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Hatch Cover Maintenance

SHIPS

Hatch Cover Maintenance

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Introduction

Cargo wet damage claims due to water ingress through hatch covers are common and can be very costly.

This briefing aims to raise awareness amongst Members and ship's staff of the common causes of ingress claims and how these causes can be avoided through best practice

Cost Versus Consequence

The mention of cost of improvement is pertinent because the disparity between this and the cost of failure to maintain weathertight integrity can be enormous. For example, we typically encounter a number of claims each year costing over $500,000 for wet-damaged cargoes resulting from hatch cover defects, not to mention numerous smaller claims.

In general, the cost of preventing these losses can usually be measured in a few thousand dollars or less, such as replacing defective rubber seals, minor steelwork repairs or sometimes quite simply cleaning the coamings and sealing surfaces before closing the hatch covers. We will aim to show just how easy it can be to prevent costly failures.

It is commonly thought that most problems are experienced by older ships and smaller ships. But larger ships, newer ships and even new-builds are not exempt from hatch cover problems and can give rise to the largest individual claims.

What is Weathertightness?

We always refer to hatch covers needing to be 'weathertight', but what does this actually mean?

The statutory requirement contained in Regulation 3(12) of the International Convention on Load Lines 1966, states:

'"weathertight" in relation to any part of a ship other than a door in a bulkhead means that the part is such that water will not penetrate it and so enter the hull of the ship in the worst sea and weather conditions likely to be encountered by the ship in service'.

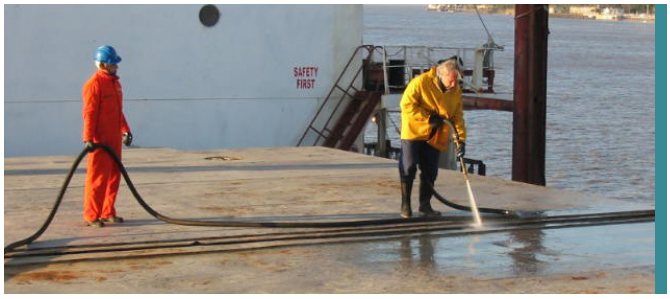
Testing for Weathertightness

The Club may periodically require a ship's hatch covers to be tested for weathertightness for example as part of a condition survey or steel preload survey. Similar surveys are also often required by classification societies, and representatives of cargo shippers, particularly where the cargo is sensitive to water. These surveys may be performed by the traditional hose test or by using the preferred and more modern method of ultrasonic leak detection.

Hose Testing

There are some practical limitations with the traditional hose test and examples of these are as follows:

- The surveyor has to enter the cargo hold in order to identify any leaks, whilst the exact source of the leak is often difficult to pin point.
- Variations in water pressure, angle of jet, distance from the hatch coaming and speed of travel can and often does lead to inconsistencies.
- Many port authorities do not allow hose testing due to local anti-pollution legislation.
- A hose test cannot be carried out in sub-zero temperatures.
- A hose test cannot be carried out with cargo loaded on board.
- A hose test requires a minimum of two surveyors, one inside the cargo hold and one on deck monitoring the operation.
- A hose test can only be carried out when holds are empty.



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Ultrasonic Testing

Ultrasonic leakage detection equipment was introduced to overcome difficulties associated with the hose test. An ultrasound transmitter is placed in the empty hold or on top of the cargo stow, with the hatch covers and accesses closed and secured.

Using an ultrasound detector, operated by the surveyor, the outer sides and cross-joints of the cover as well as any other accesses and openings are scanned to locate any leaks.

Any leaks detected by ultrasound testing equipment should not exceed 10% of the "open hatch value" (OHV), which is a control reading determined at the start of the test. This 10% OHV is an industry standard measure. Readings in excess of 10% may require any associated defects to be properly rectified before the vessel sails if the ship's operators are to be able to demonstrate that they have exercised due diligence to make the ship seaworthy at the commencement of the voyage.

For further detailed information on hatch cover testing, North has produced a Loss Prevention briefing on the topic, which is freely accessible on our website at:

www.nepia.com/latest/publications

Testing is only part of the process

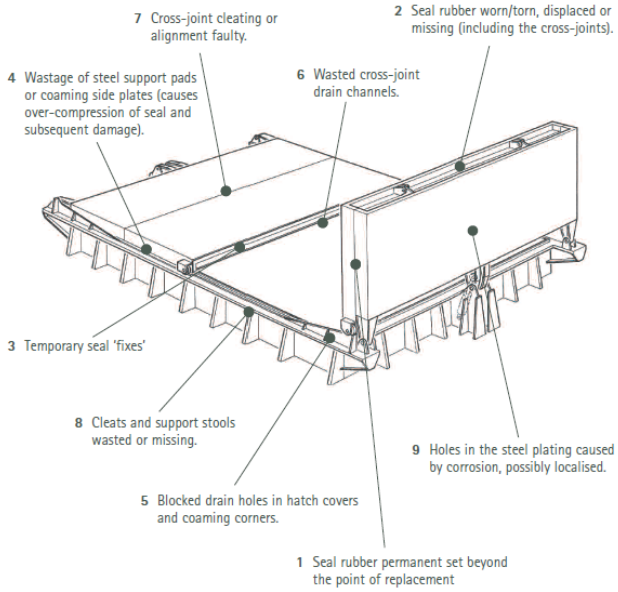
Neither the hose nor ultrasound tests can replicate the conditions experienced when a ship is rolling and pitching in a seaway with water cascading over decks and hatches – which is why testing is only part of the loss-prevention process.

Well-maintained seals, cleats, supports, drains and other hatch cover components are the key to achieving weathertightness.

Top Ten Hatch Cover Defects

The top ten hatch cover defects giving rise to claims for water damage are shown below. These are based on experience of many hatch cover surveys and damage claims. In most cases, significant claims could have been avoided with low cost preventative remedial work.

1) Seal rubber beyond the point of replacement
2) Seal rubber worn/torn, displaced or missing (including the cross joints)
3) Temporary seal 'fixes'
4) Wastage of steel support pads or coaming side plates (causes over-compression of seal and subsequent damage)
5) Blocked drain holes in hatch covers and coaming corners
6) Wasted cross joint drain channels
7) Cross-joint cleating or alignment faulty
8) Cleats and support stools wasted or missing
9) Holes in the steel plating caused by corrosion, possibly localised
10) Wear on the centreline wedge devices on side-rolling covers, which causes the cross-joint to open when the ship is at sea



10 Wear on the centreline wedge devices on side-rolling covers, which causes cross-joint to open when the ship is at sea (not illustrated on above diagram).

Carrying Out Onboard Repairs

The question arises: what do we do if, as a result of careful checking of the hatch covers, we find a problem?

In practice ship's crew face real challenges carrying out repairs during the limited time available in port and with limited resources of people and materials.

Often a temporary repair can be carried out that will alleviate the problem until more permanent repairs are possible. As long as the repair is such that it remains effective during the remaining voyage, then there is nothing wrong with this in principle.

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Note: ***All repairs whether temporary or permanent should be carried out employing the hatch cover patentees methods and materials.***

Regular inspections of the hatch covers and regular maintenance according to the hatch cover supplier's operating and maintenance manual should help to avoid surprises and the need for emergency temporary repairs. But when an unexpected defect is found, there are some basic rules to be observed.

- If an area of the rubber seal is found to be damaged or defective, then it can be repaired by cutting out and replacing the defective length. The hatch cover supplier's manual should give detailed instructions as to the size and type of seal, the type of glue, the cutting and fitting instructions and so on. In general, the minimum length which should be inserted is 500mm as shorter lengths are very unlikely to be satisfactory.
- Inserting rubber pieces to pack out defective areas will not provide a reliable seal. Once the ship is at sea, with relative movement occurring between the hatch covers and the coaming, then leaks are inevitable.
- If possible complete lengths of seal should be replaced to avoid steps in the seal level.
- If end pieces of seal or special nosings of solid rubber are needed, experience suggests that 'do-it-yourself' inserts will never be satisfactory – the manufacturer's specified items such as pre-formed sections should be used.
- The use of temporary steel packers to build up wasted supports or wedges can be effective as a temporary measure, but such work should not be undertaken without taking into account the whole hatch cover system. Sometimes what seems like a helpful remedial measure can bring into play some other unrecognised defects.

Try to avoid 'quick fixes' by spotting trouble early. If repairs become necessary for any reason, then the ideal solution is to call in a service engineer familiar with hatch cover repairs. If this option is not available, then repairs can be carried out by onboard personnel following the information available in the supplier's operating and maintenance manual. This is, of course, dependent on an adequate supply of spares onboard.

Preventative and Planned Maintenance

DNV GL provide the following guidance on preventative and planned maintenance.

1) The overall structural strength is to be preserved by protecting the exposed surfaces of the hatch cover plating and stiffeners.

   It is essential that the protective coating of the hatch cover structure is maintained in order to sustain the overall strength and avoid expensive repairs. Particularly single skin folding type covers are quite challenging in this respect as accessibility is difficult.

2) The surface smoothness and correct profile of trackways of rolling covers, compression bars and other steel work bearing on seals or friction pads are to be preserved to reduce wear rates on these components.

   Corroded or damaged trackways affect the movement of hatch covers and may lead to misalignment. Trackways are therefore to be kept clean and in a good painted condition.

   An effective seal can only be obtained if the compression bar is straight, undamaged and non -corroded. If this is not the case, the compression bar must be repaired or replaced.

   Any debris left over from the last cargo operation will accelerate the wear rate of resting pads.

3) The hydraulic or mechanically powered opening, closing, securing or cleating systems are to be maintained in accordance with the manufacturer's recommendations.

   All parts that move when operating the covers are to be kept in good condition. The play of hatch cover hinges and wheels is to be verified to be within the tolerances. Otherwise this will cause the slewing of panels. Besides other movable parts, the wheel spindles, hinge pins, racks, pinions and hydraulic cylinder bearings are to be regularly greased.

   The hydraulic system's oil stowage tank level is to be monitored regularly. This is to ensure that the hydraulic cylinder valves are balanced to prevent the hatch cover panels from twisting. Oil samples should be taken frequently to verify the condition and, if necessary, the oil is to be changed.

   While the hydraulic oil might last for approx. five years, the oil filters are to be changed more frequently as stated in the manufacturer's instructions.

4) Where it has been identified that resting pads, compression bars, seals, etc., are to be replaced due to significant wastage, wear or loss of adjustment capability, the adjustment of manual cleats is to be maintained.

   The function of the cleats is to keep the hatch covers in position and maintain the seal's design compression. The excessive trimming of cleats will not improve weathertightness but will lead to the accelerated wear of seals.

5) Seals and other wear components are to be replaced in accordance with the manufacturer's recommendations. This requires a sufficient number of spare parts of the correct specification to be carried on board or obtained, keeping in mind that seals are designed for a particular degree of compression, hardness and chemical and wear resistance.

   The lifetime of hatch cover seals is in the range of four to five years given normal operations and maintenance. This period fits perfectly with the special survey interval and allows sufficient replacement time. Otherwise, due to the

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wear on steel -to-steel work or misalignment of hatch covers, the seals might have to be replaced earlier depending on the permanent set of the seals. In general, the manufacturer should state the permissible permanent set but a well recognised standard is to allow for 50% of the initial design compression which is stated in the hatch cover operating and maintenance manual.

In general, it is advisable to change the entire length of the respective seal at the first opportunity.

If resting pads are worn out, they have to be repaired in accordance with their original dimension. Although the relative movement of hatch covers is small on typical bulk carriers compared to on open hatch vessel with a higher torsional flexibility, it is advisable to use replaceable and adjustable low friction pads.

6) All hatch cover drains and their non -return valves, where fitted, are to be kept in working order, noting that any drains fitted to the inboard side of seal lines will have non-return valves to prevent water ingress to holds in the event of boarding seas.

   It should go without saying that, after each cargo operation, the coaming tops and cross-joint channels are to be cleaned by removing any loose scale or cargo residue. The same applies to the coaming drain holes and the non -return valves, which are to be checked to ensure they function, e.g. is the rubber ball moving freely.

Use of Sealing tape

The use of sealing tapes at the cross-joints of hatch covers is common, and is sometimes expressly called for by the shipper or charterer. On the face of it, this seems like a sensible additional precaution to enhance weathertightness. However, there are negative aspects to using hatch cover sealing tape, which include:

- It can lead to a false sense of security
- The tape can wash off in heavy seas
- The tape can obstruct drain holes, trapping water in the cross-joint
- Complete sealing by means of tape is difficult due to the presence of cross-joint cleats or other fittings
- The tape can cause accelerated corrosion of the steelwork due to the deterioration of coatings upon its removal.

Tape or other material should not be used between compression bars and rubber seals as an alternative to proper repairs. Similarly, high-expansion foam is often used as a 'belt and braces' measure to achieve reliable weathertightness. This type of foam is hard to control in practice and can block drain holes and drain channels, such that water leaking in can find its way to the cargo rather than draining out as the system designers intended.

North's policy is that: ***"the use of such tape or foam is acceptable as an additional precaution on well-maintained weathertight hatch covers, but is not acceptable as an alternative to proper permanent repairs".***

Rubber seals on well-maintained hatch covers can normally be expected to last several years in normal service. However, if the seal is over-compressed due to deterioration of the hatch cover steel work, bearing pad wear or misalignment of the hatch cover panels, the seal will undoubtedly become damaged. This damage may be tearing of the rubber seal or detachment of the seal from its retaining channel, whereby it is easy to see that an immediate repair is required.

More commonly, the over-compression causes the elasticity of the seal to be lost resulting in a deep groove in the rubber known as 'permanent set' (see photograph). It is quite easy to measure the depth of the permanent set using a ruler or a gauge. This should then be compared to the designed compression of the seal, found in the onboard hatch cover operating and maintenance manual).

The simple rule for replacement of the seal is:

Manufacturers state that: ***"when permanent set reaches half the design compression – replace the seal".***

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There may be a temptation to continue service with the seals in poor condition, on the basis of cost saving. This is a false economy, as the relatively modest cost of seal replacement is dwarfed by the value of claims for damaged cargoes. Additionally, the presence of permanent set may be a symptom of other more serious problems with the hatch covers, particularly wastage of the steel or misalignment, which will require further attention.

Inspection check list

When a ship undertakes to safely carry a cargo it is taking on an onerous responsibility. The ship's personnel and superintendent are at the end of the chain of that responsibility – and their influence in preventing, identifying and rectifying problems cannot be over-stated. The task is not easy, largely because of the physical scale. For example, a typical Panamax bulk carrier will have hatch covers with a total surface area greater than a football pitch, hundreds of cleats and trackway wheels, several hundred metres of hydraulic piping and, crucially, about half a kilometre of rubber sealing material.

Of huge importance is the regular and thorough inspection of the coamings, hatch covers and in particular the sealing arrangements. Attention should be given as to the condition of these arrangements when the covers are being opened or closed. This continuous monitoring can alert crew at the onset of problems and prevent more serious damage occurring.

Close inspection need not take too much time or effort; it may simply be the process of making observations and recording them accordingly. A check list is the ideal way to systemise these observations. The checklist given here is in three sections: coamings, panels and closure/sealing.

Coamings

Are the compression bars in good condition, undamaged by corrosion, pitting, grab or wire damage and with uniform height and thickness? (Record height and width in mm)

Is the coaming-top water channel between the compression bar and the vertical coaming plate clean and free from corrosion?

Is the extension of coaming plate forming one side of the water channel in good condition without thinning, not bent from grab contact and a uniform height all around? (Record height - minimum guideline is 20mm)

Are the inboard coaming faces free from any vertical rust staining which would indicate water leakage, especially at the cross-joints or split-joints?

Are drains free from previous cargo residues and are there efficient means of closing, such as non-return valves? Are these in place and working?

Are quick-acting cleats all in place and in good, free working condition? Are the under-coaming consoles in strong condition? Are the rubber washers pliable and free from paint?

If the hatch panel side and end plates are in steel-to-steel contact with the coaming tops when closed, are the coaming tops free from grooving or wear?

If the hatch covers are supported by bearing pads, chocks or support blocks, are they free from wear or damage?

Are the coamings free of corrosion and are the coaming brackets fully connected?

Panels

Are the side and cross-joints seals in good condition? (Record permanent deflection at about 1 metre intervals and record width of existing rubber. Renewal of seals is recommended if permanent deflection in excess of half the design compression.)

Is the permanent deflection in the centre of the rubber and not to one side? (Non-central permanent set may indicate misalignment of panel)

Are the rubber seals free from deformation or tipping to one side?

Are corner pads, joints and end pieces intact and in correct position? Are they properly glued?

Are the hatch panel tops in corrosion-free condition and well coated? Are they free from pitting and wastage?

Are the undersides and internal structure of the hatch panels in corrosion-free condition and well coated?

Are the sides of the panels in way of the rubber seal retaining channel and edges in good condition and free from distortion?

Are seal retaining channels in good, corrosion free condition?

Are the cross-joint seal retaining channels straight and corrosion-free and channel supports and brackets in good condition?

Are the cross-joint compression bars in good scale-free condition, undamaged, straight and with uniform width?

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Are secondary drainage channels in scale-free condition, of adequate depth and drain freely into the coaming top water channel?

Are the covers free of any deficiencies such as:

- worn wheels/bearings or track-way
- hatch cover end distortion
- link pin wear, arm pin wear, pontoon cover locating guide wear
- hydraulic oil leaks or worn/damaged hoses
- Chain wear or elongation

Closure

Are the adjacent hatch cover panels in alignment, without one higher or lower than the next, or skewed relative to each other?

Is the necessary steel-to-steel contact or support correct?

Are the cleats correctly applied, that is applying an even holding down force?

Are the anti-lift bolts properly engaged and in sound condition, if fitted?

Are cross-joint wedges (where fitted) in place, operational and effective?

Are cross-joint wedge bridges strong?

Are cross-joint wedge support areas on panel tops in good condition, with end panel supports corrosion-free?

Do hatch panel sides form good steel-to-steel contact, with coaming tops without gaps?

Are sufficient spares onboard, such as cleats, preformed corner rubber sections, linear rubber?

Have closed and secured hatch cover panels been subjected to and proved weathertight by

a) Ultrasonic testing

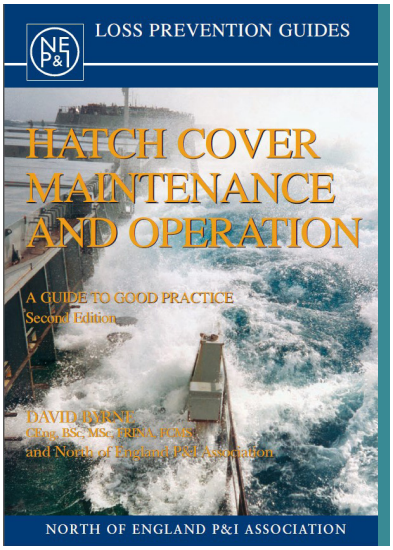
b) Hose testing using water pressure of about 2 bar pressure, through 15-18mm nozzle, aimed not more than 1 metre from and directly at, every part of the peripheral, cross-joint or split-joint seals?

Acknowledgements

The Association is very grateful to David Byrne for providing information for this briefing.

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

The Association is grateful to DNV GL for their contribution to the Preventative and Planned Maintenance section.



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