as these lubricants generally tend to react with the packing rubber's surface and cause damage. Abrasive residues will settle in the grease and cause rapid deterioration of the rubber. Only in specific cases, and when explicitly recommended by the manufacturers, special types of grease (usually silicon grease) can be applied.

When replacing packing rubber, it should be remembered that size is not the only criterion that should be observed. Issues like design compression, weight/metre, mean compression force and installation and preservation requirements should be considered.

Whilst it may be tempting to try "speeding up" replacement of the rubber by lightly inserting the rubber in the retaining channel and closing the panel to push the rubber further into the retaining channel, practice has shown that this does not work and this repair method should be discouraged.

During inspections, it is important to check packing rubbers for following defects which may affect the sealing efficiency such as:

◎ Overcompression and permanent set (imprint)

Overcompression and permanent set (imprint) which can be caused by improper adjustment of the steel to steel contact or ageing.

◎ Physical damage

Physical damage such as cuts, abrasion, deformation,...

◎ Discontinuity of the sealing

Discontinuity of the sealing, meaning that the line of contact should not be interrupted as a result from gaps, missing pieces, steps between adjacent lengths of rubber (usually after partial replacement), damages,…

◎ Off centre imprint

Off centre imprint as result from misalignment, flaws in the design, installation, fitting,….

◎ Cleanliness of the sealing surface

Impurities such as cargo remnants, rust, etc should be removed as they might affect sealing and test results or cause irrevocable damage to the packing rubber.

③ Bearing pads

In order to keep the packing rubber at the required design compression, steel to steel contact between the panel and hatch coaming is necessary. This is usually provided by the bearing pads (also called Fz stoppers) which consist of a support pad on the hatch cover and a landing pad on the hatch coaming. Apart from the straightforward steel-to-steel type bearing pads, different designs with different materials for the mating halves are available on the market.

Photograph 10 Support Pad & Landing Pad

Bearing pads will wear down in function of type, age and loads that are acting upon them. According as bearing pads wear down, the compression of the packing rubber will increase and therefore the wear process should be regularly monitored by checking the skirt clearance which can easily be measured with a ruler or feeler gauge. Information regarding the skirt clearance and max. allowed wear on the bearing pads can be found in the manual and will usually be in range of 2-3mm. Some mating surface designs include wear rings or marks that indicate the bearing pad wear.

Photograph 11　Checking skirt clearance with feeler gauge

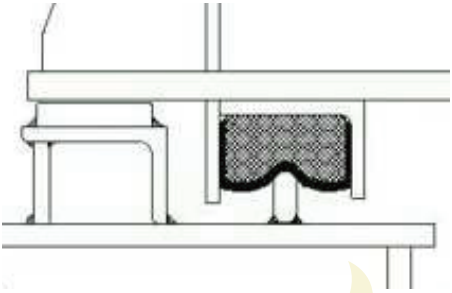


Figure 4　Bearing pad wear will result in overcompression of the packing rubber.

Bearing pads play a crucial role in the sealing process and inspections should focus on:

◎ Wear

Wear in way of the landing pads (resulting is reduced skirt clearance).

◎ Lack of contact

Lack of contact between the support and landing pads.

◎ Structural integrity

Structural integrity of the bearing pads, coaming and deck structure so that the weatherloads and stresses that are acting on the hatch covers can safely be transferred towards the deckstructure.

◎ Type of steel

Correct steel for the landing (mild steel) and support pads (hardox).

◎ Cleanliness and free movement

Cleanliness and free movement between the landing and support pads (even/smooth surfaces). Greasing of the bearing pad surfaces is usually not recommended (check with manual) and may even accelerate weardown in case dust and abrasive residues settle in the grease.

Older hatch cover designs may not have bearing pads installed in which case the steel to steel contact will be achieved through direct contact of the hatch cover side plating with the hatch coaming. In such cases, wear and damages in way of the panel/coaming interface (lower part of the hatch side plating and coaming table surface) should be checked for damages such as corrosion , grooving, thinning, deformations,….

Photograph 12
Steel to steel achieved by contact between panel side plating and coaming table. Grooving and through corrosion in way of panel/coaming interface

Bearing pads are relatively easy and quick to repair but adjustment of bearing pads is beyond the capacity of the ship's crew and should preferably be done by qualified repair personnel.

④ Locators

Besides the bearing pads, the locators (sliding positioners) will ensure that the panels are properly guided and positioned when being closed. This means that the packing rubber in way of panel intersections is properly compressed up to the manufacturers' design compression and that panels are properly aligned and centered.

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

In order to correct for wear in way of the locators, more recent designs include replaceable and adjustable locator pads (with shim plates).

Photograph 13
Locator with adjustable pads

Photograph 14 Measuring clearance of locator with tapered feeler gauge.

Together with the bearing pads, the locators are important for achieving tightness and therefore regular inspection is required. Inspectors should especially be looking for the following:

◎ Wear and excessive clearance

Wear and excessive clearance (usually 2-3m max) as excessive wear will directly compromise sealing efficiency.

◎ Structural integrity

Structural integrity to ensure that the locator parts and coaming structure can withstand loads and stresses.

⑤ Stoppers

Once properly closed in port (static condition), panels should remain in their correct sealing position throughout the voyage whilst the ship will be in a dynamic condition at sea. Relative movements will tend to distort the panel arrangement, alignment and geometry but in order to prevent forces that are acting on the hull girder to be transferred directly into the panels, some limited movement should be allowed.

Photograph 15　Panel stopper arrangement

Therefore, stoppers (sometimes also called rolling or pitching stoppers depending on their working direction (longitudinal (Fx) or transversal (Fy)) will be installed with small clearances. Depending on the loads and design of the hatch cover panels, stoppers may come in different shapes and sizes. Items to look out for during inspections are:

◎ Excessive wear/clearance

Excessive wear/clearance as with excessive clearances control over the movement of the panels will be lost which would result in damage or accelerated wear of other parts.

◎ Structural integrity

Structural integrity as damages or advanced corrosion and wastage will affect the stopper capacity.

⑥ Securing systems

Under the ICLL, it is required that hatch panels can be properly secured to the ship. This is necessary to prevent panels from being pushed off or blown away and leave the hatch and hold exposed to the elements.

Securing of the hatch panels will generally be done manually with the well-known quick acting cleats or holding down devices (the latter usually seen on board of very large

container carriers), or by means of automated systems (self auto-wedge closing systems, hydraulic cleating systems,…). The type of cleat system to be installed will depend amongst others on the number of crew available for preparing the hatch covers for sea as some cleating systems are more time consuming to open/close as others.

Photograph 16 Quick acting cleat parts

It is important to note that cleats are fitted to hold the panel down when the ship is at sea but not to obtain a tighter seal. In order to accommodate for the relative movements, cleats have to be "flexibly" mounted, hence the rubber washers which are generally used for this purpose.

Crew should also be aware that in cases of leaks being found during tests, extra tightening of the securing cleats will not help in achieving a better or tighter seal as the steel to steel contact (bearing pads) will prevent panels to be pulled further down. Excessive tightening will only restrict cleat movements and lead to deformations or even failure of the panel side plating, coaming table and cleat parts which eventually would leave the panels unsecured and the ship at risk.

In order to ensure that cleats are fit for duty, they should regularly be inspected for:

◎ Structural integrity

Cleats connect the panel with the hatch coaming table and as such, strength related issues such as corrosion, deformations and thinning (reduction of cross-sectional thickness) of the different parts of the cleating system, as well as the coaming table and panel side plating should be checked.

◎ Total number

As the required holding power can only be achieved when all cleats are in place, missing (and damaged) cleats should be replaced.

◎ Flexibility

The rubber washers should be in good condition (not overpainted, no additional steel of rubber washers fitted).

◎ Alignment

If cleats are crooked or misaligned their holding power will be affected.

◎ Adjustment

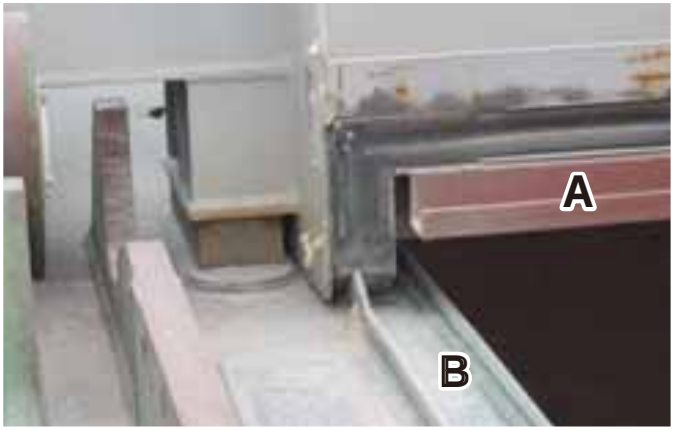
Cleats allow for adjustment of wear in the hatch cover (bearing pad) system and should be tightened to the correct tension.

Where cross wedges are installed, attention should be paid to proper installation and adjustment (no building up with shim plates) as well as deformation (bent or “banana shapes” wedges) and overtightening should be avoided.

Photograph 17　“Banana shaped” cross wedge with striker plate built up

⑦ Drain systems

When relative movements are exceeding the packing rubber’s design compression, water will pass through the sealing arrangement and collect in the drain channels which will eventually evacuate the incoming water out on deck. As such, drain systems (both in way of the cross joints (“A”) as well as on the hatch coaming (“B”)) are the last barrier to water ingress into the hold.



Photograph 18　Drain systems

Drain systems consist of a drain channel, drain hole in the coaming table and a drain pipe fitted with a non-return valve. The non-return valve will prevent water from outside to enter into the hold (in case of heavy weather).

Photograph 19　Drain systems: Principle - non-return valve

Drain valves should always be open and free but the non-return valve should be closed with the fire cap in case of CO^2 release (fire) or fumigation. Only in case the valves should become damaged during the voyage and if insufficient spare valves are available, the use of a piece of firehose, long enough to bend back on itself to prevent water on deck from entering the drainage system, can be considered as a temporary solution.

Whilst checking drain systems, inspectors should focus on the following points:

◎ Structural integrity

Structural integrity of drain channels in cross joints and on the coaming (corrosion, damage,…).

◎ Type of drain valve

Original type of drain valve fitted.

◎ Condition of the drain system

Drain system (drain channel, drain hole, drainpipe and drain valve) free and unobstructed.

◎ Fire caps

Fire caps provided and available in a clearly identified space (e.g. CO^2 station).

Whilst loading or discharging bulk cargo, it can be considered to plug the drain hole to prevent cargo from blocking the drain holes and valves, but attention should be paid to removing the plug prior to closing the hatch covers.

⑧ Compression bars

In order to achieve a weathertight seal, packing rubbers act against a packing rubber mating surface, often referred to as the compression bar. Depending on the type of rubber installed, this can either be a raised compression bar (with rounded sealing surface for normal type flex or sponge core seals – Photograph “A”) or a flat steel mating surface (which can be the steel coaming plating itself or a stainless steel strip welded onto the coaming table for the CAT or sliding profile seals - photograph "B"). The flat steel mating surfaces are easy to install, maintain and clean and have no restrictions in movement. Nowadays, the raised type compression bars will generally be made of stainless steel.

Photograph 20 Compression bars

Compression bars should usually be checked for some important issues.

◎ Structural condition

As packing rubber pressure and loads (mean compression force and relative movements) are considerable, compression bars should be structurally intact and strong to withstand the repeated forces acting on them.

◎ Straightness

Straightness of the compression bars is important as unevenness will result in irregular compression.

◎ Smoothness

Smoothness of the compression bar sealing surface will prevent abrasion of, and damage to, the packing rubber surface. Corrosion, cuts, remnants of previous cargo etc... should be identified and addressed.

⑨ Operating systems

Modern hatch panels are generally heavy pieces of equipment that require mechanical power to be opened/closed and their operation is not without risk. Electro-hydraulic operated systems are still commonplace but more recently electric driven systems are being installed as well.

From a safety point of view, it is recommended to operate hatch covers with an operator who is in charge of the controls and a supervisor who ensures that no one is passing in way of the moving hatch covers. Hatch covers should always be operated by properly trained personnel.

Strictly speaking, opening and closing mechanisms are not related to the sealing and securing arrangements but they are necessary to open and close the panels for cargo operations.

During inspection, attention should be focused on following items:

◎ Opening/closing speed

Opening/closing speed (depending on type and manual specs).

◎ Abnormal noise

Abnormal noise and sounds as well as vibrations during panel operation are indications of problems.

◎ Proper greasing of moving parts

Proper greasing of moving parts such as wheels, hinges will facilitate proper operation and extend in-service life of bearings.

◎ Oil leakage

Oil leakage from hydraulic systems (deck piping, hydraulic power pack, cylinders) will result in loss of oil, slippery surfaces and can cause pollution.

◎ Damages and deformations

Damages and deformations to deck, coaming and panel plating will affect strength, structural integrity and may jeopardize proper operations and entail safety hazards.

◎ Safety items

Safety items, such as safety latches to secure panels in open position or EMY stops should be in good condition and operational.

Hydraulic systems operate at very high pressures (up to 250 bar) and any impurities in the oil will have a devastating “shotgun” effect on the component parts of the power pack, valves etc. Impurities can also be drawn into the system via leak sites and cylinders. Leaks, regardless of their size, should be repaired immediately and it is recommended to protect hydraulic cylinders from contact with cargo remnants and dust with protective sleeves.

Photograph 21
Protective sleeve for cylinders

Piping should be thoroughly flushed after repairs to remove debris and oil, even if newly supplied, should be properly filtered before use.

Crew is to be familiar with the emergency closing procedures (EMY power packs, wire operated systems, …) in order to reduce delays in operation and/or prevent cargo in the holds from becoming wet.

When chains or wires (incl. associated gypsies and pulleys) are used for opening and closing of the hatch covers, they should be checked for strength, wear and diminution, damage, proper tension, elongation. In case the hatch cover system consists of pontoons which are lifted by crane, it is important to check the strength of the lifting points on the panels and conspicuous marking of same is recommended.

Photograph 22　Pontoon covers on container vessel properly marked/indicated

Chap. 05

MARINE TAPE: A blessing or a curse?

Most of the wetting damage claims as a result from hatch cover leakage are commercial related, rather than statutory related. In cases where cargo has sustained wetting damage, it is often assumed that the ship/owners failed to exercise due diligence in making hatch covers weathertight. Within the context of hatch covers, due diligence requires the master/owners to carry out a normal and reasonable inspection to ensure that the hatch covers are in good condition. In case defects are noted, it is expected that necessary steps are taken to correct the situation. It is important that corrective actions are made in line with good industry standards and maker's guidelines.

Very often, when being faced with unsatisfactory test results, various sealants such as marine sealing tape, expansion foam etc are used to cover the leaky spots, 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 issues and decided not to repair the problem in a proper way and decided to opt for the cheapest and quickest solution that would allow him to start the voyage and meet with commercial deadlines. By doing so the Master and shipowner would fail in their duty to provide a seaworthy and cargoworthy ship and look after the safety of the ship, crew and cargo by not complying with the due diligence requirements.

Photograph 23 Marine tape

Photograph 24 Expansion foam

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 should sustain 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 as well as a visual inspection which confirmed that all hatch cover parts are in a well maintained and good condition. In such case it might be recommended to call in the assistance of a surveyor to carry out the hatch cover test and inspection. Results of these inspections will be considered as a third party confirmation that all is in order and would provide good evidence in case of a claim. In case defects are found during such an inspection, they should be addressed in a proper way prior to applying the sealants. Finally, making a note in the ship's logbook stating that the hatch covers were tested, inspected and found in order (and making reference to the test/inspection report), and that the sealing tape was applied at the explicit request of charterers or shippers would be further proof of a professional approach towards the use of marine sealing tape.

One thing that is also often overlooked in case 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 completion of the voyage, the tape will be removed, but generally during this removal process paint becomes detached, leaving the panel surface unprotected and exposed to the elements with corrosive action setting in if not dealt with quickly and in a proper manner. Maintenance of the areas with coating breakdown is time consuming, especially when the sealing tape is applied on all hatch covers, and will deviate 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 this, 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.

With regards to the fumigation issue, it should be noted that hatch covers are built and type approved to be weathertight, not gastight. In order to reduce the risk of fumigation gas escaping (which is a threat to people and will reduce fumigation efficiency) sealants can be used, but in that case it is not used for masking defects but rather to improve fumigation safety and efficiency.
However, and before applying the sealing tape, hath covers are normally tested and inspected and only when they are in good shape and weathertight, the sealing tape can be applied in order to enhance gastightness.

Many ship owners are saying indeed that they apply sealing tape as "extra" precaution but unfortunately investigations generally reveal that the hatch covers were not weathertight at the outset of the voyage in the first place so that the sealing tape cannot be considered as an "extra security" but rather as a shortcut to avoid expenses for necessary repairs and maintenance in case hatch covers leak (which is not in line with the due diligence principle).

Always remember that there will be relative movements between the panels as well as between the panels and the ship (especially in heavy weather) which might cause the sealing tape to become damaged, detached and loose.

Chap. 06

EVIDENCE IN CASE OF CLAIMS

In the unfortunate event that a claim is filed against the ship, and in order to help the P&I club and legal people to defend the owner's interests, it will be up to the master and owners to prove that they have done whatever is necessary in order to make the hatch covers weathertight. This can be done by providing relevant documents such as:

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

Chap. 07

HATCH COVER TESTING

The ICLL states 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*".

There are different methods for testing hatch covers and in a number of cases it may be useful or recommended to combine different methods in order to get an as good impression as possible about the hatch cover condition. The most commonly used testing methods are listed below:

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

(It is beyond the scope of this article to explain each of the above testing methods in detail, but further information can be found in class regulations or by contacting the author of the article).

It should be noted that the above testing methods mainly provide information about the sealing system only. Weathertightness requires not only confirmation that hatch covers are tight, but also that the structural integrity and securing related issues are in order.

Tightness can only be achieved and maintained during the voyage on condition that all component parts are in good condition which can only be confirmed after a detailed visual inspection by qualified and knowledgeable persons. Concluding that hatch covers are weathertight on basis of an ultrasonic test alone is dangerous and might lead to cargo claims.

Chap. 08

MAIN PROBLEMS FOUND

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

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 & adjustment)
- Omitting to call in specialists (remember that being able to prove that repairs were carried out by a specialist team will help in proving due diligence)
- Overlooking the importance of involving class when shipboard repairs are carried out on hatch covers
- Improper/temporary repairs by crew
- Missing manual/drawings
- No proper and detailed on-board instructions for maintenance
- No maintenance files on board (i.e. PMS) to document maintenance and repairs
- Hatch covers not included in SMS and PMS
- No understanding of the due diligence principle and requirements
- Insufficient spare parts

Weather tightness mistakes

- Ignoring discard/replacement criteria (over-compression)
- Replace rubber packing without addressing steel to steel contact issues
- Installation of backing strips everywhere, even on top of rubber packing
- Mix of new and old rubber
- Using old rubber (from shipboard stock and ignoring shelf life)
- Use of small pieces and filling-in of gaps
- Improper maintenance of seals and rubber channel (painting)

Mechanical mistakes

- Abnormal sounds/vibration during operation ignored
- No greasing, no greasing plan
- Onboard repairs instead of landing panels ashore
- Ignoring safety issues (heavy and moving equipment)

Hydraulic mistakes

- Cleaning filters instead of changing
- Improper filtering
- Closing covers without pump
- Changing of pipes without flushing
- Valve positions during voyage
- Ignoring leaks & pollution risk
- Ignoring high pressure risk

Chap. 09

CONCLUSION

Hatch cover maintenance and operation requires a thorough understanding of basic principles together with type specific issues and requirements. Experience and claims show that hatch cover problems still remain one of the predominant causes for claims and accidents on board vessels.

Whilst hatch cover claims are generally associated with wetting damage, it should not be overlooked that incorrect maintenance or operation may involve loss of life and limb or pollution. Moreover, claims for wet damaged cargo, pollution or accidents and injuries will always have an adverse impact on the owner's business model.

To avoid hatch cover related claims, owners should consider setting up dedicated training and familiarization programmes related to occupational safety, operation and inspection. Relevant and type specific hatch cover checklists should be made and their use implemented.

TRAINING

Assistance and help with developing training strategies and checklists can be obtained from the author of this article.

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