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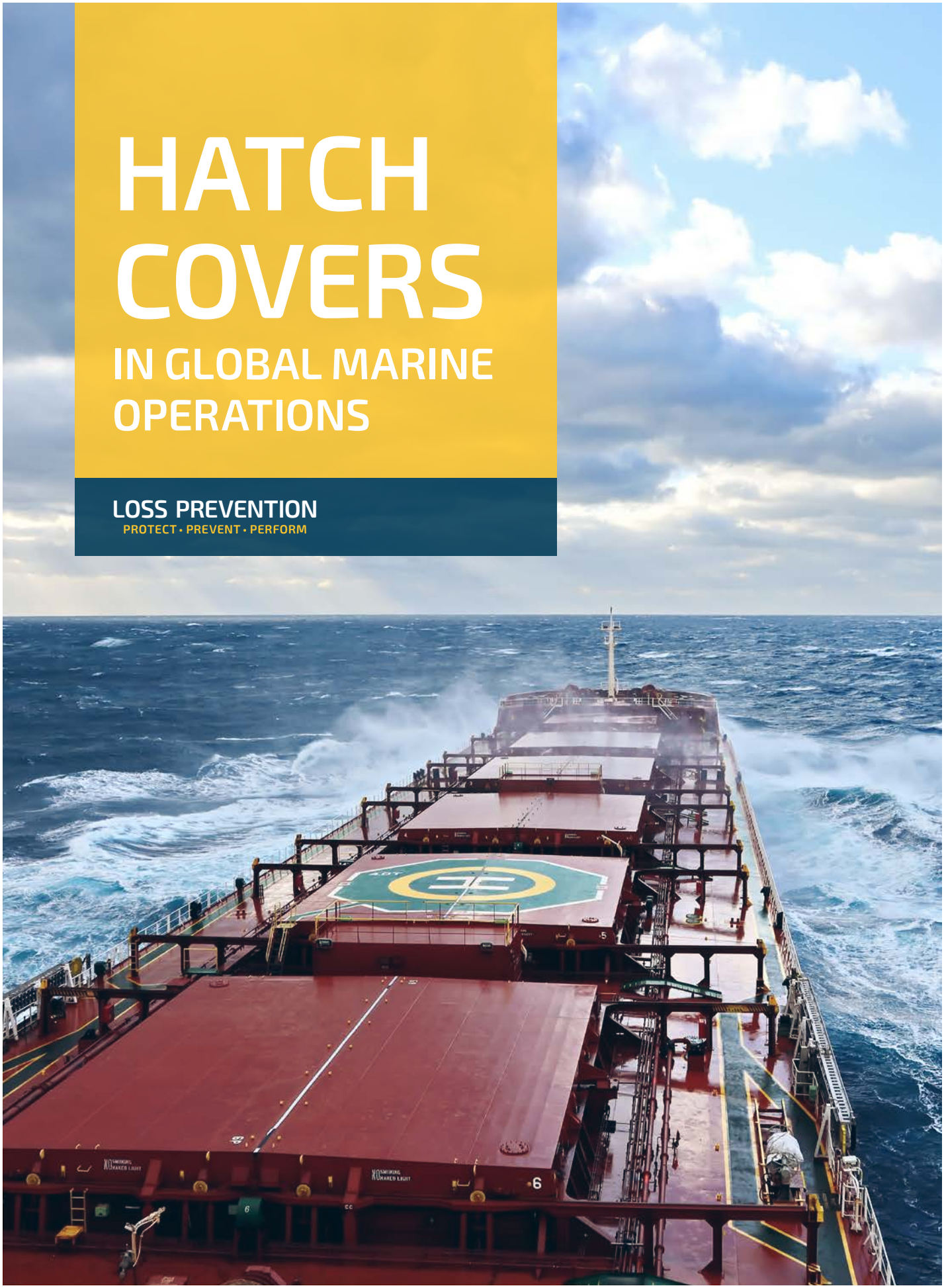
MARINE INSURANCE ENTREPRENEURS

HATCH COVERS

IN GLOBAL MARINE OPERATIONS

LOSS PREVENTION

PROTECT • PREVENT • PERFORM



HATCH COVERS IN GLOBAL MARINE OPERATIONS

Today, the most common types of vessels serving world trade and other marine operations include container ships, bulk carriers, tankers, roll-on roll-off vessels, passenger/cruise vessels, offshore vessels, fishing vessels, specialty vessels, high-speed crafts and dredgers. Cargo vessels, namely cargo ships and bulk carriers, cater to 80–90 % of the world trade needs and comprise 38.2 % of the gross tonnage on seas worldwide.

Dry cargo vessels transport mainly water-sensitive cargoes, such as grain, steel, fertilizer, ores, etc. Hatch covers on these vessels ensure the effective loading and unloading of the cargo, protect the cargo from damage caused by water intake, and ensure the safety of the crew and the vessel by preventing hazardous accidents caused by larger amounts of water entering the cargo hold.

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1. HATCH COVERS – DESIGNED FOR CARGO, CREW, AND VESSEL SAFETY

Hatch covers come in many shapes and sizes to facilitate the varying needs of the global shipping industry, and the right type of hatch cover for each vessel is chosen by the shipowner depending on the client's and the crew's specific needs as well as hatch cover-vessel compatibility. The most common types of hatch covers are folding hatch covers (e.g., for general cargo and handy-size ships), and side rolling hatch covers (e.g., for panamax and cape-size ships), whilst container vessels mainly use lift-away pontoons.

Although hatch covers are often thought of as heavy-duty shipboard equipment constructed to endure in all conditions, one should bear in mind that modern hatch covers are, in fact, high-tech equipment, and as such pose a potential operational risk if not properly used and maintained. In addition, technical failures of hatch covers pose an environmental risk, for example when functional problems emerge in the hydraulic system, causing pollution and cargo contamination. Therefore, it is paramount that hatch covers are constructed, installed, inspected, operated, and maintained in accordance with the specific rules and regulations of the industry (see below).

SHOWING WETTING DAMAGE TO BULK CARGO – COURTESY FRANS VOOGT.

2. RULES AND REGULATIONS

To ensure the safety of the crew, the cargo, the vessel, as well as the operation, hatch cover construction, installation, inspection, operation, and maintenance are governed by a set of rules and regulations issued by ship classification societies, flag states, and third parties. The parties also supervise the implementation of the rules and regulations during the entire life span of the hatch covers and take appropriate action when needed.

For example, altering the approved design of a hatch cover in order to enhance operations without the authorisation of the appropriate supervising party is not allowed. Such unauthorised changes made to hatch covers may lead to, for example, the withdrawal of classification for a vessel.

Whilst requirements from classification societies and flag states are in place to guarantee the ship's seaworthiness, industry requirements also focus on the commercial and quality-related aspects related to hatch covers, such as their ultrasonic testing, fumigation, ventilation, and cleanliness. Claims are typically introduced in connection with non-compliance with industry requirements. Common issues include leaking hatch covers, wetting damage to cargo, condensation damage, delays in hatch cover operation, and stevedore damages. However, even when a vessel may initially have been deemed seaworthy, neglect of due diligence regarding, for example, the maintenance of hatch covers may be seen as having risked damage to the cargo. This, in turn, may have rendered the vessel unseaworthy from a cargo carrying point of view due to heightened operational risks, in which case the owners are held responsible in case of an accident.

> *Weathertightness* refers to making sure that water will not penetrate the ship in any sea conditions, which entails proper testing, inspection, and confirmation of well-sealed hatch covers.

> *Watertightness* means that water cannot move from one of the vessel's compartments located under the waterline to another.

International Convention on Load Lines and other international conventions

The most important statutory instrument related to hatch covers is the International Convention on Load Lines (ICLL). The ICLL primarily involves regulations that ensure a vessel's weathertightness, watertightness, and sufficient freeboard for maintaining buoyancy and promoting overall vessel safety.

Weathertightness refers to making sure that water will not penetrate the ship in any sea conditions, which entails proper testing, inspection, and confirmation of well-sealed hatch covers. According to ICLL hatch covers comply with the regulations when they are strong, tight, and well-secured in place.

Watertightness means that water cannot move from one of the vessel's compartments located under the waterline to another. Watertight compartments are water pressure resistant, and can therefore help contain a possible leakage in one part of the ship.
Other central conventions involving hatch covers are the SOLAS, MARPOL, MLC, and COSWP (Code of Safe Working Practice).

>> For more information, see: https://www.imo.org/en/About/Conventions/Pages/ListOfConventions.aspx

3. HATCH COVERS AND CARGO DAMAGES

All hatch covers are designed and type-approved by the classification society, and if properly maintained, comply with the ICLL and any other applicable rules and regulations. They are constructed to withstand sea-, water- and cargo loads. In addition, exercising due diligence in testing the weathertight integrity of hatch cover seals as well as equipping the ship with necessary spare parts for hatch covers helps to ensure their performance during the voyage. However, in cases of extreme weather conditions, even type-approved and properly installed/tested/maintained hatch covers allow some water into the ship, and although the safety of the vessel and its crew are not compromised, the cargo may suffer wetting damage.

When wetting damage claims are filed, owners and crew should carry out a visual inspection and a hose or ultrasonic test of the hatch covers to prove that wetting damage cannot have been caused by inadequate maintenance of hatch covers. When this has been done, the wetting damage can be determined to have been caused by "perils of the sea", which means that the claim will be redirected towards the cargo underwriters.

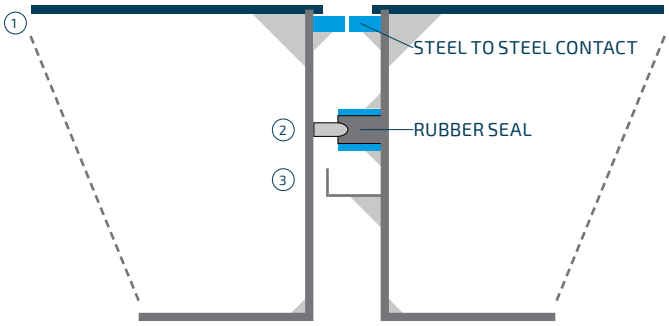
4. HATCH COVER DESIGN

Designing hatch covers that comply with the applicable rules and regulations as well as the shipowner's needs (vessel-specific requirements, conditions for maintenance and repair, cargo, budget, etc.) is challenging and often require compromise, but such compromises should never endanger ship safety. Hatch cover design includes making choices regarding type and construction (e.g., open web, double skin, corrugated, flat-topped/peak-topped), stowage space, sealing type and systems, and securing mechanisms, operation type, and weight. Design plans are then submitted to the Classification society and/or administration for approval.

VIEW OF WET DAMAGED CARGO IN THE SHIP'S HOLD.

5. RELATIVE MOVEMENT AND ENSURING WEATHERTIGHTNESS

During a sea voyage, ships encounter varying weather loads, whose effect on the hatch covers and the cargo need to be countered by specific measures. The general condition and structural integrity of the steel plating on hatch covers should be regularly assessed to ensure weathertightness. A ship's hull twists and flexes during a voyage, but since hatch covers must be strong and rigid, they do not move in unison with the hull or in relation to each other. Consequently, relative movement, caused by weatherloads, ice pressure, hogging, sagging, and twisting, takes place between the hatch cover and its coaming as well as between adjacent panels. To prevent water ingress, relative movement must be considered and controlled. Usually, water ingress into the hold is prevented by installing safety barriers which are the hatch steel plating, a flexible seal (rubber packing) and the inboard drain channel. Whilst flexible and resilient rubber packing can improve the weathertightness of hatch covers, in extreme weather the hold should be further protected from taking in water by proper drainage systems that help incoming water. Installing a drain channel underneath the rubber/compression bar interface in the cross joints, as well as around the hatch coaming, provides additional protection against water infiltration. In cases of extreme heavy weather and water infiltration, it is possible that water that accumulates in the drain channel, is spilled over the edge of the drain channel with cargo damage as a result. However as minute quantities are involved, the amount of water that is spilled will not affect the safety of the ship and crew.



SHOWING THE 3 SAFETY BARRIERS IN HATCH COVER DESIGN, I.E. THE STEEL HATCH PLATING (1), THE SEALING SYSTEM (2) AND THE INBOARD DRAIN CHANNEL (3).

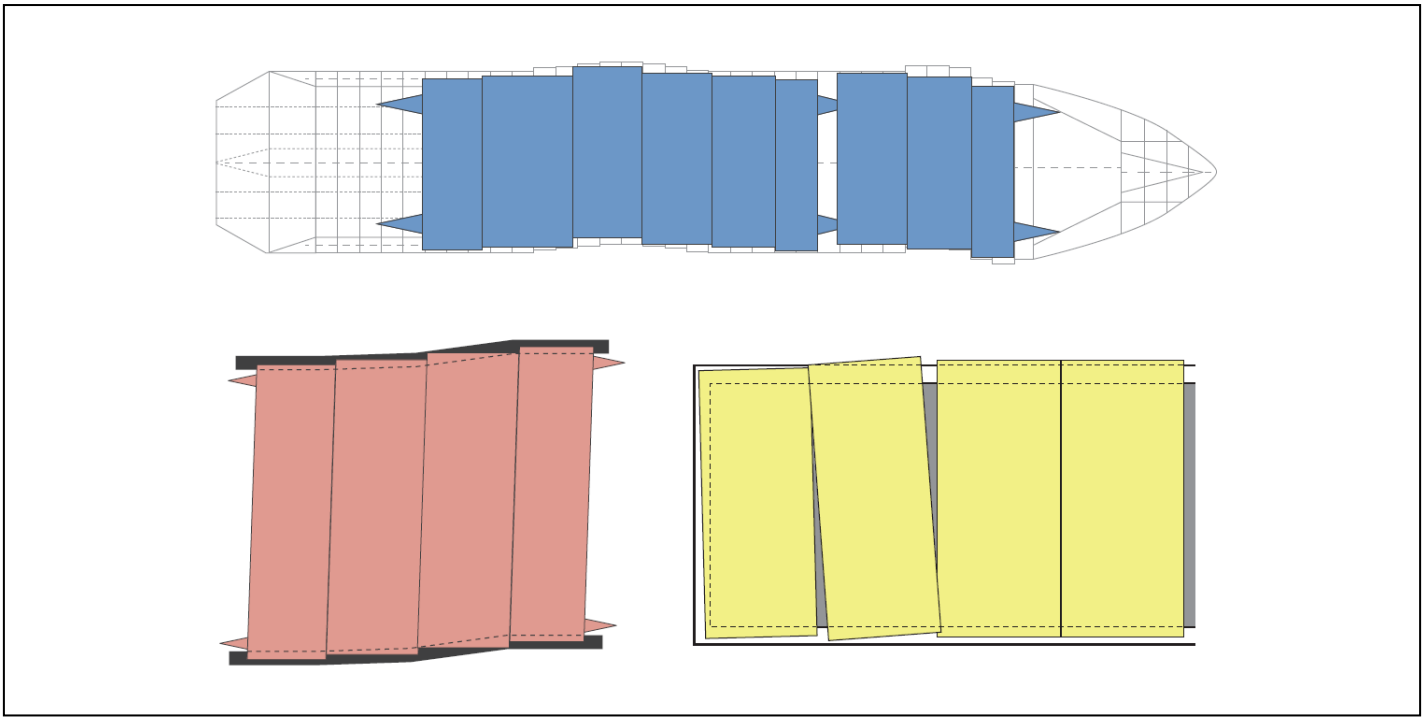


FIGURE 5 ILLUSTRATING RELATIVE MOVEMENTS BETWEEN PANELS. (COURTESY MACGREGOR)

6. KEY PARTS

Despite their apparent heavy-duty robustness, hatch covers are complex and delicate pieces of engineering with millimetre-range tolerances and clearances. Since these detailed tolerances are difficult to check or confirm with the naked eye, inspection should always be carried out using appropriate measuring equipment, such as tapered feeler gauges, depth gauges, callipers, piano wire/laser, etc.

6.1. HATCH PANELS AND COAMING PLATING

The hatch panels and coaming plating prevent water from penetrating the hold. Therefore, the regular inspection of both plating and structure scantlings is crucial for ensuring weathertightness.

Corrosion

Maintaining the painted surfaces of hatch covers is important since a thick and strong layer of paint protects them from corrosion as well as the effects of severe weather conditions and abrasive cargoes.

Physical damage

Since hatch covers are increasingly being used as cargo loading platforms, hatch covers should be regularly checked for physical damage (e.g., cracks, holes, and deformations) and appropriately repaired when needed. Furthermore, the causes of any cracks and deformations on the coaming plating should be identified and addressed, and the classification society should be notified.

Temporary repairs

Inappropriately done repairs may affect the type approval of the vessel, for example, if the hatch cover and coaming structure are subjected to heat that causes thermal deflections and deformation in the panel structure. Therefore, any welding or heat treatment work used to repair hatch covers should be consulted with the maker and reported to the classification society and carried out by professionals using proper methods.

Rust streaks and traces of leakage

Rust streaks and traces of leakage on the inner hatch coaming signal that water has leaked in through the hatch covers. The causes of any such leakage must be inspected and addressed.

6.2. PACKING RUBBERS

Packing rubbers are fitted in retaining channels that are a part of the hatch panel and as such they are frequently used as reference points for hatch panel adjustment.

Properties, types and compression

Packing rubbers should be flexible and resilient to compensate for the relative movements between the panels and the coaming. Well-maintained packing rubbers age more slowly and can withstand the effects of exposure to heat, cold, sunlight, cargo, and chemicals for approximately 5 years and even more.

There are several different types of rubber packing, such as the flex seal, the CAT (sliding) seal, and the sponge seal. The box-type packing rubber acts on a raised steel compression bar whilst the sliding profile type acts on a flat steel mating surface. All types, however, are designed with a certain design compression that can be found in the hatch cover manual. Design compression may vary and is depedent on the design of the rubber as well as materials used. The design compression corresponds with a certain reaction force (line compression) that allows the packing rubber to respond properly and quickly to relative movements in order to maintain seal tightness. It is important that packing rubber is compressed to its correct design compression. Over-compression will result in deformation of the rubber packing and this will cause the seal to lose contact with the compression bar even in less severe weather conditions and thus allow for water ingress.

To manually check if a box-type packing rubber is over-compressed and its permanent set excessive, the following rule of thumb may be used:

Design compression =
25 % of the nominal thickness of the packing rubber

Discard criterion =
50 % of the design compression.

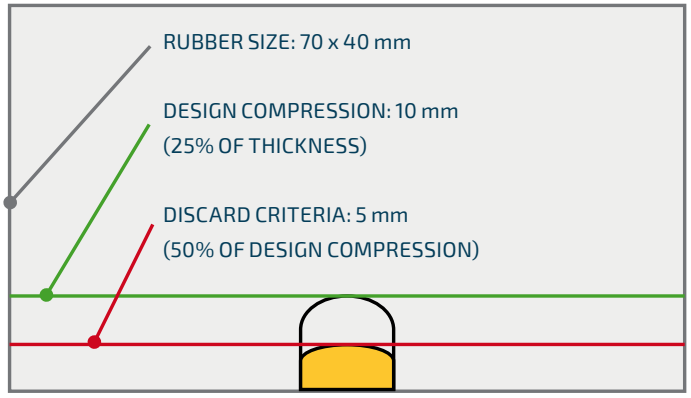
In addition to the design compression design, the shape of the packing rubber may be an indication of its performance potential. For a normal CAT seal, a round profile shape instead of a triangular shape indicates that the packing rubber is nearing the end of its life cycle.

Please note:

- Packing rubbers are normally correctly compressed up to their design by the weight of the panel and not by overtightening the cleats.
- Lubricating packing rubber with grease may damage the packing rubber because there can be a reaction with the rubber's surface which can cause it to deteriorate. Only in specific cases, and when explicitly recommended by manufacturers, special types of grease (usually silicon grease) may be applied.
- Packing rubber replacement should be carried out with observation of the appropriate size, design compression, weight/metre, mean compression force as well as installation and preservation requirements.
- Replacing packing rubber should not be carried out by inserting the rubber in the retaining channel and attempting to speed up the process by closing the panel to push the rubber further into the channel.

Packing rubber inspection should focus on:

- Over-compression and permanent set
- Physical damage
- Impaired sealing function
- Off-centre imprint



ILLUSTRATING THE DISCARD CRITERION OF AN ORDINARY BOX-TYPE PACKING RUBBER.

6.3. BEARING PADS

To keep the packing rubber at the required design compression, steel to steel contact between the panel and the hatch coaming is necessary. This is usually provided by bearing pads (or Fz stoppers), consisting of a support pad on the hatch cover and a landing pad on the hatch coaming.

Bearing pads will wear down depending on their type, age and the loads that act upon them. As a bearing pad wears down, the compression of the packing rubber increases, which is why the wear process should be routinely monitored. This can be done easily by checking the skirt clearance with the help of a ruler or a feeler gauge. Details on skirt clearance and maximum bearing pad wear are available in the manual and are normally in the range of 2–3 mm. Some mating surface designs include wear rings or marks for indicating bearing pad wear.

Bearing pad inspection should focus on:

- Wear of the landing pads
- Lack of contact between the support and landing pads
- Structural integrity of the bearing pads, coaming and deck structure
- Type of steel correct for landing (mild steel) and support pads (hardox)
- Cleanliness and free movement between the landing and support pads (even/smooth surfaces)

Bearing pads are relatively quick and easy to repair, but their adjustment should always be carried out by qualified personnel.

CRACKED PANEL SIDE PLATING AS A RESULT FROM WEAR ON BEARING PAD.

WORN OUT MATING SURFACE OF A BEARING PAD.

6.4. LOCATORS

The locators or sliding positioners ensure that panels are properly guided and positioned when closed. This means that the packing rubber in panel intersections is properly compressed up to the manufacturer's design compression and that panels are properly aligned and centred.

Locators operate against small clearances and should be installed and maintained correctly to avoid excessive clearances.

For easier correction of wear in locators, more recent designs include replaceable and adjustable locator pads (with shim plates).

Locator inspection should focus on:

- Wear and excessive clearance (excessive wear will compromise sealing efficiency)
- Structural integrity (to ensure locator parts and coaming structure can withstand loads and stress)

MEASURING CLEARANCE IN WAY OF THE LOCATOR.

SHOWING LOCATOR ASSEMBLY ON THE HATCH COAMING.

6.5. STOPPERS

Once properly closed in port (static condition), panels should remain in their correct sealing position throughout the voyage. Relative movements at sea tend to distort panel arrangement, alignment, and geometry, but to prevent forces acting on the hull girder from being transferred to the panels, some limited movements should be allowed. This is why stoppers (rolling or pitching) are installed with small clearances. Stoppers come in many shapes and sizes depending on the loads and design of the hatch cover panels.

Stopper inspection should focus on:

- Excessive wear/clearance (which could result in uncontrolled movement of the panels as well as damage or accelerated wear of other parts)
- Structural integrity (since damage or advanced corrosion may reduce stopper performance)

MEASURING EXCESSIVE CLEARANCE IN WAY OF A TRANSVERSAL (FY) STOPPER.

SHOWING STOPPER ARRANGEMENT ON THE PANEL SIDE PLATING.

6.6. SECURING SYSTEMS: CLEATS

The ICLL requires that hatch panels are properly secured to the ship to prevent panels from being pushed off or blown away, leaving the hatch and hold exposed to the elements.

Hatch panels are generally secured manually with quick-acting cleats, holding down devices (on board very large container carriers) or automated systems, such as auto-wedge closing systems or hydraulic cleating systems. The type of cleat system installed depends on many variables, such as cost, or the number of crew members available.

Cleats are fitted to hold the panel down when the ship is at sea, but not to obtain a tighter seal. Since relative movements shall be accommodated by mounting the cleats flexibly, rubber washers are commonly used on the cleats for this purpose.

If leaks are found during testing, tightening the securing cleats further will not help tighten the seal, since the steel-to-steel contact prevents panels from being pulled further down. Furthermore, excessive tightening restricts cleat movement and may lead to deformations or failure of the panel side plating, coaming table and cleat parts.

Cleat inspection should focus on:

- Structural integrity (corrosion, deformations, or thinning)
- Total number (missing or damaged cleats should be replaced)
- Flexibility (washers should be in good condition)
- Alignment (crooked or misaligned cleats have less holding power)
- Adjustment (tightened to correct tension)

SHOWING A CLEAT WITH RUBBER WASHER AND STEEL WASHER.

6.7. DRAIN SYSTEMS

When relative movements exceed the packing rubber's design compression, water will ingress through the sealing arrangement and water will collect in the drain channels that evacuate the water out on deck. Drain systems, both in the cross joints and on the hatch coaming, are the last barrier protecting the hold and cargo from water ingress.

Drain systems consist of a drain channel, a drain hole in the coaming table, and a drain pipe fitted with a non-return valve. Drain valves should always be open and free, whilst the non-return valve should be closed with the fire cap in case of CO2 release (fire) or fumigation.

Drain systems inspection should focus on:

- Structural integrity (check for corrosion/damage)
- Type of drain valve (original type fitted)
- Condition of drain system (free and unobstructed)
- Fire caps (available in a clearly defined space)

6.8. COMPRESSION BARS

To achieve a weathertight seal, packing rubbers act against a packing rubber mating surface commonly referred to as the compression bar. Depending on the type of rubber installed, the bar can be a raised compression bar or a flat steel mating surface. The flat steel mating surfaces are easy to install, maintain and clean, and their movements are not restricted.

Compression bar inspection should focus on:

- Structural condition (intact, strong, and able to withstand the strong forces repeatedly acting upon them)
- Straightness (unevenness results in irregular compression)
- Smoothness (prevents abrasion of and damage to the packing rubber surface)

SHOWING A COAMING DRAIN VALVE WITH THE FIRE CAP PROPERLY CONNECTED TO THE VALVE WITH A LANYARD.

HEAVILY CORRODED AND DAMAGED COMPRESSION BAR.

FLAT STEEL MATING SURFACE.

6.9. OPERATING SYSTEMS

Modern hatch panels are heavy pieces of equipment that require mechanical power to be opened or closed, and their operation is not without risk. Electro-hydraulic operating systems are still widely in use, although electric operating systems are becoming increasingly common.

For safety reasons, it is recommended that hatch covers be operated by an operator in charge of the controls and a supervisor who ensures that no one gets in the way of the moving hatch covers. Hatch covers should always be operated by trained personnel.

Operating systems inspection should focus on:

- Opening/closing speed (based on the type and manual specifications)
- Abnormal noise (strange sounds and vibrations indicate problems)
- Proper greasing of moving parts (facilitates proper operation and extends the life-cycle of bearings)
- Oil leakage (which may cause spillage, slippery surfaces, and pollution)
- Damage and deformations (may affect strength and compromise proper operation or safety)
- Safety items (such as safety latches or emergency stops should be in good condition and operational)

Please note:

Hydraulic systems operate at very high pressures (up to 250 bar) and any impurities in the oil will have a "shotgun" effect on the component parts of the power pack, valves, etc. Leak sites and cylinders can also draw impurities into the system. Therefore, all leaks should be repaired immediately and hydraulic cylinders should be protected from cargo remnants and dust with protective sleeves. Piping should be thoroughly cleansed by flushing it after repairs.

Also crew members must be familiar with emergency closing procedures.

7. EVIDENCE IN CASE OF CLAIMS

In case a claim is filed against a ship, it will be up to the master and the owners to prove that they have done their utmost to make the hatch covers weathertight prior to the commencement of the voyage. During this process, they should provide the following documents:

- Work schedules
- Maintenance logs & test reports
- Work specifications
- Standing instructions
- Reports & correspondence
- Logbook entries
- Hatch patentee manual
- Valid & relevant certificates
- Voyage plans & weather reports
- Proof of good seamanship (C/C, RPM, etc.)

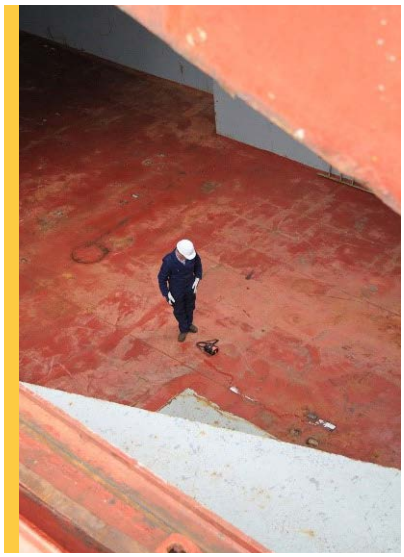
8. HATCH COVER TESTING

Hatch covers are required to be tested and inspected regularly to ensure weathertightness, including the sealing system, structural integrity and securing arrangements of hatch covers.

Testing sealing systems involves various methods or combinations of methods, including but not limited to:

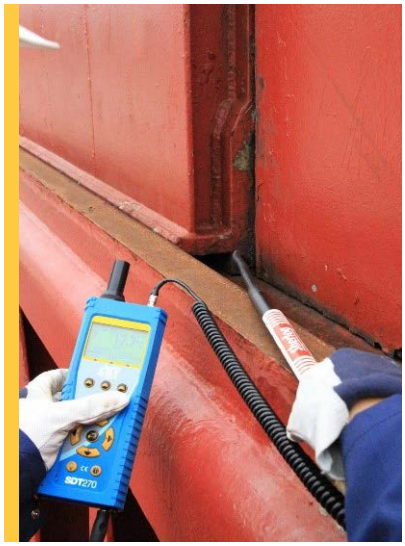
- Ultrasonic test
- Hose test
- Light infiltration
- Chalk/grease test (for normal or sliding-type rubbers)
- Smoke test
- Pressure decay.

Weathertightness can only be confirmed after a proper visual inspection the sealing systems, structural integrity and securing arrangements has been made by a properly trained crew member or inspector. In addition to the visual inspection, the sealing system should preferably be tested with ultrasonic tightness testing gear by a qualified operator and with calibrated equipment.



ULTRASONIC TRANSMITTER POSITIONED IN THE SHIP'S HOLD.

ULTRASONIC TEST IN WAY OF THE CROSS JOINTS.



ULTRASONIC TESTING ALLOWS TO FIND LEAKS WITH PINPOINT ACCURACY.

9. MAIN PROBLEMS FOUND

The following faults are commonly found in testing or inspections:

- Insufficient knowledge of hatch covers leading to inadequate inspections/ poor reporting
- Overestimating ship crew's capacity to maintain and adjust hatch covers
- Not engaging specialists (proof of repairs having been carried out by specialists will help prove due diligence)
- Not involving class and manufacturer when carrying out shipboard repairs on hatch covers
- Faulty/temporary repairs by crew
- Lack of manual/drawings
- Lack of proper and detailed on-board maintenance instructions
- Lack of on-board maintenance files (i.e., PMS) for documentation of maintenance/repairs
- Omission of hatch covers from SMS and PMS
- Lack of understanding of due diligence principles and requirements
- Insufficient spare parts

Water tightness mistakes

- Ignoring discard/replacement criteria
- Replacing rubber packing without addressing steel-to-steel contact issues
- Installing backing strips everywhere, even on top of rubber packing
- Mixing old and new rubber
- Using old rubber (from old stock, ignoring shelf life)
- Using small pieces of packing rubber to fill in gaps
- Inadequate maintenance of seals and rubber channel (painting)

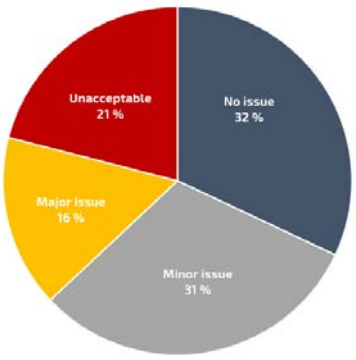
Mechanical mistakes

- Ignoring abnormal sounds/vibrations during operation
- Neglecting greasing and lack of a greasing plan
- On-board repairs instead of landing panels ashore
- Ignoring safety issues (heavy and moving equipment)

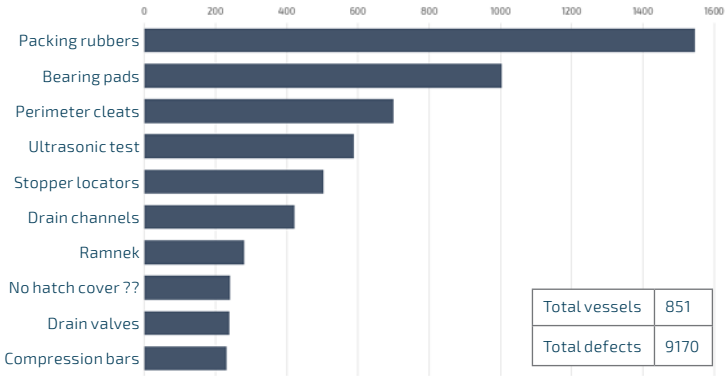
Hydraulic mistakes

- Cleaning filters instead of changing them
- Inadequate filtering
- Closing covers without pump
- Neglecting to flush the hydraulic pipes when repairing them
- Faulty non-return valve positions during the voyage
- Ignoring leaks and the risk of pollution
- Ignoring the risks associated with high pressure

ULTRASONIC TEST



MOST COMMON DEFECTS

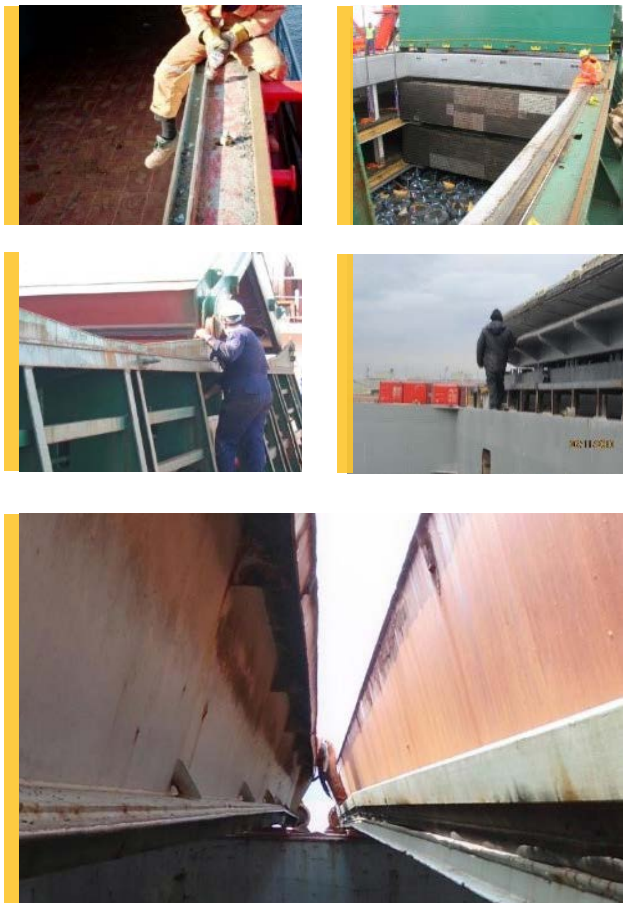


THE GRAPHS SHOW THE RESULTS OF HATCH TESTS AND VISUAL INSPECTION ON DRY CARGO SHIPS < 15000 GT. INSPECTIONS WERE CARRIED OUT IN THE NORTH WEST EUROPE AND MEDITERRANEAN AREA YEAR 2018-2023.

10. STEPS FOR SAFER MAINTENANCE AND OPERATION

Hatch cover maintenance and operation requires a thorough understanding of basic principles as well as type-specific issues and requirements. Hatch cover problems are still one of the most common causes of claims and accidents on board vessels. Whilst claims related to hatch covers are generally associated with wetting damage, it should be noted that their incorrect maintenance or operation may pose a life-threatening risk to crew as well as the risk of pollution. Moreover, whatever the reason for the claims, they always impact the owner in a negative way.

To avoid claims related to hatch covers, owners should invest in specific training programmes designed to promote occupational safety as well as safe operation and inspection. In addition, relevant and type specific hatch cover checklists should be adopted as a part of the ISM/SMS.



SHOWING BAD AND DANGEROUS PRACTICES (SITTING/WALKING ON COAMING, PUTTING HAND ON TRACKWAY,.) CREW SHOULD BE PROPERLY FAMILIARISED WITH HATCH COVERS, THEIR OPERATION AND SAFETY ISSUES.