MEC
Conductor Inspection Report

Client: OIL COMPANY

Facility: Oil Field WHT

Items Inspected: WHT01
30" Conductors No. 1-3

Inspection Method: MEC-MPS200+

Date Commenced: 21/09/14

Date Completed: 02/10/14

Type of Report: Final

Report Number: K-00

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W W W . I N N O S P E C T I O N . C O M

MEC CONDUCTOR INSPECTION REPORT (MEC-MPS200+ / UT)

Prepared for

OIL COMPANY

Final Report: K 00

Rev	Document	Author		Checked		Approved By		Date
		Name	Signature	Name	Signature	Name	Signature	
0	Issue to client for comment	M.E		K. R		A.B		24.10.2014

Name	Position
M. E	Project Engineer
K. R	Director R&D
A.B	Group Managing Director

Executive Summary

As requested by OIL COMPANY ; Innospection has carried out a MEC (Magnetic Eddy Current - an extended technique from SLOFEC) inspection on the WHTplatform in the Oil Field.

The inspection was conducted from the 3rd of September 2014 and completed on the 17th of September 2014.

This inspection report documents in detail the specific inspections that have been conducted, the individual techniques and equipment utilised, the results, observations and conclusions obtained. Below is a summary of the inspection findings:

Indications and Inspection Performance for Conductor No. 1

Isolated minor external corrosion predominantly in the eastern area of section 1 has been found with an estimated depth of 20 - 25%.
Localised external metal loss has been detected at section 2 at -4.85 m in the southern area of the conductor exhibiting an estimated depth of 35%.
On section 3, general minor internal and external corrosion between -9m and -10.5m was detected.
Additionally, an isolated external metal loss in the north-western splash zone area of the section around -10.25m exhibiting wall loss of about 80% was found.

Indications and Inspection Performance for Conductor No. 2

General internal metal loss predominantly in the north-western area of section 1 has been found exhibiting an estimated depth of 25%.
At section 2, large external and internal metal losses have been detected at -4.65 m and -4.75 m with estimated depths of 45% and 60%, respectively. The external defect corresponds to a corrosion indication confirmed by visual inspection with a depth of approx. 50% wall loss.
On section 3, general internal and external corrosion has been found between -7.5m and -9m with deeper pitting-like indications exhibiting wall loss up to 45%.

On this conductor, additional dead zones were created by the platform structure and removed pad eyes. This prevented a full coverage of the conductor at the individual sections.

Indications and Inspection Performance for Conductor No. 3

Section 1 and section 2 only show minor metal loss indications on the internal as well as on the external side. Some indications on the external side are in the rage of 20% of the wall thickness.
Section 3 shows more and deeper corrosion sites. All of these are found above the water line on the external surface. On spot of particular interest if found at -9.8m on the East-face (90º). It is small in size, but quite deep. It is about 8 cm in circumferential extend, but only 10mm in axial length. The depth is about 60% of the wall thickness. More deep external indications are found on the West side at about -8.35m.

1. Test Object Data

Object Identification :	The items inspected were six 30" conductors
Location of Object :	Oil Field WHT
Orientation of Scan :	Vertical Upwards
Wall Thickness :	Nominal 22 mm
Material :	Carbon Steel
Surface Condition :	Generally clean and free from loose debris, light marine growth below splash zone

2. Inspection Task

As requested by OIL COMPANY , a MEC (Magnetic Eddy Current) inspection was performed on the conductors of platform WHT located at the Oil Field from the 3rd September to the 17th September 2014. The inspection was performed with a MEC technology scanner, type MEC-MPS200+ (marinised).

MEC is regarded as a fast corrosion screening technique, detecting corrosion on either side of the wall inspected. This method of testing makes it practical to inspect the pipes from the external surface, whilst they are still in service and at operating temperatures.

All areas described in Section 4 – Inspection Volume were inspected with the MEC scanner. The inspection was carried out as a general inspection screening. Possible internal corrosion was of particular interest.

3. Inspection Personnel

The inspection team consisted of qualified engineers from Innospection Ltd.

Inspection Supervisor : A .T / PCN Level II / Certification No .....

4. Inspection Volume

The MEC scans were taken over one vertical track at a time until a 360º coverage of the general pipe sections was achieved.

All accessible areas of the pipe were targeted for inspection with the exception of specific dead zones, which could not be inspected due to the design of the scanner i.e. the wheels of the scanner butted against a circumferential obstacle or a protrusion along a given track.

The Dead Zone refers to the following areas:

- Any other obstructions that interfered with the access
- 340mm from either the front or back of the scanner. (wheels to sensors)

5. Inspection Equipment

The inspection system consisted of the following MEC equipment and accessories

5.1 MEC marinised scanner MPS200+

Scanner :	MEC Scanner MEC-MPS200+ (width 200mm)
Description of Scanner :	The Scanner MPS200+ is a compact MEC system equipped with electromagnet and multiplexed electronics. Eight sensors each with a width of 25 mm are located between the pole shoes. A high resolution distance encoder allows measuring the travelled distance. A carriage with four wheels houses the water-cooled electromagnet. The lift-off can be adjusted.
Scanning Speed :	10-20 m/min
Eddy Current Instrument :	EddyIQ instrumentation v. 2.0 with Multiplexer
Eddy Current Sensors :	Eight Sensors of type ECS.PS200.025. The unit covers a circumferential width of 200 mm.
Software Version :	Innospectit Version 2.26
Cable :	70 metres of specific cable connection between the computer eddy current instrument and MEC Pipe Scanner MPS200+
Reference Plate :	25 mm from Innospection Serial Number 213-1 and 213-2
Reference Defects :	20%, 40%, 60%, 80% FBH

5.2 MEC Handscanner MEC-P19

Scanner :	MEC Scanner MEC-P19 (width 150mm)
Description of Scanner :	The Scanner MEC-P19 is a handheld MEC system equipped with electromagnet and multiplexed electronics. Eight sensors each with a width of 19 mm are located between the pole shoes. A high resolution distance encoder allows measuring the travelled

	distance. The lift-off can be adjusted.
Scanning Speed :	Depending on manual movement
Eddy Current Instrument :	EddyIQ instrumentation v. 2.0 with Multiplexer
Eddy Current Sensors :	Eight Sensors of type ECS.LE150A.19. The unit covers a circumferential width of 150 mm.
Software Version :	Innospectit Version 2.26
Cable :	70 metres of specific cable connection between the computer eddy current instrument and MEC Pipe Scanner
Reference Plate :	25 mm from Innospection Serial Number 213-1 and 213-2
Reference Defects:	20%, 40%, 60%, 80% FBH

5.3 Ultrasonic Equipment

Data Unit:	Cygnus MK5-ROV-2K
Probe:	15 mm Diameter Compression
Software:	Cyglink v3.301

The probe was mounted onto the MPS200+ tool and was actuated hydraulically.

6. MEC Equipment Setting

In general, the MEC system is calibrated using test samples with artificial reference defects. The reference samples should be of the same material and thickness as the surface to be inspected.

In the case of a coating being present on the surface to be inspected, the average thickness of the coating (if applicable) should also be simulated on the reference sample for the calibration.

Typical reference defects that are used are flat bottom holes or conical bottom holes are with a diameter of 5mm, 10mm and 20mm. The depths of the artificial reference defects are typically 20%, 40%, 60%, 80% and 100%.

For calibration, the MEC system is driven over the reference defects and the channels are set (one sensor per channel) to give a sufficient sensitivity level for the detection of topside and underside corrosion defects.

The calibration is performed at beginning, after breaks, at the end of every shift or in the case of changes to the equipment. The calibration results and reference defect data from the calibration sample, is always stored in the system.

The Eddy Current signal analysis is done online. The computerised equipment and the software allow the analysis of the signal amplitude [in div.] and signal phase [in °].

7. MEC Equipment Calibration

7.1 Equipment Calibration

For internal corrosion detection, the differential mode was used. The frequency setting used for Channel 1-8 (differential mode) was 80 - 100 KHz.

The amplitude of the signals was set so that the artificial reference defect (Ø 20 mm 60% depth) was set to 8 screen divisions. This is only classed as the initial pre-calibration setup and may then be further adjusted when the first true indication is detected and evaluated for depth.

Optimum signal/noise ratio and signal phase separation between the internal defect indications and other indications were considered when selecting a suitable test frequency.

The differential channels of all the sensors were set so that internal defects were indicated in the vertical signal phase direction as shown in Figure 1. By moving the scanner in the positive forward direction, the internal defect signal would show the first peak down, followed by the second peak up with an upward movement.

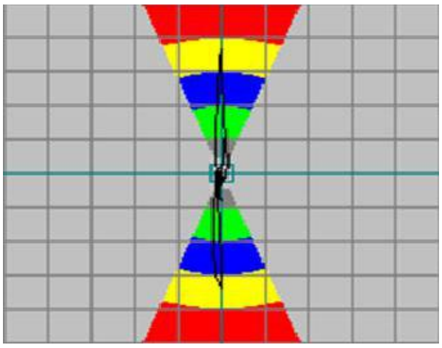


Figure 1: Sample signal display of internal defect

7.2 Calibration Control

The general setting and calibration was performed at the beginning of the inspection, with all calibration data being stored digitally. Calibration controls were performed at the beginning and end of each working shift and after any other significant interruption (i.e. breaks). Re-calibration is also deemed necessary when significant changes are made to the settings of the equipment.

Calibration samples are used for the initial set-up and for the random check of operator's settings. With this setting, external corrosion defects would be detected and distinguished by phase separation from the internal defects.

7.3 Calibration Samples

The calibration samples are manufactured by Innospection Ltd in accordance to the setting standard requirements.

7.4 Change of Settings

In the event of any scanner adjustment, re-calibration is performed.

8. Inspection Procedures

The inspection was performed according to the following valid procedure:

- Inno-PSloPIP-001-08 - SLOFEC™ Inspection Equipment on External Pipe Applications - Rev 5
- Inno-UT-001-10 - Ultrasonic Inspection of Weldments And Parent Metallic Materials - Rev 4

9. Inspection Performance

9.1 Scanner Movement

The scanner assistant, who was in permanent communication with the MEC operator, was responsible for positioning and moving the scanner on the pipe surface. For the subsea section the scanner was lowered to the start position and readings were taken while retrieving the scanner with the air operated chain hoist.

The MPS 200+ scanner was moved with the 14 scanned tracks being overlapped at all times. For the top-side inspection with the MEC-P19 the circumference was split up into 18 tracks. All scans for the inspection were recorded in the reverse direction when pulling the scanner upwards.

9.2 Scan Track Positioning

The conductor was marked circumferentially into 14 or 18 tracks. The tracks were numbered in an anticlockwise direction while looking down the conductor. Track number 1 was taken as depicted in the following diagrams. A visualisation of the track numbering can be seen in Appendix 1.

9.3 Parameter Storage

The Eddy Current testing parameter was set during the calibration and digitally stored according to the scan direction and lift off.

9.4 UT Measurements

The UT wall thickness readings were taken, when the scanner was lowered. For the measurement it had to stop and the sensor holder hydraulically pressed the sensor to the wall. Readings were noted.

10. Defect Analysis

All indications which showed a clear signal phase direction similar to that of the reference defects and had signal amplitude equivalent to that of the test piece were subjected to analysis. Signals that are clearly out of the corrosion phase direction were not reported.

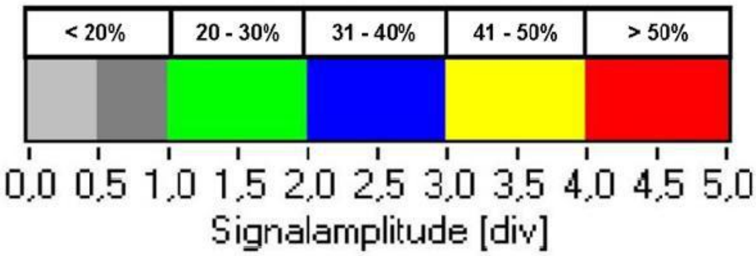
11. Comments to Inspection

The conductor was clean above the splash zone but below had light marine growth. Surrounding area was free from noise. There were a few restrictions from removed pad eyes. The maximum current achievable with the supply setup was 4.2 A.

12. Result Overview

12.1 Sensitivity Settings

The general overview of the inspected areas with the results is presented in the attached colour scan reports with wall loss being represented in colour classes as shown in the Wall Loss Legend below:



Below 20% wall loss	-	Grey
20-30% wall loss	-	Green
31-40% wall loss	-	Blue
41-50% wall loss	-	Yellow
Above 50% wall loss	-	Red

Note

Eddy Current inspection is an evaluation method of NDT; hence all results obtained are based upon the test piece used. Material and wall thickness of the test piece should be as near as reasonably practicable to the item under inspection. Artificial defects should be as near in size and shape as to the type sought.

Because MEC signal amplitudes are an indication of defect depth and volume, the defect depth analysis by signal amplitude can only be done in comparison with artificial reference defects having varying depths.

13. Scan Results

All MEC scan results and UT wall thickness measurements for the individual conductors are shown on the following pages.

13.1 Conductor No.1

WHT Conductor 1
Total Overview Map

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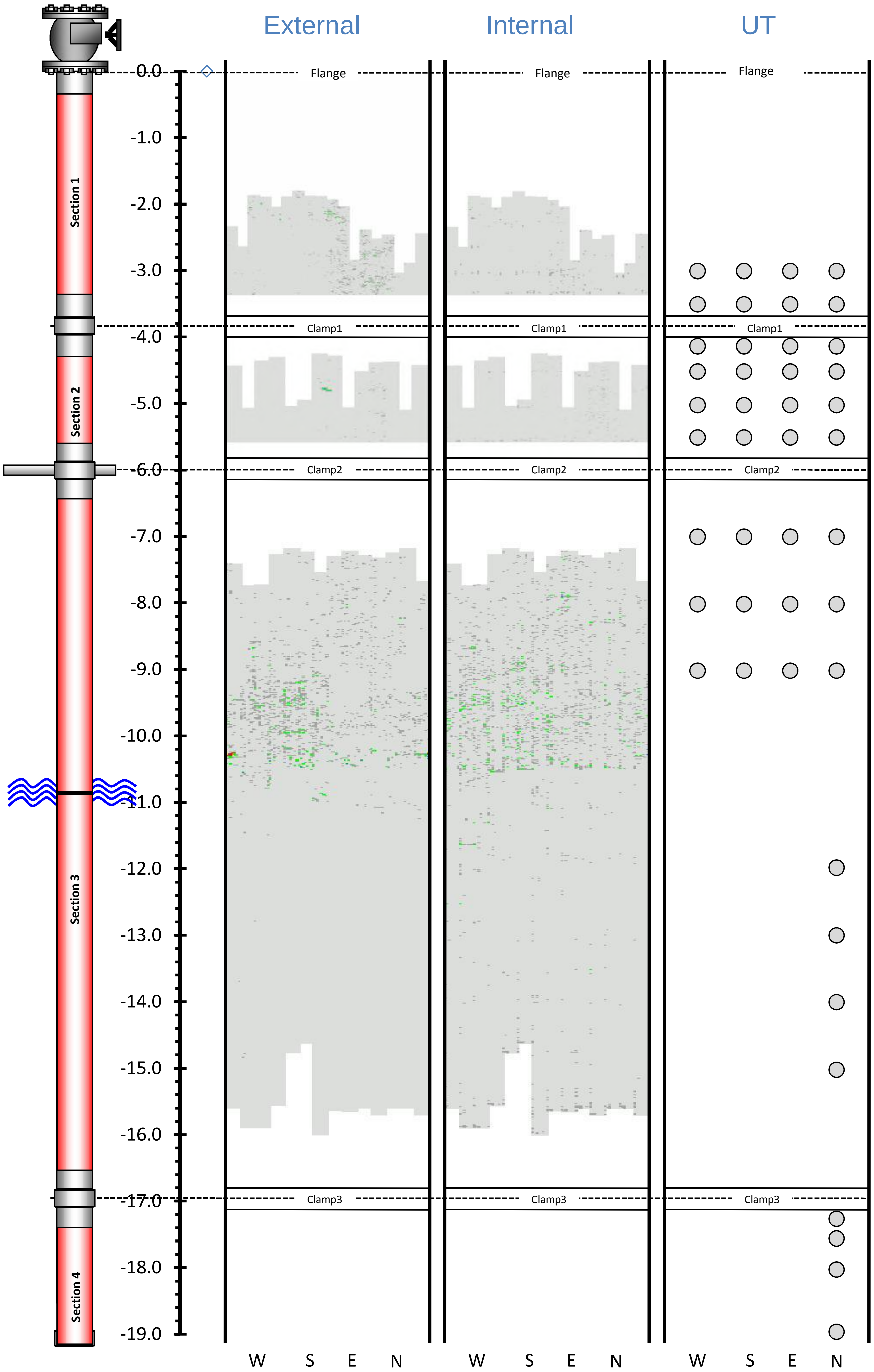
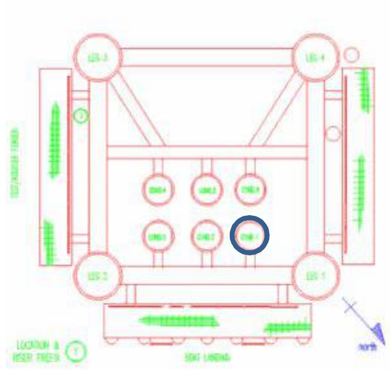
MEC Scan Report

Wall Loss Indications





Client:

Oil Company

Location:

Oil Field
WHT

Pipe Ident:

Conductor 1

Pipe Diameter:

30"

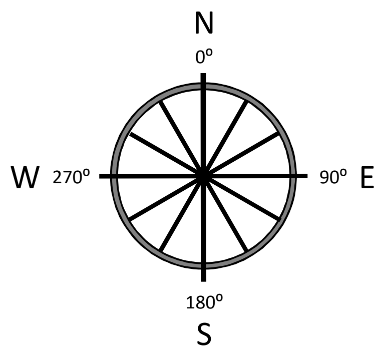
Date:

16/09/2014

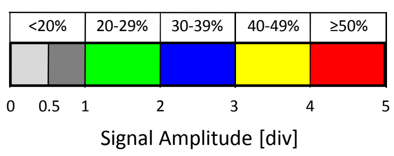
K-No.:

K00

Platform North



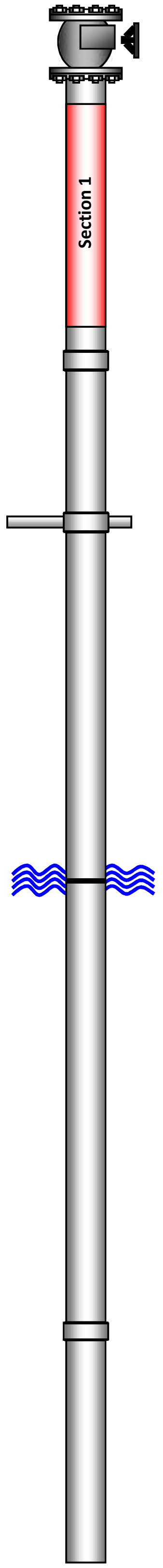
MEC and UT Color Code
wall loss in percentage
relative to nominal WT



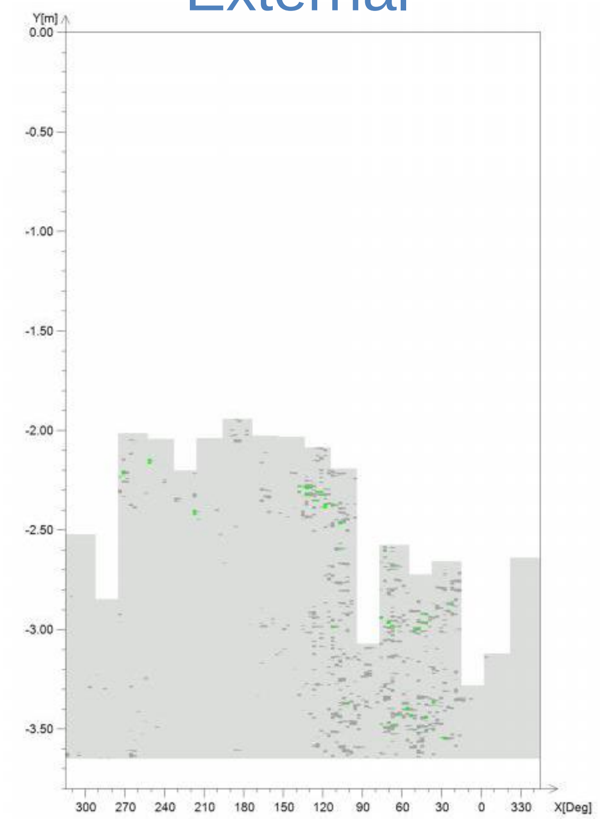
WHT Conductor 1 - Section 1

Wall Loss Condition Map

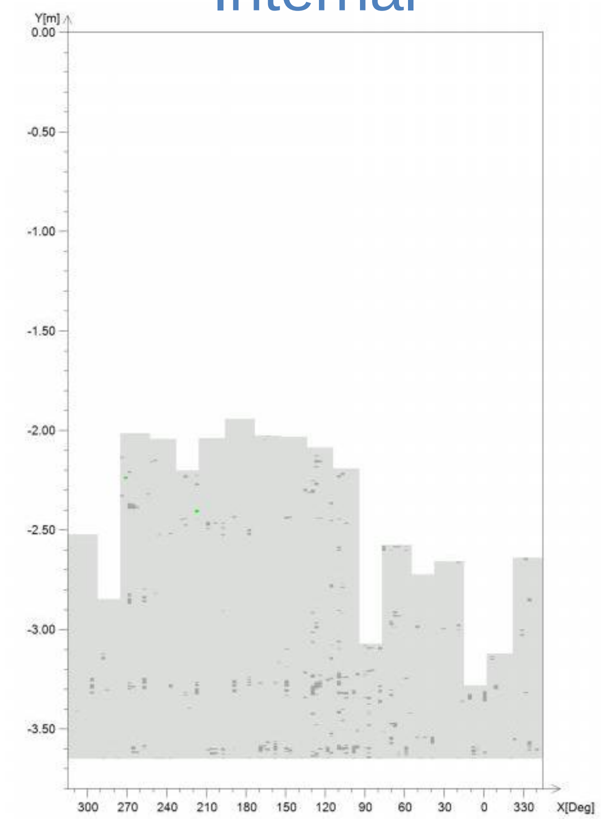
MEC Scan Report



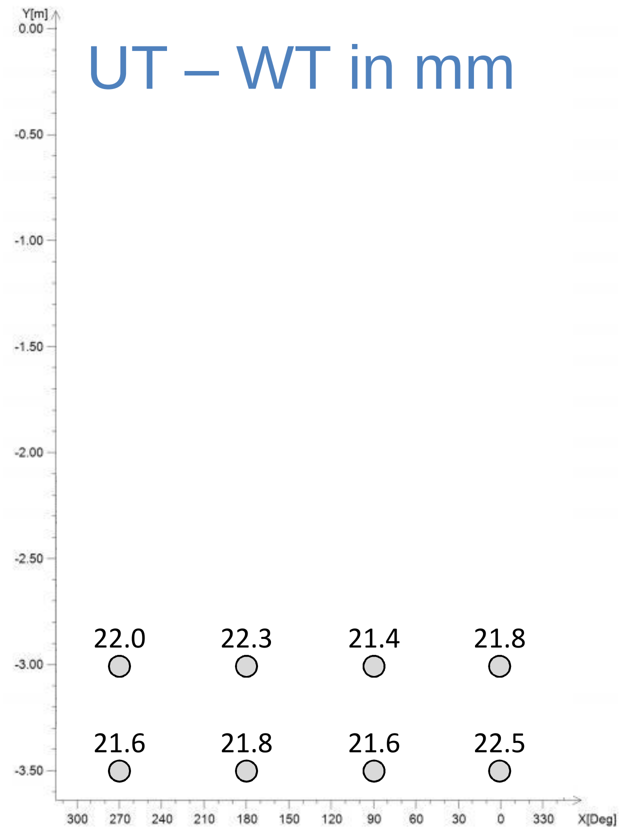
External



Internal



UT – WT in mm



Results:

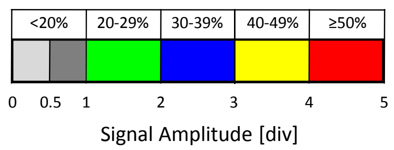
Isolated minor external corrosion predominantly in the eastern area of the section. Estimated depth: 20 - 25%.

Remarks:

Guide prevented scan of the upper part of the section.

MEC and UT Color Code

wall loss in percentage relative to nominal WT



Client:	OIL COMPANY
Location:	Oil Field
	WHT
Pipe Ident:	Conductor 1
Pipe Diameter:	30"
Date:	16/09/2014
K-No.:	K00

WHT Conductor 1 - Section 2 Wall Loss Condition Map

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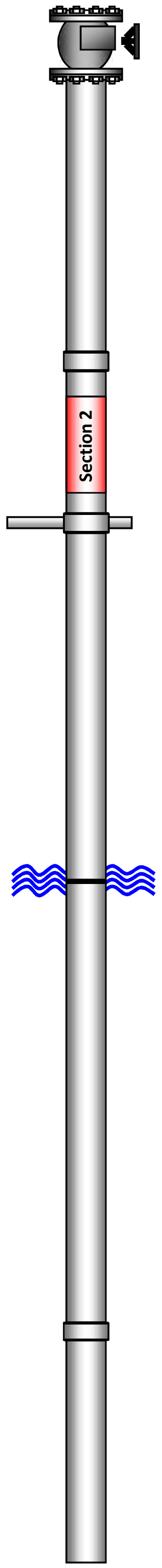
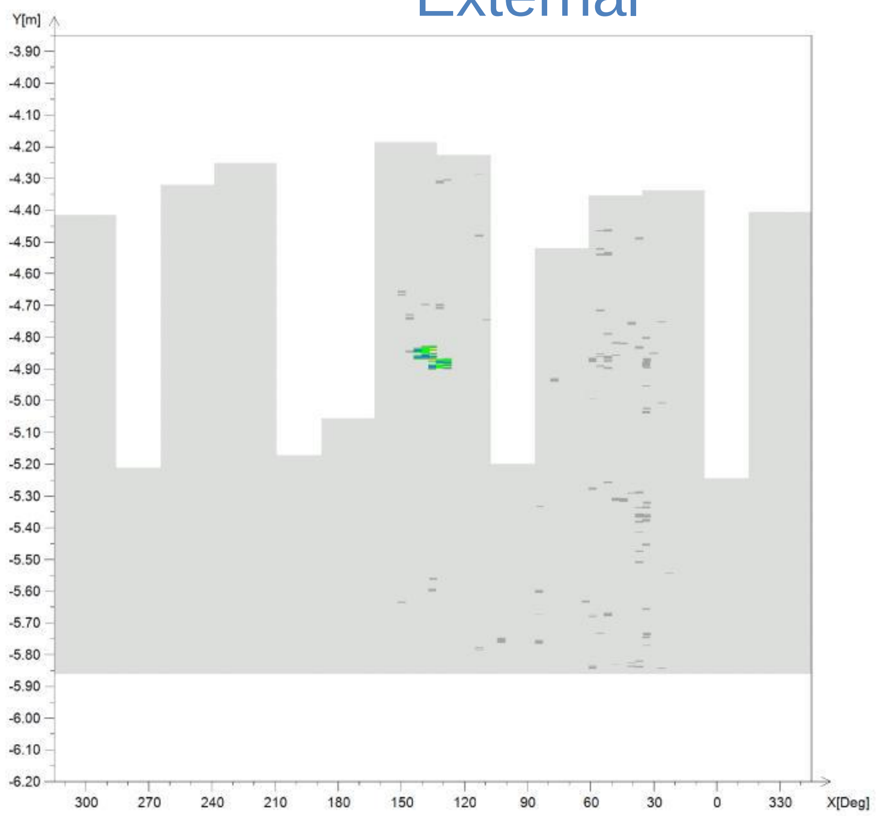
MEC Scan Report



External



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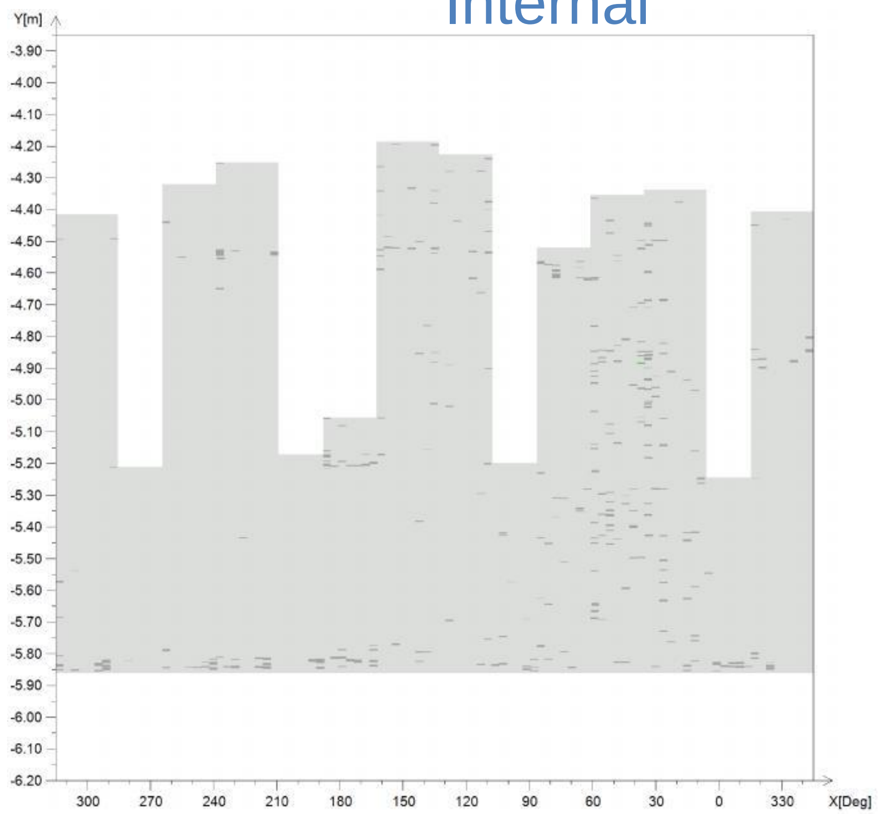
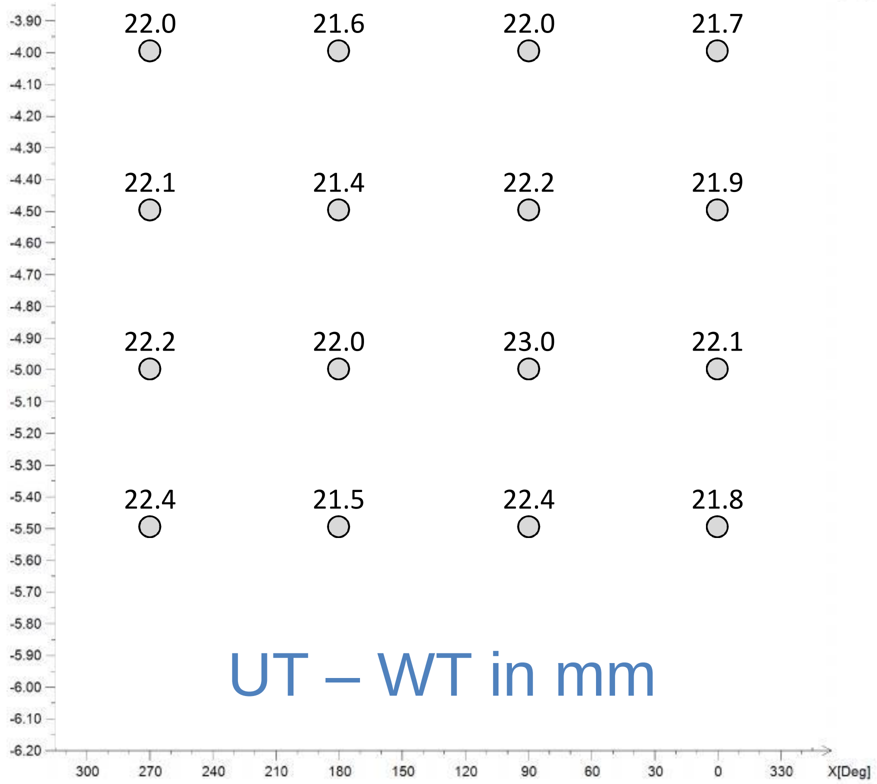




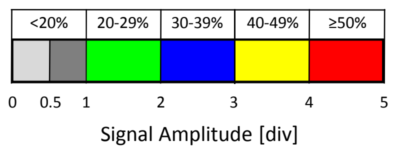
Results:

Localised external metal loss at -4.85 m in the southern area of the conductor. Estimated depth: 35%.

Remarks:

Some tracks shortened due to lifting pad eyes.

MEC and UT Color Code
wall loss in percentage relative to nominal WT



Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 1
Pipe Diameter:	30"
Date:	16/09/2014
K-No.:	K00

WHT Conductor 1 - Section 3 Wall Loss Condition Map

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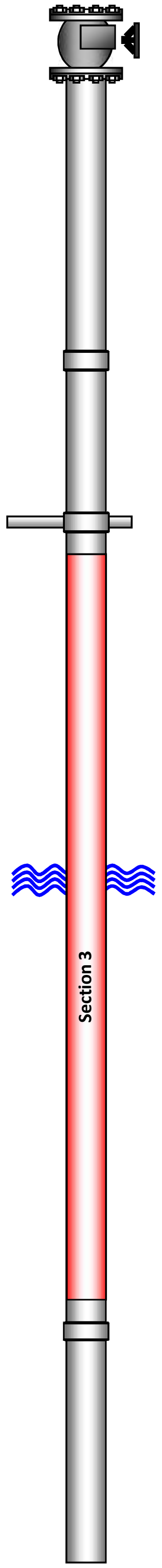
MEC Scan Report



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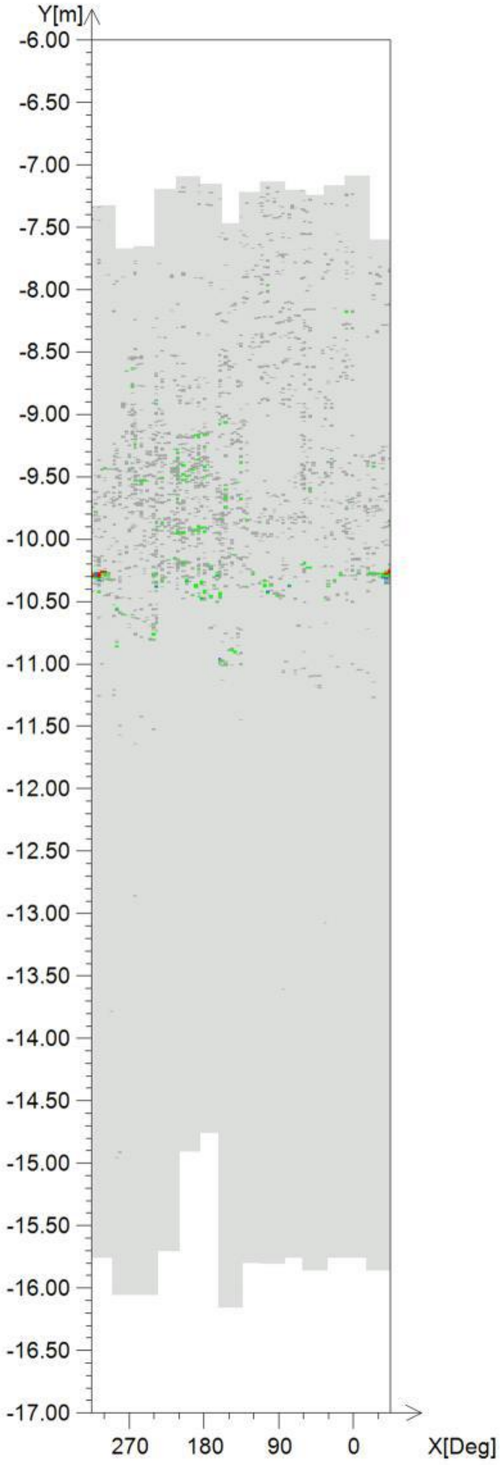
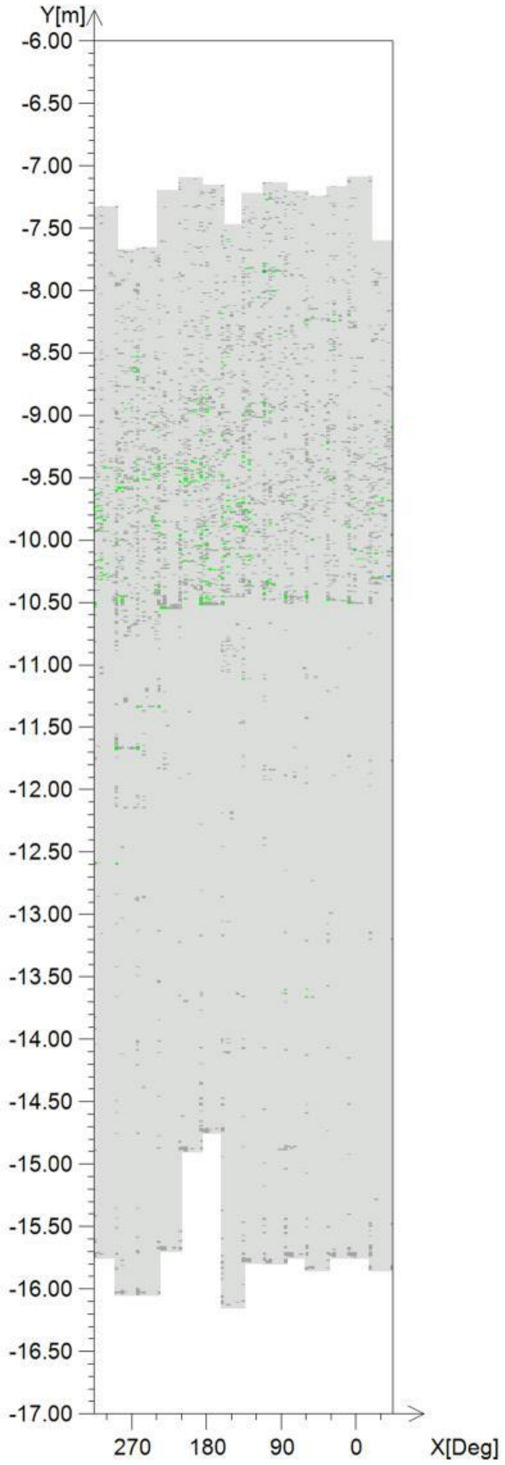
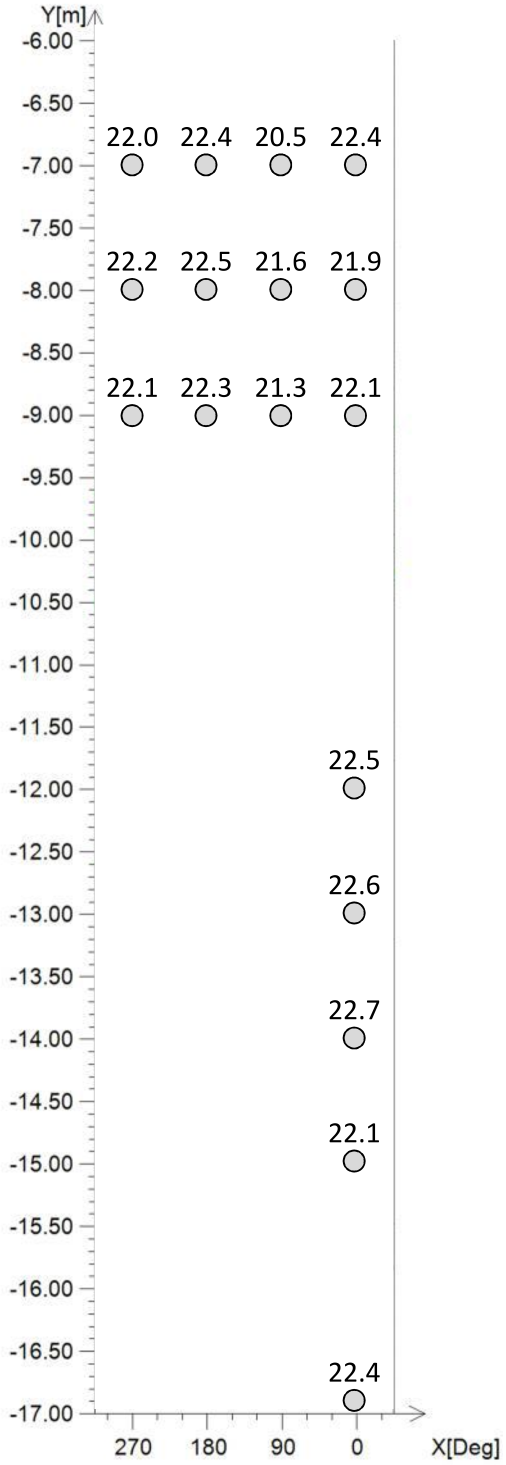


Internal



UT – WT in mm



Results:

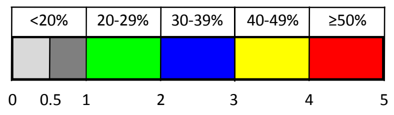
General minor internal and external corrosion between -9m and -10.5m.

Isolated external metal loss in the north-western splash zone area around -10.25m exhibiting wall loss of about 80%.

Remarks:

MEC and UT Color Code

wall loss in percentage relative to nominal WT



Signal Amplitude [div]

Client:	OIL COMPANY
Location:	Oil Field
	WHT
Pipe Ident:	Conductor 1
Pipe Diameter:	30"
Date:	16/09/2014
K-No.:	K00

13.2 Conductor No.2

WHT Conductor 2
Total Overview Map

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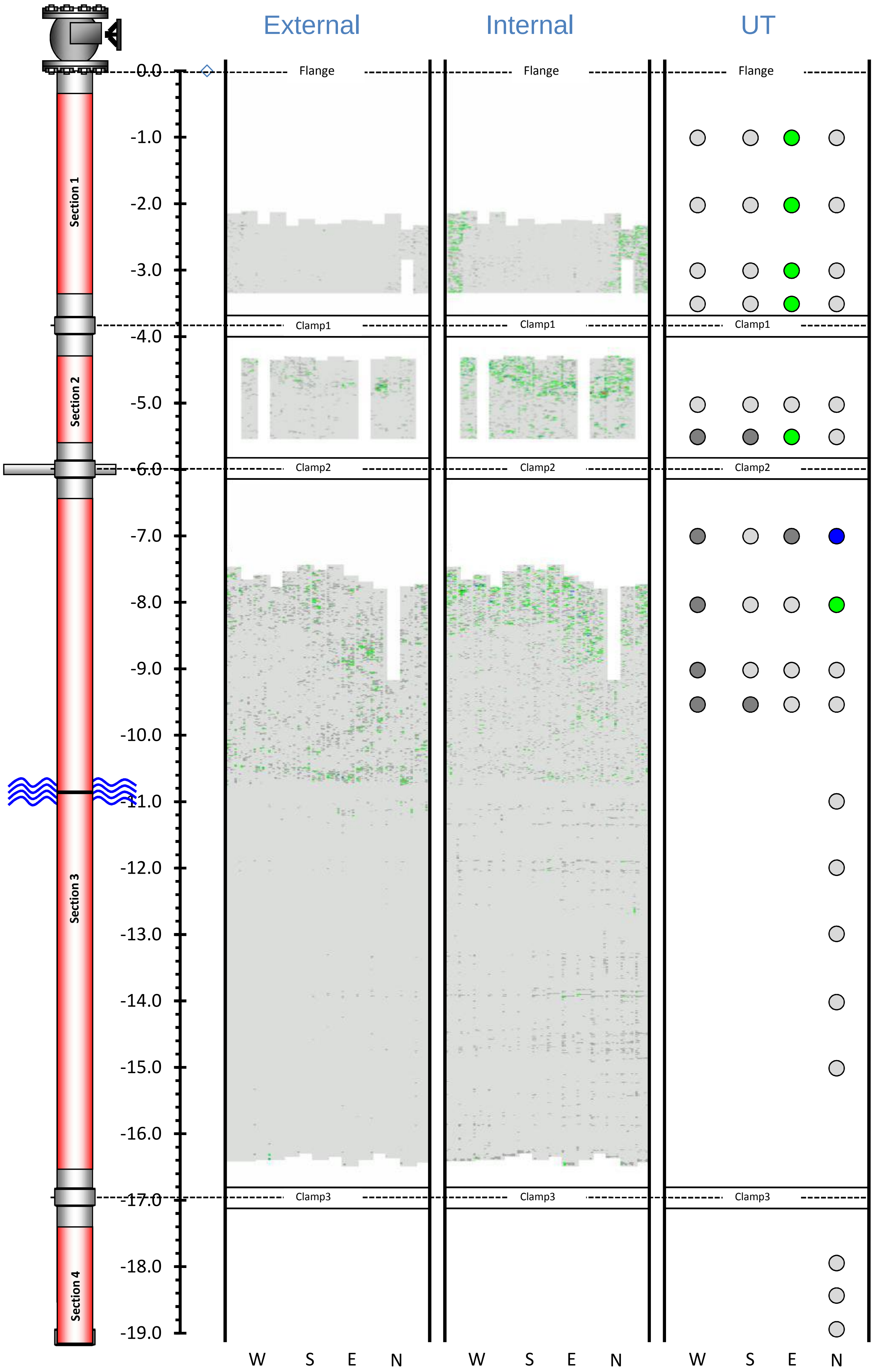
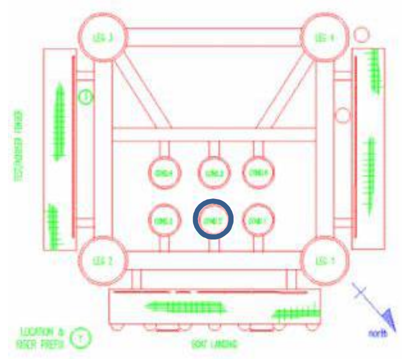
MEC Scan Report

Wall Loss Indications





Client:

OIL COMPANY

Location:

Oil Field
WHT

Pipe Ident:

Conductor 2

Pipe Diameter:

30”

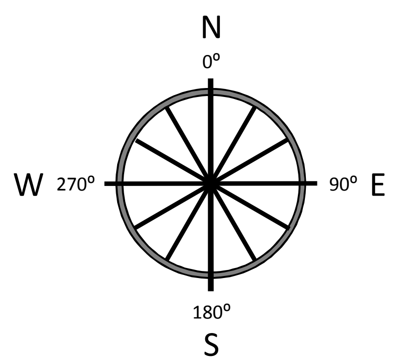
Date:

06/09/2014

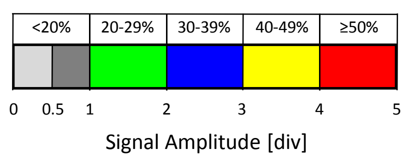
K-No.:

K00

Platform North



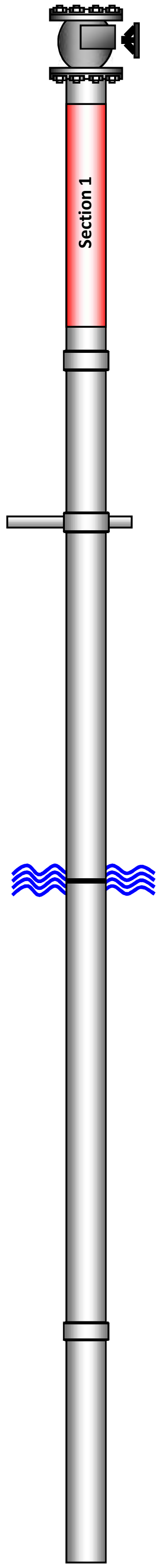
MEC and UT Color Code
wall loss in percentage
relative to nominal WT



WHT Conductor 2 - Section 1

Wall Loss Condition Map

MEC Scan Report



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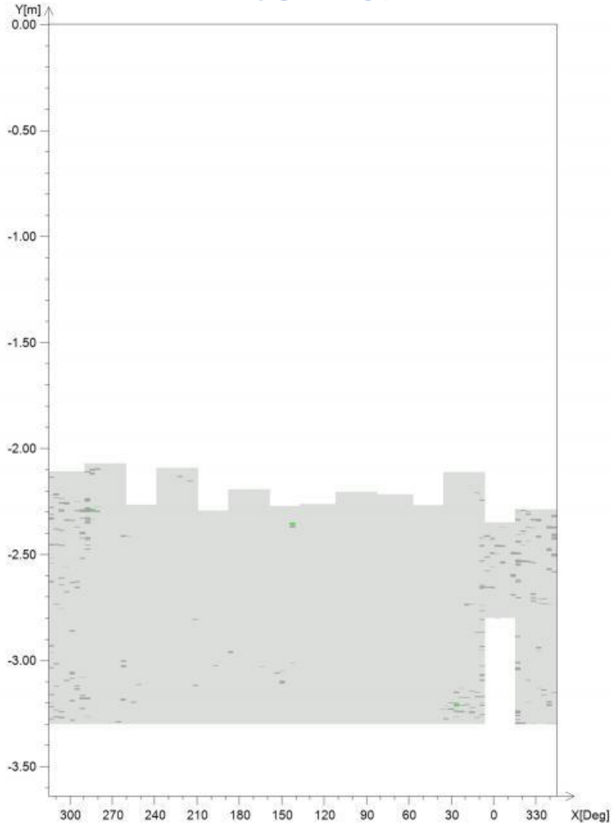
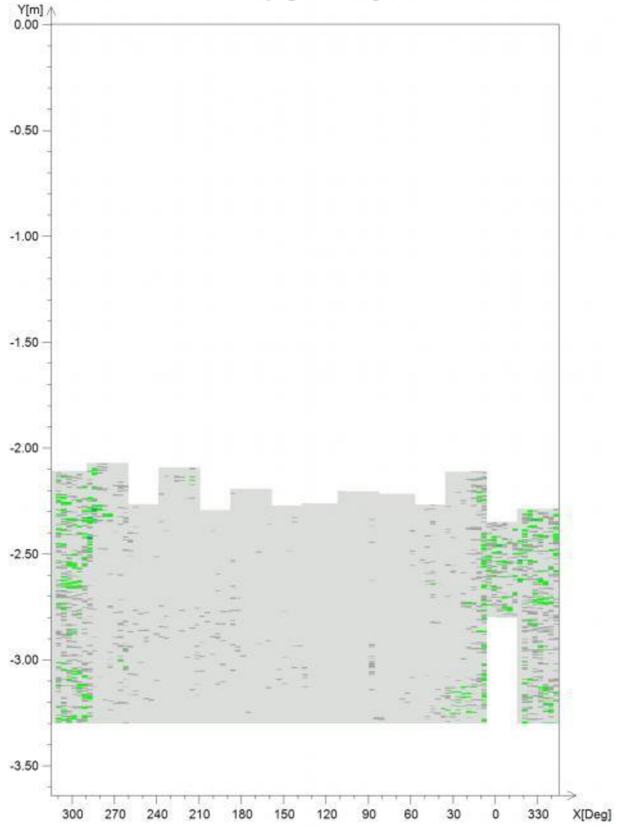
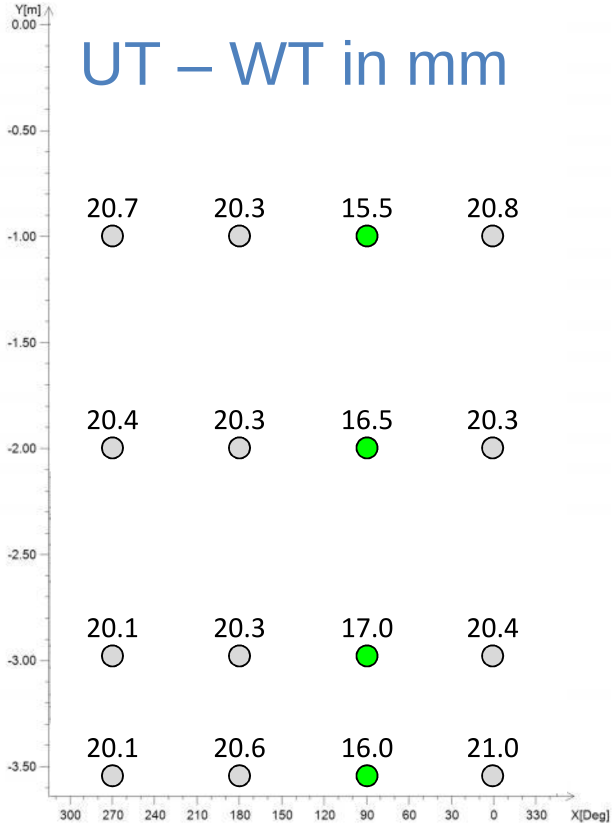


Internal





Results:

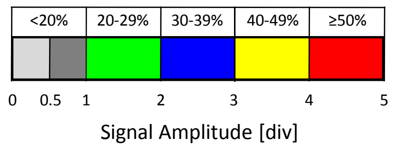
General internal metal loss predominantly in the north-western area of the section. Estimated depth: 25%.

Remarks:

Platform structure prevented scan of the upper part of the section.

MEC and UT Color Code

wall loss in percentage relative to nominal WT



Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 2
Pipe Diameter:	30"
Date:	06/09/2014
K-No.:	K00

WHT Conductor 2 - Section 2   Wall Loss Condition Map

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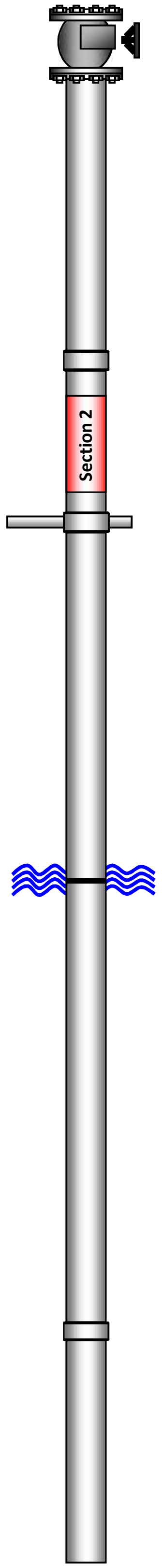
MEC Scan Report



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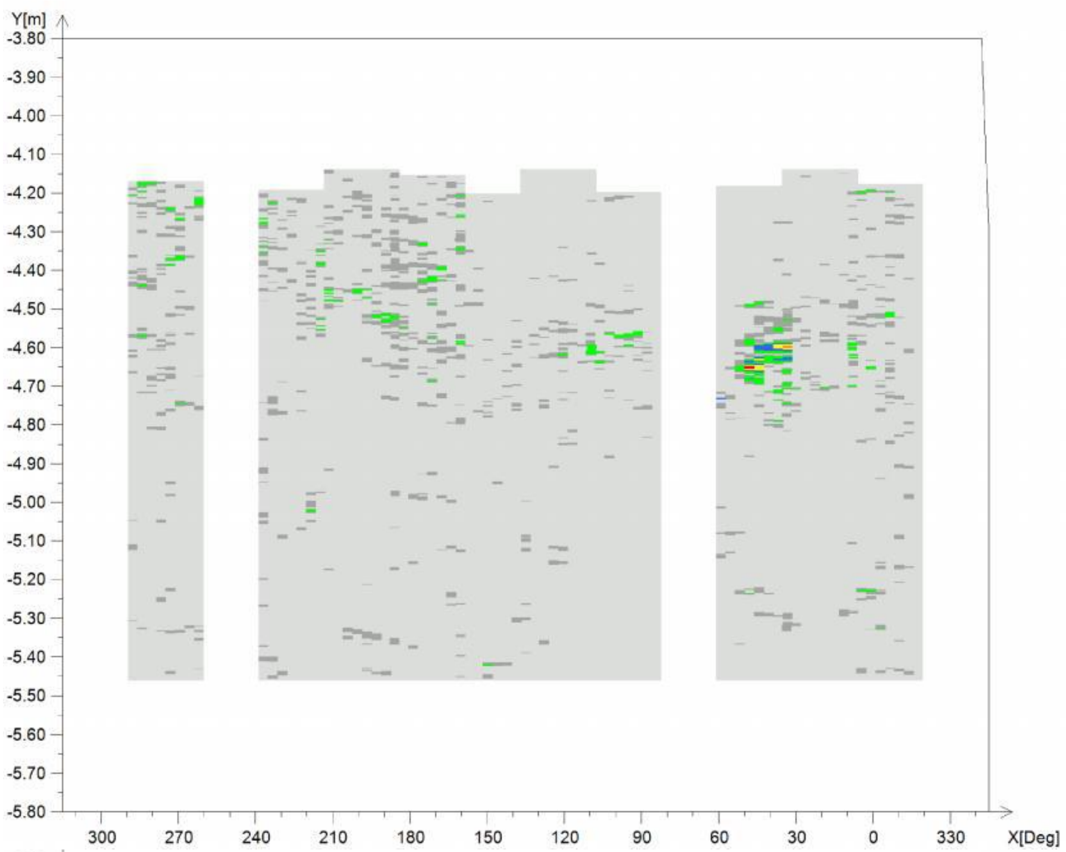
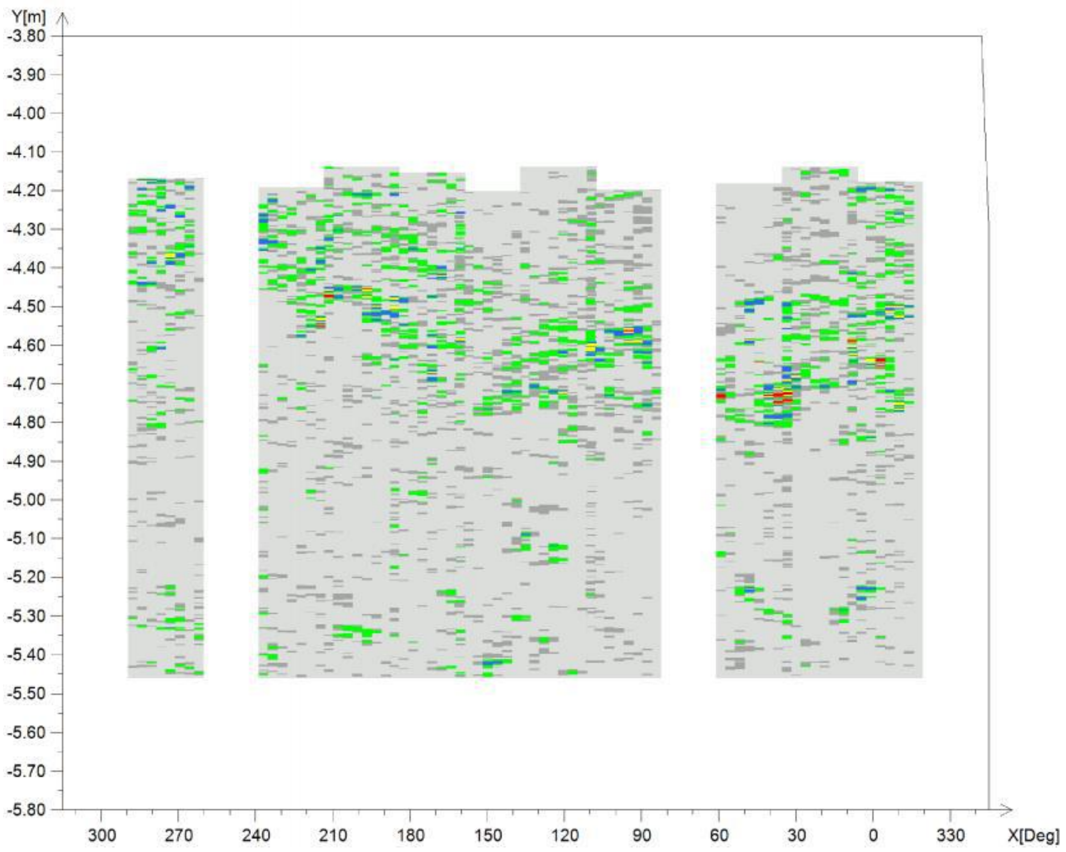
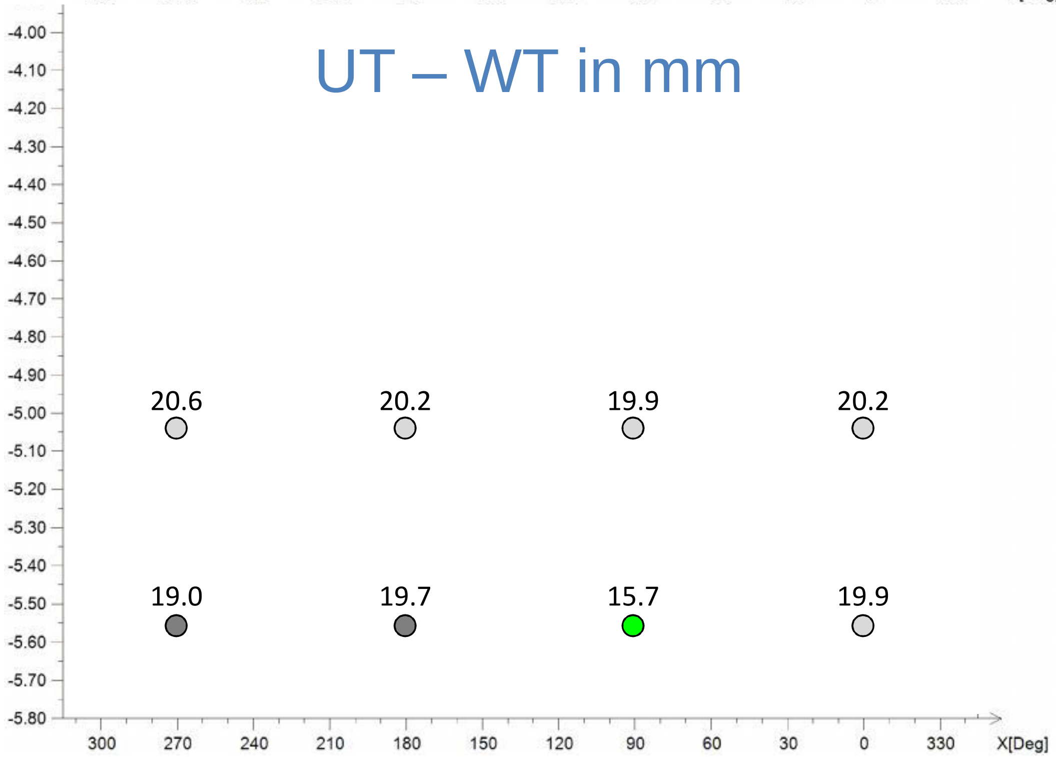


Internal



UT – WT in mm



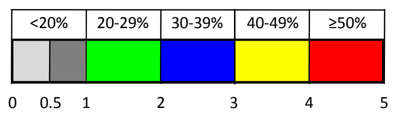
Results:

Large internal metal loss at -4.75 m.
Estimated depth: 60%.
Large external metal loss at -4.65 m.
Estimated depth: 45%.

Remarks:

Four tracks could not be done due to obstacles (lifting pad eyes)

MEC and UT Color Code
wall loss in percentage
relative to nominal WT

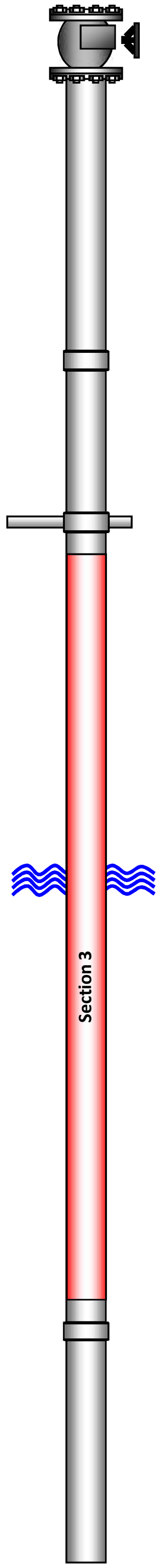


Signal Amplitude [div]

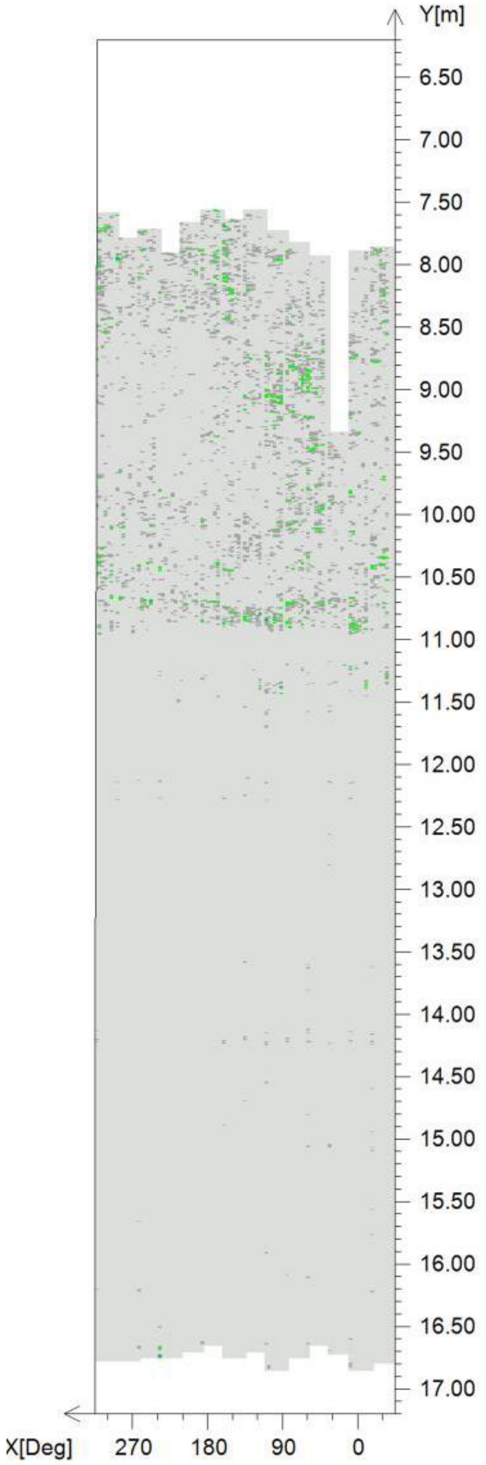
Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 2
Pipe Diameter:	30"
Date:	06/09/2014
K-No.:	K00

WHT Conductor 2 - Section 3 Wall Loss Condition Map

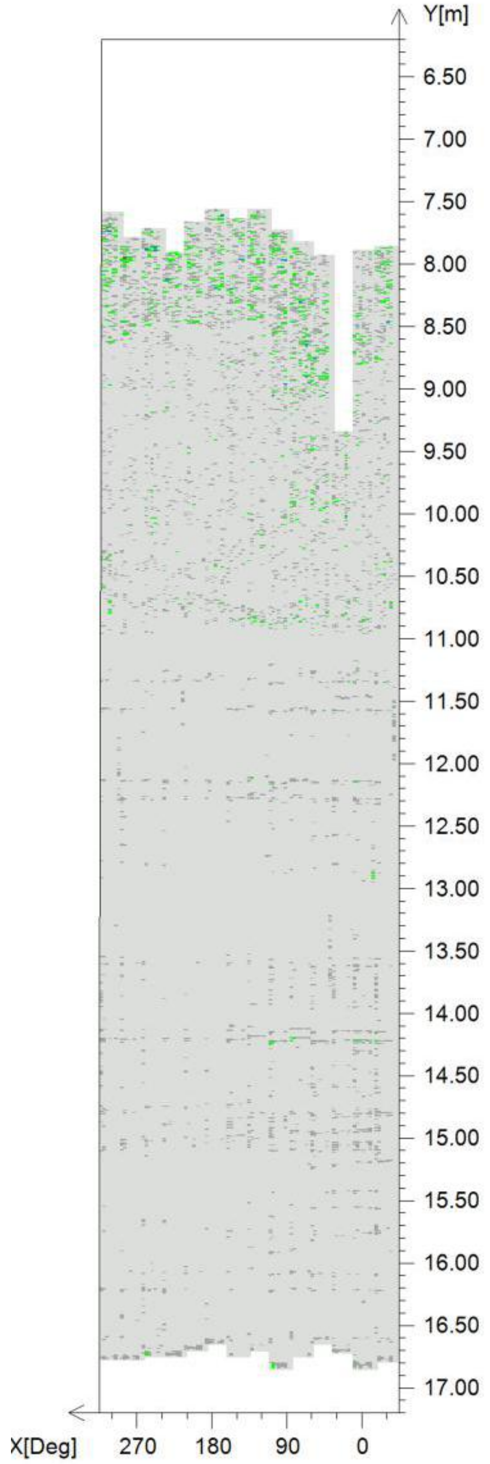
innospection
MEC Scan Report



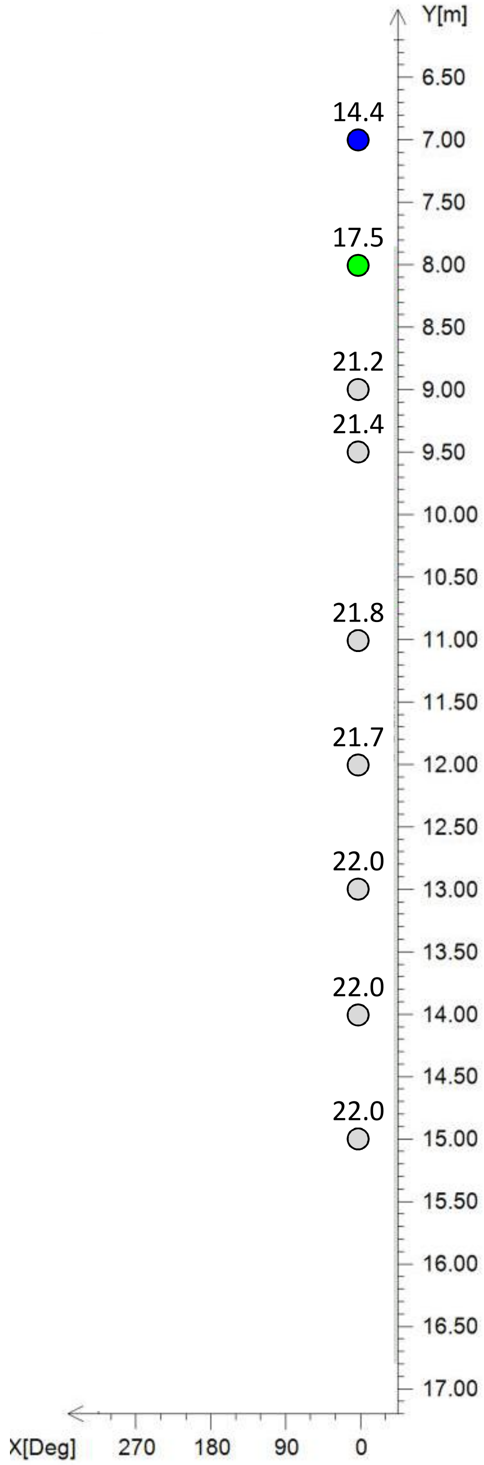
External



Internal



UT – WT in mm



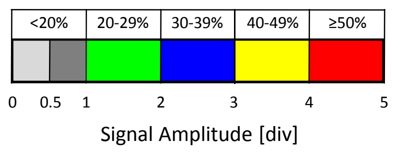
Results:

General corrosion between -7.5m and -9m with pitting-like indications exhibiting wall loss up to 45%.

Remarks:

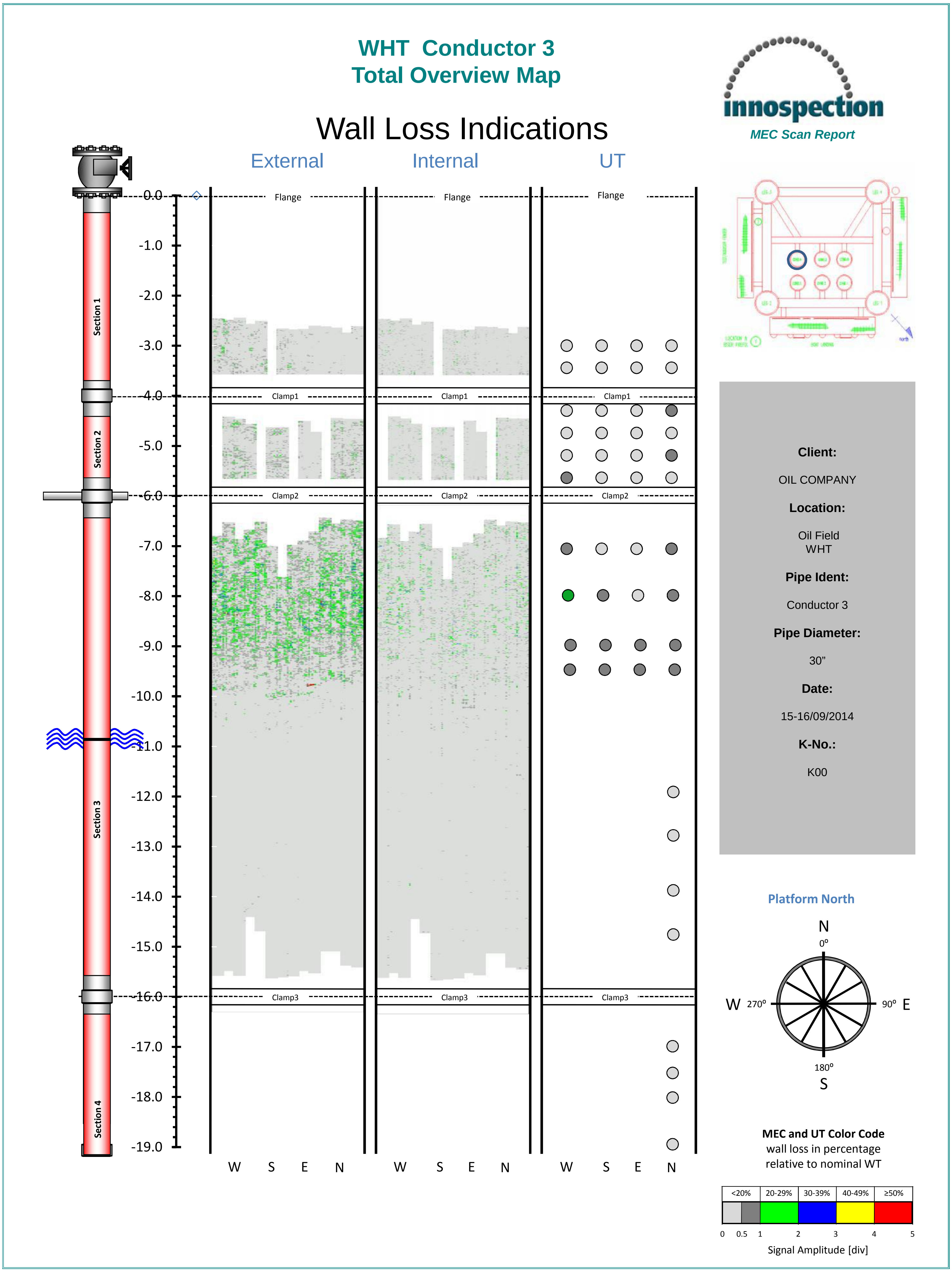
Cleaning difficult between -6m and -7.5m.

MEC and UT Color Code
wall loss in percentage
relative to nominal WT



Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 2
Pipe Diameter:	30"
Date:	06/09/2014
K-No.:	K00

13.3 Conductor No.3



WHT Conductor 3
Total Overview Map
innospection
MEC Scan Report
Wall Loss Indications
External
Internal
UT
Flange
Clamp1
Clamp2
Clamp3
Section 1
Section 2
Section 3
Section 4
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
-18.0
-19.0
W S E N
W S E N
W S E N
Client:
OIL COMPANY
Location:
Oil Field
WHT
Pipe Ident:
Conductor 3
Pipe Diameter:
30"
Date:
15-16/09/2014
K-No.:
K00
Platform North
N
0°
W 270°
90° E
180°
S
MEC and UT Color Code
wall loss in percentage
relative to nominal WT
<20%
20-29%
30-39%
40-49%
≥50%
0 0.5 1 2 3 4 5
Signal Amplitude [div]

WHT Conductor 3 - Section 1

Wall Loss Condition Map

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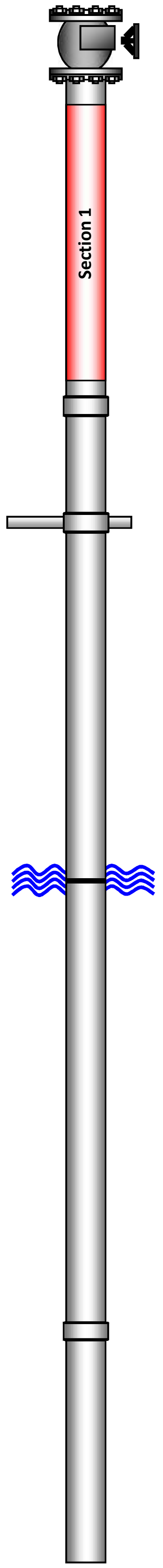
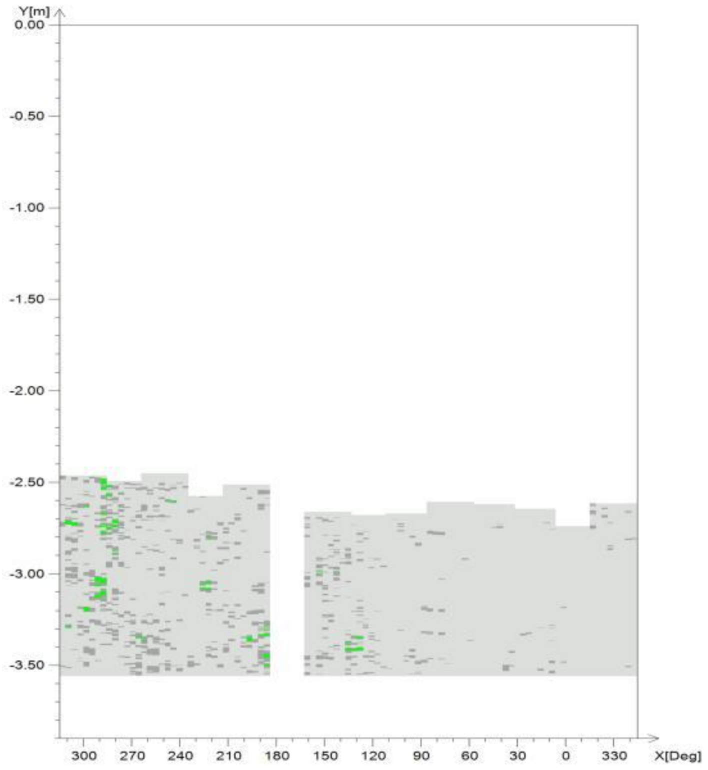
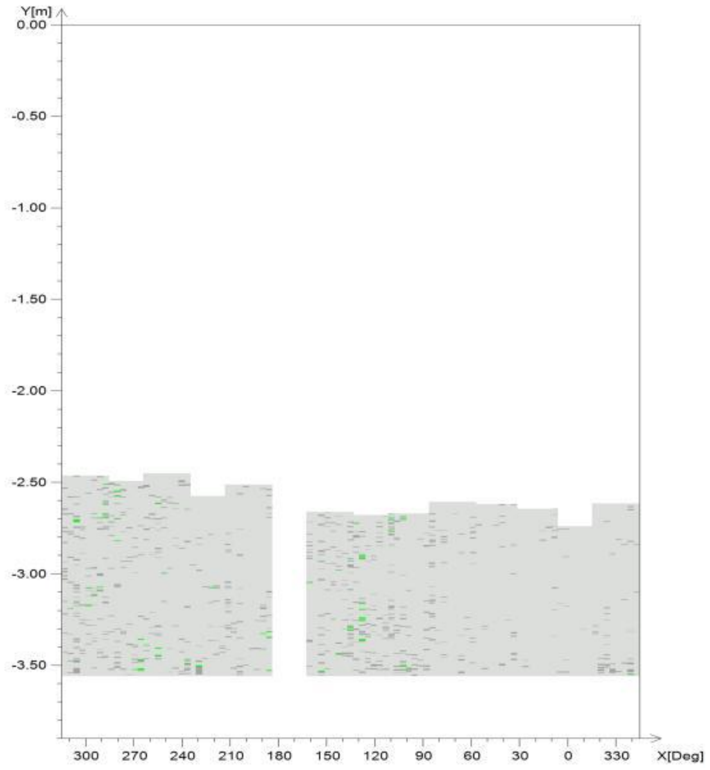
MEC Scan Report

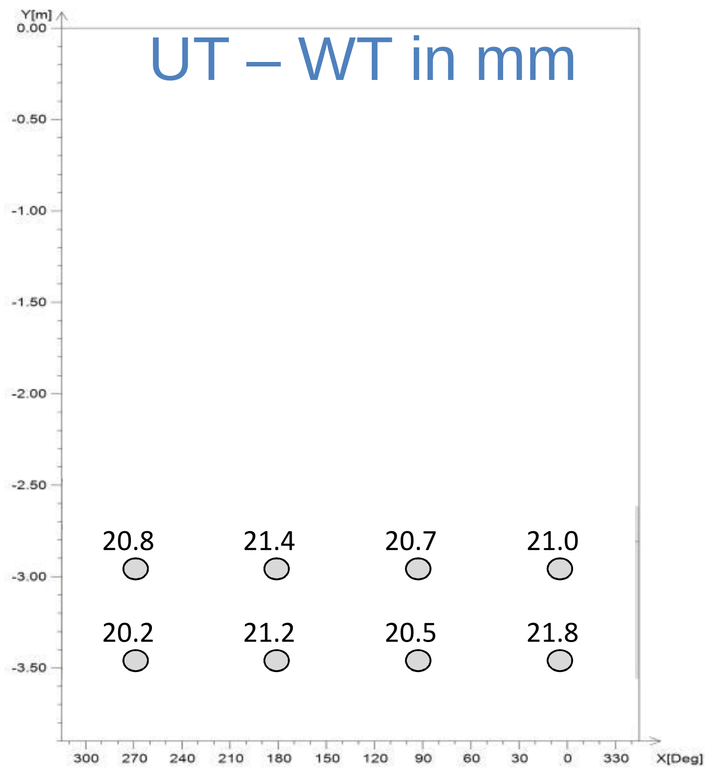


External



Internal





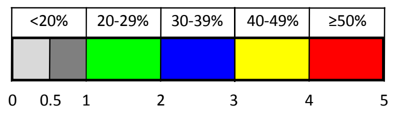
Results:

Some external corrosion on the external side mostly on the West side in the range of 20%.

Remarks:

Guide prevented scan of the upper part of the section.

MEC and UT Color Code
wall loss in percentage
relative to nominal WT



Signal Amplitude [div]

Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 3
Pipe Diameter:	30"
Date:	15-16/09/2014
K-No.:	K00

WHT Conductor 3 - Section 2 Wall Loss Condition Map

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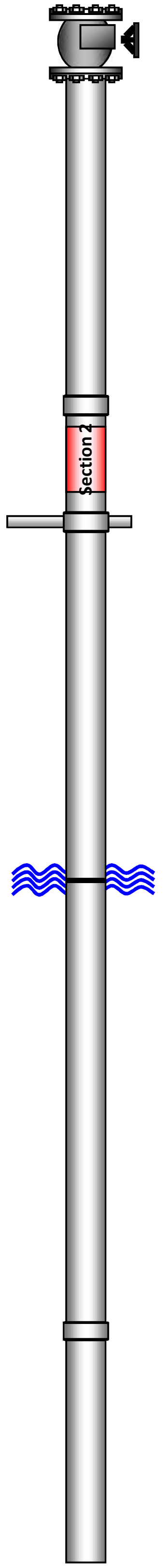
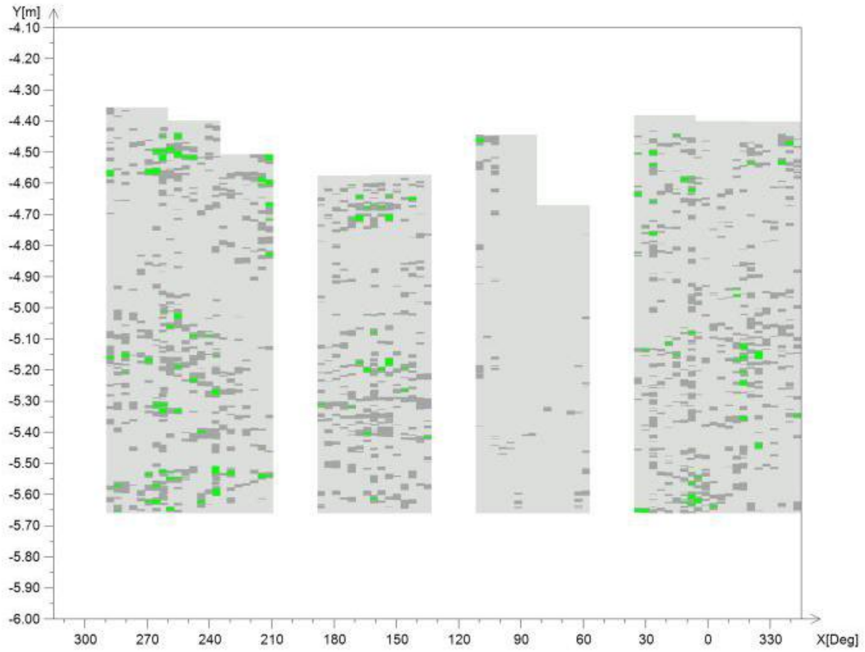
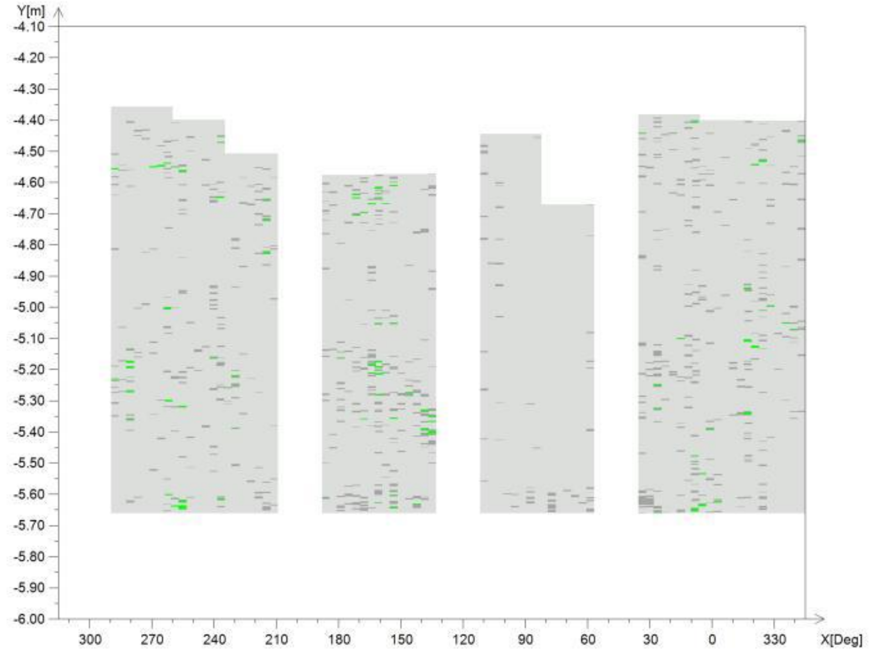
MEC Scan Report

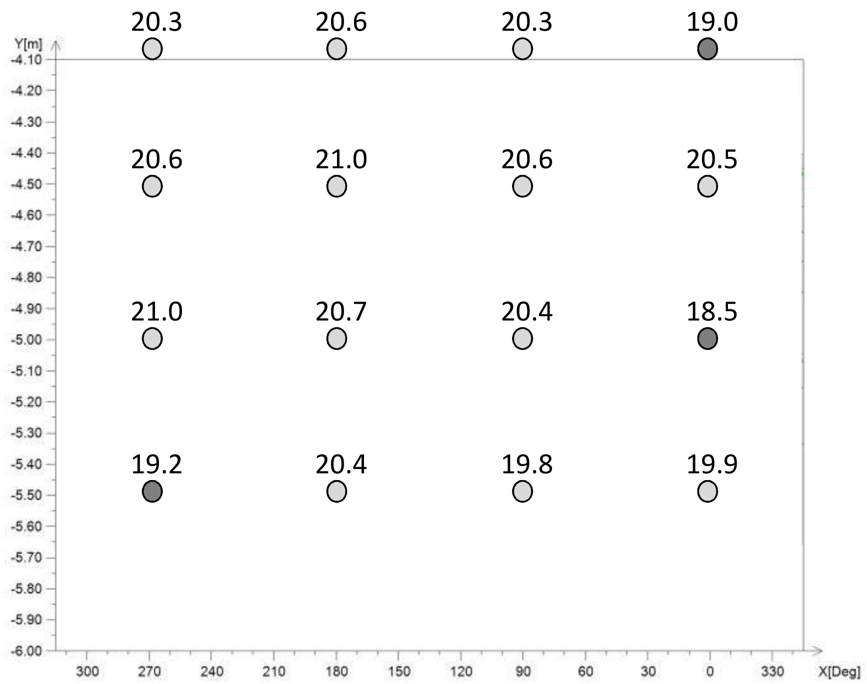


External



Internal





UT – WT in mm

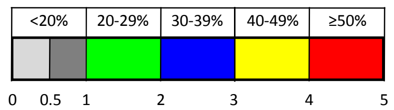
Results:

Minor localised external and internal corrosion detected.

Remarks:

Some tracks shortened due to lifting pad eyes.

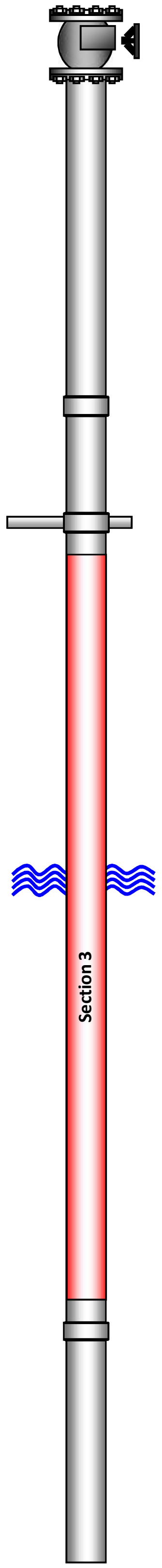
MEC and UT Color Code
wall loss in percentage
relative to nominal WT



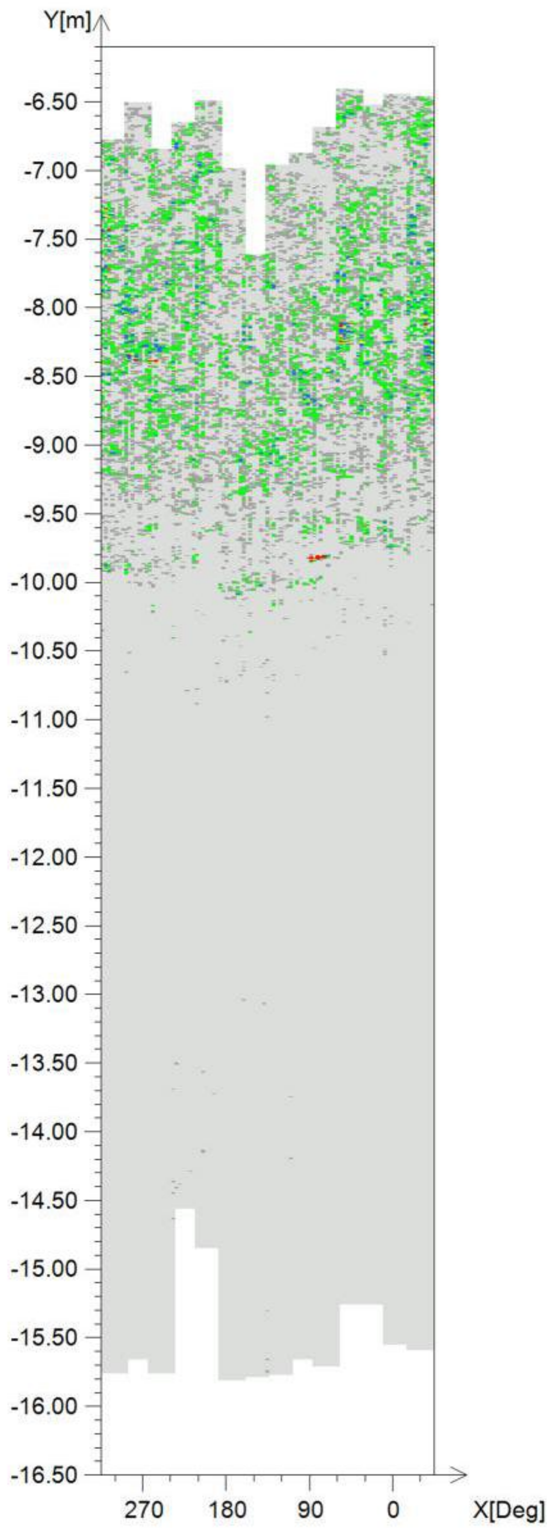
Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 3
Pipe Diameter:	30"
Date:	15-16/09/2014
K-No.:	K00

WHT Conductor 3 - Section 3 Wall Loss Condition Map

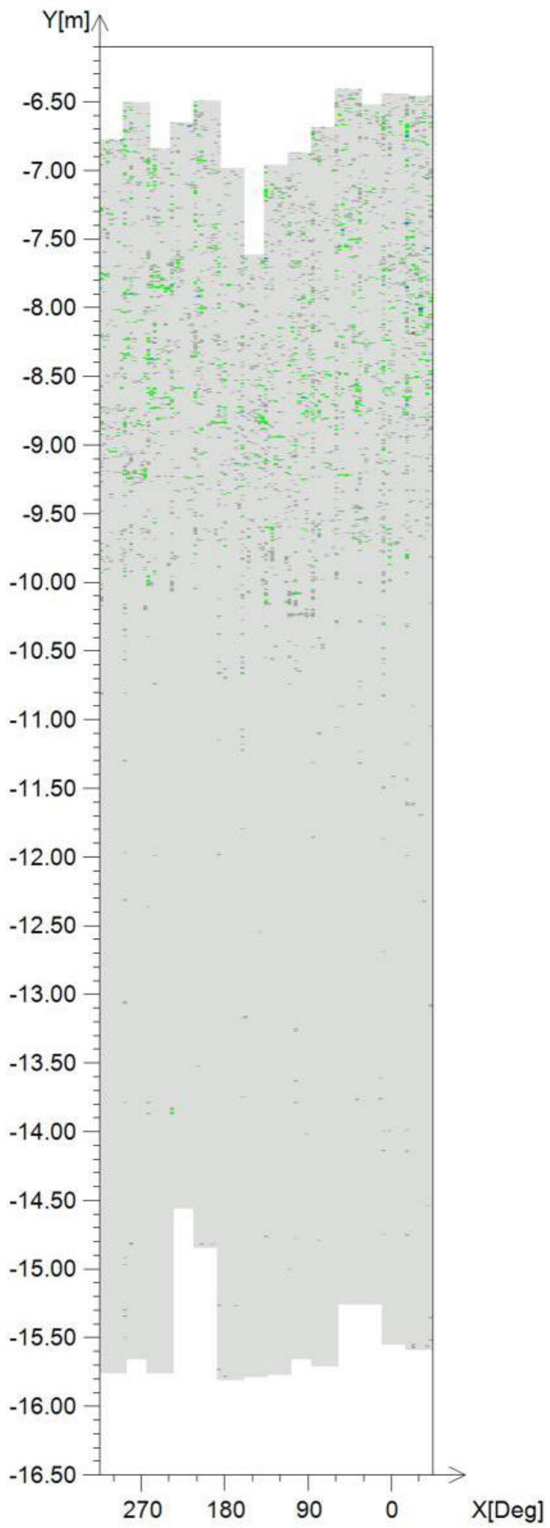
innospection
MEC Scan Report



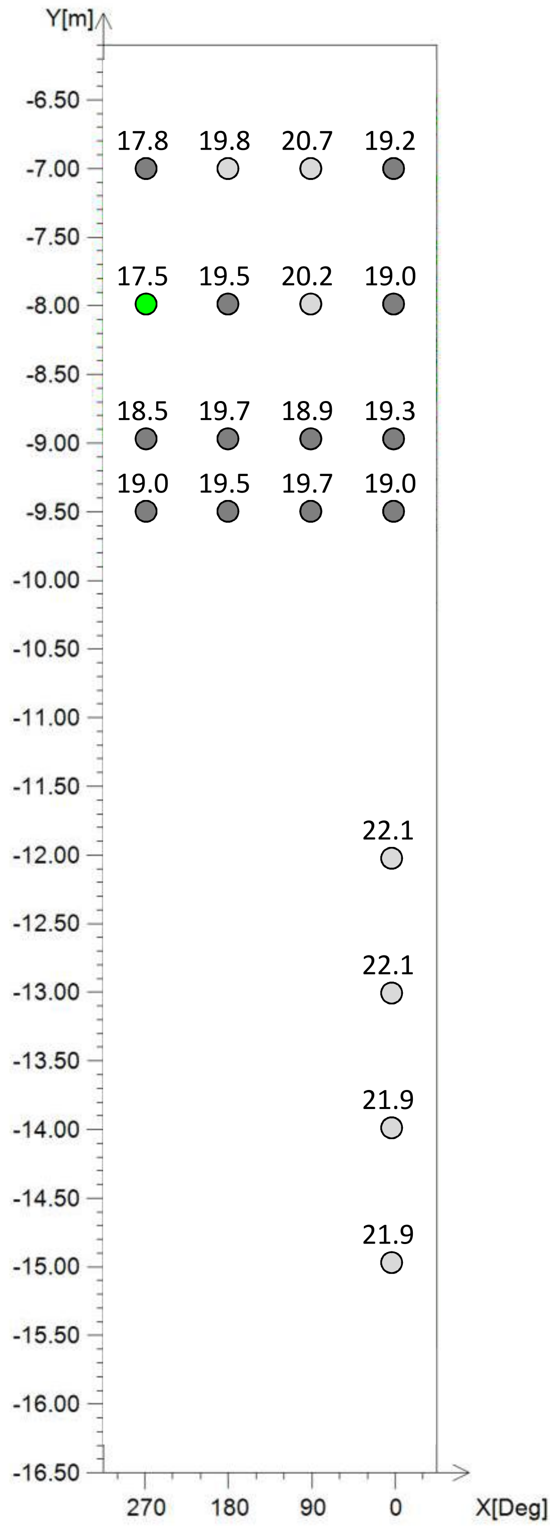
External



Internal



UT – WT in mm



Results:

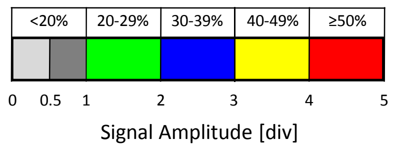
Extended corrosion found on external surface above the water level. Deepest spot at East (90º) at -9.8m with a depth of 60%.

Remarks:

Further UT measurements on North face (0º):

-17m:	22.0 mm
-17.5m:	22.0 mm
-18m:	28.0 mm
-19m:	28.4 mm

MEC and UT Color Code
wall loss in percentage
relative to nominal WT



Client:	OIL COMPANY
Location:	Oil Field WHT
Pipe Ident:	Conductor 3
Pipe Diameter:	30”
Date:	15-16/09/2014
K-No.:	K00

14. Documentation

The inspection result, parameters and data are stored in the Innospection Limited archive database system.

15. Signature

T.B
Reporting Engineer
Innospection Germany GmbH

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Senior Engineer, PCN level 3 No. 200046
Innospection Limited