** SAMPLE ADDRESS **,

xxxxxxxxxx, xxxxxxxxxx, XX11 XXX

Internal Ultrasonic Gauging Survey
Of
Aboveground Fuel Storage Tank One

Report Number: EXMNDTRF0000 SAMPLE

This report has been written in support of the recent inspection undertaken on xx/xx/xxxx at **ADDRESS** by EX Mechina on behalf of **CLIENT**.

CONTENTS

INTRODUCTION, EQUIPMENT AND PERSONNEL

Introduction

An internal ultrasonic gauging survey and visual inspection of Fuel Storage Tank One was carried out using a Digital Wall Thickness Gauge, the results were recorded and are shown within this report.

Equipment

Ultrasonic Set	CorDEX UT5000
Ultrasonic Probe	CorDEX Intrinsically Safe Transducer – XP570
Ultrasonic Test Block	Steel 1-12mm Step-Wedge Test Block
Couplant	CorDEX XP-560

Process

Limitations to Test:	None
Departures from Test Procedure:	None
Surface Condition:	Bare Metal
Primary Reference Gain:	65dB
Scanning Sensitivity:	N/A

Personnel

Mr R. Friend	NDT Inspector	– EX Mechina

Signature  Name: **R W FRIEND** Date: **xx/xx/xxxx**

GENERAL NOTES

1. The survey undertaken is in accordance with the specification shown in BS EN ISO 16809:2019 (Non-Destructive Testing – Ultrasonic Thickness Measurement).

2. The acceptance specifications given are: Report Findings. All results are given for the client's own evaluation. All recommendations given within this report are advisory and may not reflect the condition or status of any items examined after the time of completion of the inspection.

3. All ultrasonic thickness readings within this report are shown in millimetres.

4. The steel thickness only is shown. Scale, rust, and paint thicknesses are not included in the ultrasonic readings but may be commented on if there are items of note.

5. Any and/or all pipework was inspected externally, and internal condition is unverifiable.

6. Drawings in this report are diagrammatic and no scale has been used.

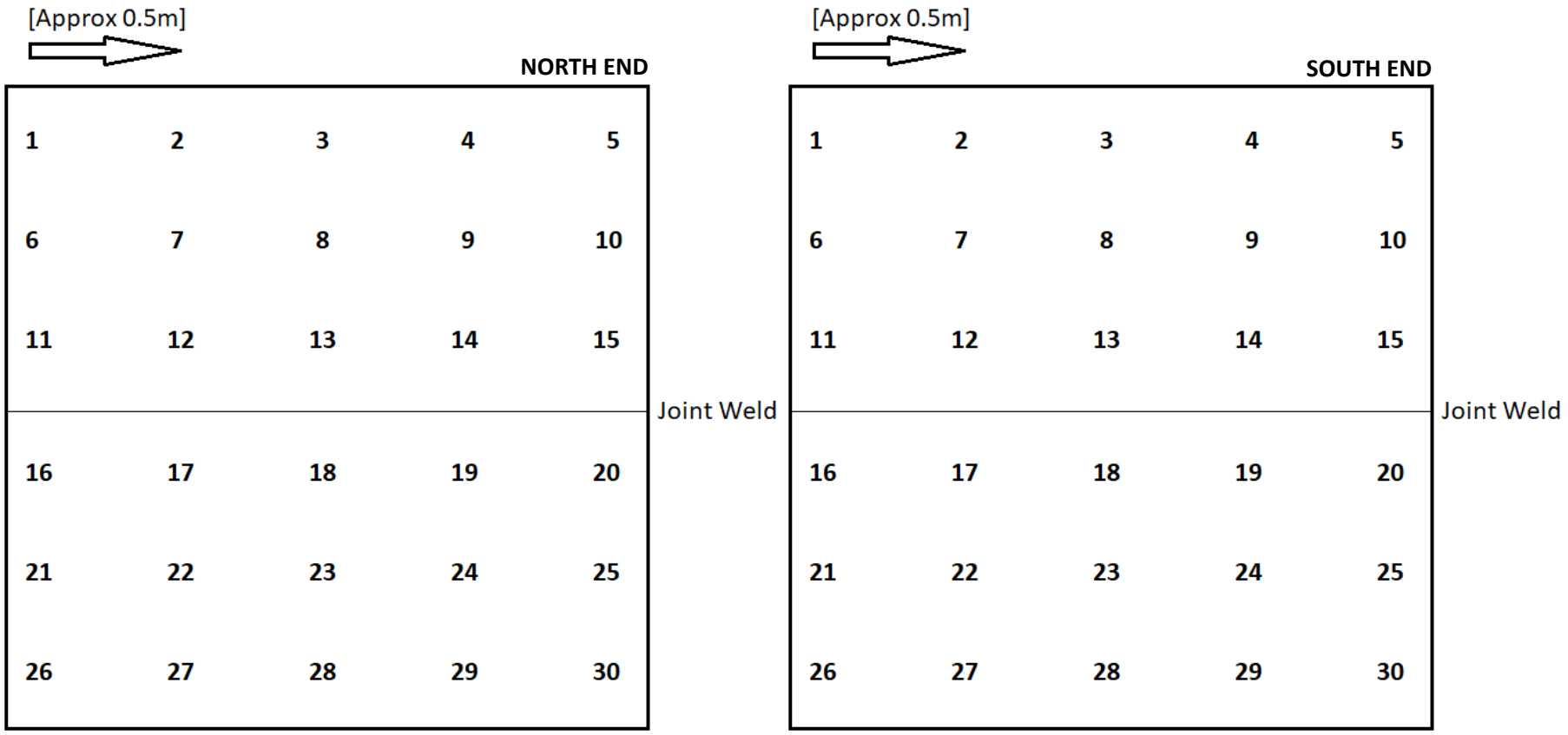
7. Any recommendations recorded within this report relating to 'future monitoring' should be undertaken in accordance with the time scale stipulated by the manufacturer unless otherwise stated.

8. All information contained in this report is correct at the time of survey/inspection. EX Mechina cannot be held responsible for defects or deterioration occurring at any time after the inspection.

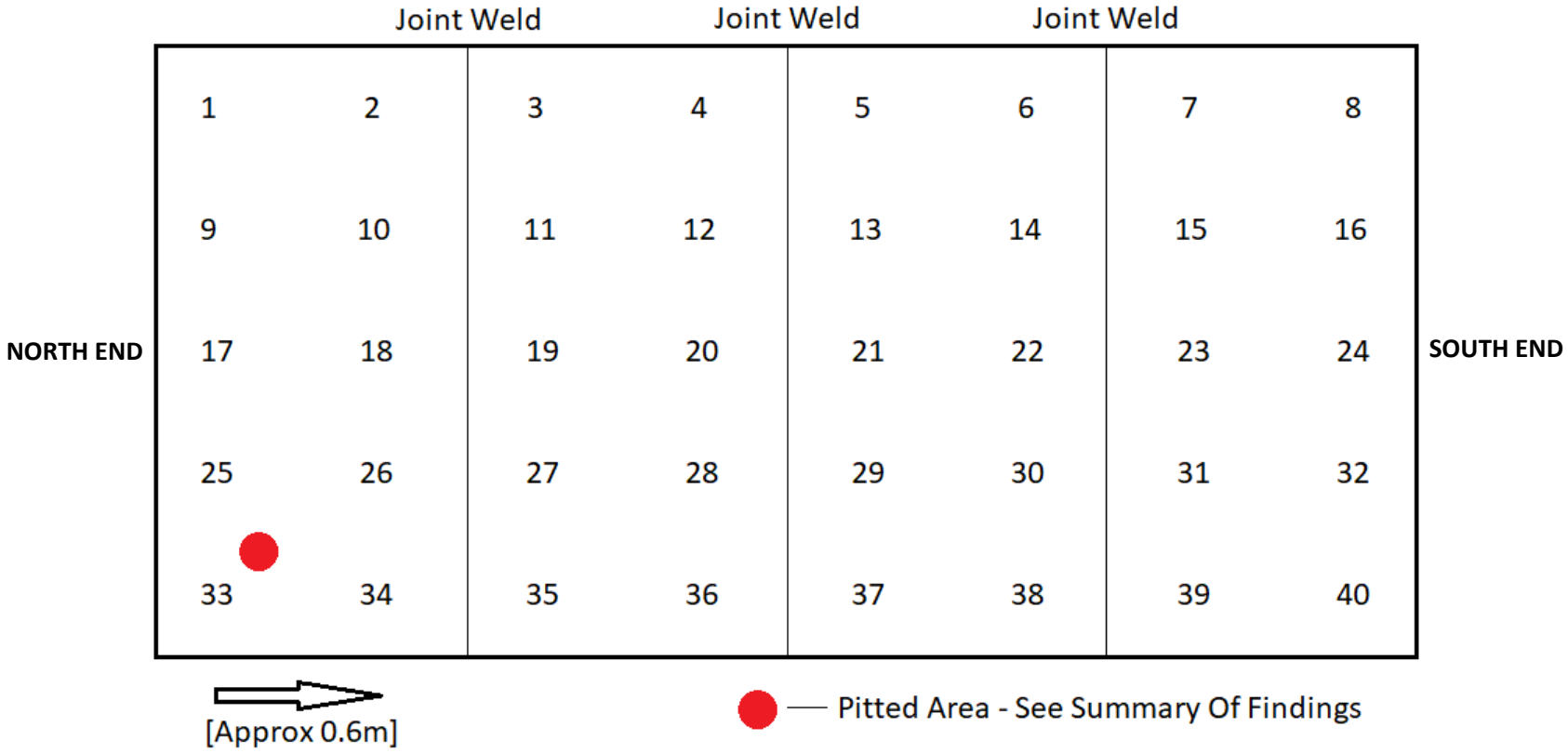
9. EX Mechina do not hold ourselves responsible in the event of any dispute arising between the client and any of their contractors or customers due to the information presented in this report.

10. This report is confidential to our client for the purpose to which it refers and may not be relied upon by any third party, who do so at their own risk.

THICKNESS MEASUREMENT LOCATION DIAGRAMS
FUEL TANK ONE - NORTH & SOUTH ENDS



THICKNESS MEASUREMENT LOCATION DIAGRAM
FUEL TANK ONE - FLOOR PLATING



THICKNESS MEASUREMENT LOCATION DIAGRAMS
FUEL TANK ONE – EAST & WEST SIDES

[Approx 0.5m]

EAST SIDE

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
Joint Weld									
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60

[Approx 0.5m]

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
Joint Weld									
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60

WEST SIDE

NDT MEASUREMENTS TABULATION

	Ultrasonic Thickness Measurements
Position	
TANK ONE NORTH END	
1	*6.6 mm*
2	*6.6 mm*
3	*6.6 mm*
4	*6.5 mm*
5	*6.6 mm*
6	*6.6 mm*
7	*6.6 mm*
8	*6.5 mm*
9	*6.6 mm*
10	*6.6 mm*
11	*6.6 mm*
12	*6.6 mm*
13	*6.6 mm*
14	*6.6 mm*
15	*6.6 mm*
16	*6.5 mm*
17	*6.6 mm*
18	*6.6 mm*
19	*6.6 mm*
20	*6.6 mm*
21	*6.6 mm*
22	*6.5 mm*
23	*6.6 mm*
24	*6.5 mm*
25	*6.6 mm*
26	*6.6 mm*
27	*6.6 mm*
28	*6.6 mm*
29	*6.6 mm*
30	*6.6 mm*
TANK ONE SOUTH END	
1	*6.3 mm*
2	*6.4 mm*
3	*6.4 mm*
4	*6.4 mm*
5	*6.4 mm*

6	*6.4 mm*
7	*6.4 mm*
8	*6.4 mm*
9	*6.4 mm*
10	*6.3 mm*
11	*6.3 mm*
12	*6.3 mm*
13	*6.4 mm*
14	*6.4 mm*
15	*6.4 mm*
16	*6.4 mm*
17	*6.4 mm*
18	*6.4 mm*
19	*6.2 mm*
20	*6.4 mm*
21	*6.4 mm*
22	*6.4 mm*
23	*6.4 mm*
24	*6.4 mm*
25	*6.4 mm*
26	*6.4 mm*
27	*6.4 mm*
28	*6.4 mm*
29	*6.2 mm*
30	*6.4 mm*
TANK ONE FLOOR	
1	*5.2 mm*
2	*5.3 mm*
3	*5.2 mm*
4	*5.2 mm*
5	*5.2 mm*
6	*5.2 mm*
7	*5.2 mm*
8	*5.3 mm*
9	*5.2 mm*
10	*5.2 mm*
11	*5.2 mm*
12	*5.2 mm*
13	*5.2 mm*
14	*5.2 mm*
15	*5.3 mm*
16	*5.2 mm*
17	*5.2 mm*
18	*5.2 mm*
19	*5.2 mm*
20	*5.2 mm*
21	*5.2 mm*

22	*5.2 mm*
23	*5.2 mm*
24	*5.3 mm*
25	*5.2 mm*
26	*5.2 mm*
27	*5.2 mm*
28	*5.2 mm*
29	*5.2 mm*
30	*5.2 mm*
31	*5.2 mm*
32	*5.2 mm*
33	*5.2 mm*
34	*5.2 mm*
35	*5.2 mm*
36	*5.2 mm*
37	*5.2 mm*
38	*5.2 mm*
39	*5.2 mm*
40	*5.2 mm*
TANK ONE EAST SIDE	
1	*6.4 mm*
2	*6.4 mm*
3	*6.4 mm*
4	*6.4 mm*
5	*6.4 mm*
6	*6.4 mm*
7	*6.3 mm*
8	*6.4 mm*
9	*6.4 mm*
10	*6.4 mm*
11	*6.4 mm*
12	*6.4 mm*
13	*6.4 mm*
14	*6.4 mm*
15	*6.4 mm*
16	*6.4 mm*
17	*6.3 mm*
18	*6.4 mm*
19	*6.3 mm*
20	*6.4 mm*
21	*6.4 mm*
22	*6.4 mm*
23	*6.4 mm*
24	*6.4 mm*
25	*6.4 mm*
26	*6.4 mm*
27	*6.3 mm*

28	*6.4 mm*
29	*6.4 mm*
30	*6.4 mm*
31	*6.2 mm*
32	*6.2 mm*
33	*6.2 mm*
34	*6.3 mm*
35	*6.2 mm*
36	*6.3 mm*
37	*6.3 mm*
38	*6.2 mm*
39	*6.2 mm*
40	*6.2 mm*
41	*6.2 mm*
42	*6.2 mm*
43	*6.2 mm*
44	*6.2 mm*
45	*6.2 mm*
46	*6.2 mm*
47	*6.2 mm*
48	*6.2 mm*
49	*6.2 mm*
50	*6.2 mm*
51	*6.2 mm*
52	*6.2 mm*
53	*6.2 mm*
54	*6.2 mm*
55	*6.2 mm*
56	*6.3 mm*
57	*6.2 mm*
58	*6.2 mm*
59	*6.2 mm*
60	*6.2 mm*
TANK ONE WEST SIDE	
1	*6.2 mm*
2	*6.2 mm*
3	*6.2 mm*
4	*6.2 mm*
5	*6.2 mm*
6	*6.2 mm*
7	*6.2 mm*
8	*6.2 mm*
9	*6.2 mm*
10	*6.2 mm*
11	*6.2 mm*
12	*6.2 mm*
13	*6.2 mm*

14	*6.2 mm*
15	*6.2 mm*
16	*6.2 mm*
17	*6.2 mm*
18	*6.2 mm*
19	*6.2 mm*
20	*6.2 mm*
21	*6.3 mm*
22	*6.2 mm*
23	*6.2 mm*
24	*6.2 mm*
25	*6.2 mm*
26	*6.2 mm*
27	*6.2 mm*
28	*6.2 mm*
29	*6.2 mm*
30	*6.2 mm*
31	*6.2 mm*
32	*6.2 mm*
33	*6.2 mm*
34	*6.2 mm*
35	*6.3 mm*
36	*6.2 mm*
37	*6.2 mm*
38	*6.2 mm*
39	*6.2 mm*
40	*6.2 mm*
41	*6.2 mm*
42	*6.2 mm*
43	*6.2 mm*
44	*6.2 mm*
45	*6.3 mm*
46	*6.3 mm*
47	*6.2 mm*
48	*6.2 mm*
49	*6.2 mm*
50	*6.2 mm*
51	*6.2 mm*
52	*6.2 mm*
53	*6.2 mm*
54	*6.2 mm*
55	*6.2 mm*
56	*6.2 mm*
57	*6.2 mm*
58	*6.2 mm*
59	*6.3 mm*
60	*6.2 mm*

EXTERNAL PHOTOGRAPHS

Fig 1. Exterior from South West

Fig 2. Exterior from North West

Fig 3. Exterior from North East

Fig 4. Exterior from South East

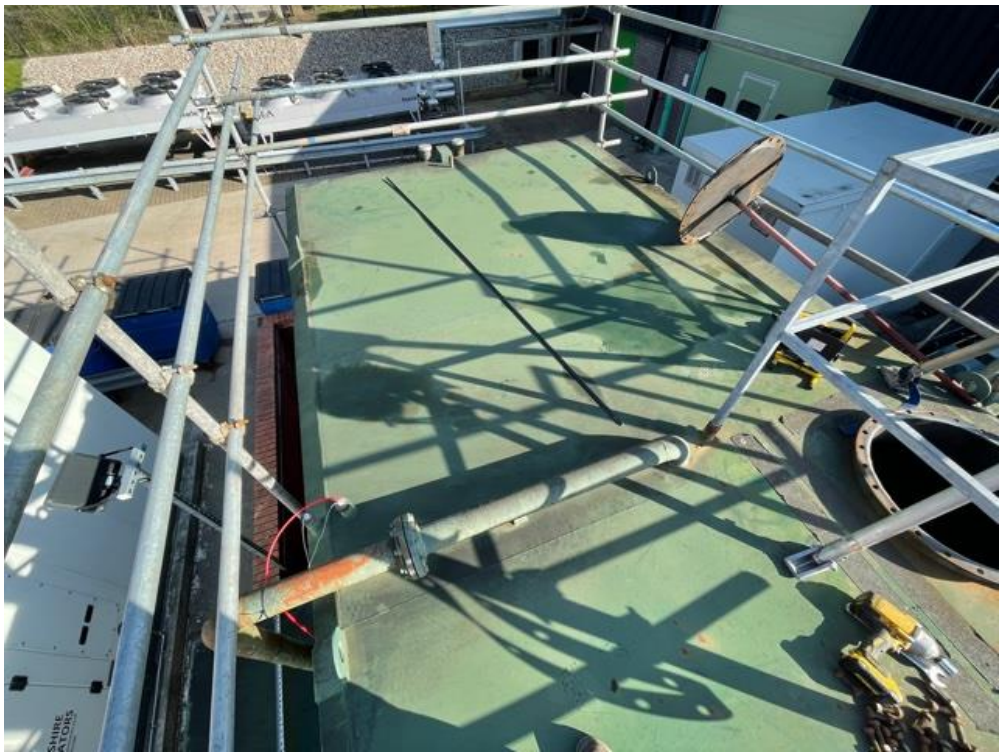


Fig 5. Tank Roof

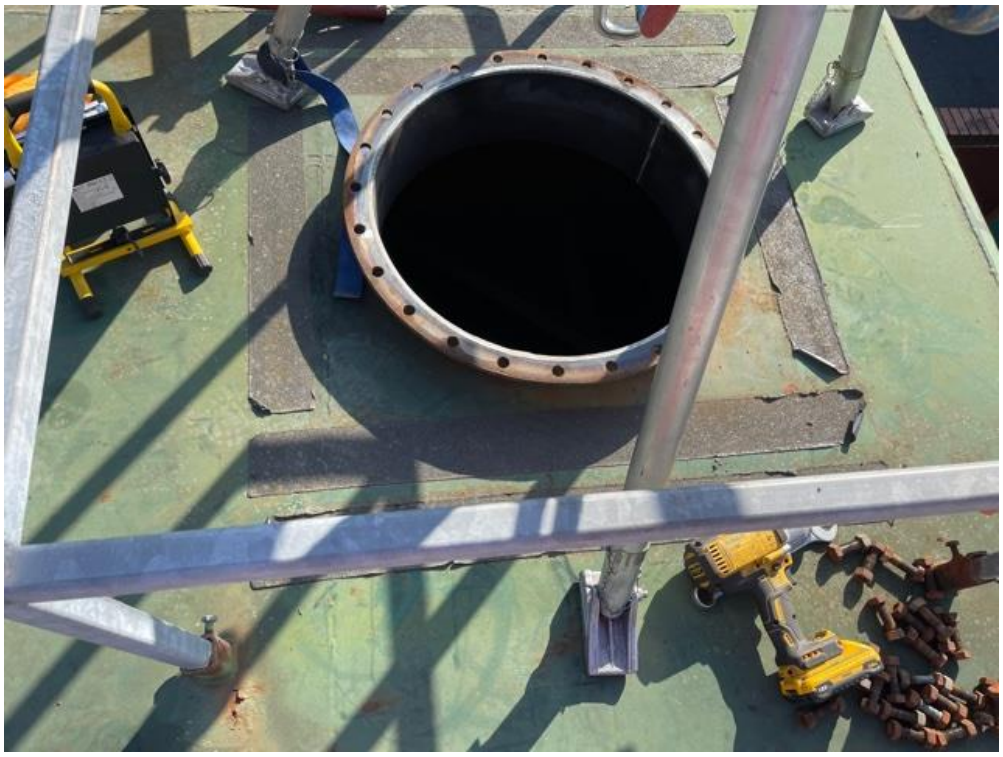


Fig 6. Tank Access Lid

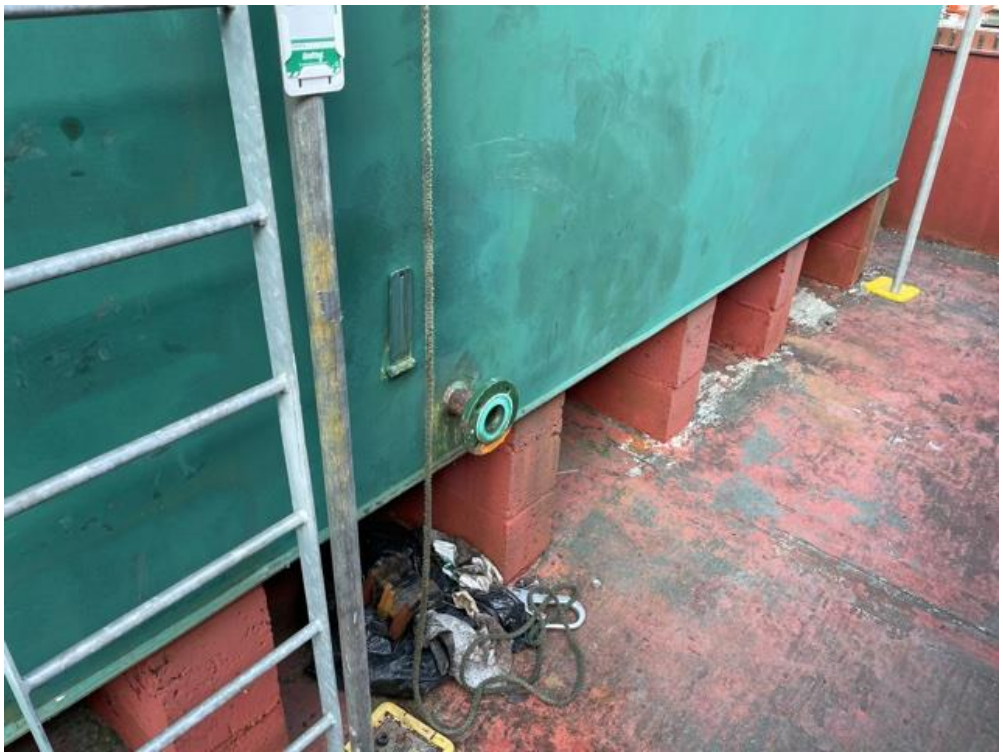


Fig 7. Tank Supports & Base

Fig 8. Outlet Nozzle

Fig 9. Outlet Nozzle Close-Up

Fig 10. Outlet Nozzle Corrosion

Fig 11. Protrusion Corrosion

Fig 12. Protrusion Corrosion

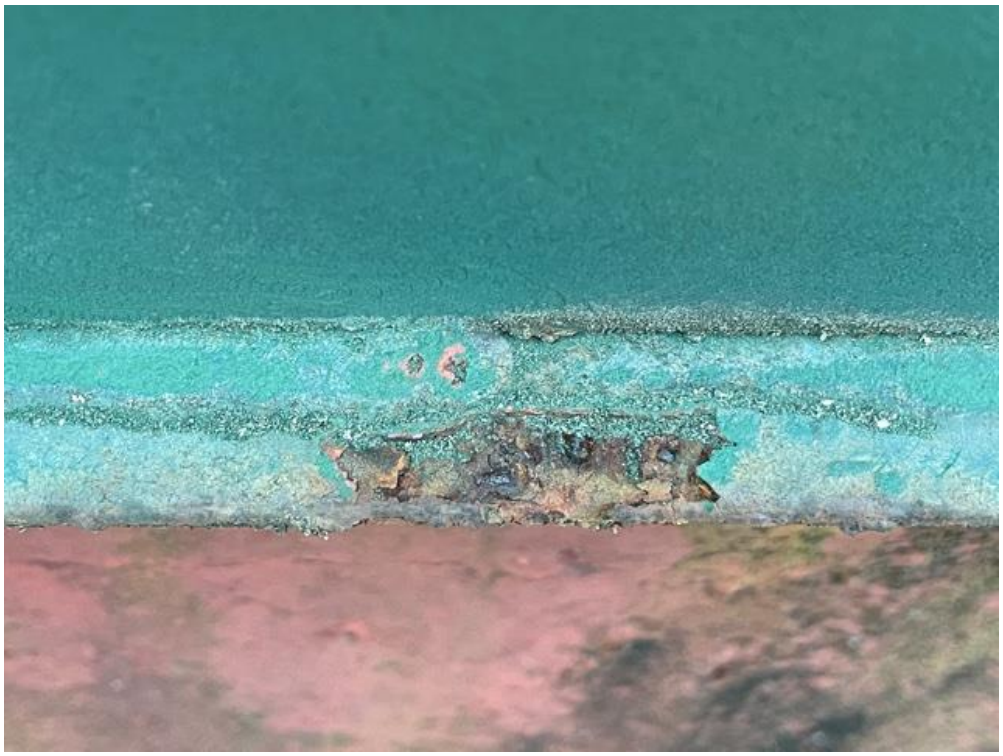


Fig 13. Protrusion Corrosion

Fig 14. Exterior Bund Corrosion

Fig 15. Gauge Pipe Inlet

Fig 16. Fill Pipework

Fig 17. Tank Vents & Dip

INTERNAL PHOTOGRAPHS

Fig 18. Central Internal View

Fig 19. Tank Bracing & Dip Tube

Fig 20. Tank Floor

Fig 21. Tank Roof

Fig 22. Tank East Wall

Fig 23. Tank West Wall

Fig 24. S/W Floor & Gauge

Fig 25. S/E Floor & Outlet

Fig 26. Outlet Close-Up

Fig 27. Internal Tac Welds

Fig 28. Unwelded Bracing

Fig 29. Bracing Close-Up

Fig 30. N/W Floor Pitting

Fig 31. Pitting Close-Up

SUMMARY OF FINDINGS AND RECOMMENDATIONS

There was no previous cleaning and inspection work history available for this tank. Prior to this April 2021 inspection, the fuel was removed, and the inside was cleaned. The inspection surfaces presented a clean and bare metal.

The pre-flange exterior outlet nozzle pipework was found to be severely corroded with heavy pitting and skin loss to the pipe [see figures 8 to 10]. There is evidence of pinhole leakage on the bottom of the pipe and if the tank is to be returned to use, then this will require suitable prior rectification.

The exterior shell of this tank shows signs of minor corrosion. There are a small number of surface-corroded areas due to paintwork damage and subsequent water entrapment on the floor protrusion and north wall [see figures 11 to 14].

The OCIO tank product level gauge's PU tube enters the tank through a drilled hole in a screwed cap fitted to a nozzle on the tank roof. An attempt has been made to seal the surrounding hole with a type of putty, but this is ineffective, and no seal has been made. Consequently, there is a chance of water ingress to the main body of the tank around the edges of the tubing at this point [see figure 15].

The interior north end-wall of this tank shows no signs of corrosion or warping of the rolled plate. The ultrasonic readings found were between 6.5mm and 6.6mm. The junction welds between this plate and the neighbouring floor and sidewall plates [the tank roof is not subject to this] is fully welded only on the exterior side [within the bund] and the interior is only tac welded [see figure 27]. This does not confirm to the current British Standard set out for the construction of double-skinned fuel storage tanks of this type and construction; it is a weaker design and consequently presents a higher possibility of eventual failure. The central weld of the end plating joining the two halves together is in good condition with no signs of cracking, seepage, or delamination. No further internal damage appears to have occurred and the metal is in overall fair health.

The interior south end-wall of this tank shows no signs of corrosion or warping of the rolled plate. The ultrasonic readings found were between 6.2mm and 6.4mm. The junction welds between this plate and the neighbouring floor and sidewall plates [the tank roof is not subject to this] is fully welded only on the exterior side [within the bund] and the interior is only tac welded. This does not confirm to the current British Standard set out for the construction of double-skinned fuel storage tanks of this type and construction; it is a weaker design and consequently presents a higher possibility of eventual failure. The central weld of the end plating joining the two halves together is in good condition with no signs of cracking, seepage, or delamination. No further internal damage appears to have occurred and the metal is in overall fair health.

The interior east sidewall of this tank shows no signs of corrosion or warping of the rolled plate. The ultrasonic readings found were between 6.2mm and 6.4mm. The junction welds between this plate and the neighbouring floor and end-wall plates [the tank roof is not subject to this] are fully welded only on the exterior side [within the bund] and the interior is only tac welded. This does not confirm to the current British Standard set out for the construction of double-skinned fuel storage tanks of this type and construction; it is a weaker design and consequently presents a higher possibility of eventual failure. The tank outlet pipework exits through this wall and is only welded on the exterior junction with the sidewall, leaving a gap around the pipework from the hole cut out of the sidewall. This area relies solely on the strength of this welding [which cannot be seen or assessed as it is inside the bund] to protect from product loss from the internal tank to the bund. The central weld of the sidewall plating joining the two halves together is in good condition with no signs of cracking, seepage, or delamination. No further internal damage appears to have occurred and the metal is in overall fair health.

The interior west sidewall of this tank shows no signs of corrosion or warping of the rolled plate. The ultrasonic readings found were between 6.2mm and 6.3mm. The junction welds between this plate and the neighbouring floor and end-wall plates [the tank roof is not subject to this] are fully welded only on the exterior side [within the bund] and the interior is only tac welded. This does not confirm to the current British Standard set out for the construction of double-skinned fuel storage tanks of this type and construction; it is a weaker design and consequently presents a higher possibility of eventual failure. The central weld of the sidewall plating joining the two halves together is in good condition with no signs of cracking, seepage, or delamination. No further internal damage appears to have occurred and the metal is in overall fair health.

The floor of this tank has one area of pitting corrosion and corresponding skin loss [see figures 30 and 31]. The location is marked with a red dot on the diagram found on page six of this report. In the north-west corner of the tank floor corrosion pitting was found, measured at 1.82mm in depth. This is an approximate loss (from original floor thickness of circa 5.2mm) of 35%. This does not meet the 40% level of loss that industry standards would describe for remedial action but owing to the closeness of the loss level it is suggestable that remedial works are advisable here. It is also noted that despite the highest risk of corrosion and metal thickness loss occurring on the tank floor, the four steel plates used to construct this section are thinner than those of the rest of the tank. The junction welds between this plate and the neighbouring sidewall and end-wall plates are fully welded only on the exterior side [within the bund] and the interior is only tac welded. This does not confirm to the current British Standard set out for the construction of double-skinned fuel storage tanks of this type and construction; it is a weaker design and consequently presents a higher possibility of eventual failure. The inner welds joining the four floor plates together is in good condition with no signs of cracking, seepage, or delamination.

There is a considerable amount of flex in the tank floor owing to the design of the internal bracing. There is a full horizontal bracing install within the tank, but there is no vertical bracing. This allows the floor of the tank to flex up and down when pressure is applied to individual areas of the floor. No

cracking to the welding or floor plates was found to have occurred from this, but it presents a point of note to be referenced when inspecting for damage or deterioration in any subsequent inspections. The lowest corner bracing bar in the northwest corner of the tank is only partially attached to the shell walls; one end is welded to the north end-wall, but the opposing end is not attached to any part of the tank. There is no indication that this has been caused by damage or deterioration, rather there is no evidence that this was ever welded together during the manufacture stage. This presents a small potential weak spot in the structural rigidity of the tank [see figures 28 and 29].

The functionality of the high-level warning alarm float was tested by manually raising the interior float and full functionality was confirmed.

The functionality of the overfill prevention device was tested by manually raising the interior float and full functionality was confirmed.

In summary, at the time of inspection there was one point of failure found –

- Corrosion and pinhole leakage in the fuel outlet nozzle.

There are numerous other negative and potentially weakened aspects of the system –

- Pitting on the tank floor almost at 40% skin loss.
- Interior tac welding rather than full length welds.
- Lack of interior welding of the outlet pipe to the sidewall.
- Bracing bar not welded to the tank sidewall.
- Thinner original thickness of the tank floor plating compared to walls.
- Significant flex in the tank floor due to lack of vertical bracing.
- OCIO level gauge PU tube top entry-point not sealed.
- Floor protrusion surface corrosion.