pmac

INSPECTION

Gamma Flooded Member Detection

PMAC Inspection was formed in 2009 providing our clients cost effective packages through a greater service offering and Multi-Task Engineers. With offices in Aberdeen and Singapore, PMAC offers worldwide services and through its subsidiaries have gained a reputation for delivering cost effective quality services.

Traditionally full CP inspection and FMD are performed separately. In response to client and industry re-quests to improve surveying efficiency, PMAC Inspection has been set up to combine the tasks, saving cost, time and bed space on its customers' survey vessels. As FMD and CP are rarely performed at the same time PMAC personnel are cross trained to operate both systems immediately reducing the number of personnel required to perform a work scope.

Flooded Member Detection is designed to indicate whether through-thickness cracking has occurred to a structure, resulting in member flooding, without the need for the member to be cleaned down to bare metal. This allows detailed crack inspection to be carried out on a limited number of high-risk members, saving both time and cost.

The use of radioactive sources for the inspection for flooded members on offshore steel structures is a well-proven technique. The Group members have operated with radioactive sources offshore for more than 25 years and have successfully utilised logging techniques for various monitoring applications.

The Flooded Member Detection system was developed from this extensive experience to address the specific needs of repair and maintenance programs in conjunction with subsea inspection requirements. The majority of the Group offshore personnel are trained and competent in the safe use of radioactive sources. The FMD apparatus uses a small radioactive source mounted in a source housing detector pod. Computer and FMD software logs all relevant data and produces reports. A radioactive source and robust detector unit are mounted on opposite forks of a variable yoke positioned across the diameter of the member under inspection. The equipment can be configured to operate at any angle from horizontal to vertical to suit measurements on horizontal, diagonal or vertical members.

The ROV-mounted FMD system operates on the principle that a collimated beam of radiation is transmitted through the member and received by the detector at the other side. The strength of the received beam is compared with computer predictions for a dry or flooded member. These predictions are derived from calibration measurements performed in a specially-constructed test assembly in Groups laboratory. The system is mounted on the front of any ROV type and requires a screened twisted pair and a 24 volt power supply subsea within the ROV umbilical. The system in normal mode can determine whether a member is dry or flooded with great accuracy. Reliability of the results allows checks to be carried out quickly. PMAC has carried out FMD operations in a variety of different locations around the globe for many of the leading operators.

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pmac GROUP

NACE INTERNATIONAL THE CORROSION SOCIETY

DNV·GL ISO 9001 = ISO 14001 OHSAS 18001

UKAS QUALITY MANAGEMENT 013

BUREAU VERITAS

Equipment And Operation

A radioactive source and robust detector unit are mounted on opposite forks of a variable yoke positioned across the diameter of the member under inspection. The equipment can be configured to operate at any angle from horizontal to vertical to suit measurements on horizontal, diagonal or vertical members. The ROV-mounted FMD system operates on the principle that a collimated beam of radiation is transmitted through the member and received by the detector at the other side. The strength of the received beam is compared with computer predic-tions for a dry or flooded member.

These predictions are derived from calibration measurements performed in a specially constructed test assembly. The results of these calculations provide positive information regarding the flooded or dry status of the member.

Frame Assembly

The FMD frame is of modular construction to facilitate fast, flexible and convenient frame configuration. Fabricated from acetal with hard anodised aluminium and stainless steel fittings. The design of the system permits inspection of members with diameters from 150mm to 2000 mm (this may be extended dependent upon the capabilities of the host ROV) and wall thickness of up to 60mm to be tested. The system in normal mode can determine whether a member is dry or flooded with 100% accuracy.

Detector Head

Cased in Hard-anodised HE-30 aluminium and acetal cylinder designed to operate in water depths in excess of 3000 f.s.w.
Dimensions: 66mm Dia. x 380mm Long (excluding bulkhead connector).

Power and Comms Requirements

The detector head requires a nominal 24 Vdc supply at maximum 150mA from the ROV. Comms to surface are via a screen twisted pair (RS-485) in the ROV umbilical or via the hot vehicle control multiplexer (RS-232).

Source

Small radioactive source mounted in a source housing 40 x 83 mm.

Weight

Overall weight of subsea equipment in air – 12Kg. maximum.
Overall weight of subsea equipment in sea-water – 4Kg.
A range of additional buoyancy is supplied as standard.

Surface Equipment

The subsea equipment is complemented by a notebook PC running a powerful, bespoke software package for data analysis data-recording and production of reports.

The equipment is shipped in flight cases and the source as a UN2910 Excepted package in a Type A transit pot. The system is Type Approved by Bureau Veritas.

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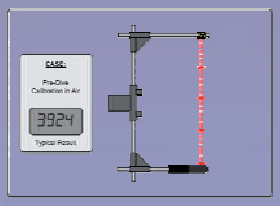
Typical Calibration results ...

STEP 1 **Calibration in Air :-**

Once the frame has been appropriately configured, an air calibration is carried out :-

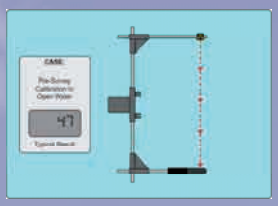
Air Count = 3924



STEP 2 **Calibration in Water :-**

Once in the water, an open-water calibration is carried out :-

Water Count = 47

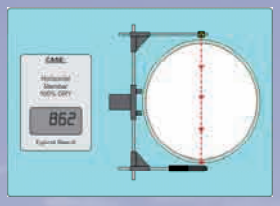


The calibration routine adds only seconds to vehicle launch time and the GFMD equipment is then ready to approach the structure and commence active survey...

Typical GFMD survey results ...

STEP 3 (a)

100% Dry Case :- **Survey Count = 862**

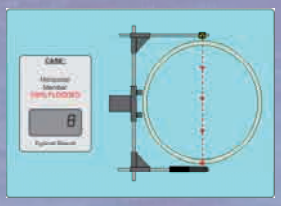


STEP 3 (b)

Partially Flooded Case (17%) :- **Survey Count = 202**

STEP 3 (c)

100% Flooded Case :- **Survey Count = 8**



The figures shown above were recorded during an actual survey program and are typical of those routinely achieved.
The total lack of ambiguity between flooded, partially flooded and dry results is clearly illustrated.
The component under test had an O.D. of 1000 mm and a nominal wall-thickness of 32 mm, the GFMD equipment was loaded with 185 MegaBecquerels (5 milliCuries) of CAESIUM -137, and the source / detector separation was set to 1050 millimetres.

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