UK P&I CLUB

IMCS

RISK FOCUS: HATCH COVERS

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Are the ships' hatch covers weathertight?

This seemingly simple but important question is what surveyors, whether acting on behalf of P&I clubs, shippers, charterers or courts have to answer on a regular basis. Whilst the answer should be invariably "Yes" or "No", the way to come to the right conclusion is not so easy and requires a good understanding of hatch covers, their operation and tightness as well as industry requirements.

This brochure has been designed to help those involved in inspecting, testing and evaluating the weathertight integrity of hatch covers in making well informed decisions, and assist owners and shipboard personnel in maintaining their hatch covers and closing appliances in line with good industry practice and standards.

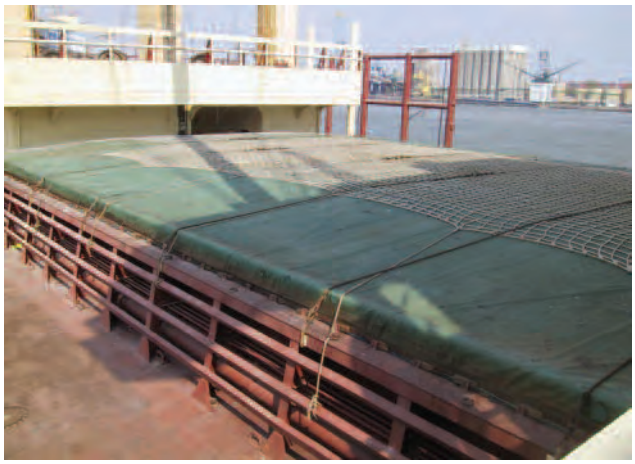
History

In 1929, the first ever steel hatch covers were introduced and patented by the brothers Robert and Joseph MacGregor (MacGregor & Company) and in 1941 the prototype of the single pull hatch covers was made available on the market and further developed.

Following the Second World War, another interesting evolution took place in that we saw the transition of the traditional types of ships (mainly general cargo ships, tankers and passenger vessels) into a wide variety of dedicated ships types such as e.g. bulkers, reefer, roro, container and multipurpose vessels. Each of these ship types required their own hatch cover design, in order to accommodate their respective cargoes.

Over the last decades, the major challenges and hurdles that had to be overcome were those associated with jumboizing. With the rapid increase in the number of larger ocean going vessels, there was a need to engineer solutions that allowed larger, heavier hatch covers to remain weathertight while at sea. Furthermore, properly engineered and well-designed hatch covers should allow for quick and safe operation whilst being lean on maintenance without compromising reliability.

Different plies of tarpaulins used for making hatch covers weathertight



Tarpaulin type hatch covers, properly battened down and ready for going to sea

With safety and delivering the cargo in good condition being the main prerequisites when it comes to hatch covers, it will be seen that proper and well planned maintenance is of paramount importance in order to ensure that hatch covers perform well under harsh conditions.

The International Convention on Load Lines and Weathertightness

Like most equipment found on board, hatch covers are also subject to certain rules and regulations. One of the most important conventions that deals with hatch covers and hatch cover safety, is the International Convention on Load Lines (ICLL).

Evidence of leakage in way of the hatch cover cross joints

The main goal of the ICLL is to "*Establish uniform principles and rules with respect to the limits to which ships on international voyages may be loaded having regard to the need for safeguarding life and property at sea".*

We further note that ICLL states *"The load line shall never be submerged at any time when the ship puts to sea, during the voyage or on arrival".*

The idea behind the above statements is that a ship should never be overloaded as this would reduce the vessel's freeboard which is crucial for the ship's safety.

The ICLL also states that "the vessel's hatch covers need to be weathertight". This means that in any sea conditions, water should not enter the ships hold, as this would add additional weight to the vessel and could lead to overloading (submerging of the loadline) which would put the ship in danger. For this reason, and under the ICLL, it is a prerequisite that the ship's hatch covers are weathertight in order to prevent water entry into the ship's holds.

Although it is quite common to mix the terms "weathertightness" and "watertightness", they have different meanings, which may give rise to some confusion. According to ICLL, watertight means *"...capable of preventing the passage of water through the structure in either direction with a proper margin of resistance under the pressure due to the maximum head of water which it might have to sustain."*

Finally, the ICLL mentions *"The means of securing weathertightness shall be to the satisfaction of the Administration. The arrangements shall ensure that the tightness can be maintained in any sea condition, and for this purpose, tests for tightness shall be required at the initial survey, and may be required at periodical surveys and at annual inspections or at more frequent intervals" (Reg.16-4).* The latter statement refers to the involvement of the Administrations, the need to maintain tightness when at sea, and the need for regular testing.

It is clear that, in order to comply with the ICLL, hatch cover design requires careful consideration at the design stage.

Manufacture and design

The stringent requirement under the ICLL that *"…tightness can be maintained in any sea condition…",* makes designing and manufacturing of hatch covers a challenge. Building hatch covers that are able to keep water out in any sea condition requires a good knowledge and understanding of how hatch covers will behave (both in port and at sea) and issues such as hull, coaming, panel deflections and movements, exposure to elements (effects of temperature, wind, sea [water] loads, cargo) and type of ship and trade.

Hatch cover design

In order to design hatch covers that comply with ICLL, and meet with customer's demands and expectations, different issues have to be considered, such as:

- Hatch way dimensions
- Available deck space for stowing the panels
- Available stowage height for panels
- Required coaming height
- Required extent of opening
- Type of operation (opening and actuating mechanisms)
- Available power
- Required opening/closing time
- Degree of automation (available crew)
- Repair possibilities (availability of shore specialists/ship's crew repair skills, spare parts)
- Carriage of cargo on hatch covers
- Required degree of tightness (weathertight/reduced weathertight and non-weathertight)
- Cost (min – max scantling, steel price)
- Required/Max. panel weight (ship's gear, shore gear, power and rubber packing line compression)
- Construction type (open web, double skin) and required fittings (cleats, packing)
- Trading pattern (warm/cold, tropical rain showers/speed of closing)

In addition, the design has to be such that the cost (for manufacture, installation and maintenance) is low and that the in-service life (without failures) is long.

Hatch covers and tightness

Apart from being designed and developed by specialists, compliance with the ICLL needs to be further confirmed by the Administration/Classification Societies in the form of type approval.

In order to understand the difficulties related to design, it is important to know that ships are subject to different deformations when in port and at sea. These distortions are brought about by loaded/empty/ballast conditions as well as flexing and twisting of the hull as a result of wave action, which all have an influence on the hull form and eventually, the hatch covers.

It is therefore important to understand the relationship between hatch covers and the ship.

In the first place, one has to think of a ship as a steel box, and in this context, it is useful to compare a ship with a box of cookies. Such a box will be quite rigid as long as the lid (comparable to the deck of a ship) is on. However, once the lid is removed, the box becomes very flexible as it has lost part of its structural integrity. Whilst on a ship, the deck is not completely removed, big openings (hatch ways) are created, which in turn leads to the structure of the ship becoming more flexible. An extreme example of this is the open hatch-type ship, which has large hatch openings and therefore, less deck space than an ordinary design.

In order to maintain the vessels weathertightness, it is necessary to cover up these openings in the deck.

Open hatch design

Whilst a certain degree of flexibility of the ship's hull is necessary, the hatch covers will generally have a different type of construction and will be more rigid than the ship onto which they are fitted.

This difference is responsible for relative movements between the ship and hatch covers at coaming level. Therefore, it is necessary to equip the hatch covers with a flexible medium in way of the coaming interface to compensate for these relative movements. This flexible medium is generally known as the hatch cover packing rubber, which is available in different forms and sizes depending on the type of ship or service.

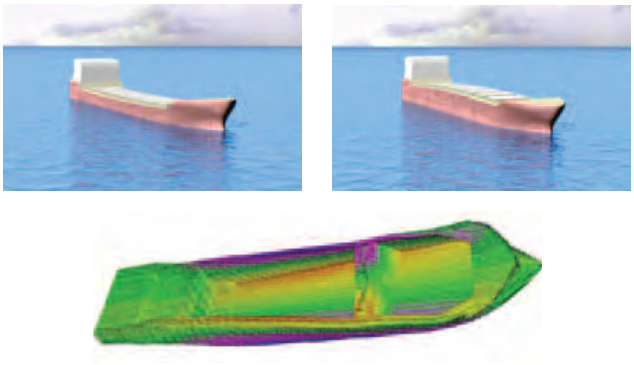
Water ingress into a ship poses a safety and financial risk. Minimising this risk can be achieved by designing hatch covers that are able to withstand the rigours of an ocean voyage. Whilst packing rubber plays an important role in making hatch covers weathertight, achieving weathertightness is not possible with the packing rubber alone. Although well maintained packing rubbers will already reduce the risk for water ingress significantly, further risk reduction calls for additional safety barriers.

In a weathertight hatch cover system, the following three safety barriers will be required:

- A strong steel structure
- Packing rubber (flexible seal with design compression to compensate for known movements)
- Drain and collect any incoming water that passes through the joint in extreme conditions

By carefully considering and including the above safety barriers in a hatch design, it will be possible to comply with the ICLL requirements, as the combined action of these safety barriers will prevent, even in the worst conditions at sea, significant quantities of water entering the ship's holds, and as such, contribute to ship, crew and cargo safety.

Ship movements



Showing ship deflections

Relative movements will exert loads and forces on the component parts of the hatch covers, and as such, the above movements can be divided into three main components:

- Vertical forces (also referred to as Fz)
- Longitudinal forces (also referred to as Fx)
- Transversal forces (also referred to as Fy)

Key parts

In a weathertight hatch cover system, various key parts need to work in unison in order to ensure that weathertightness is achieved and can be maintained throughout the voyage.

Details about the design and wear limits or tolerances of these key parts can be found in the manufacturer's manual, and it is worthwhile to include specific details of these key parts in the hatch cover checklist as this will facilitate inspections. In order to gain a better understanding of the most important key parts, some additional information is provided below:

Packing rubbers

Different types of packing rubbers (from left to right: Sponge rubber, CAT or Sliding seal and Flex seal)

Different shapes of packing rubbers (from left to right: linear rubber, end piece with solid nosing, flat corner and vertical corner)

Hatch covers span a huge opening and the relative movement between the covers and the coaming is such that a compression seal is needed to achieve and maintain a tight seal between the covers and the compression bar. A compression seal/rubber is designed to be compressed up to a specific depth. This will allow the rubber to compress and relax, and as such, absorb relative movements between the hatch covers and coaming compression bar.

As coaming deflections (both transversal and longitudinal deflection) will cause continuous interaction between the rubber and compression bar, packing rubbers are subject to wear and tear. Furthermore, and throughout the voyage, packing rubbers are exposed to heat, cold, sunlight, cargo (abrasive/chemicals), chlorides, etc, which also affect the packing rubber's in-service life.

It is clear that developing packing rubbers that are fit for duty and retain their flexibility throughout their in-service life is not easy. Such rubbers also require proper and correct maintenance in line with manufacturer's guidelines.

Packing rubbers are designed to be compressed to a certain depth, which is generally referred to as the design compression *(rule of thumb for estimating the design compression of ordinary box-type packing rubbers is as follows: Design compression = 25% of the nominal thickness of the packing rubber).* Depending on the type of rubber packing, design compression will generally be in the range of 4-20mm, and this is either specified in the maker's manual or indicated in the drawings (although not always easy to find).

Rubber size: 70 x 40

Design compression: 25% of thickness = 10mm

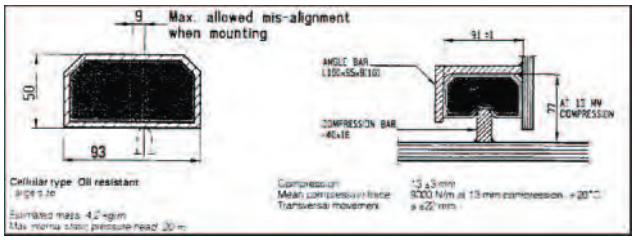
Discard criteria: 50% of design compression = 5mm

Overcompression of the packing rubber will result in permanent damage over time. This will become apparent in the form of a set groove in the impact area between the packing rubber and compression bar, as shown in the following images.

Deep permanent groove in packing rubber as a result of overcompression. Also note the off-centre permanent imprint

The best comparison one can make is with an elastic band. This can be gently stretched to a certain limit, and when released, it will regain its original size and length almost immediately. However, when "overstretched", plastic deformation will occur and the elastic band will no longer return to its original length and the return process will also take more time (Hook's law). Overcompressed rubber will therefore loose its elastic properties and flexibility (and hence, it's capacity to compensate for relative movements).

Apart from identifying the need for regaining its original shape, a second element that is equally important can now be identified, i.e. time. Not only should the rubber be able to compensate for the relative movements between the panels and the coaming, it is also necessary that this reaction is instantaneous as otherwise a temporary gap might be created between the packing rubber and the compression bar in the time that is needed by the packing rubber to adapt to the new situation, which could give rise to water ingress when waves are breaking over the deck and hatches. In order to allow it to regain its original shape quickly, the packing rubber will need to have a certain compression force (e.g. the compression force of a normal 90x50 packing rubber can be in the range of 9000N/m).



Considerable force is required to bring the panels down to the rubber packing design compression, but on most modern ships, the weight of the panels alone is sufficient to achieve the required design compression.

Whilst the original design will cater for some slight variations in compression (due to waviness of coaming or compression bar), the criteria for discarding a packing rubber is, as a rule of thumb, generally considered to be equal to 50% of the design compression. So if the design compression is 12mm, it is recommended to discard the rubber packing when the permanent imprint has reached a depth of 6mm. When renewing the rubber packing, it is important to find out what caused the permanent set to develop. Whilst several years are needed to achieve the discard limit as a result of normal wear and tear, improperly maintained and adjusted hatch covers will generally cause accelerated wear and deep permanent imprint. In the latter case, replacing the rubber packing alone will not solve the problem and finding the root cause of the problem is necessary to ensure that repairs will be efficient.

Whenever packing rubbers need replacing, it is tempting to look for alternative (cheaper) products but, when doing so, it is extremely important to ensure that not only the dimensions are compatible, but also that the alternative product will meet with the required performance criteria, which may not always be the case (in many cases, it is true to say that "a cheap packing rubber is not good and a good packing rubber is not cheap").

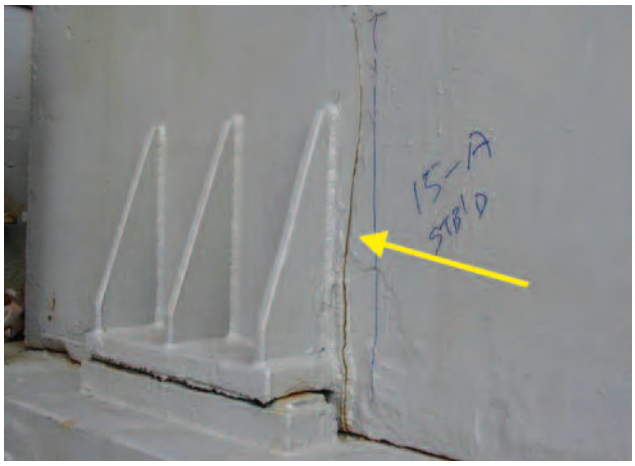
Bearing pads

Bearing pads are supporting pads that comprise of two parts. One part is fixed on the panels and the other part is welded on the coaming. Bearing pads work in the vertical plane (Fz). They provide steel to steel contact between the panels and the coaming, and, as such, prevent the panels from sitting too low on the coaming, which would cause overcompression of the packing rubber, or panels from being pushed down under weather loads causing the cleats to be come disengaged.

They also prevent other structural parts like wheels and axles from taking up the load acting on the panels. Furthermore, bearing pads contribute to proper alignment/adjustment of the panels and transfer the load into the deck structure. Finally, in case of wear, they can relatively easily be repaired and restored to their original height.

Knowing that there is a relative movement between the hatch covers and the coaming, bearing pads should also allow for some movement between the mating halves of the bearing pad system. To prevent wear and corrosion that would prevent sliding action between the mating halves, compatible steel needs to be used. Bearing pads are available in different sizes and materials, and their wear will depend on their position and loads. This means that not all bearing pads will wear down to the same extent simultaneously, and require regular checking/inspection to determine if allowable wear limits have been exceeded and if repairs or replacement are necessary. The use of low-friction material is recommended to allow for smooth movement between panels and coaming, and to avoid the disturbing noise that is created by friction between ordinary steel to steel pads.

Bearing pads are fine pieces of engineering and replacing them with non-original spares or non-compatible steel could result in serious problems. Far too often bearing pads are replaced or repaired by the ship's crew with only one thing in mind, i.e. restoring the height of the bearing pads, whereby the correct size and use of appropriate material for the mating surfaces is overlooked. For bearing pad adjustment, it is



Improper repairs to bearing pad and a crack developing in the hatch panel side plating due to advanced bearing pad wear

strongly recommended that manufacturers or specialists are called in for advice.

On hatch covers that are equipped with bearing pads, an operational clearance in range of 10-15 mm will generally be present between the panel side lower edge and coaming. The exact distance should be checked with the manual and clearly noted on inspection sheets as it is one of the first indicators of bearing pad wear down.

Operational clearance between the lower edge of the panel side plating and the coaming table

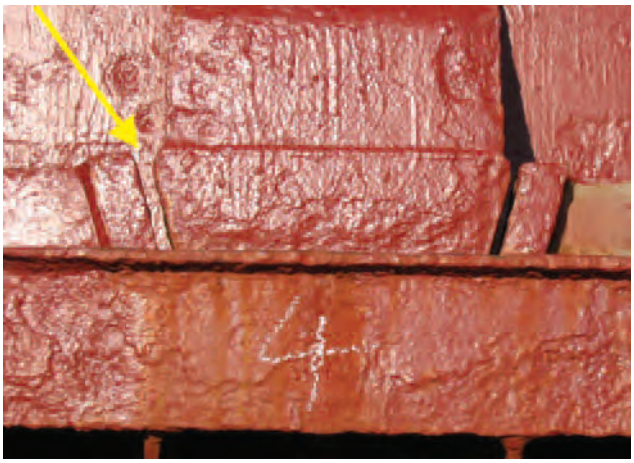
Whilst many people think that bearing pads take up all the loads that are acting on the hatch covers, it should be borne in mind that the rubber packing has a compression force that takes up part of this load as well.

Locators

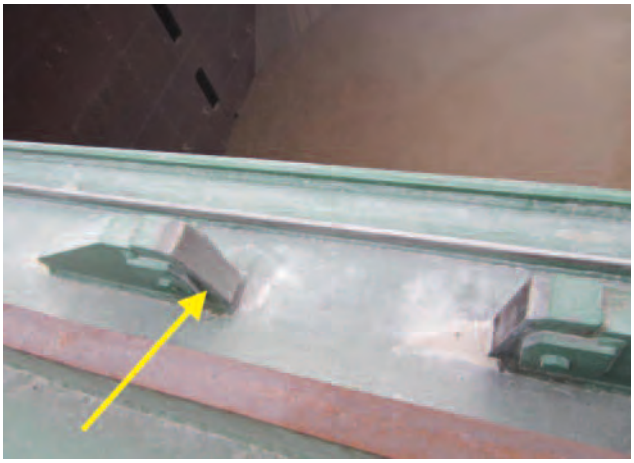
Locators guide the panel in its correct closing position and ensure that panels are kept properly positioned during the voyage. Correct positioning is important to avoid problems with opening systems, wheels, hinges, cross joint drains, securing mechanisms, etc, and slight wear on the locators in one place might well result in significant loss of compression or improper positioning at another place. Therefore, locator wear should also be regularly monitored.

Properly maintained and adjusted locator

More recent designs of locators have replaceable mating surfaces and allow for the use of shim plates, which facilitates installation and adjustment in case of wear down.



Excessive wear on locator

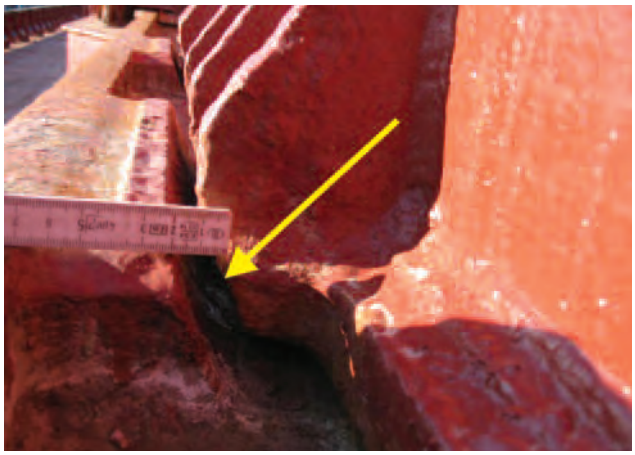


Replaceable locator pads

Stoppers

While a vessel is at sea, panels are exposed to a number of powerful forces, including loads and accelerations, as well as waves from the ocean, which will try to dislocate them from their correct sealing positions. With this in mind, it is

clear that failing to control hatch cover movements would lead to excessive loads acting on component parts of the hatch covers with accelerated wear and damage as a result. This is basically the role of stoppers (restraints). Whilst some degree of movement is allowed, stopper wear needs to be controlled and closely monitored, and it is recommended to consult the manual to obtain more information on allowable wear limits.



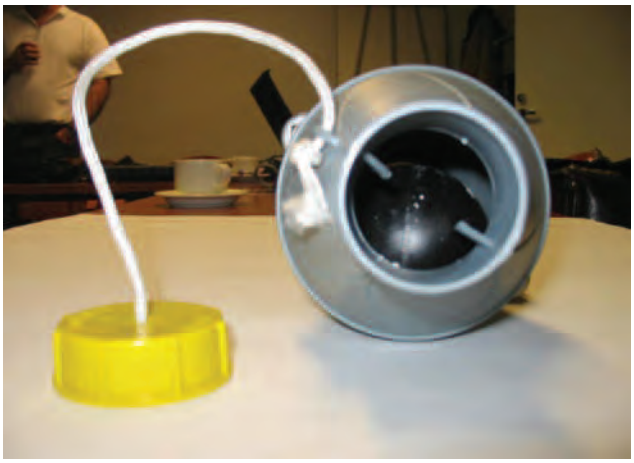
Excessive clearance in way of stoppers

Draining system

The drain system is the last safety barrier to water entry through the sealing system in a weathertight hatch cover system. If water enters the hatches it will be collected in the drain channel and expelled via the drain pipe. Regular inspections and maintenance of the drain channels and pipes needs to be conducted to ensure they continue to be effective.

Corrosion wasted drainpipe

Also, in heavy weather, with waves crashing over the deck and hatches, there is a risk that water will be pushed into the drain pipe and infiltrate the hold, causing wetting damage to the cargo. To prevent this from happening, drain valves should be equipped with a non-return system that needs to be checked and maintained.



Drain valve with ball inside acting as non-return system

Drain channel capacity should be carefully considered in the designing stage and damages to coaming and cross joint drain channels should be repaired.

Proper maintenance should include regular cleaning of the drain channels (as well as drain holes, drain pipes and drain valves), especially after completion of cargo operations when spilled cargo may have accumulated in the drain channels and drain pipes.

Presence of rust and debris will eventually lead to the clogging of the drain hole/drain pipe

In order to prevent drain pipes and valves from becoming clogged up by cargo debris during loading or discharge, some crews put a wooden bung in the drain hole in the coaming. This is fine as long as the plug is removed when cargo operations are completed, and before going to sea.

Finally, in order to keep extinguishing gas (CO_2) in the hold and/or prevent outside air from entering in case of a cargo hold fire, drain valves should be fitted with so-called "fire caps", which allow the drains to be closed off. Also, in case of fumigation, these caps should be fitted in order to seal off the cargo compartments.

Drain valve (yellow) with threaded fire cap firmly connected by a lanyard

Securing mechanism

Another requirement under the ICLL is that the hatch cover panels should remain in place during the voyage to prevent the holds being left open at sea, which is unacceptable, both from a safety and a cargo point of view.

The combination of multiple tasks needing to be performed in a limited time frame, has resulted in the development of a wide variety of security systems, ranging from manual systems (the normal, manually engaged, quick acting cleats used on smaller types of vessels), and hold down devices generally fitted on ships equipped with lift away type hatch covers (mainly container vessels) to automated types (auto cleating systems, hydraulic operated systems).

Corrosion and diminution of a quick acting cleat crutch and thinned down snugs

Whatever cleating system is used, it is of paramount importance that the system is structurally sound and strong. Not only the cleat itself, but also the other component parts to which cleats are welded or acting on should be fit for duty (coaming table, crutches, snugs/panel side plating). In this context, the wear component should not be overlooked. Corrosion, maintenance and sandblasting will, during the in-service life of the ship, have an effect on the cross-sectional steel thickness of the cleating arrangements, and affect the strength and holding power of the securing system.

The primary function of the cleats is to hold the panels down when the ship is at sea. However, as there will be relative movement between the panels and coaming, cleats should also cater for some movement. In many cases where ships fail an ultrasonic or hose test, the crew is seen to tighten up the cleats with spanners, cheater bars, etc. However, it is important to know and understand that cleats should never be overtightened to obtain a tighter seal. Excessive tightening makes the system too rigid and eventually results in the cleats becoming damaged. In view of the steel to steel contact between panels and coaming, it would be impossible to compress the rubber packing further once steel to steel contact has been achieved.

Overtightening of securing arrangements and crew member overtightening cleat with a spanner and cheater bar (top) until the rubber washer is reduced to pancake size (bottom)

After completion of the securing operations, it is worthwhile making a final check to ensure that the cleats are all in place and correctly positioned. Crooked cleats or cleats that are not properly fitted or engaged may be an indication of improper closing or misalignment of the panels, which should be investigated and corrected before commencement of the voyage since improperly fitted cleats will affect the holding power of the cleating system.

"Banana" shaped cross wedge

Crooked quick acting cleat (improper vertical alignment)

Compression bars

In order to achieve a tight seal, packing rubbers need to be compressed up to their design compression and as such they need to act against a compression surface. As compression bars are the mating part for the packing rubbers, their sealing surface should be smooth as a rough surface would cause rapid deterioration of the rubber surface. Whilst on older ships the standard was to have a mild steel compression bar, more modern designs are made of stainless steel.

A variety on the traditional compression bars are the flat steel mating surfaces which are used in combination with "sliding" type seals. In many cases the steel coaming plating can act as the mating surface for sliding type seals, however, it is best to weld a stainless steel strip on the coaming table as the smooth surface will contribute to the longevity of the seal during its in-service life.

Stainless steel mating surface for sliding type packing rubber on coaming

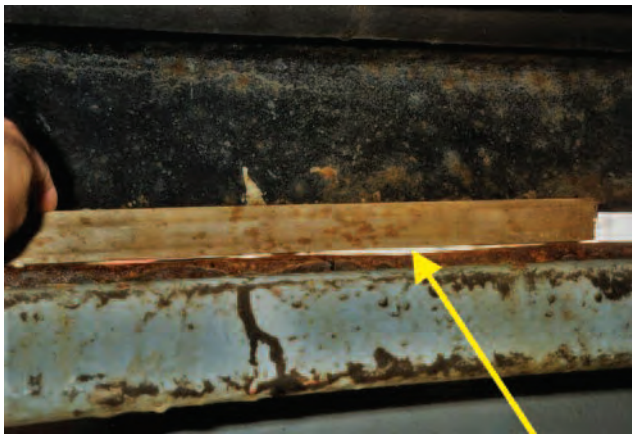
The packing rubber is not really sliding over the compression bar, but acting on the compression bar surface with a huge force (up to 9000N/m for an ordinary 90 x 50mm seal). As such, the compression bars, especially the ordinary/raised type of compression bar, need to be strong as well.

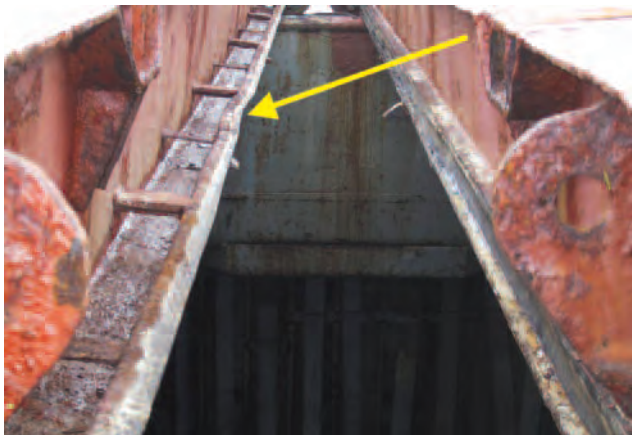
Taking into consideration the compression force that acts on the rubber packing, sharp edges can easily cause damage to the packing rubber. This is the reason why the sealing surface of the compression bars should be round shaped and not square. Replacing damaged sections of compression bars with ordinary steel flat bars (often seen in cases of stevedore damage) should be avoided.

Round shaped (top) and square shaped (bottom) compression bars

In order to ensure that the packing rubber interacts properly with the compression bar or sealing surface, contact has to be made in the correct position, and therefore, compression bars or sealing surfaces need to be properly aligned.

Whilst some limited tolerances are allowed with regards to straightness (these are generally stipulated in the maker's manual), waviness (either + or -) will lead to over or under compression of the seal, both of which should be avoided). Taking into consideration that design compression is a matter of millimetres (generally in the range of 10-12mm), even slight unevenness or waviness by a few millimetres represents a significant percentage of lack of compression or overcompression.

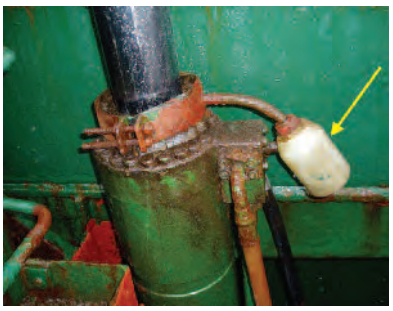




Compression bar waviness will result in loss of compression

Operating mechanisms

Depending on the hatch cover design, different types of opening/closing mechanisms are available. Apart from the lift away type hatch covers, which consist of pontoons that rely on shore gear to be lifted on and off, all other systems are operated with the ship's own equipment or have their own operating system. However, in many cases, and in view of the weight involved, hydraulic systems are the most appropriate system to drive the hatch cover opening/closing system, and most of these hydraulic systems incorporate cylinders, control valves, motors and pump units, which should be properly maintained. The use of hydraulics (which often operate at high pressures of up to 250 bar) in combination with heavy and moving objects presents a safety hazard for operators and crew in the vicinity of the hatch covers. Therefore, both operators and assisting crew should be well informed and familiar with the safe operation of the system. Hydraulic systems should also be inspected for leakages, which could entail pollution and present a slip and fall hazard.



Temporary repair (rubber patch and jubilee clip) and shipboard made systems to contain hydraulic oil leakage from hydraulic piping and cylinders

The opening and closing of well maintained hatch covers should be silent and smooth. Any abnormal noise and/or vibrations during operation, wobbling wheels, creaking sound from hinges, or opening/closing times that are not in line with the manual are indications that a more detailed inspection is necessary.

Improperly maintained or wrongly operated hatch covers can result in serious damages or accidents

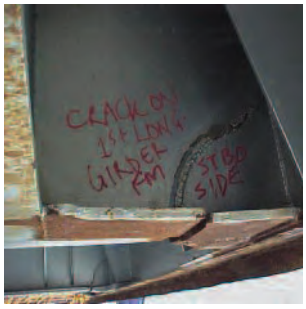
Hatch panels

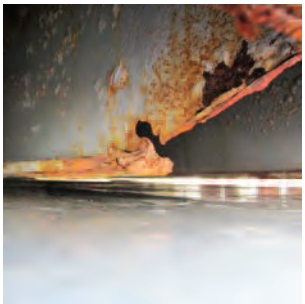
When thinking about weathertightness, packing rubbers are often seen as the most important item. Whilst packing rubbers do compensate for the relative movements between panels and coaming, and are of paramount importance in maintaining a tight seal whilst on passage, the importance of the hatch panels should not be overlooked as it is still the steel top

plate of the hatch panels that covers up the hatch opening. Any cracks or holes in the top plating will invariably lead to water directly leaking into the hold without the possibility of it being drained off.

Another point that is often overlooked, is to check and ensure that the hatch plating and supporting structure is still sound and strong. Properly painted hatch top plating may contribute to the cosmetic appearance of the hatch covers (and is sometimes mistaken as proof that panels are in good condition), but it is the panel structure and scantlings that give the panels their strength and allow them to withstand the rigours of an ocean voyage and the accompanying sea loads.

Both advanced corrosion and stress fractures (caused by improper maintenance, improper panel adjustment, bearing pad wear, overloading, heavy weather damage, etc) will affect the structural integrity of the panels. Therefore, the structural condition of the panels should be carefully monitored.

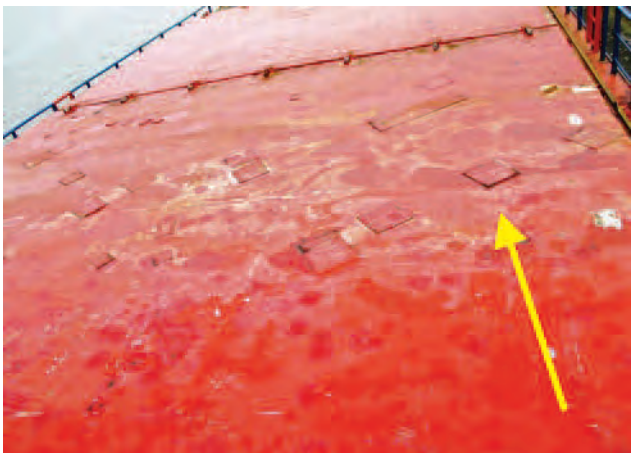




Cracks and corrosion will affect the panel's structural integrity

Sometimes panel damage like cracks or holes are repaired with doublers. Whilst doublers might, under certain circumstances, be acceptable as a temporary repair, they are never to be considered as a substitute to a proper insert repair. Doublers will actually cover up damage and prevent water ingress, but they will never restore the original strength or stop the corrosion process. Furthermore, welding work on hatch covers needs to be carried out by trained and qualified personnel as excessive heat during welding might cause distortion of the panel structure, which is very difficult to correct.

An important issue, related to the structural integrity of the panels, is panel stiffness. It has already been explained that panel strength is important to allow loading of cargo on the panels, and to withstand weather loads. However, panel stiffness is also required to allow the panels to be opened and closed properly. Panels that lack stiffness might become deformed or distorted during the act of opening or closing, which could lead to accidents. Taking into consideration that hatch panels are required to be stiff and strong, whilst the ship itself is more flexible, explains the difficulites that have to be overcome and the compromises made to make hatch covers weathertight.



Multiple doubler plates on the hatch top plating

Hatch cover maintenance

To ensure that hatch cover related parts and equipment are in good condition, on board inspections and maintenance are very important. However, both claims analysis and third party inspections, as well as condition surveys and claim investigations, indicate that in many cases, hatch cover maintenance is not considered to be a priority, and when maintenance is carried out, it is often not done in line with the manufacturers' guidelines and good industry practice.

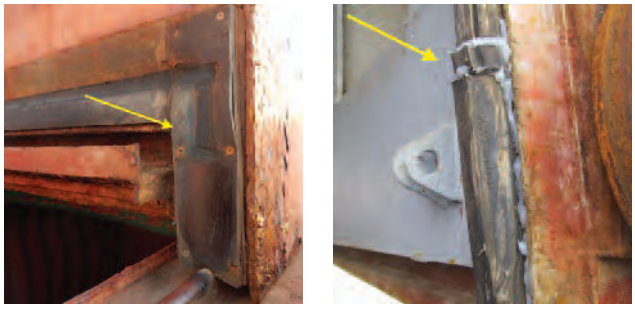
Good maintenance starts with good inspections, during which items that need attention are identified. This requires proper planning (consider including it in the ship's Planned Maintenance System), developing of ship/hatch specific checklists, and educating shipboard staff in inspecting and maintaining hatch covers. Inspections should be carried out against the manual specifications, and not against the crew's or superintendent's own criteria or opinions. If inspections are carried out in a systematic way, at frequent intervals and are well documented, possible problems will be identified at an early stage, which generally allows for easier, cheaper and better repairs.

In many cases, damaged rubber packing is considered to be the chief reason for water ingress. However, what is generally overlooked is that packing rubber damage is generally a symptom rather than the root cause. A careful inspection of the packing rubber (for damage, overcompression or lack of compression, off-centre imprints) at regular intervals can give a good idea of the root cause or upcoming (more serious) problems like bearing pad wastage, excessive hinge clearance and compression bar damage.

When it appears to be impossible to have hatch covers inspected and tested by the shipboard staff, it should be considered to include this in the task of the superintendents or alternatively, appoint an external company to carry out inspections and tests at regular intervals.

Very often, necessary maintenance and repairs are only carried out after a ship has entered the loading port and fails

a hatch cover tightness test (which is generally carried out before loading water sensitive cargo). Short rubber packing inserts, applying backing strip on the packing rubber's sealing surface, use of silicon etc are frequently seen and considered as evidence of poor repairs.



Backing strips (here nailed into the original packing rubber) and short insert repairs are frequently seen as evidence of improper repairs

Commonly, and often as a last resort, abundant quantities of Vaseline or grease are applied to the packing rubbers and/or compression bars in order to pass the tightness test and satisfy (actually mislead) the attending surveyor, so that the order to begin loading can be given without any further delay. This entails a big risk as hatch covers treated and prepared in such a way might pass a test in port, but will allow water entry when at sea. It is in such cases that it is frequently seen that, although the ship passed a hatch test whilst in port, the cargo is delivered in the discharge port with wetting damage.

Whenever a substantial claim is filed against the ship, surveyors will be instructed to attend on board and carry out an investigation into the cause of the damage, which then generally reveals that in the load port, quick or improper temporary repairs were carried out, which were not sufficient to withstand the rigours of an ocean voyage. Moreover, by doing these types of improper or quick repairs, another important issue is overlooked, namely that of due diligence.

Under the due diligence principle, owners are required to carry out a reasonable inspection to ensure that the hatch covers are in good condition. If a defect is found during this inspection, then repairs should be carried out in line with good industry practice in order to restore the condition of the hatch covers.

Emphasis should be placed on the fact that a "reasonable" inspection should be carried out, i.e. a good and detailed inspection by a knowledgeable person / crew member, to confirm that all is in order. The principle of "reasonable" might change with time, e.g. 20 years ago, it would not have been reasonable to expect a shipowner to carry out an ultrasonic tightness test. However, the fact that the equipment and approved operators are more widely available nowadays would no longer make the requirement for ultrasonic testing to be unreasonable and especially when carrying water sensitive cargoes, having such a test carried out (preferably at regular intervals) and being able to document this in a proper way would demonstrate that the shipowner is aware of the importance of hatch covers and has exercised due diligence.

Another important maintenance and inspection related issue is that hatch covers are type approved equipment. Therefore, repairs involving modifications and changes made to the existing design can only be made with the approval of the respective class or flag state. Experience shows that on board repairs to coamings, brackets, panels and supporting structures are not always properly and promptly reported to the classification society or flag state. Apart from the fact that it is a class requirement to be informed of any repairs to structural items carried out on board, the involvement of class is also recommended in order to obtain the correct repair information in line with class rules. Quite often, repairs are made on board with the wrong materials, incompatible steel grades, incorrect spare parts, and this might actually give rise to more serious problems (a well-known problem here is bearing pad repairs with incompatible steel qualities between the stool and landing pads, with the development of cracks in panels and coamings as a result.

Crack progressing from the landing pad into the coaming

Finally, a good maintenance strategy also includes proper record keeping. Maintenance related documents, such as test reports, work orders, spare part orders, work schedules, hatch manual and drawings, on board checklists and inspection reports, etc. should be properly kept and filed. In case a claim for wetting damage should be filed against the ship, a well prepared maintenance file will be of great value in defending the owner's interest and proving that due diligence was exercised.

From a repair point of view, it is tempting to order cheap spares, cut costs, select the cheapest repair shop, etc. However, it should not be forgotten that, in shipping, money and profit is made by trading cargo (or transporting passengers) and well maintained hatch covers can make the difference between a profitable or loss making voyage. Claims resulting from wetting damage due to leaking hatch covers still rank high on the overall loss figures on dry cargo ships, and can weigh heavily on the owner's operational budget and profit.

Training issues

Taking into consideration that a hatch cover is a heavy, moving and high-pressure operated piece of equipment that requires regular inspection and maintenance, the ship's crew

and shore based technical staff should be familiar with the ship's hatch covers. It is therefore recommended that both general and hatch type specific training is given to those involved with hatch cover operation and maintenance.

From a hatch cover training point of view, three different types of training can be considered.

Occupational safety training

Statistics show that accidents as a result of improper hatch cover operation still occur. Unsafe practices, especially in conjunction with a lack of knowledge about the correct operation of hatch covers are a recipe for accidents and injury.

Bad and dangerous practices (sitting/walking on coaming, putting hand on trackway). Crew should be familiarised with hatch covers, their operation and safety issues

This is also recognised by the CSWP (2015 edition) where Ch. 16 addresses a wide variety of hatch cover related issues in Ch. 16.2.8 where it is stated that "*All personnel involved with the handling and/or operation of hatch covers should be properly instructed in their handling and operation. All stages of opening or closing hatches should be supervised by a responsible person".* In practice, however, it is often seen that no proper familiarisation programme that covers hatch cover work is available on board.

In view of the different types of hatch covers (and operating conditions) involved, a one size fits all hatch cover training is not applicable. It is therefore recommended that the company uses the maker's manuals for drafting guidelines about correct hatch cover operation. Also, and if deemed necessary under specific circumstances, making a risk assessment should be considered.

Operational training

Apart from the correct operation of the hatch covers from a safety point of view, the conditions under which hatch covers can (or cannot) be safely operated should also be known and understood.

Depending on the type of hatch cover system installed on board (stacking and lift away pontoons, hydraulic operated/ wheeled systems, side rolling) operational limitations that pertain to specific ship conditions such as trim, heel, transversal and longitudinal coaming deflection will be found in the manuals of reputable manufacturers. Failure to observe these limitations whilst working out the loading/discharge plans as well as during the act of loading/discharging (uneven distribution of cargo, ballasting operations and effects of squat on river berths) might cause hatch covers to derail or result in hatch covers not being opened/closed in time. The OOW/cargo officer should be vigilant and monitor such operational limitations closely.

During the design stage, owners should be critical and try to provide manufacturers with a maximum of operational and trading information which, in their opinion, might have an influence on safe and efficient hatch cover operation (such as loaded draft, whether the vessel will be trading high density cargo or light cargoes), so that possible difficulties or problems related to hatch cover operation can be identified and tackled in the design stage. Calling in the advice of external experts in identifying specific trade/hatch type related details might help manufacturers with designing hatch cover systems.

A typical example of operational conditions is listed below:

Maximum operating conditions
- Heel ± 3°
- Bow Trim 0.25°
- Aft Trim 1.0°

Maximum coaming deflections on weather deck level:

Transversally
- Inwards 2 x 25mm
- Outwards 2 x 15mm

Longitudinally
- Warping over the ship's breadth 40mm
- Hogging/sagging 0.6mm/m

Inspection training

Training for inspecting hatch covers in a proper way should be considered as well.

Whilst it is beyond the ship officer's duties to examine hatch covers in the same way as experts or servicing personnel, providing the ship's staff with some useful information on the role of key parts, such as what to look for, how to make a proper inspection prior to going to sea (and making corresponding entries in the logbook as ultimate proof of due diligence) is not a big effort, and would greatly contribute to ship and cargo safety and reduce claims.

For superintendents, port captains and surveyors, a more enhanced training should be considered. Such training should not only deal with the obvious mishaps, but should provide a more profound understanding of hatch cover problems, inspections and planning for drydock, repairs, discussing repairs with shipyards, etc. Advanced courses are organised by the IMCS Training Academy (see "hatch cover level 2" training course and workshop on

www.imcs-training.eu). Also, a better understanding of hatch covers and their operation will allow for proper root cause investigation and contribute to more professional and efficient repairs.

Ultrasonic tightness testing

From the ICLL (Reg. 16.4 – "Means for Securing Weathertightness") we note that: *"The arrangements shall ensure that the tightness can be maintained in any sea conditions, and for this purpose tests for tightness shall be required at the initial survey, and may be required at periodical surveys and at annual inspections or at more frequent intervals".*

The above is a statutory requirement that is aimed at safeguarding life and property at sea.

However, weathertightness of hatch covers is also important for cargo interests and whilst testing for statutory and classification purposes is generally done at periodical and annual inspections, cargo interests very often include passing of a tightness hatch test as a condition for loading in the charter party.

Different testing methods exist such as light infiltration, chalk/grease test (for normal or sliding type rubbers respectively), as well as smoke tests and pressure decay, but hose testing and ultrasonic tightness tests are the most commonly used and appropriate tests for checking the weathertight integrity of hatch covers.

However, it is wrong to assume that, when a hose or ultrasonic tightness test is passed, the vessel's hatch covers are weathertight. Both testing methods give the operator or inspector an idea of the tightness condition of a sealing system, but, when taking into account ICLL criteria, having a good sealing system alone is not sufficient to conclude that the hatch covers are weathertight. This can only be concluded after a visual inspection has been carried out to confirm that all parts that contribute to achieving and maintaining a weathertight seal when the ship is at sea are in good condition.

Hose tests

When carrying out hose tests for class and statutory purposes, it is necessary to check compliance with the ICLL criteria, which require that, in any sea condition, water will not enter the hold and that, at any stage of the voyage, the load line mark will not be exceeded.

This is the reason why class surveyors will carry out a test with two persons, i.e. one surveyor on deck in order to ensure that the test is carried out correctly, and another surveyor who is in the hold to check that no water enters the hold. When considering the three safety barriers of a weathertight hatch cover system, we know that when water enters the hold during the hose test in port, there is a problem with the sealing arrangement (lack of contact that allows water to pass) and that the water ingress is so much that it can no longer be contained by the drain channel, which is the last safety barrier to water entry in the hold. This indicates a significant problem (leakage) that will not allow to issue or revalidate the loadline certificate and requires repairs.

Whilst the drain channel will allow the collection and evacuation of water that passes through the sealing arrangements, in extreme heavy weather conditions (under normal conditions seals should not leak), it will be clear that when the vessel is rolling and pitching in a seaway, part of the water that accumulates in the drain channel might spill over the drain channel rim. Typically, this would happen when the packing rubber is no longer in contact with the compression bar, which will be the case when relative movements between the hatch and coaming (in extreme heavy weather) are more than the design compression of the packing rubber. In such a situation, and for rather short periods there would be a gap between the compression bar and packing rubber (as there would be no contact or compression any more) and eventually, water will pass and accumulate in the drain from where it is evacuated out on deck. Also minor damages to the sealing arrangements could cause similar problems. The amount of water that would enter the hold in this way (i.e. by spillage over the drain channel rim) is such that it will not put the safety of the ship and crew at risk, but might be sufficient to generate a cargo claim.

In situations where a ship encounters extreme heavy weather, and arrives with wet damaged cargo in the port of destination, and on condition that an investigation reveals that the hatch covers are well maintained, it will be accepted that the water ingress could only have been caused by extreme deflections, which were beyond the design compression and compensating capacity of the packing rubber. This would then have caused water to accumulate in, and be spilled over the drain channel, and as such, be responsible for causing the wetting damage to the cargo in question. In such cases, the wetting damage would be considered to be the result of an "Act of God" or "Force Majeure", and any claims for cargo damage would be compensated by the cargo underwriters.

However, and when water enters under normal weather conditions that are likely to be expected when at sea (and which do not create extreme deflections), and when an investigation reveals that hatch covers are not well maintained, the damage sustained by the cargo will not be considered as being the result of heavy weather, but rather as the result of failing to exercise due diligence. This would leave the owners with little evidence to defend the claim in a successful manner.

Whilst physical damages to a sealing system are rather easy to detect during a visual inspection (cuts/missing lengths of packing rubber, gouged compression bars, etc) lack of compression in the sealing system is more difficult to observe and may not be detected with hose tests. As long as there is a physical contact between the packing rubber and the compression bar, the physical barrier that is created will prevent water passing through. However, areas with light contact may, even with relatively small movements, open up on passage and allow water to enter and damage the cargo.

Another issue to keep in mind is that the jet of water, generated by a fire hose that is equipped with a nozzle, may actually prevent the testing water to reach the rubber/compression bar interface through the cross joints. This is

because the space between the top plating of adjacent hatch panels is very small and will cause the jet of water to break apart on top of the panels instead of entering the interpanel void space. In such a case, the absence of water in the hold would not be an indication that the sealing arrangements are in order, but merely the result of lack of water and hydrostatic pressure acting on the seal.

Strong jet of water being applied to the cross joint

An improved testing method when carrying out hose tests with a view to assessing the integrity of a weathertight system (especially when delicate cargoes are to be loaded) would be to close the panel's side guttering and fill up the cross joint interpanel void spaces with water (with a fire hose without a nozzle, without applying a high pressure jet).

Filling up of interpanel void space with water from a fire hose without a nozzle

This will allow hydrostatic pressure to build up on top of the packing rubber/compression bar interface, and in case of leakage, water that passes through a leaky area would be collected in the drain channel and evacuated out on deck through the drain valve. (Note: Perimeter joints would still require a water jet for testing). Therefore, water that is seen leaking out of the drain valve during a hose test is an indication of problems with the packing rubber/compression bar interface. As a lot of water is generated during hose tests, it may not always be easy to see if water is leaking out of the drain, and therefore, it is recommended to put a plastic bag at the discharge end of the drain valve. This bag will, in case of leakage, fill up with water and provide evidence that there is a problem with the hatch cover's sealing arrangements.

When there is lack of compression in the sealing arrangement, the seal in question will open up prematurely and allow water entry. This will not only be in extreme heavy weather conditions due to extreme coaming and hull deflection but also during more clement weather conditions, which should not happen on well maintained hatch covers. As normal heavy weather conditions, say force 7-8, are encountered frequently at sea, the risk exposure for wetting damage to cargo is higher when the hatch cover packing rubber compression force and compensating capacity is impaired which increases the claim potential significantly.

In view of the above, hose tests may not be the ideal testing method to ensure that the hatch cover's sealing system is fit for service, especially when considering cargo safety, as they do not provide information on the packing rubber compression. When it comes to checking sealing systems for compression, ultrasound testing may provide additional information and evidence.

Ultrasonic tests

Explaining the ultrasound tightness testing method is a bit more difficult as using ultrasound detection equipment is more complicated than aiming a jet of water to a panel joint. It is beyond the scope of this brochure to provide a scientific contribution on ultrasound technology, but the basics of ultrasound will, in simple terms, be explained below.

The ultrasound testing principle is quite simple. Ultrasound equipment for hatch cover tightness testing requires a transmitter and a receiver unit. The transmitter emits ultrasound and is placed in the ship's hold.

Transmitter being placed in the ship's hold

Once the hatch covers are closed, the operator scans the sealing areas of the closed hatch covers (cross joints and perimeter rubber/compression bar interface) with the receiver unit and will detect ultrasound signals that are passing through the seal with pin point accuracy, which allows for quick and easy detection of leaky areas.

Ultrasound testing is based on the characteristics of a piezo electrical crystal, which vibrates when subject to an electrical current and which, when squeezed, discharges an electrical current, which can easily be measured.

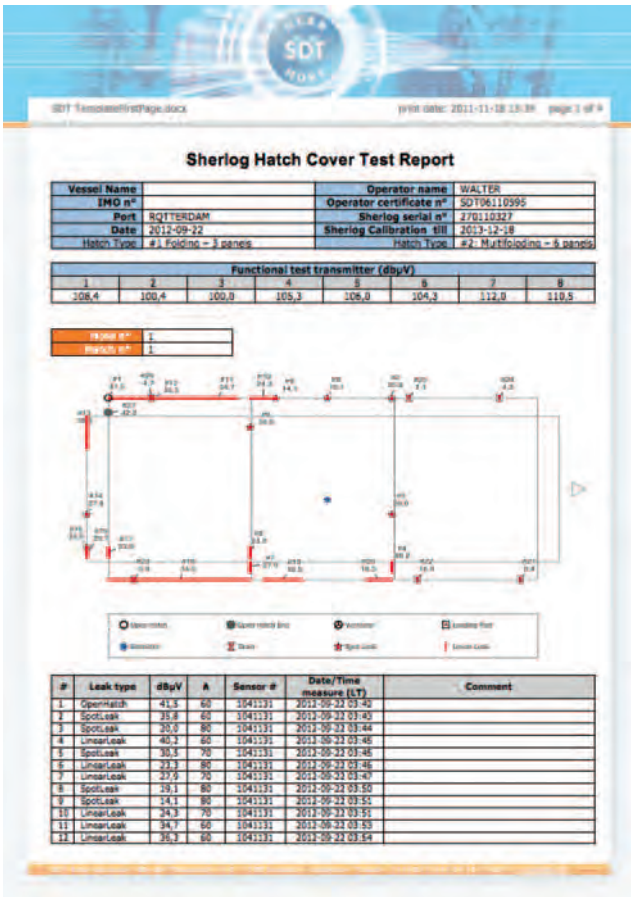
Checking tightness via the cross and perimeter joints

As such, we are able to the strength of an ultrasound signal, a signal that would not be heard by the human ear (if it was not heterodyned). Following the above logic, a small leak will only allow a small amount of ultrasound to escape and hit the receiver's sensor, which will result in a small electrical current being discharged, resulting in a low measurement, which is an indication of a small leak. In case of a big leak, a "cloud" or "beam" of ultrasound will hit the receiver's sensor and cause a significant electrical discharge, resulting in a high measurement that indicates a big leak.

Within the scope of ultrasonic testing, the word "leakage" may not be completely correct. It would be more appropriate to use the words "lack of compression" as this is what is being detected in a spot or area where the packing rubber lacks sufficient compression force to provide a tight seal. Only when there is a transition from lack of compression to lack of contact, will water start to infiltrate and cause a real (water) leak.

In order to obtain an idea of the importance of a leak, a reference value is useful. This reference value is found in the form of an "open hatch value" (OHV), which is the ultrasound signal that is measured through an open hatch, i.e. a 'big hole'. The value measured through the open hatch will be quite significant, and is, in fact, the highest value one can find for a particular hold (the measurements recorded during the test will and can normally not be more than the OHV). The fail-pass criteria for an ultrasonic test has been set at 10% of the OHV and not 0%, which provides an acceptable tolerance for a certain degree of wear on the sealing system.

The biggest advantage of ultrasound testing is that the test results give an indication of not only the contact with the packing rubber, but also the compression of it. If compression is good, then we know that the packing rubber has sufficient compression force, which means that the rubber packing will be able to compensate for relative movements and, as such, provide a tight seal. The fact that we can find out whether the rubber will perform well at sea whilst the ship is still in port provides extra safety. Moreover, in hatch cover tightness, compression is the governing factor and not contact.



Sherlog Hatch Cover Test Report

Vessel Name		Operator name	WALTER
IMO n°		Operator certificate n°	SDT06110395
Port	ROTTERDAM	Sherlog serial n°	270110327
Date	2012-09-22	Sherlog Calibration till	2013-12-18
Hatch Type	#1: Folding – 3 panels	Hatch Type	#2: Multifolding – 6 panels

Functional test transmitter (dBµV)							
1	2	3	4	5	6	7	8
108,4	100,4	100,8	105,3	106,0	104,3	112,0	110,5

Hatch n°	1

#	Leak type	dBµV	A	Sensor #	Date/Time measure (LT)	Comment
1	OpenHatch	41,5	60	1041131	2012-09-22 03:42	
2	SpotLeak	35,8	60	1041131	2012-09-22 03:43	
3	SpotLeak	20,0	80	1041131	2012-09-22 03:44	
4	LinearLeak	40,2	60	1041131	2012-09-22 03:45	
5	SpotLeak	30,5	70	1041131	2012-09-22 03:46	
6	LinearLeak	23,3	80	1041131	2012-09-22 03:46	
7	LinearLeak	27,9	70	1041131	2012-09-22 03:47	
8	SpotLeak	19,1	80	1041131	2012-09-22 03:50	
9	SpotLeak	14,1	80	1041131	2012-09-22 03:51	
10	LinearLeak	24,3	70	1041131	2012-09-22 03:51	
11	LinearLeak	34,7	60	1041131	2012-09-22 03:53	
12	LinearLeak	36,3	60	1041131	2012-09-22 03:54	

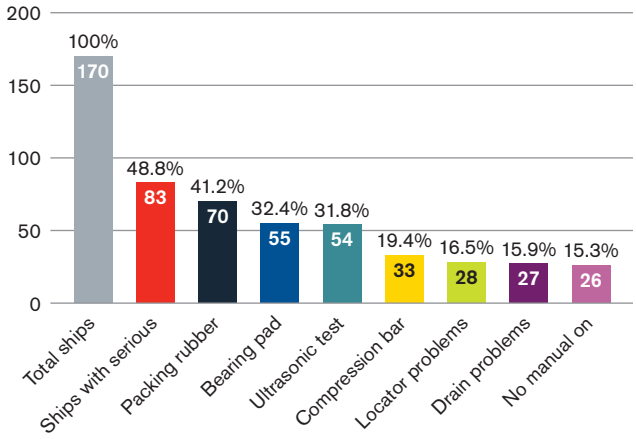
Typical example of a hatch cover test report

Other advantages offered by ultrasound tightness testing are:

- One man operation (observe safety!)
- No pollution risk
- Not limitated by temperature/weather
- Possible during day/night
- Pinpoint accuracy
- Quick and easy to use
- Holds can be loaded/emptied
- A clear pass/fail criteria can be set resulting in enhanced safety
- Professional test report can be generated in a few seconds
- The test is (or should preferably be) carried out by a qualified operator

However, this is not completely correct as it is impossible to say that hatch covers are weathertight on the basis of an ultrasonic test alone. This is because, with ultrasound testing, only the sealing arrangement is tested. Whilst this is indeed an extremely important part of the hatch cover arrangement, the sealing arrangement alone does not make a hatch cover weathertight.

Weathertightness also depends on the other key parts that help the hatch covers and sealing system to be weathertight and remain weathertight (and safely secured) during the voyage. Therefore, the condition of these key parts also needs to be assessed, and this can only be done with a visual inspection. This is also clearly explained in the DNV 403 tightness testing procedure, which states that, in case measurements taken during an ultrasound test are <10% OHV, the hatch covers can be considered to be weathertight "subject to a visual inspection".



Main hatch cover problems in numbers and %

Almost 50% of the 170 ships inspected over a three month period had serious hatch cover related problems that would affect weathertightness

So in order to advise on whether or not a hatch cover is weathertight, both tightness test results and visual inspection details should be considered.

Of course, it is a fact that carrying out a visual inspection of the hatch covers will take more time, as will the drafting of a test and inspection report with photographs. Both time pressure and costs result in many principals only asking for an ultrasound inspection, as they are convinced that this will be sufficient, which is actually not the case.

Whilst operating ultrasonic test equipment is not difficult, it requires some skill and experience to use the equipment in the correct way. Operators should also learn how to evaluate the measurements obtained during a test on board a ship.

Another practical problem is that there are many surveyors and inspectors who have an ultrasound testing kit, but there are not many operators who are able to carry out a good visual inspection as well. Therefore, it may not always be easy to obtain the necessary and correct information to evaluate whether the ship's hatch covers are indeed weathertight or not.

The fact that the importance of a visual inspection should not be underestimated is also made clear by the IACS UR Z17 procedures for service suppliers, which requires operators using ultrasound equipment for tightness testing of hatch covers to be familiar with hatch designs, hatch cover operation, maintenance and repairs, etc.

Another reason why operators of ultrasound equipment should have a good understanding of hatch covers is that, prior to the test being carried out, they should be able to confirm that the hatch covers are ready for testing. Evidence such as crooked/misaligned cleats, improper steel to steel contact, misaligned or mismatching panels, are indicators that the panels are not properly closed and battened down, which might result in lack of compression and affect the test results.

Operators should also be aware of the effects of grease or Vaseline on the packing rubbers, as well as of the effect of overcompression on test results, false echoes, etc.

Once the test is completed, the biggest challenge is to evaluate the test results and find out if the hatch covers are fit for duty. In this context, readers should be aware of the fact that ultrasonic tests are carried out in order to provide information on the possible risk of water ingress (and damage to the ship and cargo). It is therefore important to understand the meaning of the readings obtained during the test and link this data to the possibility of water ingress. The most dangerous conclusion that one can make is to say that, if during an ultrasonic test no measurements in excess of 10% OHV are found, the hatch covers are weathertight and that there is, therefore, no risk of water ingress and cargo damage. As stated earlier, hatch covers can only be considered weathertight when they pass an ultrasonic test and when a visual inspection indicates that all the parts that contribute to achieving and maintaining weathertightness are in good condition.

Another example is that many decision makers will be concerned when they receive a report that indicates a number of red dots/stars (spot leaks) that are in a range of 50% or more of the OHV. On the other hand, they will feel quite relaxed to see a measurement that is slightly above the fail-pass criteria value over a longer length in a cross joint. What is important and necessary in order to make the correct conclusions is to understand that ultrasound measurements reflect a certain degree of compression (or lack thereof) and of course, the higher the measurement, the more compression has been lost. The real question that needs to be answered is: How much water will infiltrate the hold as a result of the leaky spot that is found? In the case of spot leaks with a high value, water can indeed infiltrate, but the overall amount that will infiltrate is unlikely to be that much that it cannot be safely evacuated by the drain system. However, in the case of the leaky cross joint, the main issue is that even a reading that is slightly above the fail/pass criteria indicates that there is lack of compression in the sealing arrangement over a longer length. This is generally a more dangerous situation as the readings in this case indicate that there is loss of compression over a longer length and this means that the seal will open up prematurely, i.e. during more clement weather conditions where distortions between the panels and the panel/coaming are not excessive. In the case of a cross joint opening up over a longer length, the amount of water that can infiltrate will be significant, and this will normally result in a more significant amount of water being spilled over the drain channel rim.

The above example makes it clear that a few spot leaks with high values might not always present a big risk or result in a significant claim, and therefore, it may well be that, from an ingress and claim potential point of view there is no need to overreact or panic. After all, as long as the water can reasonably safely be evacuated by the drain channel, there is no risk of being non-compliant with the ICLL, and the overall risk exposure for cargo damage will be remote.

Hatch covers and due diligence

Most of the claims that are filed on the grounds of hatch cover leakage are commercial related, rather than statutory related. In cases where cargo has sustained wetting damage, it is often assumed that the shipowners failed to carry out due diligence. In the context of hatch covers, and as explained earlier, due diligence requires the master/shipowner to carry out a normal and reasonable inspection to ensure that the hatch covers are in good condition. However, when defects are noted during a test or visual inspection, it is expected that the necessary steps are taken to correct the situation. It is important that corrective actions are made in line with good industry standards and the manufacturer's guidelines.

Very often, when being faced with unsatisfactory test results, marine sealing tape, expansion foam, etc. are used to mask the leaky spot, which is not in line with the due diligence principle. The use of extra sealants allows claimants to assume that the master/shipowner was aware of the tightness problem and decided not to repair it in the proper way, and opted for the cheapest and quickest solution that would allow him to start the voyage and meet the commercial deadlines. By doing so, the master/shipowner fails in his duty to provide a seaworthy and cargoworthy ship and also fails in his duty to look after the safety of the ship, crew and cargo by not complying with the due diligence requirements.

It is, however, a fact that many charterers or shippers are asking masters to apply sealing tape after loading, and by doing so they put the master in a difficult position. On the one hand, masters have the duty to cooperate with charterers and comply with reasonable requests that do not affect the ship's safety, but on the other hand, masters are (or should be) aware of the fact that applying marine sealing tape might put them in a difficult position in case the cargo sustains wetting damage during the voyage. In such cases, masters and owners should ensure that they can prove that, before applying the sealing tape, the hatch covers were weathertight, i.e. passed an ultrasonic (or hose) test, and that a visual inspection confirmed that all hatch cover parts are in a well-maintained and good condition. It would be wise to call in the assistance of a surveyor to carry out the hatch cover test and inspection, as a third party confirmation that all is in order would provide good evidence. Of course, if defects are found during such an inspection, they should be addressed in a proper way. Finally, making a note in the ship's logbook stating that the hatch covers were tested and inspected, and found to be in order (and making reference to the test/inspection report), and that the sealing tape was applied at the request of the charterers or shippers would be further proof of a professional approach towards the use of sealants.

One thing that is also often overlooked when it is decided to apply marine sealing tape (various types are currently on the market), is that this sealing tape adheres strongly to the hatch panel surface (it is even recommended to heat the panel surface/tape to ensure proper adhesion, especially in cold weather). Upon completing the voyage, the tape is then removed, but generally during this removal process, paint becomes detached, leaving the panel surface unprotected and exposed to the elements, with corrosion setting in. Maintenance of the areas with coating breakdown is time consuming, especially when the sealing tape is applied on all hatch covers, and will divert attention from other (and perhaps more necessary) shipboard maintenance tasks. When owners are convinced that their hatch covers are in good condition and able to prove it, it is better to reconsider the charterers' request to apply marine sealing tape and/or to include in the C/P that no sealing tape will be applied.

Evidence to produce in case of a claim

In the unfortunate event that a claim for wetting damage is filed against the ship, even when the hatch covers are well maintained and in good condition, it is considered good practice to provide the below information and evidence of due diligence in order to help your P&I club and lawyers to defend the owner's interest.

- Work schedules
- Maintenance logs and test reports
- Work specifications
- Accounts
- Standing instructions
- Reports and correspondence
- Logbook entries
- Hatch patentee manual
- Holding valid (relevant) certificates
- Evidence of planning voyage and weather reports
- Proof of operating the ship in a good seamanlike manner during the voyage (C/C, RPM…)

Of course, and when appropriate, a sea protest should be prepared as well, and a local P&I surveyor will be able to assist the ship's staff with further survey and test requirements.

Main problems found

Experience has revealed that, when testing and inspecting hatch covers, the following typical or frequently seen mistakes are identified:

Common mistakes

- Insufficient knowledge about hatch covers, not allowing for good inspections and proper, understandable reporting
- Overestimating the capability of the ship's crew for repairs (maintenance and adjustment)

- Overlooking the importance of involving class when shipboard repairs are carried out to hatch covers
- Improper or temporary repairs by crew
- Missing manuals and drawings
- No on board instructions for maintenance
- No maintenance files on board (PMS)
- Hatch covers not included in SMS
- No understanding of the due diligence principle/issues

Weather tightness mistakes

- Ignoring discard/replacement criteria (overcompression)
- Replace rubber and not fix the pads
- Install backstrip rubber everywhere
- Mix new and old rubber
- Using old rubber (from shipboard stock, ignoring shelf life)
- Use small pieces and fill in gaps
- Not (or lightly) painting rubber channel

Mechanical mistakes

- Ignore abnormal sounds/vibration during operation
- No greasing, no greasing plan
- On board repairs instead of ashore
- Ignoring safety issues (heavy and moving equipment)

Hydraulic mistakes

- Cleaning filter instead of changing it
- Improper filtering
- Close covers without pump
- Change pipes without flushing
- Valve positions during voyage
- Ignore leaks and pollution risk
- Ignore high pressure risk

CONCLUSIONS

As you will have seen above, answering the simple question "are the hatch covers weathertight" is slightly more complicated than generally believed, and cannot be confirmed by carrying out an ultrasonic test alone. It actually requires knowledgeable and professional people to carry out the test and advise principals not only about the test results, but also about the overall condition of the hatch covers, their key parts and possible exposure to risk and water ingress.

IMCS Group of Companies
The history of the IMCS Group of Companies goes back to 1990 when IMCS-Belgium was founded in Antwerp. From 1993, IMCS branch offices were set up in strategic locations throughout Europe and in the Baltic and Black Sea areas.

In 2001, under the Chairmanship of Walter Vervloesem (FNI), the "IMCS Group of Companies" was set-up with a view to strengthening ties between the different IMCS entities, streamlining survey and reporting standards, and enhancing professionalism through an in-house quality system, training programs, seminars and Group meetings.

After 2005, further expansion included representation in overseas areas such as China and Brazil and in 2016, offices in Chile and India were set-up.

The worldwide IMCS Group network presently comprises 20 offices, and our surveyors carry out 5000+ surveys per year. More than 1000 hatch cover and cargo worthiness surveys (part of which are within the scope of dedicated ship inspection programs) are carried out annually by a team of highly trained surveyors.

The recent economic downturn brought several challenges, which were turned into opportunities by recognising our principal's needs and working out tailor-made solutions, developing dedicated ship vetting platforms and setting-up the IMCS Training Academy as well as by embracing modern techniques such as 3D scanning and the use of drones.

Throughout the years, IMCS has worked hard to make quality its hallmark, and significant efforts are made every day to ensure high standards of performance and customer satisfaction.

The Author
After leaving the sea in 1988, Walter Vervloesem (FNI) redirected his career and became a marine surveyor and consultant. He joined IMCS Belgium in 1995, and became Chairman of the IMCS Group in 2001. He pioneered the use of ultrasonic tightness testing back in the late eighties and early nineties, and is the training instructor for the SDT-IMCS worldwide training program for operators using ultrasonic tightness testing equipment for testing the weathertight integrity of hatch covers. In 2011, he founded the IMCS Training Academy. Walter is the author of several major reference works published by the Nautical Institute, such as "The Ship Survey and Audit Companion" (2000), "Hatch Covers Inspections" (2004), "Mooring and Anchoring Ships" (2009) and has contributed to many books and articles for leading maritime organisations.

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