



NDT Section, TWI Ltd,
Granta Park, Great Abington, Cambridge CB21 6AL, UK
Telephone: 01223 899000 Telefax: 01223 890952

RADIOGRAPHIC INTERPRETATION INSPECTION REPORT

Client	HSL	Sheet	1 of 1
Sample identification	J3910, Band A, Weld 02	Date of inspection	29-Sep-14
Job No.	24000		

TWI Reference MI 1638
IQI 10ALEN5
Wire Visible 5 wires

Results	
Item Reference	Comments
A-B	Lack of Fusion 0 to 190 (Full length)
B-C	Lack of Fusion 0 to 25
	Lack of Fusion 62-205
C-D	Lack of Fusion 0 to 205 (Full length)
	Pore @ 113
D-E	No radiograph
E-F	Lack of Fusion 0 to 205 (Full length)
	Pore @ 180
F-G	Lack of Fusion 0 to 107
	Lack of Fusion 142 to 205
G-H	Lack of Fusion 0 to 55
	Lack of Fusion 76 to 205
	Pore @ 148

Interpreter

Ivan Pinson

Signature of operator

Qualification

ASNT Level III



The TEST HOUSE



Certificate of Test

Page 1 of 3

Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 17 September 2014
Reference No.: T41333
Order No.: To follow

Date of test: 18 September 2014
MI No.: 1638
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir, 16mm thick (in area of interest) x 1450mm long, W02 is the only weld of interest.

Identity: Project No. 24000/11, Project Leader: M Haslett

Test methods: Procedure: TP29, BSEN ISO 17636-1:2013

Inspection Authority: N/A


RADIOGRAPHIC INSPECTION REPORT

INSPECTION DETAILS						Focus film distance (mm): 800		
Single wall single image	✓	Double wall single image		Double wall double image		Object film distance (mm): 16		
						Exposure time (mA min): 20		Beam angle (°): 90
Type of equipment: Pantak 160kV CP Unit						Screens: Nil		Filters: Nil
Tube voltage (kV): 48						IQI	Type & size: BSEN 462 10 Al EN	
Focal spot/source dimensions: 3mm							Source side: <div>✓</div>	
Film - make and type: Fuji 80							Film side: <div></div>	
Film density range: 1.9 – 2.6							Sensitivity: Wire No. 11	

RESULTS		Acceptance criteria: None specified	
Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0664	Trial shot	N/A	Settings assessment and adjustment
P0665	A-B IQI shot	N/A	No assessment of weld was made
P0666	A-B	N/A	No assessment of weld was made
P0667	B-C	N/A	No assessment of weld was made
P0668	C-D	N/A	No assessment of weld was made

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson	Witnessed by:
Certificate Approved by: P Robinson, Section Leader	
Signed:  Date: 24/9/2014	



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Certificate of Test

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Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 17 September 2014
Reference No.: T41333
Order No.: To follow
Date of test: 18 September 2014
MI No.: 1638
Specification: N/A


Description: Section of aluminium butt welded fuel tanker reservoir, 16mm thick (in area of interest) x 1450mm long, W02 is the only weld of interest.
Identity: Project No. 24000/11, Project Leader: M Haslett
Test methods: Procedure: TP29, BSEN ISO 17636-1:2013
Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT										
INSPECTION DETAILS						Focus film distance (mm): 800				
Single wall single image	✓	Double wall single image		Double wall double image		Object film distance (mm): 16				
						Exposure time (mA min): 20		Beam angle (°): 90		
Type of equipment: Pantak 160kV CP Unit						Screens: Nil		Filters: Nil		
Tube voltage (kV): 48						IQI	Type & size: BSEN 462 10 A1 EN			
Focal spot/source dimensions: 3mm							Source side:		✓	
Film - make and type: Fuji 80							Film side:			
Film density range: 1.9 – 2.6							Sensitivity: Wire No. 11			

RESULTS		Acceptance criteria: None specified	
Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0669	D-E	N/A	No assessment of weld was made
P0670	E-F	N/A	No assessment of weld was made
P0671	F-G	N/A	No assessment of weld was made
P0672	G-H	N/A	No assessment of weld was made
P0673	G-H IQI Shot	N/A	No assessment of weld was made

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson		Witnessed by:
Certificate Approved by: P Robinson, Section Leader		
Signed:  Date: 24/9/2014		



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Certificate of Test

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Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 17 September 2014
Reference No.: T41333
Order No.: To follow

Date of test: 18 September 2014
MI No.: 1638
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir, 16mm thick (in area of interest) x 1450mm long, W02 is the only weld of interest.
Identity: Project No. 24000/11, Project Leader: M Haslett
Test methods: *Procedure:* TP28, BSEN ISO 3452-1:2013
Inspection Authority: N/A

LIQUID PENETRANT INSPECTION REPORT

INSPECTION DETAILS

System: Colour contrast	Material surface condition: As welded
Cleaning agent: Johnson and Allen JAC-2 Cleaner Batch Number: M302329	Viewing equipment: Portable UVA Lamp Identification number: B438
Penetrant: Johnson and Allen JAP penetrant Batch Number: H1307	Penetration time (minutes): 30
Penetrant remover Johnson and Allen JAC-2 Cleaner Batch Number: M302329	Development time (minutes): 30
Developer: Johnson and Allen JAD Developer Batch Number: D844	Viewing conditions: White Light measured at: 2300 Lux UVA Light measured at: N/A

RESULTS

Acceptance criteria: None specified

Surface	MI number	Indications	Comments
100% of weld and 15mm either side	1638	Isolated pore	C+118mm
		Scattered porosity	F+80mm, 84mm long
		Isolated pore	G+154mm

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by:

J Fordham

Witnessed by:

Certificate Approved by:

P Robinson, Section Leader

Signed

Date

24/9/2014



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Certificate of Test

Page 1 of 2

Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 10 October 2014
Reference No.: T41352
Order No.: To follow

Date of test: 11 October 2014
MI No.: 1779
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir containing 2 longitudinal welds (Only weld 9 is suitable for radiography), 16mm thick (in area of interest) x 1520mm long.

Identity: Project No. 24000/11, Project Leader: M Haslett

Test methods: Procedure: TP29, BSEN ISO 17636-1:2013

Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT

INSPECTION DETAILS						Focus film distance (mm): 800		
Single wall single image	✓	Double wall single image		Double wall double image		Object film distance (mm): 16		
						Exposure time (mA min): 20		Beam angle (°): 90
Type of equipment: Pantak 160kV CP Unit						Screens: Nil		Filters: Nil
Tube voltage (kV): 57						IQI	Type & size: BSEN 462 10 Al EN	
Focal spot/source dimensions: 3mm							Source side: ✓	
Film - make and type: Fuji 80							Film side:	
Film density range: 2.2 to 2.9							Sensitivity: Wire No. 12	

RESULTS

Acceptance criteria: None specified

Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0725	A-B, IQI shot	N/A	N/A
P0725	A-B	N/A	See Appendix 1
P0726	B-C	N/A	
P0727	C-D	N/A	
P0728	D-E	N/A	
P0729	E-F	N/A	
P0730	F-G	N/A	
P0731	G-H	N/A	
P0732	G-H, IQI Shot	N/A	

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson

Witnessed by:

Certificate Approved by: P Robinson, Section Leader

Signed:  Date: 21/10/2014





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Certificate of Test

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Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 10 October 2014
Reference No.: T41352
Order No.: To follow

Date of test: 13 October 2014
MI No.: 1780
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir containing 2 longitudinal welds (Only weld 10 is suitable for radiography), 16mm thick (in area of interest) x 1470mm long.

Identity: Project No. 24000/11, Project Leader: M Haslett

Test methods: Procedure: TP29, BSEN ISO 17636-1:2013

Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT

INSPECTION DETAILS						Focus film distance (mm): 800			
Single wall single image	✓	Double wall single image		Double wall double image		Object film distance (mm): 16			
						Exposure time (mA min): 20		Beam angle (°): 90	
Type of equipment: Pantak 160kV CP Unit						Screens: Nil		Filters: Nil	
Tube voltage (kV): 57						IQI	Type & size: BSEN 462 10 Al EN		
Focal spot/source dimensions: 3mm							Source side:	✓	
Film - make and type: Fuji 80								Film side:	
Film density range: 2.2 to 2.9							Sensitivity: Wire No. 12		


RESULTS

Acceptance criteria: None specified

Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0734	A-B, IQI shot	N/A	N/A
P0734	A-B	N/A	See Appendix 1
P0735	B-C	N/A	
P0736	C-D	N/A	
P0737	D-E	N/A	
P0738	E-F	N/A	
P0739	F-G	N/A	
P0740	G-H	N/A	
P0741	G-H, IQI Shot	N/A	

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson	Witnessed by:
Certificate Approved by: P Robinson, Section Leader	
Signed:  Date: 21/10/2014	



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TEST REPORT

Client:	TWI	Sample identity:
Job reference:	T41352	Appendix 1
Date:	13-Oct-14	


Radiographic Interpretation

Weld	Position (mm)	Results
9	A - B	Fine linear indication throughout (Lack of sidewall fusion) Isolated pores and cavities
	A + 265mm to film end	Longitudinal crack
	B - C	Longitudinal crack , Isolated pores and cavities throughout
	C to C + 115mm	Longitudinal crack + Lack of sidewall fusion to film end
	D to E + 110mm	Lack of sidewall fusion, Isolated pores and cavities to 2.5mm diameter
	E+110mm to F+150mm	Longitudinal crack opens up from Lack of sidewall fusion Isolated pores
	F+150mm to G+150mm	Longitudinal crack
	G + 150mm to H	Intermittent lack of sidewall fusion
10	A - B	Lack of sidewall fusion and isolated pores to 2mm diameter
	B to C + 80mm	Lack of sidewall fusion and isolated pores to 2mm diameter
	C+80mm to D +230mm	No significant indications
	D+230mm to E+80mm	Isolated pores and linear porosity indicating lack of fusion
	E + 80mm to F+185mm	Lack of sidewall fusion throughout
	F + 185mm to H	Intermittent lack of sidewall fusion throughout

It should be noted that the 'Lack of sidewall fusion' interpretation is based on fine linear indications that may or may not be as interpreted. Only a metallographic section would accurately identify the defect and it is recommended that this is carried out to confirm the interpretation.

There are many isolated pores up to a diameter of 2.5mm and there are also many cavities of various shapes and sizes none of which are longer than 3mm.

The longitudinal cracks are not subject to misinterpretation only the start and finish positions which depend on the measurements of the person viewing the films and his interpretation of where the defects start and end..

Report prepared by:	P Robinson	Inspection:
Signed..... 	Date: 13/10/2014	



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Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 7 October 2014
Reference No.: T41348
Order No.: To follow

Date of test: 8 October 2014
MI No.: 1742
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir containing 2 longitudinal welds (W3 and W4), 16mm thick (in area of interest) x 740mm long.
Identity: Project No. 24000/11, Project Leader: M Haslett
Test methods: Procedure: TP29, BSEN ISO 17636-1:2013
Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT

INSPECTION DETAILS				Focus film distance (mm): 800	
Single wall single image	✓	Double wall single image		Double wall double image	Object film distance (mm): 16
Type of equipment: Pantak 160kV CP Unit				Screens: Nil	Beam angle (°): 90
Tube voltage (kV): 48				Filters: Nil	
Focal spot/source dimensions: 3mm				Type & size: BSEN 462 10 Al EN	
Film - make and type: Fuji 80				Source side: ✓	
Film density range: 1.9 to 2.4				Film side:	
				Sensitivity: Wire No. 13	


RESULTS

Acceptance criteria: None specified

Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
N/A	Trial shot	N/A	Settings assessment and adjustment
N/A	A-B IQI shot	N/A	N/A
P0716	A-B	N/A	See Appendix 1
P0717	B-C	N/A	
P0718	C-D	N/A	

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson	Witnessed by:
Certificate Approved by: P Robinson, Section Leader	
Signed:  Date: 10/10/2014	



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Certificate of Test

Page 2 of 3

Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 7 October 2014
Reference No.: T41348
Order No.: To follow

Date of test: 8 October 2014
MI No.: 1743
Specification: N/A

Description: Section of aluminium butt welded fuel tanker reservoir containing 2 longitudinal welds (W5 and W6), 16mm thick (in area of interest) x 820mm long.
Identity: Project No. 24000/11, Project Leader: M Haslett
Test methods: Procedure: TP29, BSEN ISO 17636-1:2013
Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT

INSPECTION DETAILS		Focus film distance (mm): 800	
Single wall single image	<input checked="" type="checkbox"/>	Double wall single image	Double wall double image
Type of equipment: Pantak 160kV CP Unit		Object film distance (mm): 16	
Tube voltage (kV): 48		Exposure time (mA min): 20	Beam angle (°): 90
Focal spot/source dimensions: 3mm		Screens: Nil	Filters: Nil
Film - make and type: Fuji 80		Type & size: BSEN 462 10 Al EN	
Film density range: 1.9 to 2.4		Source side:	<input checked="" type="checkbox"/>
		Film side:	<input type="checkbox"/>
		Sensitivity: Wire No. 13	


RESULTS

Acceptance criteria: None specified

Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0719	A-B	N/A	See Appendix 1
P0720	B-C	N/A	
P0721	C-D	N/A	

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson	Witnessed by:
Certificate Approved by: P Robinson, Section Leader	
Signed:  Date: 10/12/2014	



The TEST HOUSE



Certificate of Test

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Client: TWI, Granta Park, Great Abington, Cambridge, CB21 6AL
Date of receipt: 7 October 2014
Reference No.: T41348
Order No.: To follow

Date of test: 8 October 2014
MI No.: 1744
Specification: N/A


Description: Section of aluminium butt welded fuel tanker reservoir containing 2 longitudinal welds (W7 and W8), 16mm thick (in area of interest) x 820mm long.
Identity: Project No. 24000/11, Project Leader: M Haslett
Test methods: **Procedure:** TP29, BSEN ISO 17636-1:2013
Inspection Authority: N/A

RADIOGRAPHIC INSPECTION REPORT									
INSPECTION DETAILS					Focus film distance (mm): 800				
Single wall single image	✓	Double wall single image		Double wall double image	Object film distance (mm): 16				
Type of equipment: Pantak 160kV CP Unit					Exposure time (mA min): 20		Beam angle (°): 90		
Tube voltage (kV): 48					Screens: Nil		Filters: Nil		
Focal spot/source dimensions: 3mm					IQI	Type & size: BSEN 462 10 Al EN			
Film - make and type: Fuji 80						Source side:		✓	
Film density range: 1.9 to 2.4						Film side:			
					Sensitivity: Wire No. 13				

RESULTS		Acceptance criteria: None specified	
Radiograph identity	Weld/Sample identity	Accepted/Rejected	No space to place the IQI alongside the weld so a specific IQI shot was taken at each end of the weld, before and after the radiography of the weld was completed
P0722	A-B	N/A	See Appendix 1
P0723	B-C	N/A	
P0724	C-D	N/A	
N/A	C-D-IQI Shot	N/A	N/A

- End of Test Results -

Note - The test results detailed above apply only to the sample(s) of material submitted to the laboratory.

Tests Performed by: P R Robinson	Witnessed by:
Certificate Approved by: P Robinson, Section Leader	
Signed:  Date: 10/10/2014	

The TEST HOUSE



TEST REPORT

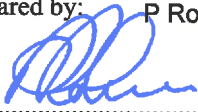
Client:	TWI	Sample identity: Appendix 1
Job reference:	T42348	
Date:	09-Oct-14	

Radiographic Interpretation

Weld	Position (mm)	Results
3	0 - 100	Lack of sidewall fusion throughout
	100 - 200	Intermittent lack of sidewall fusion
	155 - 170	Elongated cavity
	200 - 300	Intermittent lack of sidewall fusion
	300 - 400	Intermittent lack of sidewall fusion
	400 - 500	Intermittent lack of sidewall fusion
	500 - 600	Isolated pores
	600 - 700	Intermittent lack of sidewall fusion

5	0 - 45	No significant indications
	45 - 160	Intermittent lack of sidewall fusion and isolated pores
	160 - 300	Intermittent lack of sidewall fusion
	300 - 400	Intermittent lack of sidewall fusion and pores
	400 - 500	Intermittent lack of sidewall fusion and pores
	500 - 600	Intermittent lack of sidewall fusion and pores
	600 - 700	Intermittent lack of sidewall fusion and pores
	700 - 800	Intermittent lack of sidewall fusion and pores
		Please note that W5 has an indication along the side of the weld that is thinner than the surrounding plate

7	0 - 100	Intermittent lack of sidewall fusion and longitudinal indications throughout
	100 - 200	Intermittent lack of sidewall fusion and longitudinal indications throughout
	200 - 300	Intermittent lack of sidewall fusion and longitudinal indications throughout
	300 - 400	Lack of sidewall fusion and lack of root fusion
	400 - 500	Intermittent lack of sidewall fusion and lack of root penetration
	500 - 550	Intermittent lack of root penetration
	550 - 700	Isolate and scattered pores
	700 - 800	Isolate and scattered pores

Report prepared by: P Robinson	Inspection:
Signed:  Date: 09/10/2014	