MEASURING THE CORROSION EFFECTS OF BALLAST WATER TREATMENT SYSTEMS ON BALLAST TANKS

WHY WAS THE METHOD INTRODUCED?

Shipping moves over 80% of the world's commodities and transfers approximately three to five billion tonnes of ballast water internationally every year. Ballast water is essential to the safe and efficient operation of shipping, but it also poses a serious ecological, economic and health threat through the transfer of invasive aquatic species inadvertently carried in it. Ballast water contains a variety of organisms including bacteria and viruses and the adult and larval stages of the many marine and coastal plants and animals. While the vast majority of such organisms will not survive to the point when the ballast is discharged, some may survive and thrive in their new environment. These 'non-native species', if they become established, can have a serious ecological, economic and public health impact on the receiving environment.
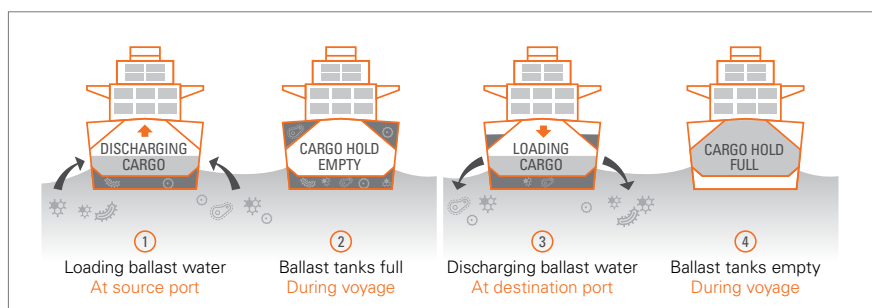
In February 2004, the International Maritime Organisation (IMO) adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Ballast Water Management or BWM Convention) to regulate discharges of ballast water and reduce the risk of introducing non-native species from ships' ballast water. The Convention entered into force on 8 September 2017. From this date, all ships are required to manage their ballast water on every voyage by either exchanging or treating it using an approved ballast water treatment system. Technologies developed for ballast water treatment are subject to approval through specific IMO processes and testing guidelines. These are designed to ensure that such technologies meet the relevant IMO standards, are sufficiently robust, have minimal adverse environmental impact and are suitable for use in the specific shipboard environment.

As part of the approval process there is a requirement to protect the ship and personnel safety. Tests are performed to evaluate physical and chemical hazards and determine whether active substances contain potentially hazardous properties. One area of concern is the effect active chemicals have on the pre-approved ballast tank coatings, especially relating to Chlorine and Ozone.

Chlorine is acidic in nature because in water it forms a mixture of two acids, HCl and $HOCl$, which is corrosive.

Ozone increases oxygen content and therefore the corrosion rate at the splash zone. This can degrade painted surfaces (colour, texture) and may reduce anode effectiveness (oxidation).

1	2	3	4
DISCHARGING CARGO	CARGO HOLD EMPTY	LOADING CARGO	CARGO HOLD FULL
Loading ballast water At source port	Ballast tanks full During voyage	Discharging ballast water At destination port	Ballast tanks empty During voyage

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TESTING THE EFFECT OF ACTIVE CHEMICALS ON A SHIPS STRUCTURE

In April 2009 the Group of Experts on the Scientific Aspects of Marine Environmental Protection Ballast Water Management Working Group (GESAMP-BWWG) meeting at the Marine Environmental Protection Committee (MEPC) stated:

- Testing was required to evaluate the effect of a ballast treatment systems on both the ballast tank coatings and associated pipework

- Testing should include uncoated substrates and marine epoxy (in accordance with IMO PSPC) coated steel

- Testing should be in accordance with ISO 2812-2 (immersion method)

- Assessment criteria include adhesion, blistering, rusting, cracking, delamination from scribe

NACE International submitted an INF paper laying out a proposed methodology to determine the compatibility between ballast water management systems and ballast tank coatings, the test method was developed by TG452 and originally issued as TM0112-2012 - Test to Determine the Potential Corrosion Effects of Ballast Water Treatment Systems on Ballast Tanks.

In the intervening years the International Paint and Printing Ink Council (IPPIC) has carried out various testing programs to evaluate the test method. IPPIC along with NACE international were invited to harmonize their recommendations and provide a joint submission to IMO GESAMP working group committee. The work carried out concentrated on the effects of Chlorine which indicated that some of the original assessment criteria was unnecessary. Tests showed that lower concentrations of chlorine had very limited or no effect on the coating systems and higher levels showed some effect, as a result the method was adapted.

IPPIC members believe that ballast water management systems developing low levels of Chlorine in the region of 10ppm do not require testing further. However, systems developing higher chlorine concentrations must carry out testing on a number of generic types of ballast tank coatings as well as other relevant materials to determine the long term effects.

Based on results and recommendations, NACE TG452 was reformed and TM0112 was revised, the major differences are;

- Concentrate on ballast water treatment systems using active chemicals

- Reduction in the number, and better definition of the coating to be tested

- Clarification of testing on generic rather than named coatings

- Increase the number of changes in treated water to increase the severity of the test

- Reduce the number of assessments to be more aligned with Performance standard for protective coatings

Under NACE rules a test method cannot include pass / fail criteria but joint work has been carried out to provide recommendations on allowable differences between samples tested with treated water when compared to samples tested without chemically treated water.

The revision was sent for ballot in December 2017 with results and comments due to be discussed at NACE Corrosion 2018 which will be in Phoenix on 15th April.

John Carter - Chair TG 452
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(Extracts taken from LR & IPPIC)

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