Leak / Through Hole (Worm Hole) Defect Detection with SLOFEC™ Technology

Version Control

Version	Date	Changes to previous
0	06/02/2017	
1		

Approval

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Checked by:	Andreas Boenisch	
Approved by:		

Classification

☐	Internal use only (default)
☒	Internal use plus distribution to: CLIENT
☐	Public

1. Introduction

As requested by CLIENT, Innospection has carried out a SLOFEC™ (Saturation Low Frequency Eddy Current) inspection on a floor plate sample from Tank XXXX.

The plate was previously inspected with the MFL technique which missed the holes. Innospection was asked to inspect a cut-out plate sample to test in particular the leakage area to analyse if the SLOFEC technique could detect the holes. The CLIENT's integrity team described the defects as worm hole like through-hole defects.

2. Sample Plate

The sample plate was made available for Innospection on Wednesday 1st Feb 2017 and the test was done on 2nd Feb 2017 in the presence of the CLIENT. The sample was cut out from the Tank annular zone with the bottom to shell weld still on the plate side. The plate is 10mm thick with no coating on. See **Figure 1**.

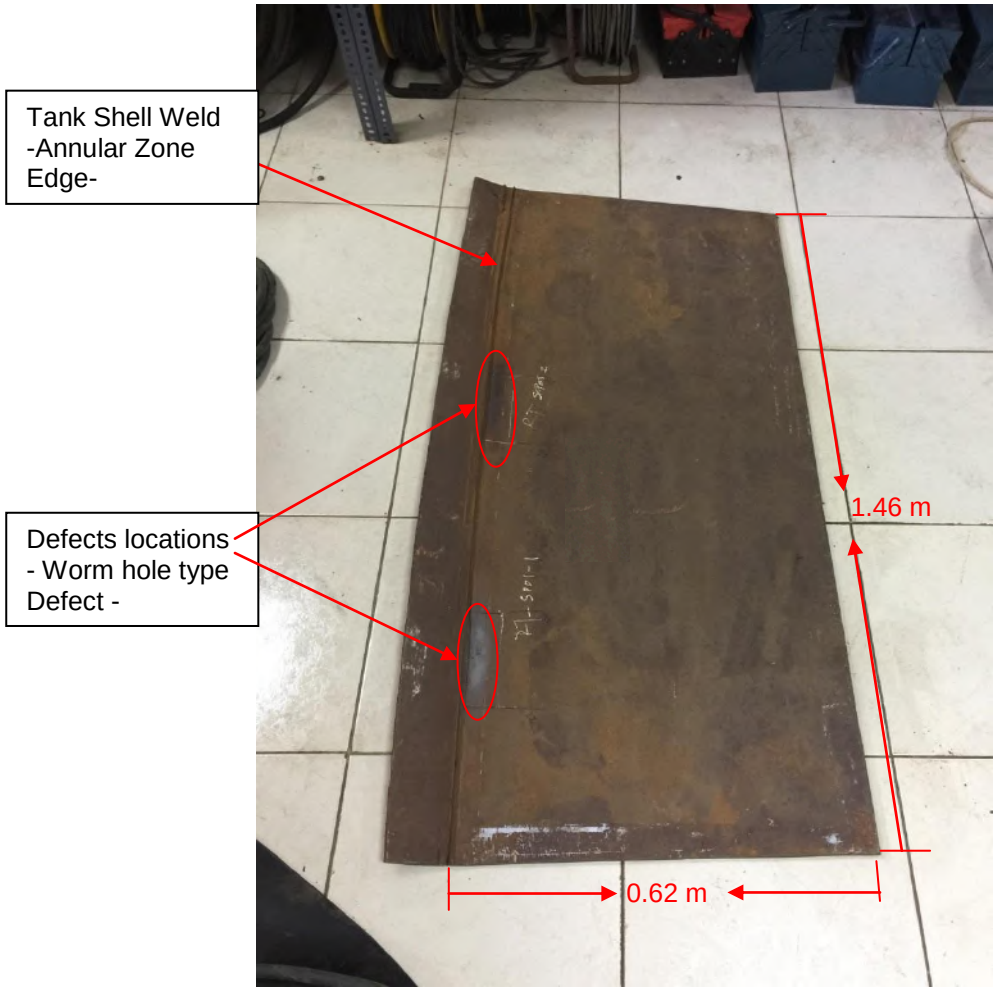
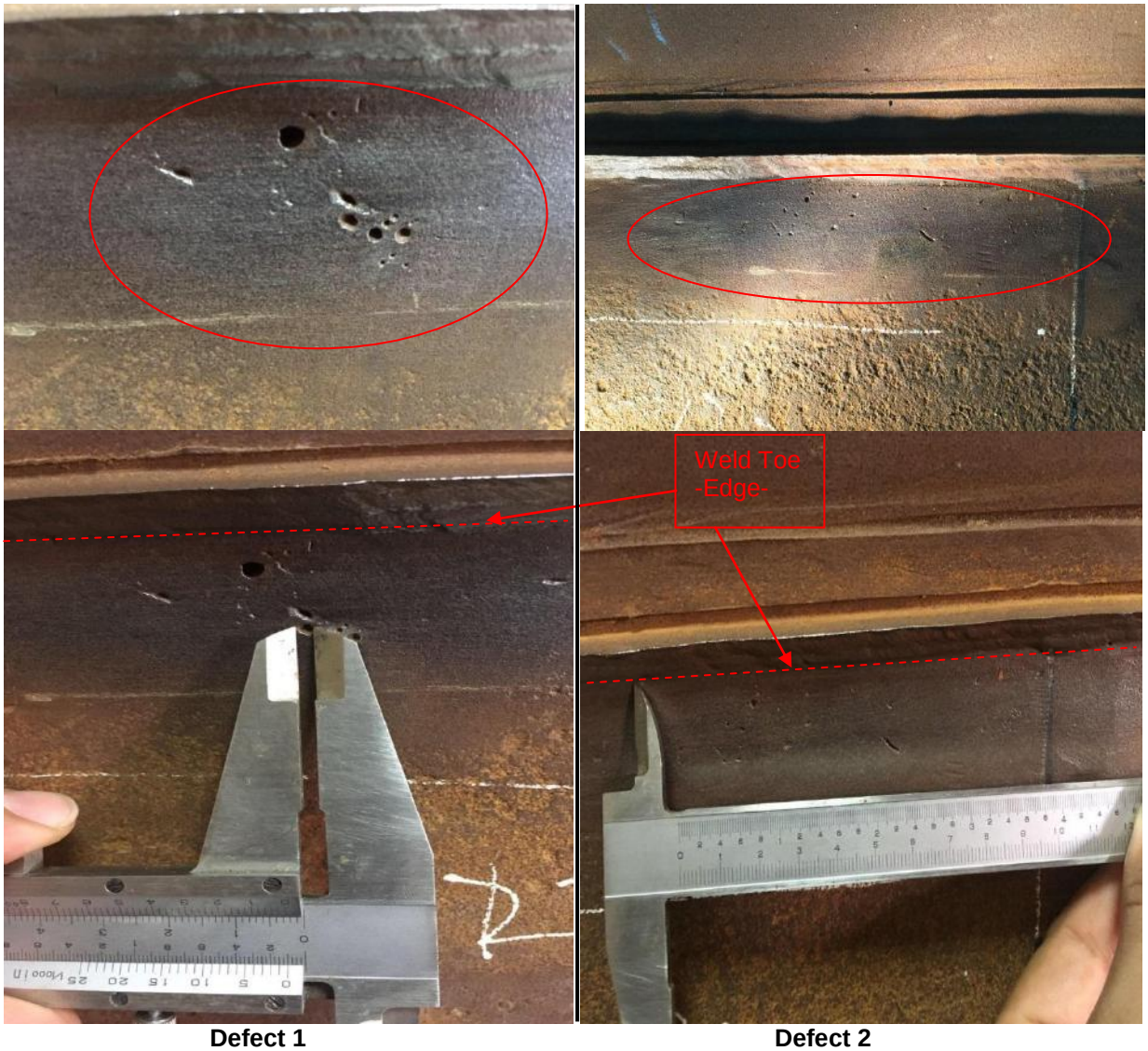


Figure 1: Cut out Sample dimensions & leak locations

Two leak locations on the test plate were inspected by RT and identified by CLIENT. At the leak locations are very small pitting on the topside of the plate and small pits on the underside.

Figure 2 shows the areas of the two leaking defects.



Defect 1 **Defect 2**

Figure 2: showing both leaked locations from topside

As seen in the pictures in Figure 2, the defect locations are very close to the weld toe; with a distance of 5mm to 10mm between the defects and the bottom to shell weld toe.

The SLOFEC™ Scanner setup allows the sensors to scan very close to the tank shell to cover almost the entire annular plate area.

As displayed in Figure 3, the scanner wheels are at the front and rear of the scanner and allow the sensor to reach as close as possible to the shell.

To allow a consistent scan drive along the shell, the scanner is equipped with guidance wheels to keep the scanner running along the shell with a consistent but smallest distance. For the operation of the scanner driving along the shell, the scanner handle is designed to be set supportive for the side scan and annular to shell contour following

Defect 1 is small pitting which can be seen from top; the largest pit is around 4mm in diameter; at the second leak area, Defect 2 is the pitting of around 1mm in diameter.

Figure 3: SLOFEC™ FS300 Floorscanner inspecting annular zone area next to the Tank wall; MEC-F15 Floorscanner – next generation and a further development of the SLOFEC™ Floorscanners

3. SLOFEC™ Inspection Results:

SLOFEC™ FS300 floor scanner was utilised to perform this test. A reference sample with the same thickness as the cut out plate was used for calibration i.e. 10mm thick with manufactured flat bottom holes defects.

Figure 4 below illustrates the calibration of the underside defects:

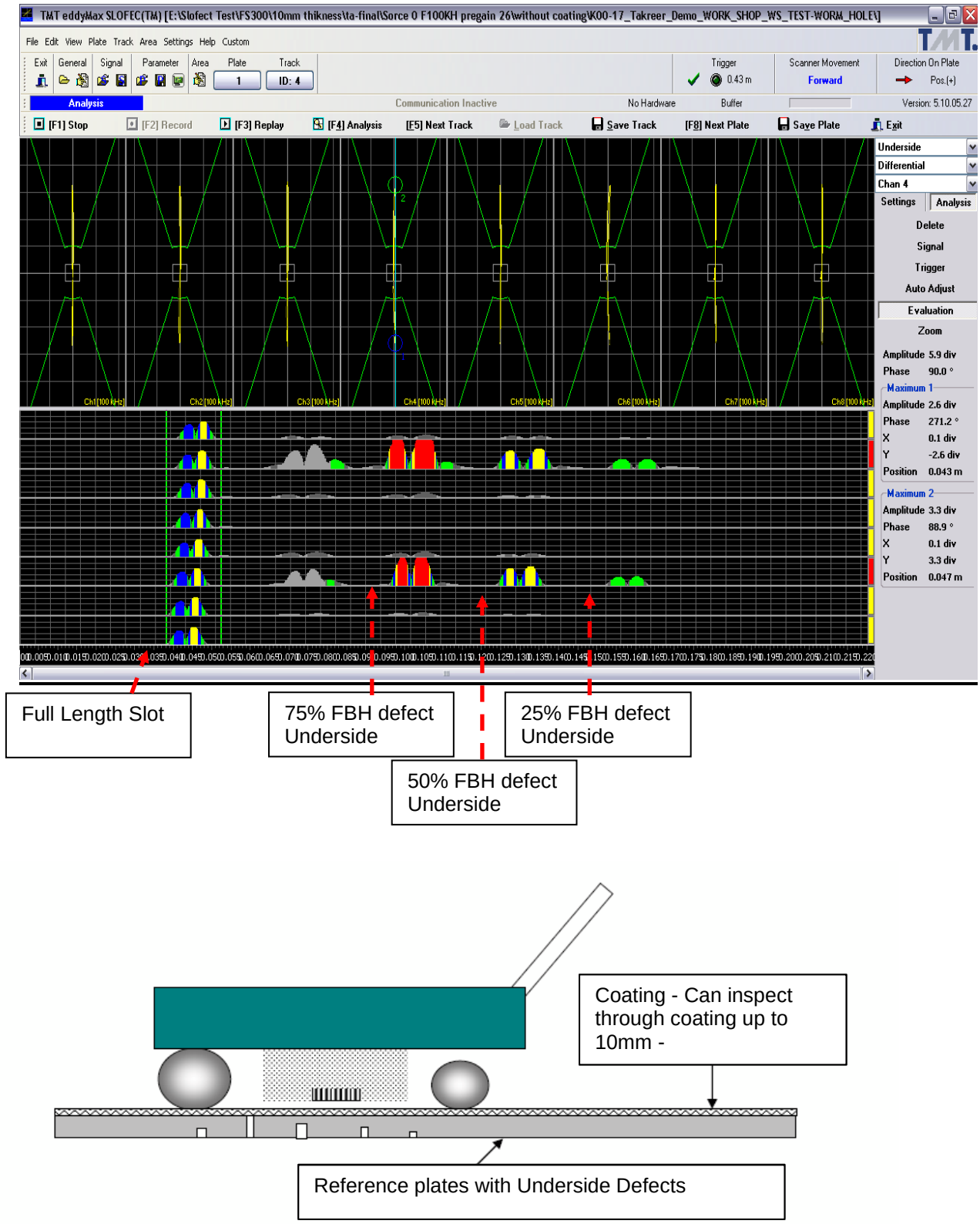


Figure 4: Calibration of the underside defects

After calibrating the FS300 Floorscanner, the cut out plate sample was inspected and the leak locations were detected clearly with the SLOFEC scanner.

Figure 5 shows the SLOFEC scan screen shot of the scan results for the first track running closest and parallel to the weld:

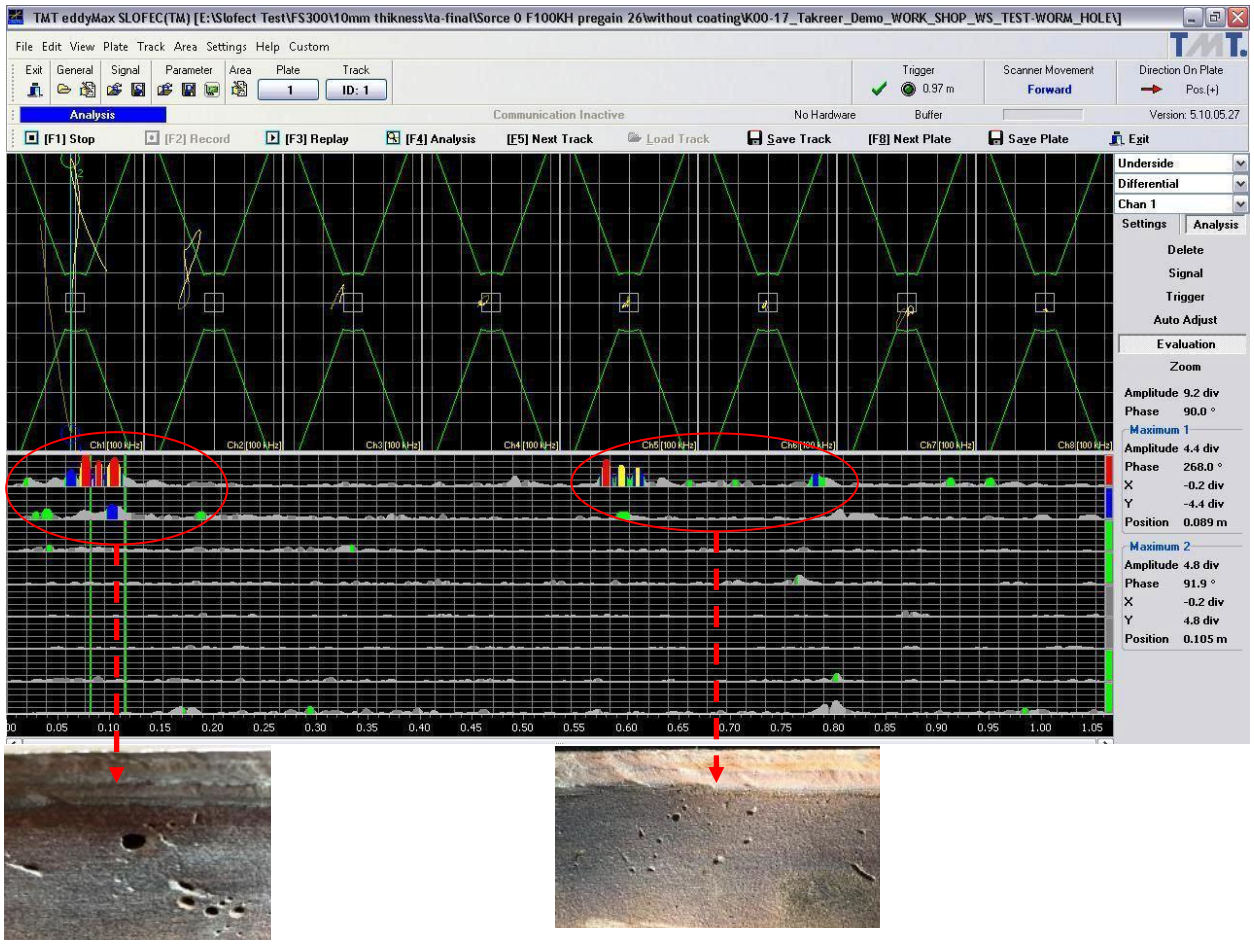


Figure 5: Showing the SLOFEC™ Signal response from both defect locations

The signals of the defects of concern were clearly detected with amplitude of more than 50% wall loss and the signal phase tends towards the underside signal.

However, a part of the indication can also be seen on the topside signal.

A further few indications at the test plate were also detected in other locations, however those reached a signal amplitude mainly on topside reaching around 20% wall loss maximum.

In the attachments, the corrosion C-scan maps separate for the underside condition and for the top side condition are displayed.

4. Conclusion

The test at the cut out plate had demonstrated that the specific concern of the Client's described worm hole like through-hole defects as well as lighter corrosion defects in the plate client were well detected with the SLOFEC technique.

The inspection technology using the combined direct current magnetic field and Eddy Current field allows the detection of such through-hole defects as well as topside or underside corrosion defects from small volume and low wall loss onwards towards through holes.

The technique as such allows the inspection through all typical coatings at the bottom and annular plates.

The design of the Floorscanner with front and rear wheels allows the scanner to drive as close as possible along the tank shell to detect defects in the structural integrity important annular plates.

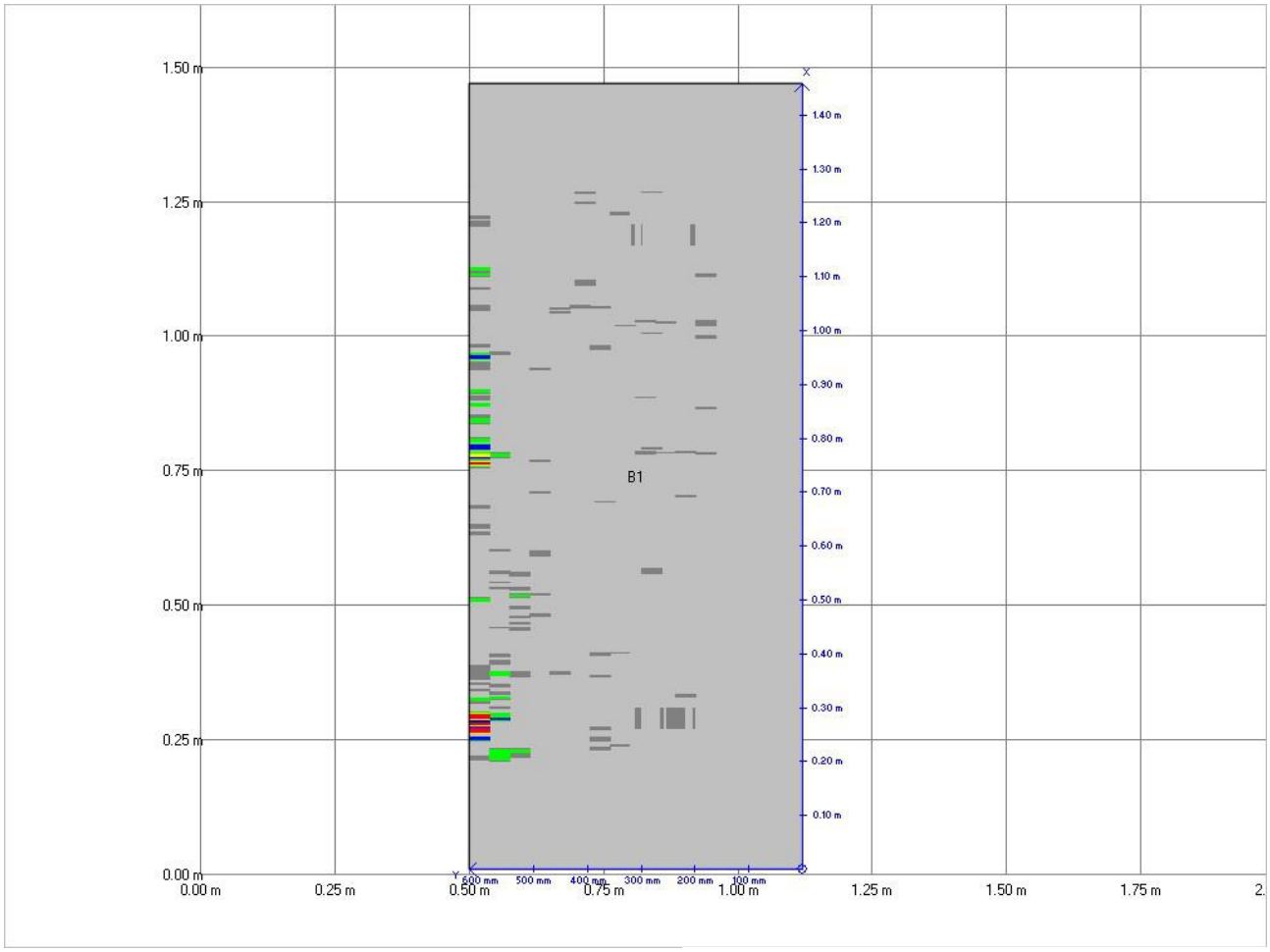
5. Bitmap Report for Test Sample - Topside & Underside

SLOFEC ™

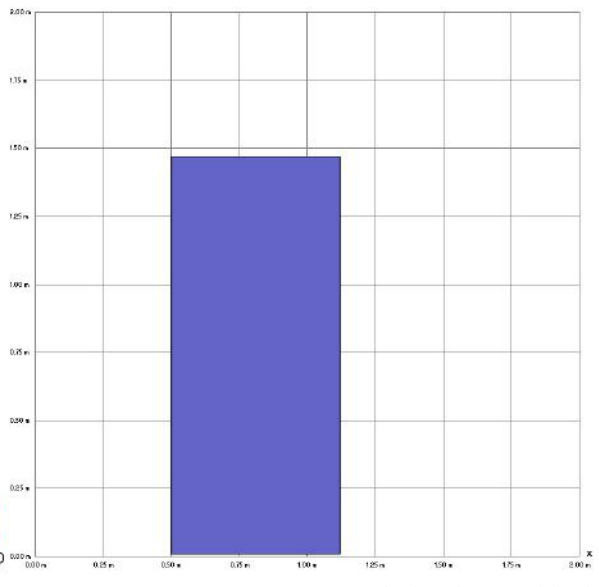
Inspection - Scan Report

Client	: **xxxxxx**	Subject	: **WS TEST-WORM HOLE**
Place	: **WORK SHOP**	K-Nr.	: **K00-17**
Date	: **02/02/2017**	Order-No.	:
Plate No.	: **B 1**		

Underside

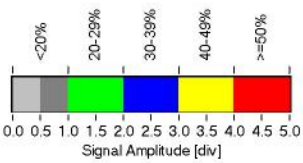


Remarks



Color Palette:

Classification of corrosion indications in comparison to reference defects.



SLOFEC ™

Inspection - Scan Report

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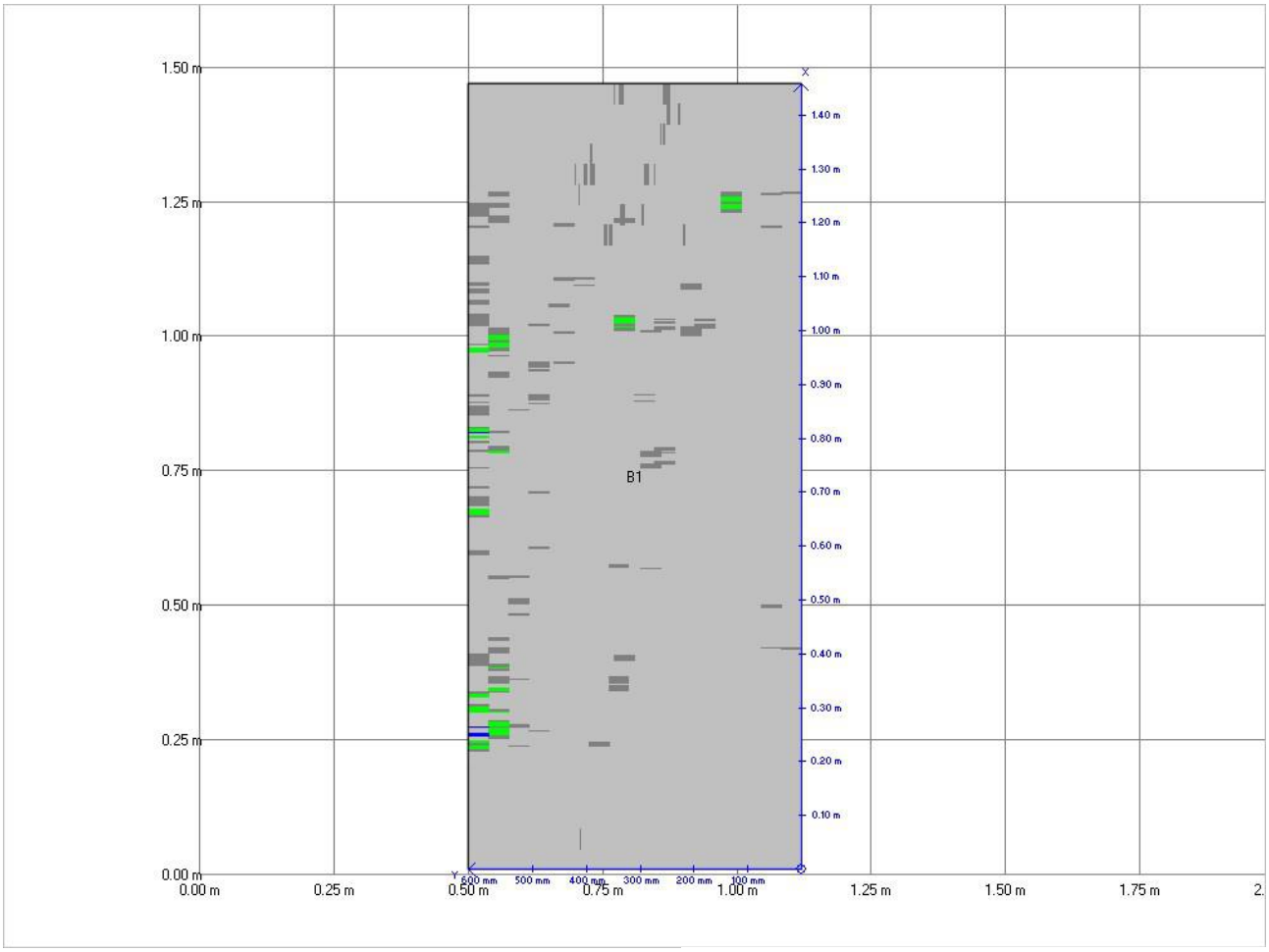
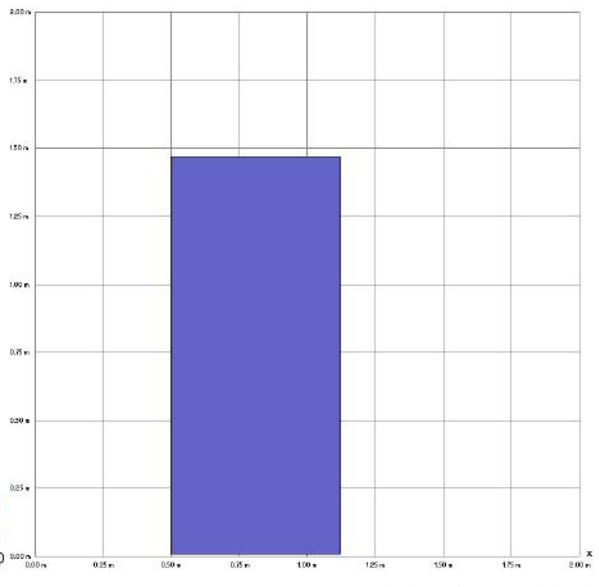
Place	: **WORK SHOP**	K-Nr.	: **K00-17**
Date	: **02/02/2017**	Order-No.	:
Plate No.	: **B 1**		

Topside



Remarks



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