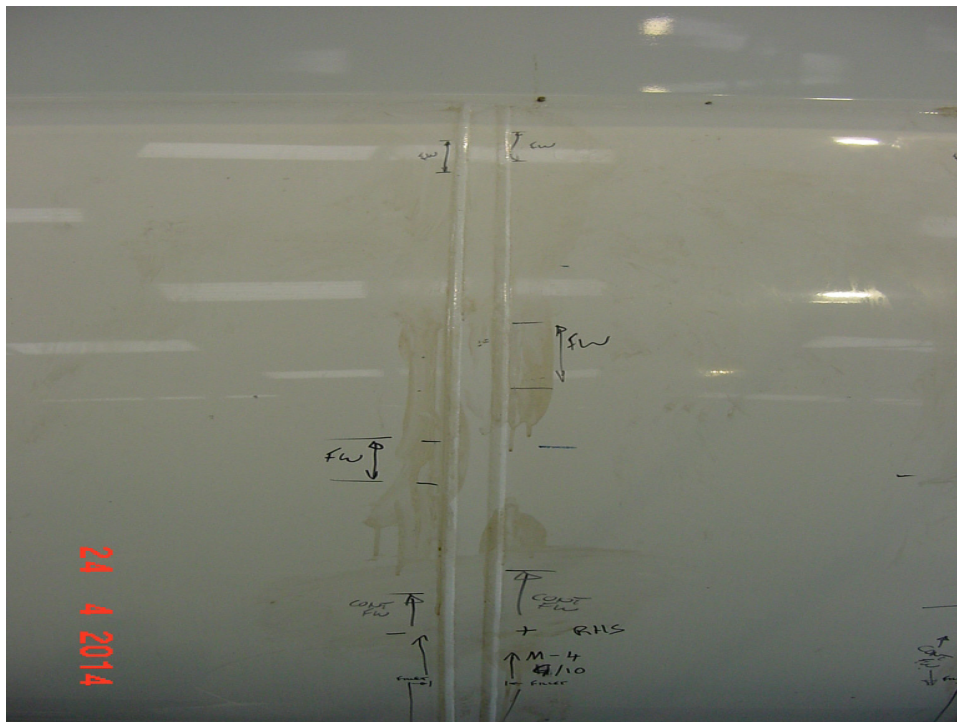
**Figure A31** Offside (labelled right-hand side, RHS), Band F.



**Figure A32** Offside (labelled right-hand side, RHS), Band F.

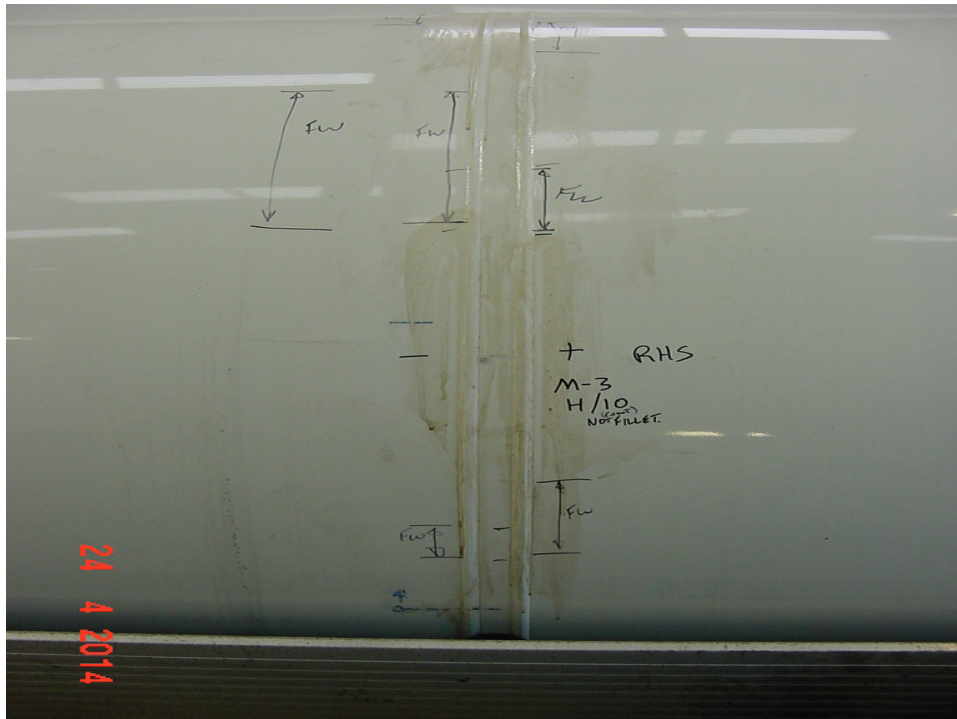


**Figure A33** Offside (labelled right-hand side, RHS), Band G.

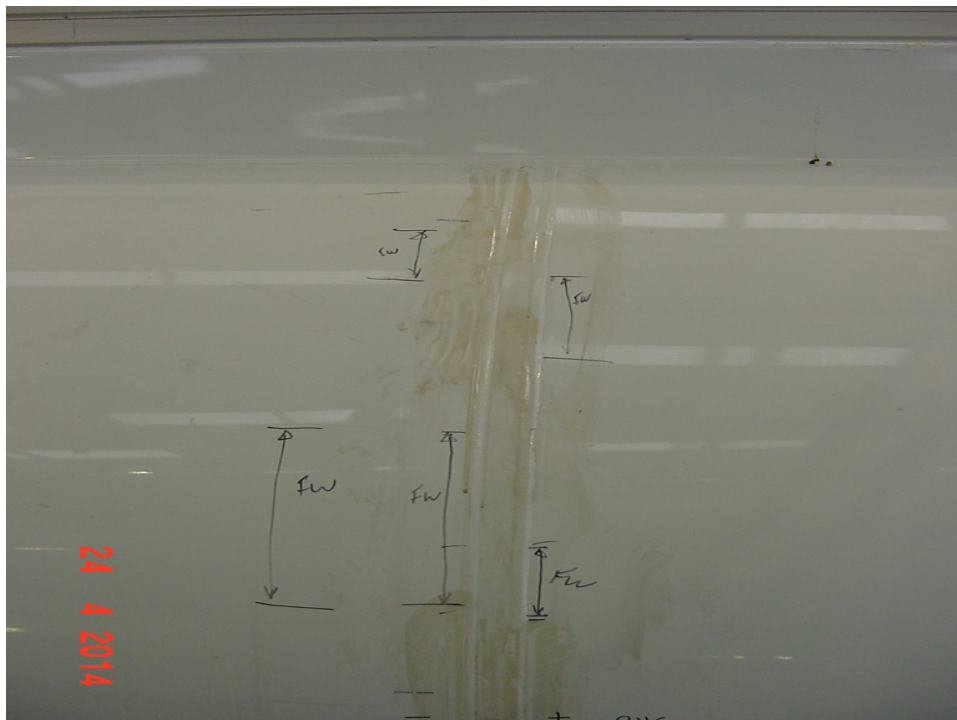


**Figure A34** Offside (labelled right-hand side, RHS), Band G.



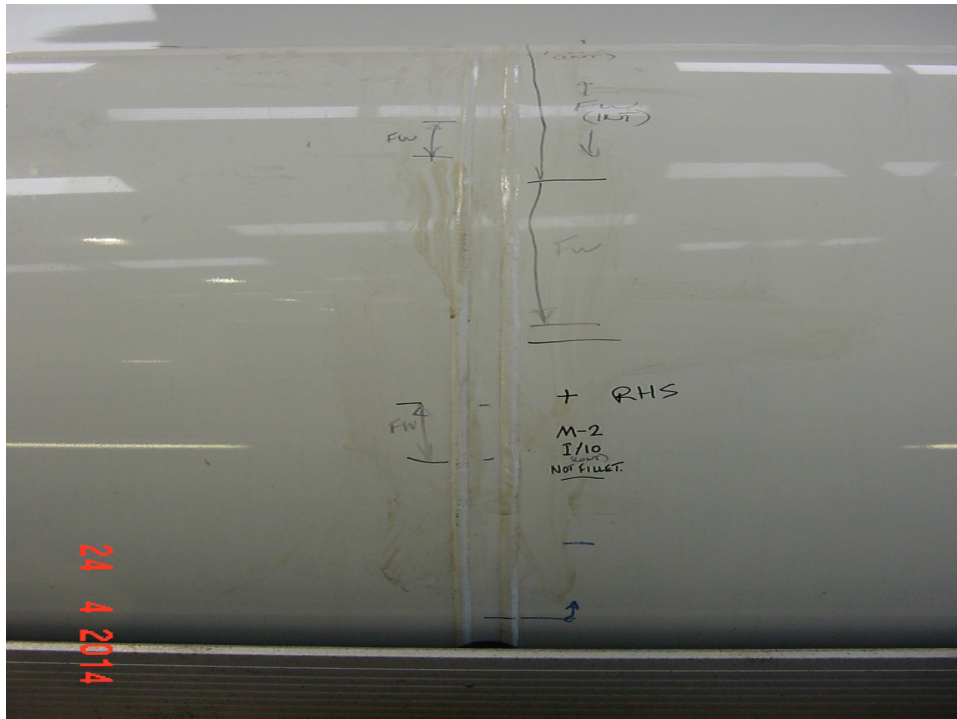


**Figure A35** Offside (labelled right-hand side, RHS), Band H.



**Figure A36** Offside (labelled right-hand side, RHS), Band H.





**Figure A37** Offside (labelled right-hand side, RHS), Band I.



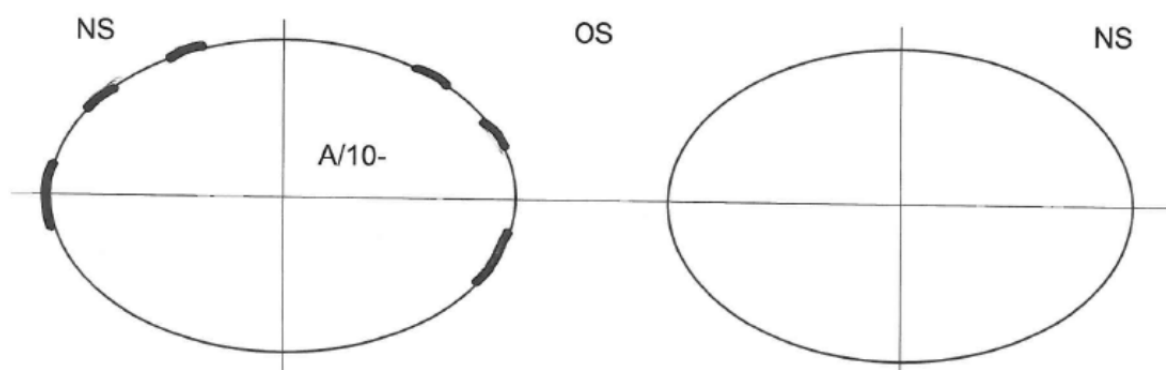
**Figure A38** Offside (labelled right-hand side, RHS), Band I.



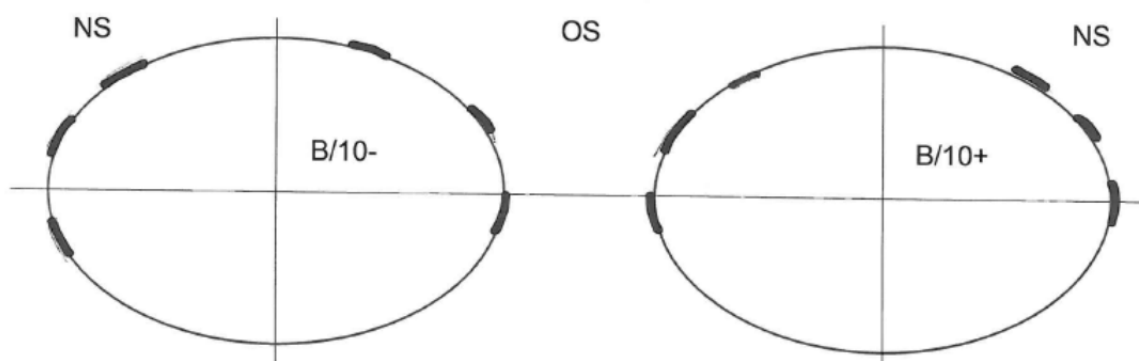
**Figure A39** Offside (labelled right-hand side, RHS), Band J.



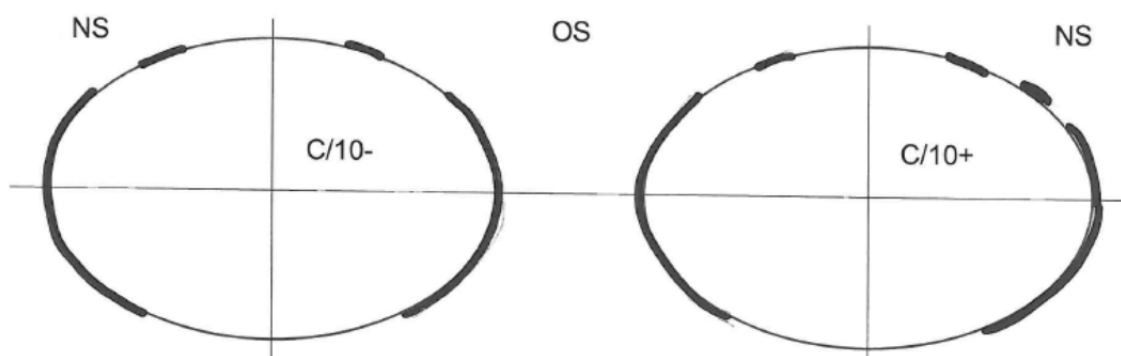
**Figure A40** Offside (labelled right-hand side, RHS), Band J.



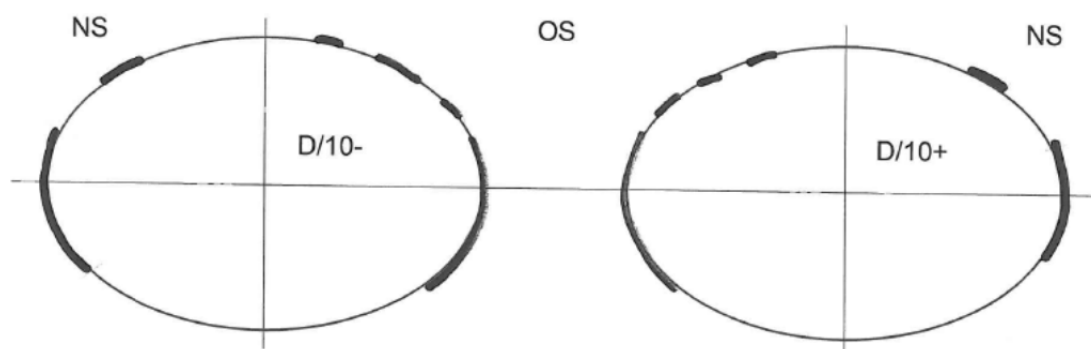
**Figure A41** Fillet weld map diagram for band A/10.



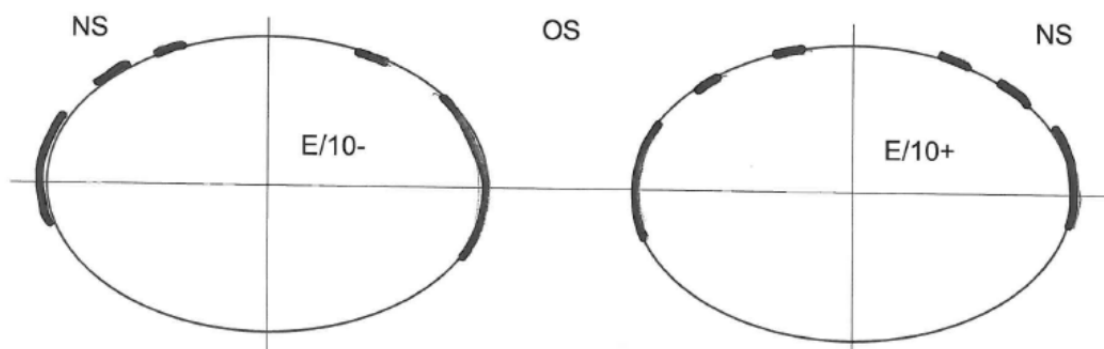
**Figure A42** Fillet weld map diagram for band B/10.



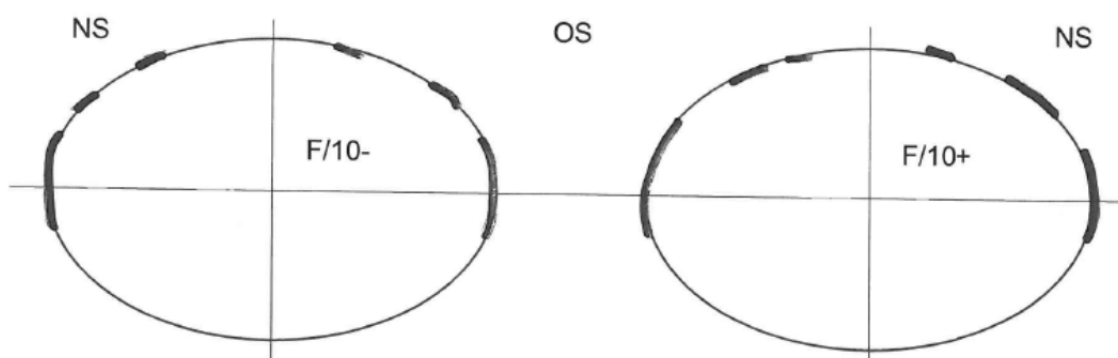
**Figure A43** Fillet weld map diagram for band C/10.



**Figure A44** Fillet weld map diagram for band D/10.

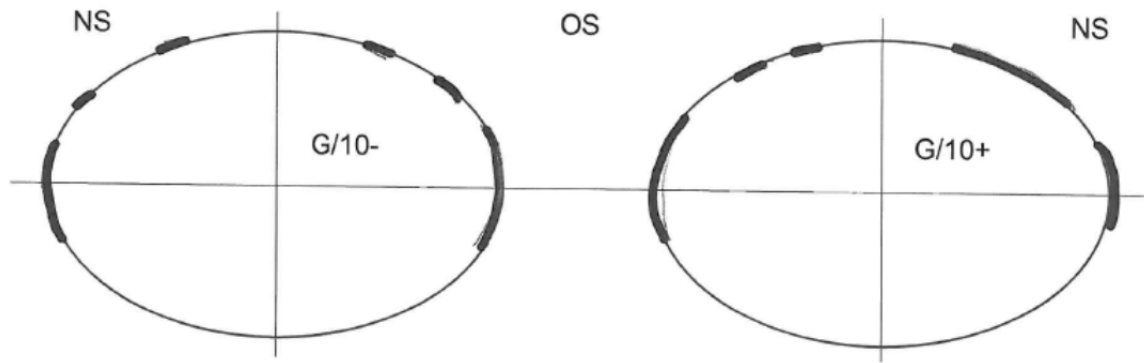


**Figure A45** Fillet weld map diagram for band E/10.

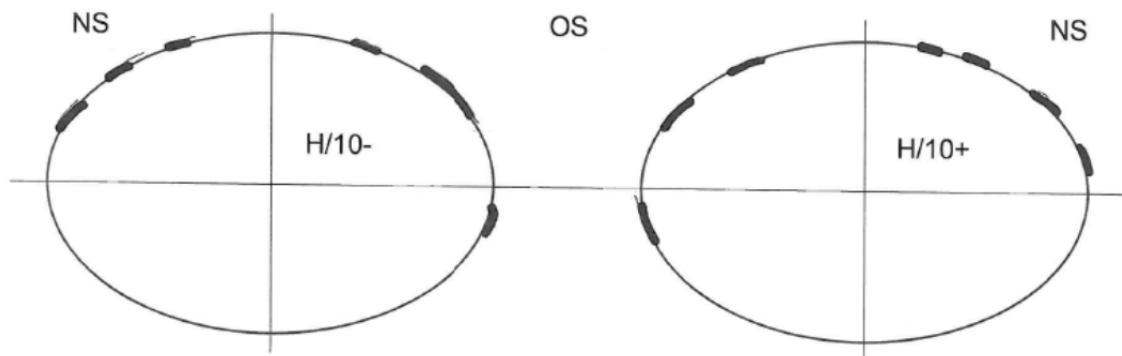


**Figure A46** Fillet weld map diagram for band F/10.

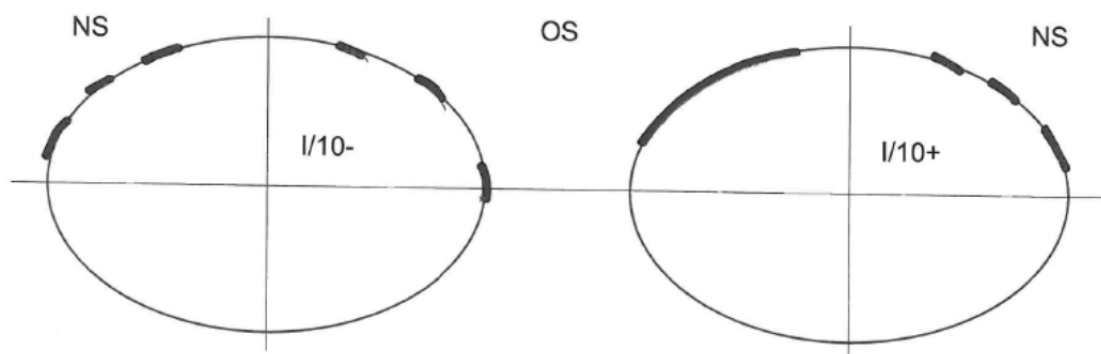




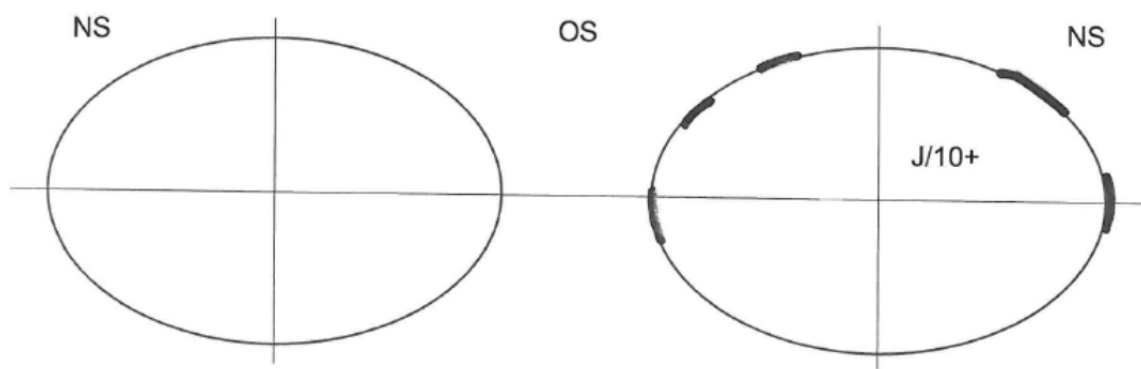
**Figure A47** Fillet weld map diagram for band G/10.



**Figure A48** Fillet weld map diagram for band H/10.



**Figure A49** Fillet weld map diagram for band I/10.



**Figure A50** Fillet weld map diagram for band J/10.