Air Diving Inspection of ABC Mock-Up Caisson Project 123

Client:	**CLIENT**
Facility:	**CDE, Norway**
Item Inspected:	**ABC Mock-Up Caisson**
Inspection Method:	**Manual Surface Eddy Current**
Date Commenced:	**04 November 2013**
Date of Completed:	**07 November 2013**
Type of Report:	**Final**
Report Number:	**K1912**

nqa. ISO 9001 Registered — UKAS QUALITY MANAGEMENT 015

FPAL empowered by Achilles — Registered — Supplier Number: 10051207

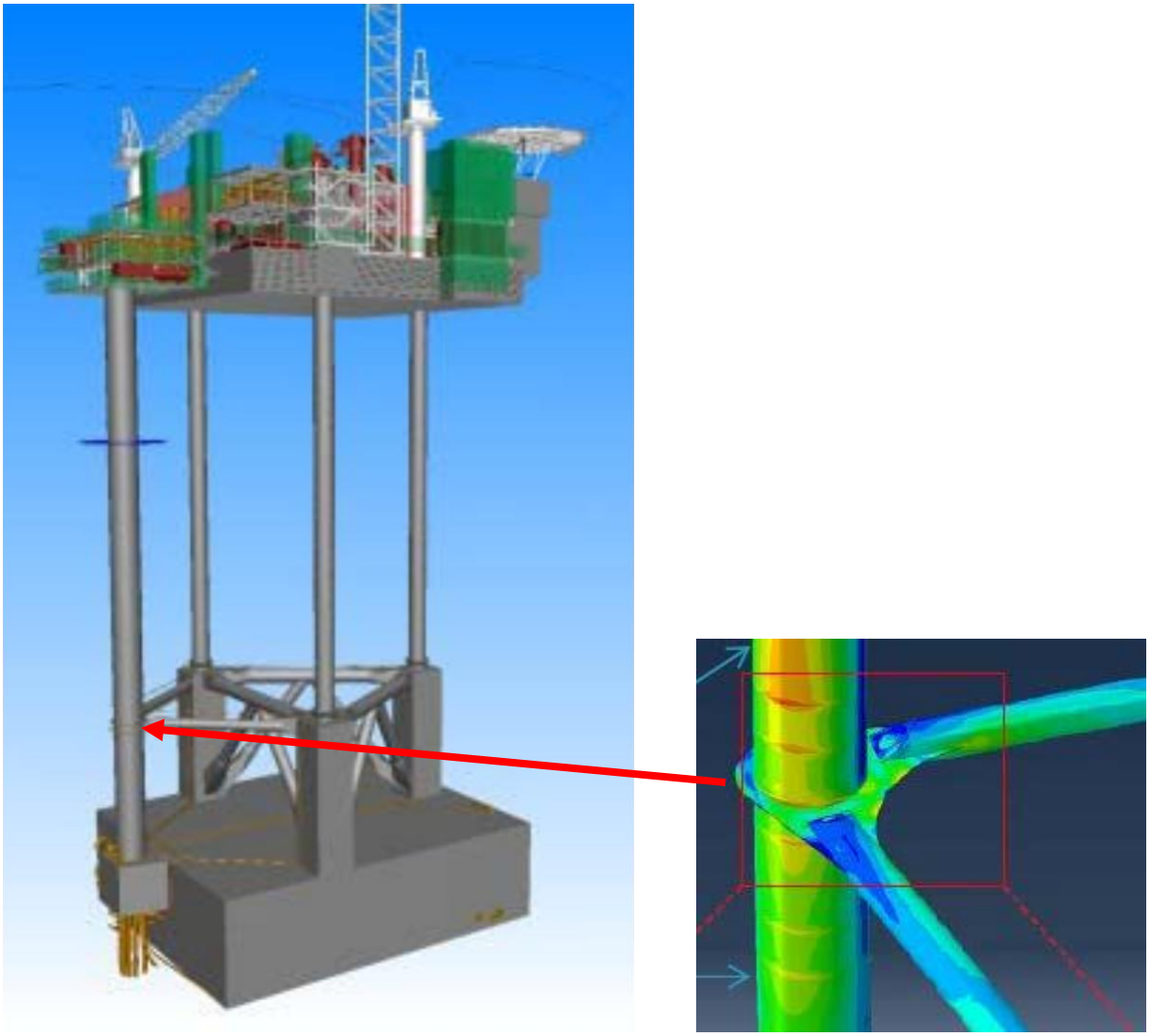
Unit 27/28
Webb Ellis Park
Rugby CV21 2NP
Warwickshire, UK
Phone: +44 (0) 1788 5472 94
Fax: +44 (0) 1788 5472 99

Howemoss Avenue - Unit 1
Kirkhill Industrial
Dyce AB21 0GP
Aberdeen, UK
Phone: +44 (0) 1224 724 744
Fax: +44 (0) 1224 774 087

innospection

Intentionally Blank

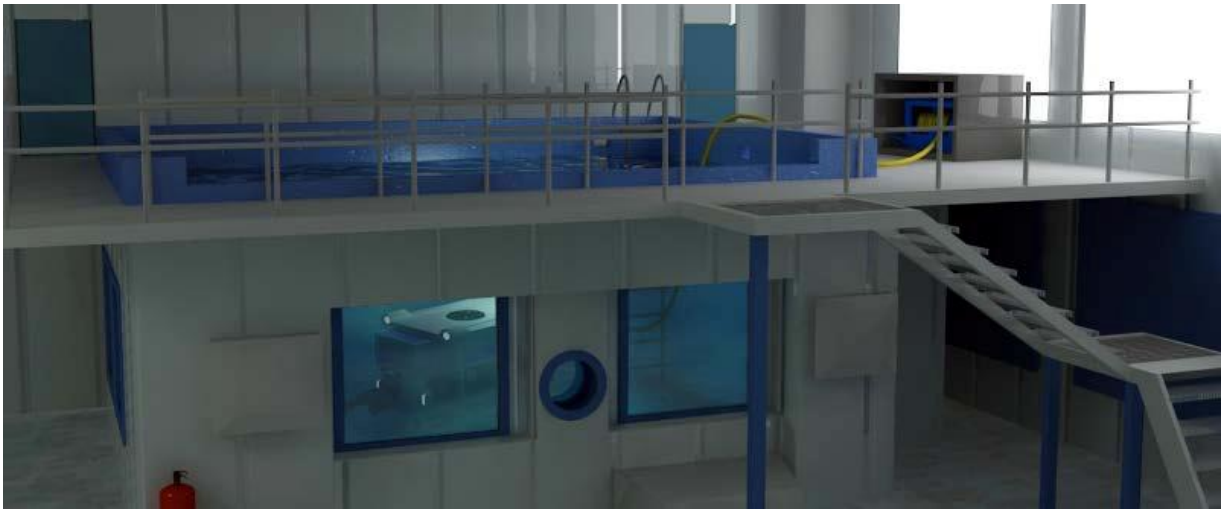
MANUAL EDDY CURRENT INSPECTION REPORT FOR ABC CAISSON MOCK-UP PROJECT 123



Picture 1: Focus of ABC Platform Caisson area.

Executive Summary

Innospection Limited was invited by the Client, under project 123 to participate in the wet trials at CDE, Norway (picture 2) in order to develop a strategy for the offshore inspection of certain structural zones of the ABC caisson structure (picture 1). A mock-up of the area of interest had been constructed and this was the focus of the inspection at CDE (picture 3).



Picture 2: CDE facility test pool.

This inspection report documents in detail the specific inspections that have been conducted; the individual technique and equipment utilised, and the results, observations and conclusions obtained.

As a part of the ABC caisson inspection and repair wet test procedure, a combined Eddy Current with air diving inspection of the mock-up was performed under Project 123. The main inspection scope comprised of surface flaw detection at specific locations where artificial defects had been introduced. The divers were working at a depth of approximately 3.5 msw.

Of the 5 separate areas inspected a total of 16 defects were located and sized.

The following areas were inspected in accordance with the client's instructions contained in the wet test procedure identification: CA-7A-A, CA-7B-A, CA-7A-B, CA-7B-B and CA-5.

There were no restrictions to prevent the required inspection scans. Surface conditions were ideal with a smooth newly painted condition, producing minimal surface noise during inspection. The signal to noise ratio was in excess of 6 dB providing good quality inspection results.

Contents

Page No

1.0) Test Object Data

Object Identification: ABC Caisson mock-up, inspection location identification; CA-7A-A, CA-7B-A, CA-7A-B, CA-7B-B and CA-5.

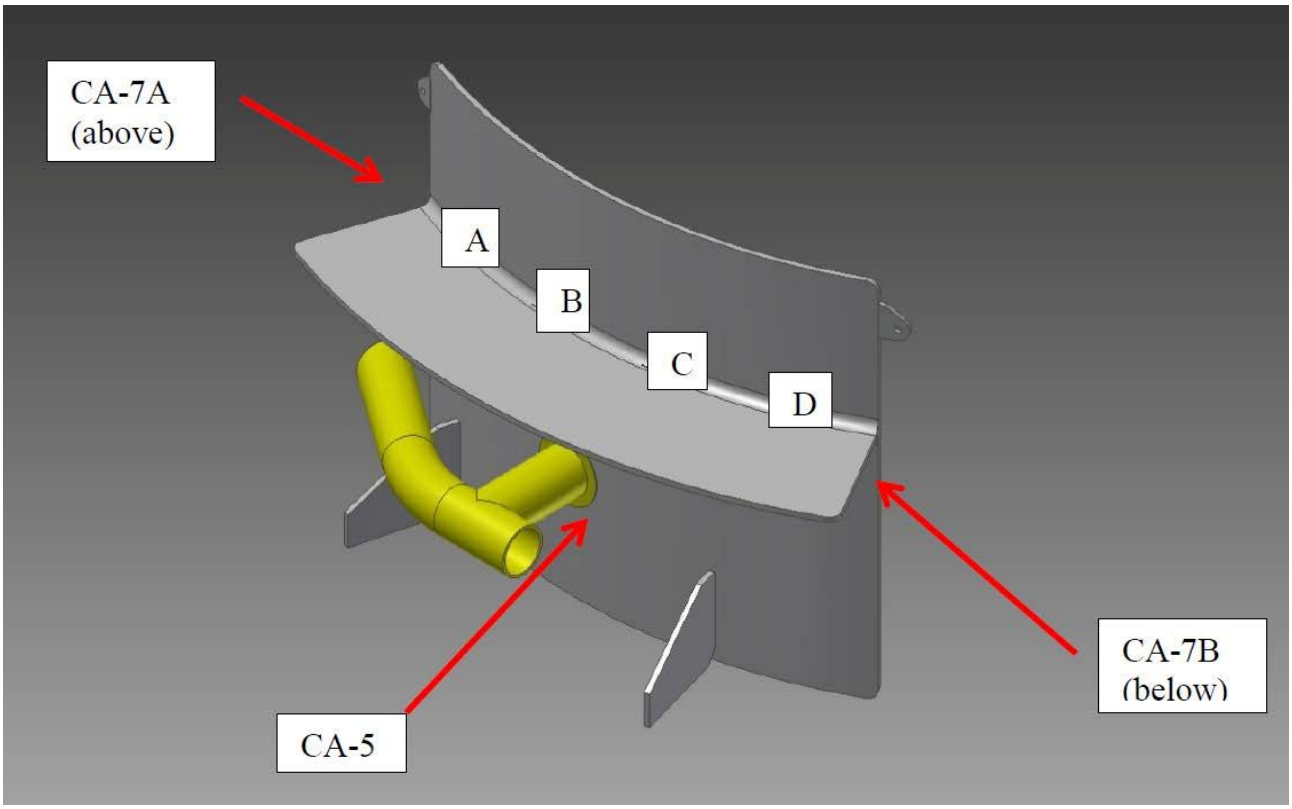
Location of Object: The inspection was carried out in sea water in the CDE test pool.

Orientation of Scans: In accordance with procedure Inno-W/Fe/Man/SubSea Weld/Cast 001-13-Rev 2

Wall Thickness: N/A

Material: 50D Carbon Steel.

Surface Condition: Clean and free from loose debris, painted with nominal thickness of approximately 1.0 mm



Picture 3: ABC caisson mock-up showing inspection locations.

2.0) Inspection Task

To detect surface breaking EDM slots of various lengths and depths, longitudinally positioned in the weld material and weld toe and in the circumference of a circular cut out in the caisson structure using marinised weld probes. A diver was employed as the probe operator who followed the directions of the inspection engineer (IE). When a defect indication was located the IE alerted the diver who then used a subsea monitor which reflected the view the IE could see to allow for sizing and location of the defect.

The diver used a pencil to mark the extent of the defect at this stage for further analysis later using ACFM technique (alternating current field measurement), and subsequent remedial action.

3.0) Inspection Personnel

Inspection Engineers : Mr. AJ, PCN L2 ET, MT, UT / Certification No x
Mr. IW, PCN L2 ET, MT, UT / Certification No x

4.0) Inspection Volume

The Eddy Current scans were carried out over 100% coverage of the weld and heat affected zone (HAZ) and periphery of cut out around 8 inch pipe as identified in this report. All areas of the weld, HAZ and periphery of cut out were targeted to locate longitudinal running defects in accordance with clients' instructions.

5.0) Inspection Equipment (picture 4)

Beltronic Computer:

5.1) Flaw Detector:

Beltronic Computer - Serial Number 1
EddyMax ECT Instrument – #EMC 02/07.01
Non-Intrinsically Safe.
Beltronic IBM-AT-Compatible Computer.
2 x Eddy Current (Plug-In Cards) Type EddyMax.
Input 100v – 250v AC.
TMT ScanMax Version 4.10.03.31 Software.

5.2) Eddy Current Ancillary Equipment

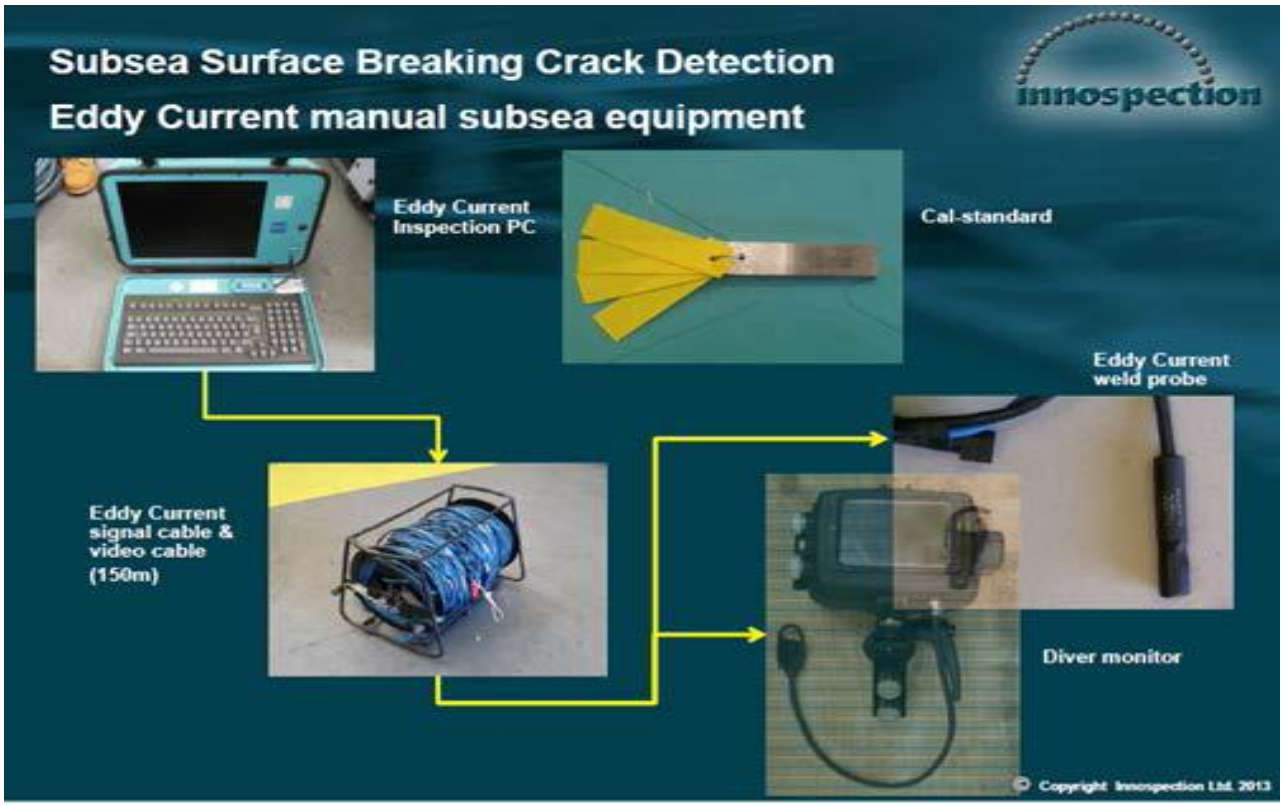
List of Probes Used & Serial Numbers

GE Weldscan Probe straight 100 kHz Fe, Differential mode, Part No 800P04MN1PV1, Serial No 579138/05.

GE Absolute mode Probe Part No 130P3, Serial No 095.

Calibration Samples:

50D Test Sample Block and Shims EDM Spark eroded notches 0.5 mm, 1.0 mm & 2.0 mm Depth.



Picture 4: Eddy Current inspection equipment.

6.0) Equipment Calibration

6.1) Flaw Detector Calibration

For all manual Eddy Current inspections carried out, the flaw detector was calibrated in accordance with Innospection Limited inspection procedure: - Inno-W/Fe/Man/SubSeWeld/Cast 001-13-Rev 2. All equipment utilised was accompanied by in-date manufacturer's periodic calibration certification.

6.2) Calibration Control

The equipment setting and calibration was performed at the beginning of the inspection, with all calibration data being recorded. Calibration controls were performed at the beginning and end of each working shift and after any other significant interruption (i.e. breaks or lunch). Re-calibration was also required when significant changes were made to the equipment.

6.3) Calibration Samples

The calibration samples are manufactured by "GE Inspection Technologies" and manufactured / machined to the relevant British standard requirements, containing the relevant artificial defects.

7.0) Inspection Procedures

The inspection was performed according to the following valid procedure:

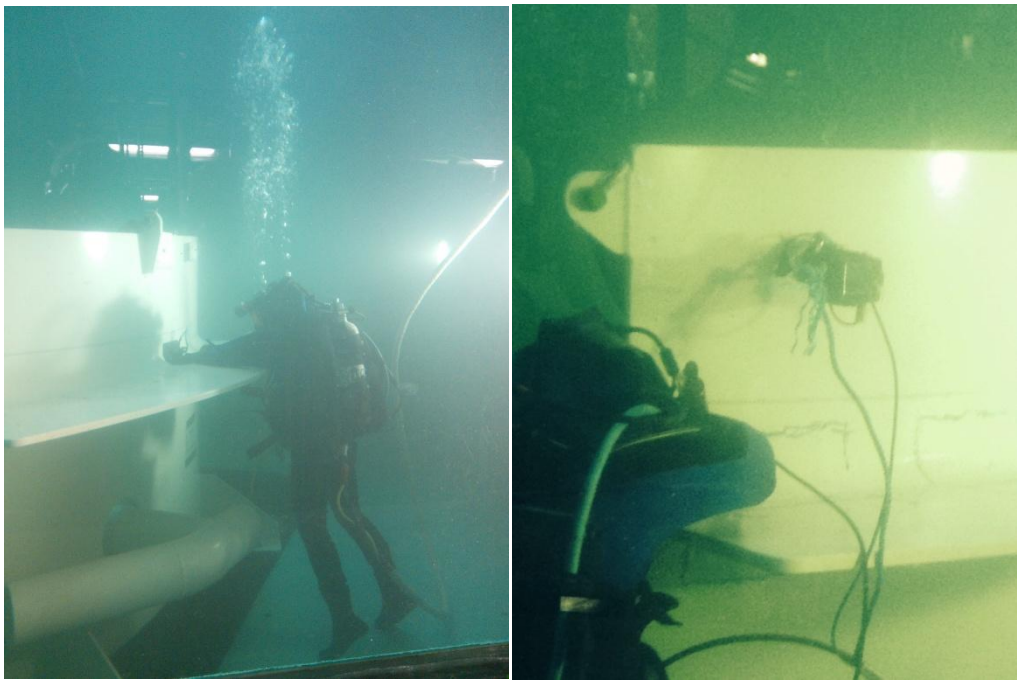
Inno-W/Fe/Man/SubSea Weld/Cast 001- 13-Rev 2

8.0) Comments to Inspection

The accuracy of the results obtained on the whole were encouraging, given the remote nature of the inspection site to the IE and limited diver exposure to inspection equipment prior to mobilisation. Accuracy of plotting location and surface length of defects could be marginally improved with increased top side training of the diver prior to commencement of the inspection programme. It would be beneficial in the case of the ABC campaign to have the mock-up available on the vessel in order for divers to experience the logistics of the inspection process.

Availability of a hands free communications system, headset, may have improved the accuracy of the eddy current based defect sizing by improving diver to IE comms. It should be possible for the diver to mark the extent of the defect with help from the monitor (which reproduces the IE screen), this could then be checked by the IE after, utilizing the diver's helmet mounted camera.

It was commented by the diver that the use of the subsea slave monitor was invaluable to them when plotting fault location and sizing. It would be difficult for both the diver and IE to communicate the defect sizing process without the ability for both parties to view the screen shots live



Picture 5 and 6: Showing diver operations using Eddy Current equipment.


Picture 7 and 8: Showing location of IE and test object post inspection.

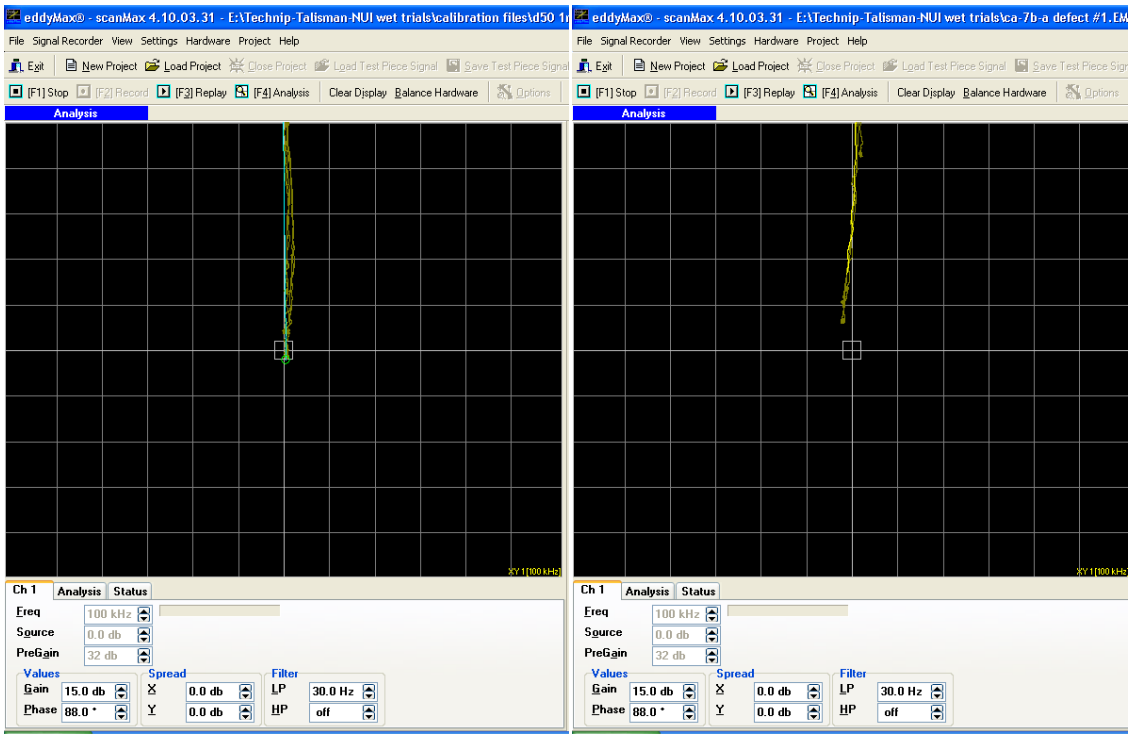
Picture 9 and 10: Showing inspected area locations.

9.0) Result Overview

All results are listed at table 1.

Area under inspection	Defect indication number	Position from master datum (mm)	Length of defect indication (mm)	Severity of defect indication (% full screen)	Where defect is (toe, weld or HAZ)
CA-7A-A	1	175-235	60	100% + 1dB	Lower toe of weld
	2	280-335	54	100% + 1dB	Mid weld
	3	390-440	54	100% + 1dB	Upper toe of weld
CA-7B-A	1	180-245	62	100%	Upper toe of weld
	2	300-325	27	90%	Mid weld
	3	425-435	10	60%	Lower toe of weld
CA-7A-B	1	820-845	25	100% + 3dB	Lower toe of weld
	2	890-915	25	100% + 1dB	Mid weld
	3	960-990	30	100% + 2dB	Upper toe of weld
CA-7B-B	1	805-825	20	100% + 1dB	Upper toe of weld
	2	885-910	25	100%	Mid weld
	3	950-975	25	80%	Lower toe of weld
CA-5	1	12 o'clock	40	100%	Perpendicular to hole
	2	3 o'clock	30	80%	Perpendicular to hole
	3	6 o'clock	50	90%	Perpendicular to hole
	4	9 o'clock	20	90%	Perpendicular to hole

Table 1: Inspection Results.



Picture 11 and 12: Showing signal comparison.

Picture 11 shows signal response from 50D test sample block EDM spark eroded notch 1.0 mm depth. Picture 12 shows signal response from defect at location CA-7B-A, 1 upper toe.

10.0) Documentation

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

11.0) Signature

Project Engineer
Innospection Limited

Senior Engineer
Innospection Limited