SUBSEA FLOODED MEMBER DETECTION

FLOODED MEMBER DETECTION BY GAMMA SOURCE ALLOWS FOR SUBSEA MEMBERS TO BE INSPECTED FOR FLOODING AS A RESULT OF CRACKING, DAMAGE, CORROSION OR WELD DEFECT, WITHOUT THE NEED FOR THE HIGH LEVELS OF CLEANING REQUIRED BY OTHER METHODOLOGIES. AS SUCH, A MORE TAILORED INSPECTION PLAN CAN BE PREPARED FOR MORE DETAILED INVESTIGATION AS WELL AS OTHER INSPECTION TASKS AND TECHNIQUES.

Gamma 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 PMAC Gamma FMD system with radiaoactive sources has been operated for more than 25 years and was developed from extensive experience to address the specific needs of repair and maintenance programs in conjunction with subsea inspection requirements.

Traditionally full CP inspection and FMD are performed separately. In response to client and industry requests to improve surveying efficiency, PMAC have combined the tasks, saving cost, time and bed space on its cilents' 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.The majority of PMAC field personnel are trained as Radiation Protection Supervisors and are competent in the safe use of radioactive sources.

The PMAC ROV-mounted FMD apparatus uses a small radioactive source mounted in a collimator and a scintillating crystal detector pod obtaining a result from a member in a matter of seconds. The system is controlled by a proprietary software system allowing the user to measure, store and report in an integrated package. The FMD software logs and analyses all relevant data, recording it quickly and efficently for production of a report within hours of completing a workscope and highlight anomalies within minutes to client.

Our technicians hold Radiation Protection Supervisor (RPS) certification as well as other regulatory requirements for the region of operation to assure safety and meet legal requirements. They will generally also hold specialist CSWIP CP certi-fication at levels 2 or 3 enabling them to fulfil multiple roles on a vessel, saving on time, bed-space and ultimately cost. With Offices in Aberdeen and Singapore, PMAC operate globally and are are licensed to operate radioactive sources for FMD in various territories. PMAC are certified to ISO 14001:2015 / ISO 9001:2015 / ISO 45001:2018 as well as being Corporate Members of AMPP and the Institute of Corrosion.

THE ADVANTAGES OF THE SYSTEM INCLUDE, BUT ARE NOT RESTRICTED TO, THE FOLLOWING:-

- Survey is fast and can exceed 30 components per hour with the resulting assessment instant and clear.
- Prior removal of marine growth and cleaning is unnecessary saving time and cost
- May be safely and effectively deployed by ROV
- A proven system with an impressive track record since 1991
- Configured for survey of horizontal or vertical components

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A maximum 370 MBq Caesium -137 radioactive source and robust detector unit (rated for 900 msw, up to 3000msw units can be supplied) 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 calculated predictions for a dry or flooded member. These predictions are derived from calibration measurements performed in a specially-constructed test as well as calibration counts performed in air and water during survey. The system is mounted on the front of any ROV type and requires either RS485 via screened twisted pair or RS232 coms via host ROV Mux to surface and a 24 V dc (max 150 mA) power supply from vehicle.

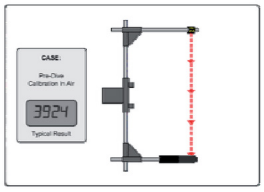
The system in normal mode can determine whether a member is dry or flooded with great accuracy. Reliability of the results allows checks to be carried out quickly. The FMD frame is of modular construction to facilitate fast, flexible and convenient frame configuration. Fabricated from steel and acetal sections with hard anodised aluminium and stainless steel fitings with additional bouyancy being supplied. The design of the system permits inspection of members with diameters from 150mm to 3000 mm (this may be extended dependent upon the capabilities of the host ROV) and wall thickness of up to 60mm, dependant on the diameter/WT combination to be tested.

Overall weight of subsea equipment in air – 13kg. Maximum. Overall weight of subsea equipment in sea-water – 4kg. The equipment is shipped in flight cases and the source ships as a UN2910 Excepted Package in a Type A transit package for overseas operations.

TYPICAL CALIBRATION RESULTS ...

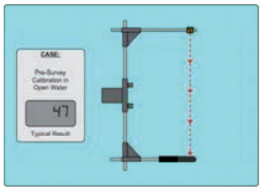
STEP 1 Calibration in Air :-
Once the frame has been appropriately configured, an air calibration is carried out :-

Air Count = 3924



STEP 2 Calibration in Water :-
Once in the water, an open-water calibration is carried out :-

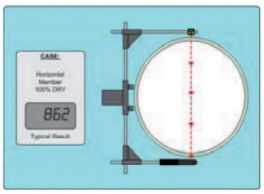
Water Count = 47



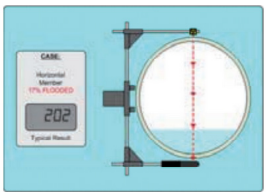
THE CALIBRATION ROUTINE ADDS ONLY SECONDS TO VEHICLE LAUNCH TIME AND THE GFMD EQUIPMENT IS THEN READY TO APPROACH THE STRUCTURE AND COMMENCE ACTIVE SURVEY.

TYPICAL GFMD SURVEY RESULTS ...

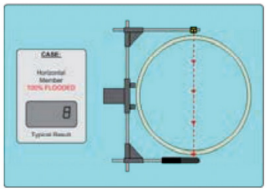
100% Dry Case :- Count = 862



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



100% Flooded Case :- 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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