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Hatch Cover Testing



SHIPS

Hatch Cover Testing

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Introduction

In a recent publication¹, classification society Det Norske Veritas (DNV) noted that

"The classification societies' overall objective is to ensure the safe operation of the ship in all sea and weather conditions. As long as the seaworthiness of the ship is ensured, class pays limited attention to the 'well-being' of water-sensitive cargo.

The ingress of a small amount of seawater into the cargo hold does not usually represent any risk to the safety of the ship, but even small amounts of water may do extensive damage to cargoes that are sensitive to seawater, e.g. grain, fertilizer, steel and paper cargoes."

Ensuring a ship's hatch covers are weathertight is an essential aspect of exercising due diligence to make a ship cargoworthy that may not be covered by routine classification society inspections. This requires an appropriate method of testing to enable any potential problems or defects to be identified and resolved.

In this briefing Walter Vervloesem of IMCS Group, and training instructor for SDT-IMCS Ultrasonic Hatch Cover Tightness Testing Training course, compares the principal methods of testing hatch cover weathertightness.

Weather-tightness Under Dynamic Conditions

Water will not infiltrate a hatch cover if there is physical contact between the packing rubber and compression bar. Whether the rubber is slightly touching the compression bar, or whether the packing rubber is being heavily over-compressed, will not make a difference.

However, it should be appreciated that in case of light contact and when in a dynamic condition at sea, minor distortion of the hatch covers will cause the panels to flex, thereby allowing water entry into the hold even in relatively clement weather conditions. In the case of over-compressed rubbers, when packing rubbers are showing a deep permanent set or imprint, the packing rubber may lose its resilience and sealing performance. As a result, it will not be able to compensate for the movements of the ship and may allow water entry into the holds. This entails a risk of wetting damage to cargo.

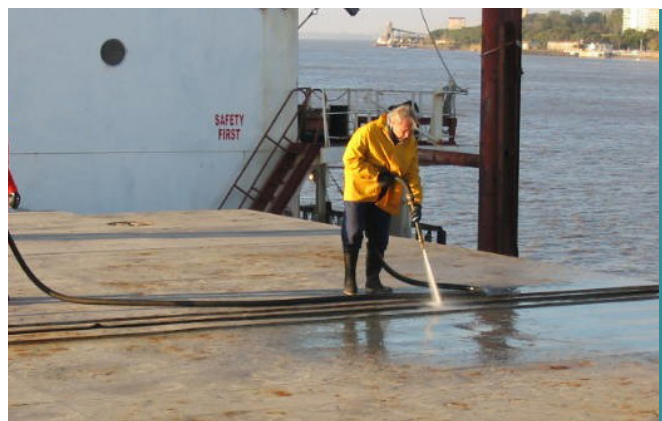
To achieve tightness when the ship is in a dynamic condition while at sea, it is important that the packing rubber exerts a required amount of compression on the compression bar. This is called the design compression, which is determined by the hatch-cover manufacturers in the design stage for the packing rubber to compensate for movements of a ship in a seaway.

Hose tests

A hose test carried out in accordance with the guidelines of the International Association of Classification Societies (IACS) is a long-recognised way of testing the apparent weathertightness of hatch covers. As its name suggests, it involves moving along a hatch-cover joint while directing a powerful jet of water at the joint to determine if any water passes through.

Hose tests show whether the physical contact between packing rubber and its mating surface is satisfactory in a static condition as any discontinuity or lack of contact will allow water infiltration. Contact and compression, as described above, are two different things.

A hose test will not show if the compression of the packing rubbers is satisfactory.



Ultrasonic tightness testing

An ultrasonic test involves placing a transmitter in the cargo space and measuring an ultrasonic signal received outside the space. It provides an idea of the compression of a sealing system and gives an indication of areas where the sealing system is compromised.

¹ "Fitness for Cargo", DNV Bulk Carrier Update No.1 2010.

Hatch Cover Testing (cont.)

To check that the hatch covers are weathertight, a transmitter is placed in the hold and an open hatch value (OHV) is taken. The OHV represents the strength of an ultrasonic signal that reaches the receiver in a direct line and represents a situation where there is no sealing at all. After closing and securing the hatch covers, the surveyor will then pass around the hatch-cover perimeter and over the cross-joints and check for ultrasound passing through the sealing system. When there is a good compression no, or almost no, ultrasound will pass. Whenever there are flaws or discontinuities in the sealing system, ultrasound will pass and be picked up by the receiver. The measurements thus obtained can then be compared with the OHV taken at the outset of the test and by doing so an idea can be obtained about the importance of the leak, which actually represents a certain loss in compression of the sealing system.

It is generally accepted that in areas where a reading of more than 10% of the OHV is found, there is lack of compression that requires further investigation and repairs or corrective action. The rationale behind this 10% standard lies in the fact that loss of compression in a sealing system will reduce the compensating capacity of the sealing system and, as such, there is an increased risk of water infiltration while on passage.

Classification societies agreed in 2001 that ultrasonic testing, when carried out with class type-approved equipment and qualified operators, was acceptable as an alternative method to hose testing for determining the weathertight integrity of hatch covers for class and statutory inspections. IACS developed standards and criteria under IACS UR Z17 for firms engaged in ultrasonic testing. This was necessary to ensure that surveyors checking hatch covers for class and statutory purposes were familiar with the theory of ultrasound and had practical testing experience and basic knowledge of hatch-cover design, maintenance and repairs.

Calibrated and classification society type-approved equipment should always be used so that repeatability of test results is guaranteed.

The world's leading hatch-cover manufacturers have also recognised the benefits of ultrasonic testing. They are providing training programmes for their service engineers to allow them to use the equipment in a proper way for checking repairs and carrying out tests as class service suppliers in repair and new-building scenarios.

It should also be noted that, with ultrasound, the sealing system is checked for compression, which means that the physical condition of the packing rubbers must be such that they are still able to exert compression. Situations whereby the packing rubber is over-compressed, or where the compression bar is very thin and knife edged and therefore cutting into the rubber rather than compressing it, are two examples where ultrasound may not pass through the sealing system. This would give the false impression that all is in order, whereas

actually the sealing situation is unacceptable. This is why it is recommended that an ultrasonic inspection is followed by a visual inspection whenever possible.

Comparison of Hose and Ultrasonic Testing

Whilst hose tests give an idea of the physical contact between a packing rubber and its compression bar/mating surface, ultrasonic tests give an idea of areas where the compression of the sealing system is compromised. As mentioned above, contact and compression are two different things and consequently the test results of hose tests and ultrasonic tests cannot be compared in practice.

Ultrasonic testing allows hatch covers to be tested in a static condition in port but allows the operator to form an opinion as to whether or not the hatch-cover sealing system will perform well when the ship is at sea in a dynamic condition. This is a major advantage when compared to the hose test and can be a very important tool when exercising due diligence to determine if a ship is cargoworthy and if hatch covers are weathertight.



Benefits of Using Ultrasonic Testing

The use of ultrasonic testing equipment has other benefits, including the following.

- Ultrasonic testing is a reliable and non-destructive testing method, which gives an indication of the compression status of the sealing system.
- Ultrasonic testing allows easy detection with pin-point accuracy of damaged areas or areas where lack of compression exists. This significantly reduces the time needed to identify potential leaks.

Hatch Cover Testing (cont.)

- Once the correct location of the leak is known, the correct repair method can be determined and, as small and local damages can easily be identified; unnecessary extensive repairs can be avoided. Repeated testing can be used to check the effectiveness of the repairs.
- Ultrasonic testing is a 'dry' testing method without the risk of damaging water sensitive cargo or causing pollution of the dock, river or sea water.
- Ultrasonic testing is a quick and easy means of testing, and no assistance from the ship's crew is required other than for supervision and safety.
- There is the possibility to produce a download of test results, which provides ship operators with a detailed test report.
- Ultrasonic testing equipment can be used in loaded or empty holds, which in certain cases allows repairs to covers during loading and checking of repairs during or after the loading period, but prior to going to sea.

Ultrasonic equipment can safely be used under all weather conditions (even with sub-zero temperatures).

Carrying out ultrasonic testing on board

If ultrasonic equipment is carried on board, tests can be carried out regularly to allow the crew to take timely action in case of damage or when lack of compression is identified.

Because of the repeatability of class type-approved equipment, the compression status can be trended and repairs planned well in advance.

Carrying out regular tests will help provide the ship with an inspection, testing, maintenance and repair history which is evidence of the exercise of due diligence.

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Address: Bataviastraat 19, B-2000, Antwerp, Belgium

Tel: + 32 3 458 29 30

Fax: + 32 3 457 79 66

Email: imcs@imcs.be

Website: www.imcs-group.com/

The second edition of North's comprehensive loss-prevention guide entitled *Hatch Cover Maintenance and Operation: A Guide to Good Practice*, also written by David Byrne, is available from the Associations' Loss Prevention Department.

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