LOSS PREVENTION GUIDES

# HATCH COVER MAINTENANCE AND OPERATION

## A GUIDE TO GOOD PRACTICE

Second Edition

DAVID BYRNE
CEng, BSc, MSc, FRINA, FCMS
and North of England P&I Association

NORTH OF ENGLAND P&I ASSOCIATION

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# HATCH COVER MAINTENANCE AND OPERATION

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# FOREWORD

The first edition of this loss-prevention guide, published in 1997, has been widely distributed in the marine industry with the objective of helping to control the substantial level of claims associated with hatch covers. The guide continues to be found useful and so a second edition has been produced. This new edition brings the guide up to date with the addition of some new material; the opportunity has also been taken to revise the presentation.

The objective of the guide remains as before: to provide information in a simple and straightforward way to those onboard ship and those ashore who have an interest in the voyage. The aim is to provide practical guidance to the target audience of ship's officers, ship operator's technical staff, surveyors, lawyers and claims handlers.

The guide deals with hatch cover design principles, operation, maintenance and safety.

Appendices are included which provide checklists for routine onboard inspections, notes on recent IACS contributions to hatch cover design and operation, and a glossary of terms.

# *Chapter 1*

# BENEFITS OF KEEPING GOOD HATCH COVERS

The hatch cover is the single item of shipboard equipment that causes the largest and most expensive claims.

Around a third of all P&I claims are for damaged or lost cargo. Though not all cargo claims relate to hatch cover defects, internationally compiled statistics indicate that hatch covers, their seals and securing arrangements account for a very high proportion of reported cargoworthiness defects.

The overall value of claims arising from defective or poorly maintained hatch covers shows no signs of diminishing, despite considerable efforts in training and the raising of awareness. This guide demonstrates that useful improvements can be achieved without huge cost; often just being the application of good practice in operation and efficient maintenance in service.

The benefits of keeping hatch covers in good order are highlighted when the costs of good practice are balanced against the cost of failure to maintain weathertight integrity; for example, in the North of England P&I Association alone, there are typically three or four claims each year valued between US$500,000 and US$1,000,000 for water-damaged cargoes resulting from hatch cover defects, and very many of somewhat smaller cost. In general, the cost of preventing these losses will usually be measured in a few thousand dollars or less – such as replacing some defective rubber seals, repairing some minor steelwork or sometimes just cleaning down a coaming before closing the hatch covers. This guide aims to show just how easy it can be to avoid costly failures.

The problems associated with defective hatch covers are particularly severe in middle-aged ships, from 10 years to 20 years old, pointing to poor maintenance as a major contributory factor. However, whereas newer ships have fewer reported hatch cover problems, they are not free of them. The causes of loss are thus not solely due to the age or poor condition of the hatch covers on the vessel.

Even a perfect hatch cover can, in a moment of carelessness, become the vehicle of a commercial disaster. It is thus vital to consider both maintenance and operation.

# *Chapter 2*

# HATCH COVER DESIGN PRINCIPLES

The introduction of steel hatch covers some 70 years ago solved many of the problems associated with the earlier wood-and-tarpaulin arrangements. Unfortunately, while solving these problems, some new ones were introduced. Although the incidence of large-scale stoving-in or carrying away of hatch covers is now uncommon (although not unknown), the ingress of water is now an everyday event.

Modern hatch covers are relatively large, complex and unexpectedly refined pieces of engineering, which means that rather small errors or defects can have very damaging effects, far beyond that which everyday experience would lead us to expect (Fig.1).

The aim of this chapter is to introduce basic hatch cover design features and to describe how the various parts of the system are intended to work so that operation and maintenance can be better understood.

*Fig. 1 Damage to cargo caused by water ingress resulting from poor hatch cover condition*

## 2.1 TYPES OF HATCH COVER

The susceptibility of modern, relatively complex hatch covers to water ingress could be seen as the price for the undoubted convenience of such covers in terms of labour-saving and time-saving in port. This is what largely drove the introduction of the first steel hatch covers and has led, over the years, to a surprising variety of types of hatch cover, each finely-tuned to the need of a particular trade or ship configuration.

To assist in describing the many possible design variants, Table 1 gives a classification of the types of hatch cover in service today together with a list of the various operating systems which can be encountered. A full glossary of hatch cover terms can be found in appendix III.

*Table 1. Classification for hatch covers*

| Category | Sub-category | Panel arrangement | Operating system (see key) |
|---|---|---|---|
| Folding | High-stowing | Two-panel*<br>Three-panel (direct pull)*<br>Three/four- panel*<br>Four/six-panel*<br>Four/six-panel<br>* *Self-auto-cleating available* | A, B, C<br>B<br>A+D<br>A+E, B<br>E, B |
| | Low-stowing | Single-pull multi-panel<br>Compact-folding multi-panel | B, F, G<br>B, F |
| Rolling | Side-rolling<br>End-rolling<br>Telescopic | One/two-panel<br>One/two-panel<br>Multi-panel | F, H, I<br>F, H, I<br>B, F, M |
| Piggy-back | Side-stowing | | F, H, G, J, K |
| | End-stowing | Two-panel<br>Multi-panel (in pairs) | F, H, G, J, K<br>H, K |
| Stacking | | Multi-panel piggy-back | H, F, N |
| Lift away | | One/multi-panel (sequence or non-sequence cross-joints) | O |
| Coiling | Load-bearing<br>Non-load-bearing | | L<br>L |
| Miscellaneous | Inflatable canvas<br>Wooden boards + tarpaulins | | L<br>M |

| Key | Operating system |
|---|---|
| A | External cylinders |
| B | Wire operation (crane or winch) |
| C | Link mechanism |
| D | Bell crank |
| E | Link mechanism in one or more pairs |
| F | Long-chain drive |
| G | Fixed-chain drive |
| H | Hydraulic rack and pinion |
| I | Rack-wire system |
| J | Traction drive |
| K | High-lift cylinders |
| L | Electric or hydraulic motor |
| M | Manual |
| N | Coaming-mounted gantry |
| O | Crane or gantry |

### *Folding covers*

Folding covers may be fitted at both weather-deck and tween-deck hatchways. The simplest arrangement is two flat-topped, open-web panels (Fig. 2). This means that the top plates are supported and stiffened by webs and girders, but there are no closing plates on the underside. If closing plates are fitted, the panels are known as box or double-skin panels.

Fig. 3 shows the operation of a hydraulically operated pair with self-auto-cleating. The adjacent panels are hinged together so they can fold as shown.

When the hydraulic cylinder rod is extended out of the cylinder body, using the nearby controls, the panels first 'rack back' releasing the cleat wedges and then they peak and fold. The panels have wedges fitted around the sides which engage in similar wedges on the coaming, thus keeping the seal or gasket in contact with its compression bar.

When the covers are down and automatically cleated there is a firm contact between the side plate of the hatch cover panel and the coaming bar. Alternatively, a support pad arrangement is fitted to the coaming. In this position there is a

*Fig. 2. Hydraulic folding pair of hatch covers 'peaked' during opening*

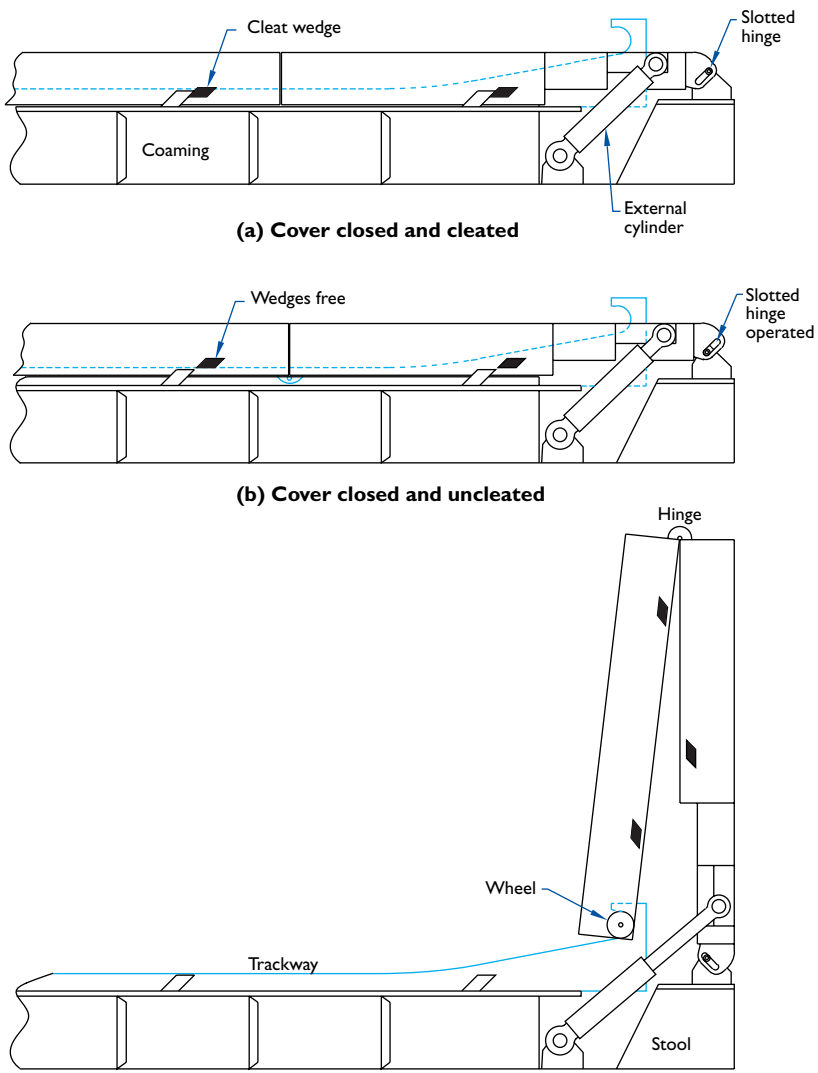



*Fig. 3. Rack-back operation of two-panel hydraulic hatch cover*

precise amount of compression of the seal rubber, usually expressed as, say, 8mm ± 2mm. The actual figures depend on the size and the type of seal fitted to the ship.

It is vital to appreciate that:

- the geometry of seal compression depends on, and is controlled by, the steel-to-steel contact
- the job of the cleats is to maintain, with some resilience, that steel-to-steel contact.

Opening a hydraulically operated folding hatch cover fitted with manual cleats is similar to that described above except that all of the cleats must be manually released prior to operating the hydraulics. This may seem obvious, but it is surprisingly easy to overlook a partially hidden cleat which is tucked away in an inaccessible spot.

In a four-panel arrangement, the cylinders are operated once the cleats are all released, causing the first pair of panels (the leading pair) to peak while the wheels of the second pair (the trailing pair) roll up onto their trackways (Fig. 4).

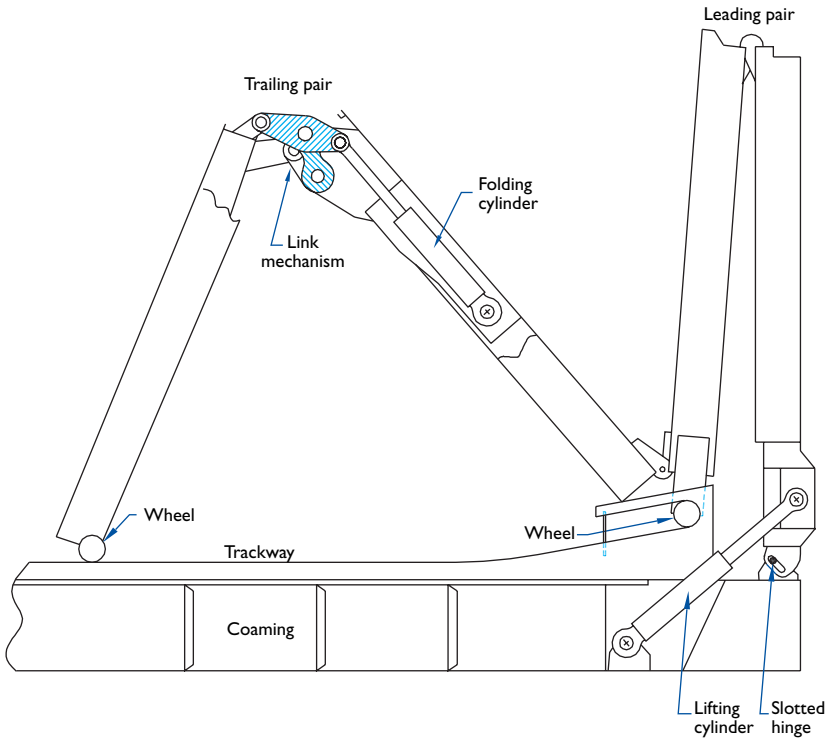



*Fig. 4. Four-panel hydraulically operated hatch cover*

The slotted hinge ensures that the open and closing action of the panels in the important last 100mm or so does not scuff or tear the seal.

When the leading pair are fully raised (or stowed), the trailing pair are raised by one or other of the available mechanisms.

- The link mechanism (Fig. 4) is an ingenious system of levers, operated by a hydraulic cylinder, which causes the two panels that it connects to close through 180°.
- The bell crank (Fig. 5) consists a pair of hydraulically operated arms, one each side, which engage in a lug or roller on the first panel of the trailing pair. The bell crank then rotates the panels to their final stowage position (Fig. 6).

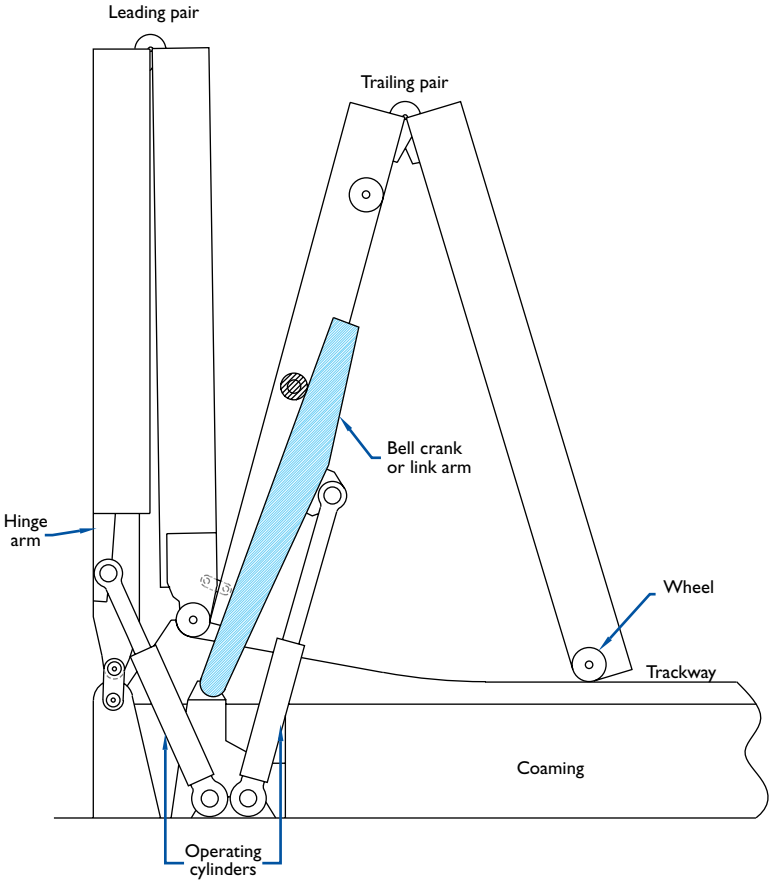



*Fig. 5. Four-panel hydraulically operated hatch cover*

Where there is an arrangement of hatch cover panels at each end of a hatch, for example a folding pair at each end, the centre joint where the two pairs meet is properly known as the 'split joint' whereas the other, hinged joints are known as 'cross-joints'. However, for the sake of clarity, cross-joint will be used to describe all hatch cover joints in this guide.

Wire-operated covers are frequently encountered in which there are no hydraulic cylinders. Wires led from the ship's winches or cargo cranes are used. A bull wire is led from the winch or crane through a sheave at the stowage end of the hatchway. When the wire is pulled by the crane, the covers fold open in the same way as hydraulic covers. Although there is a variety of wire rigging arrangements, the principles are all similar.

Single-pull folding covers can be operated by variety of wire and chain drives (Fig. 7).

In the stowage position, the panels are retained by stowage hooks. Prior to lowering, the weight is taken off the hooks, the hooks are released and then the panels will freely roll down the trackways under gravity, restrained only by the bull wire.

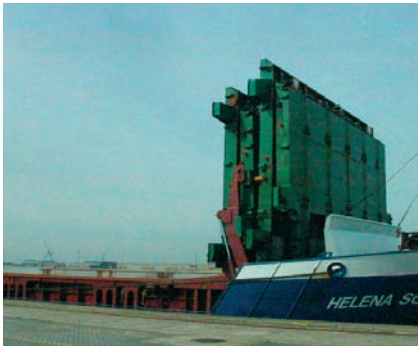



*Fig. 6. Four-panel hatch cover*

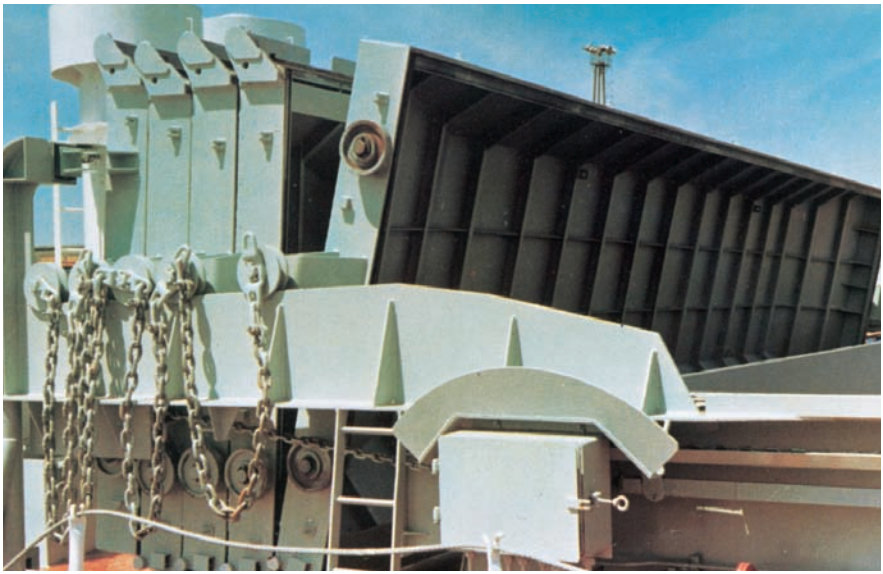


*Fig. 7. Single-pull hatch covers with long-chain drive operation*

*Rolling covers*

Side-rolling covers usually consist of two large panels at each hatchway. They are fitted with wheels which roll along a track at both sides of the coaming top. Stowage rails extend this track via pillars welded to the deck (Fig. 8).

To open the covers, the cleats are first released. These may be manual quick-acting cleats (Fig. 9), which are applied using a portable lever, or hydraulic wedges of various designs. The covers are then raised to the rolling level by pot lifts – these are simply hydraulic jacks which raise a short section of rail to bring the rolling wheels up to the running level.

The covers are then rolled to each side using a hydraulically driven rack-and-pinion or a toothed-wheel drive. This type of drive may be fitted port and starboard or, often, only to one side. In the latter case a continuous wire connects both panels so that, as the hydraulically driven panel opens, the other panel is also pulled open by the wire. This is known as rack-wire operation.

As with folding covers, the seal compression is accurately controlled by steel support pads, which are sized to give the correct compression when the steel-to-steel contact occurs.

Closing the cover is the reverse process. As the pot lifts are lowered, wedge-shaped battening devices fitted to the panels engage in mating devices on the coaming on each side of the cross-joint. This wedging action forces the compression bar on one panel into the seal on the other panel.

The maintenance of good compression on the cross-joint is vital

*Fig. 8. Side-rolling hatch covers*

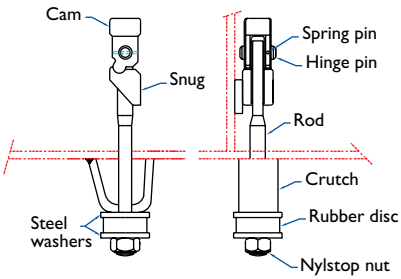



*Fig. 9. Quick-acting cleat*

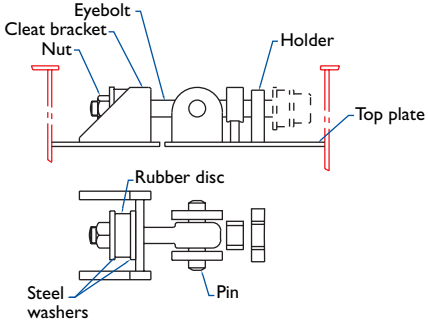
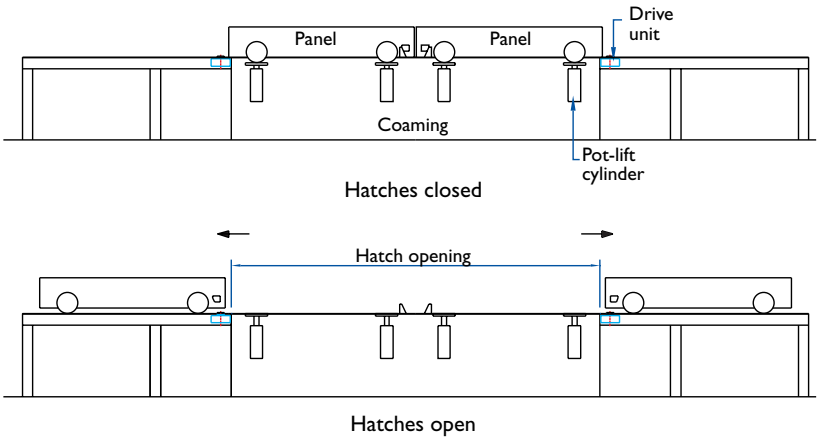


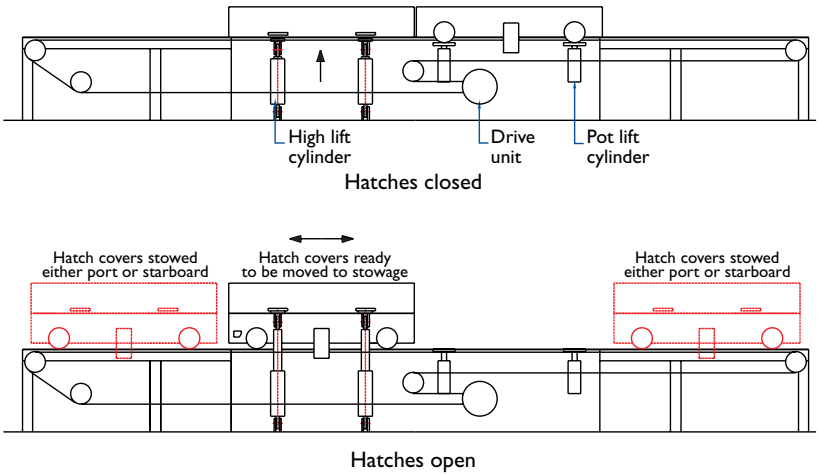

*Fig. 10. Top cleat assembly*

– many of the leakages reported on hatch covers arise here. Additional cross-joint cleats are fitted on many ships in order to keep this joint tight (Fig. 10).

A development of the side-rolling cover is the piggy-back or lift-and-roll cover (Fig. 11). In this case, a dumb panel with no wheels is lifted vertically upwards by four hydraulic lift cylinders fitted to the coaming. These engage in lugs on the




**Side-rolling rack and pinion operation**




**Side-rolling , chain drive 'piggy back'**

*Fig. 11. Side-rolling hatch covers)*

*Fig. 12. Typical multi-stacking hatch covers showing four panels stacked and two panels rolling beneath*

sides of the dumb panel and lift it high enough above the coaming for a rolling panel to be moved underneath.

The dumb panel is then lowered onto the rolling panel, which can then be pulled or driven to one side or one end of the hatch opening.

### *Stacking covers*

A further development, often seen on small/medium-sized bulk carriers, especially coastal vessels, is the multi-panel stacking hatch cover. In this arrangement, at least one panel out of, say, seven panels, fitted to a one-hatch ship, is a dumb panel lifted by four cylinders (Fig. 12).

The hatch opening can be opened completely or partially by lifting the dumb panel and rolling the first rolling panel underneath. The dumb panel is then

*Fig. 13. Gantry crane operation of hatch covers*

lowered onto the rolling panel. The cylinders continue to lower until the lifting head clicks underneath lifting lugs on the rolling panel. This enables the two panels to be lifted together, enabling a third panel to be rolled underneath, and then all three lifted, and so on.

The rolling panels are powered horizontally by a long-chain drive which, as its name suggests, consists of a long endless chain drive by a hydraulic motor and gypsy wheel at one end. The rolling panels can be hitched to this drive chain, as required, to pull them along.

A variant which has become very popular with smaller vessels consists of a travelling gantry which runs on the coamings and can pick up any panel and transfer it along the hatch to a stack forward or aft. This avoids the need for systems to drive panels up and down the coaming and has the great merit of being simple to operate and maintain (Fig. 13).

### *Lift-away or pontoon covers*

Lift-away or pontoon covers, as fitted to container ships, are sized to be able to be lifted by shore-side container gantry cranes (about 30 tonnes in weight and about 14 metres in length). They may not always have rubber seals and the cleats are more in the nature of anti-lift bolts to resist upward forces generated by stacks of containers loaded on top of the covers.

The panels always have large locators to absorb athwartships and longitudinal forces caused by deformation of the coaming when such open-hatch ships are working in a seaway. The panels rest on a number of rectangular support pads which have to support the massive container loads and slide as the hull flexes at sea. These support pads were originally steel blocks, sometimes with the hatch cover block being specified as harder than the block on the coaming. Because of increasing loads of containers on the hatch covers, these blocks are now often made of low-friction, wear-resistant composites.

## 2.2 BASIC DESIGN FEATURES

Hatch covers are not simply dumb ‘lids’, they are rather complex objects which, although large in size, rely on precise millimetric tolerances for their correct performance.

All the skills of the designers, maintainers and operators should be directed to the same purpose:

**To defend the thin line where the compression bar and the seal rubber meet.**

The difference between a cargo delivered undamaged and one expensively damaged will often be just a few millimetres of wear or movement. Any weakness at this thin line will be found by the sea.

Before starting the design, the designer will need to know from the owner or the shipyard the key design requirements, such as:

- size of clear openings
- method of operation preferred
- deck cargo loadings
- sea loads
- cargo characteristics
- estimated coaming movement
- stowage space available
- single skin / double skin panels.

From this, a design will be produced which deals with the following five main design issues:

- STRENGTH
- SECURITY
- SEALING
- SUPPORT
- SAFETY

*Strength*

The structure must be strong enough to withstand:

- loads coming from inside the hatch covers, such as those due to sloshing water ballast
- loads coming from outside the hatch, such as seawater over decks and hatches
- loads coming from cargo loaded on top of hatch covers.

The hatch cover must not experience any main hull girder stresses, rather it must 'float' on the coaming as the ship bends and twists at sea.

*Security*

- There must be means fitted to prevent the hatch cover sliding longitudinally or athwartships when at sea.
- There must be means of keeping the hatch cover in contact with the coaming (cleats).
- Cleats need to be resilient to allow for small horizontal and vertical coaming movements at sea.

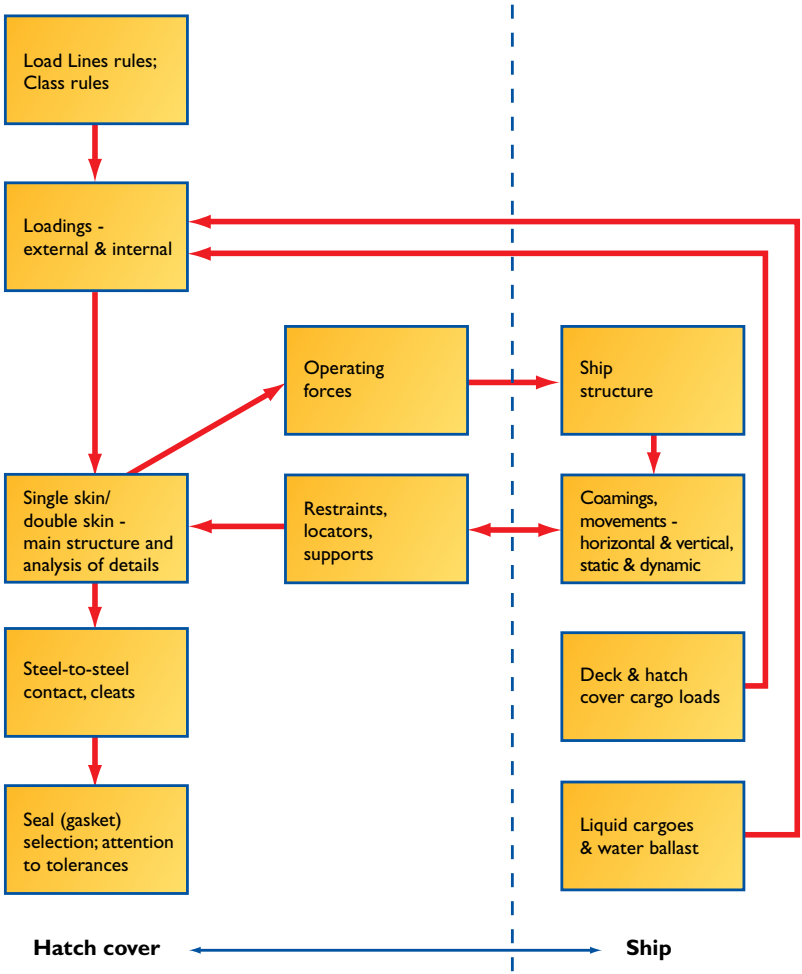



*Fig. 14. Simplified hatch cover design process*

*Sealing*

- Water must be kept out of the ships holds – an obvious requirement but one often not met.
- Cargo must be kept inside (relevant in the case of OBOs, in particular, when carrying oil).
- Seal material must be compatible with cargo carried.
- Seal must be resilient or elastic enough to make up for hull and coaming deformations.
- Seal must be easily maintained.
- Seal must be suitable for expected weather conditions, such as Arctic routes.

*Support*

- The hatch covers need to be supported on a sufficient number of steel-to-steel supports.
- Support pads need to allow for sliding as the hull and coaming deform at sea.

*Safety*

- The hatch covers must be able to be operated without endangering personnel up to the maximum angles of heel and trim which are specified.
- Covers must be able to be fully secured in the open position and released without endangering personnel.
- All fittings used for routine or emergency operation must be of adequate strength.

Fig. 14 summarises the key factors in the design of hatch covers.

It will be noticed that many of the points above relate to the behaviour of the ship at sea, in a seaway. It is essential to see the hatch cover as a dynamic (or mobile) object on the coaming rather than a simple static device. This is particularly relevant when considering testing for weathertightness.

It is common for hatch covers to pass a hose test in port (see chapter 3.7) but to leak when the ship is at sea. This apparent contradiction is one that causes much surprise and dismay, but it should not to those who know that the 'thin line' (where the seal squeezes against the compression bar) will be constantly challenged by relative movements between hatch cover and coaming at sea and leakage will occur where there is any weakness.

*Weathertightness*

The statutory requirements contained in Regulation 3(12) of the International Convention on Load Lines 1966, and Protocol of 1988, states:

**Weathertight means that in any sea conditions water will not penetrate into the ship.**

'Weathertight' therefore means sealed against fluid coming from one side of the seal (the 'weather' side). It does not mean a lower standard of seal than watertightness – only that it is primarily in one direction, whereas watertightness is in both directions across the seal (up to a certain maximum pressure head).

In the departure port prior to loading, a ship's hatch covers should be tested (see chapter 3.7) and, if no leaks are detected, then it could be said to be 'seaworthy' as far as the hatch covers are concerned (see chapter 5).

When the ship is at sea and acting in a seaway and there is relative movement between hatch covers and coamings, it should remain weathertight, safely carrying the cargo.

The only exception to this would be where the sea conditions were abnormal or beyond the worst normally expected, in which case loss of cargoworthiness could be claimed to be due to a peril of the sea and therefore not the owner's fault. This would generally appear to be a difficult defence and, among other things, would require evidence of diligent and regular inspection and maintenance of the hatch cover system. Such evidence would include:

- work schedules
- maintenance logs
- work specifications
- accounts
- standing instructions
- reports and contemporaneous correspondence
- log book entries.

The collation of maintenance records should be integral to, and part of, shipowners' safety management, quality management and International Safety Management (ISM) Code procedure manuals.

Note that the comments above are given in a technical sense and do not constitute a legal interpretation.

## 2.3 RECENT CHANGES TO HATCH COVER DESIGN RULES

### *IACS Unified Requirement UR S21*

Classification societies began to re-evaluate their regulations for hatch cover and coaming design in the mid-1990s after a number of casualties raised concerns that the strength requirements of the Load Line Convention might be inadequate. The International Association of Classification Societies (IACS) decided to introduce new, improved design rules over a period from 1997 to 2003. These rules were to be applied to new bulk carriers, ore carriers and combination carriers.

The new design rules built upon the old hatch cover design rules but increased the strength of forward-end hatch covers significantly to resist green-water loadings. The result is hatch covers at the forward end that are at least twice as strong as older covers (hatch covers aft of number 2 hatch are usually similar to those designed to the earlier rules).

Coamings were also increased in strength against wave impact and new hatch covers are now to be fitted with stoppers to resist wave impact which might otherwise push the hatch covers off the coamings, with number 1 hatch being given extra strength. Additionally, corrosion was allowed for by increasing hatch cover steel thicknesses by 2mm.

### *IACS Unified Requirement UR 30*

In 2003 IACS introduced a further requirement (UR S30) for existing bulk carriers to upgrade their number 1 and 2 hatch covers, recognising that the risk of hatch covers being impacted by green seas needed to be considered on existing ships as well as newly-built ones. The new design rules require cleats to be of a defined strength and stoppers to be fitted to the coamings to absorb specified longitudinal and transverse sea loadings.

Existing bulk carriers are required to comply with the new rules on a rolling basis, with older ships (15 years or more as at 1 January 2004) being required to incorporate the changes soonest and newer ships having longer to comply.

## 2.4 IMPORTANCE OF STEEL-TO-STEEL GEOMETRY

As described in section 2.1, the achievement of weathertightness is heavily dependant on the quite precise extent of penetration of the hatch cover seal rubber by the compression bar on the coaming: too much or too little penetration is bad. Too much will quickly damage the seal rubber and cause rapid failure of the seal. Too little can allow seawater to get past the seal, especially when the ship is rolling and pitching in waves. The extent of the penetration is controlled by what is referred to as 'steel-to-steel' geometry.

This simply refers to the fact that the hatch cover is designed such that when it rests, with steel-to-steel contact between the side plate or the support pads and the coaming, the geometric relationship between the compression bar and the seal rubber is exactly right.

Of course, when the side plates or the support pads become corroded or worn down the relationship between the compression bar and the seal becomes incorrect, leading to rapid breakdown of the seal and water ingress.

The same general principles apply to sliding rubber types of seal.

If this important feature of hatch cover design is appreciated, then many of the problems of leaking hatch covers can be avoided. Often the remedial steelwork repairs are quite minor considering the great savings in potential costs of claims which may be so avoided.

## 2.5 SEALING ARRANGEMENTS

As emphasised in section 2.1, hatch covers rely for effective weathertightness on a thin line of contact between the rubber seal and the compression bar. The compression bar is usually about 40mm to 50mm in height and 16mm wide, preferably with the top edge made of a stainless-steel round bar welded to a supporting flat bar. This helps to avoid the problems associated with corroding compression bar tops.

In this guide the rubber seal is simply referred to as the 'seal'. It is also known as the 'gasket', 'packing' or 'waterseal', and is often just called 'the hatch rubber'. Whatever it is labelled, it is the single most important component in the hatch cover system. The vast majority of leakages are not due to obscure technical defects, but to seals that are overdue for replacement.

On ships where relative movements between seal and compression bar/coaming are expected to be small, then the familiar rectangular rubber seal will be fitted (Fig. 15).

If, however, coaming movements are expected to be significant, the designer will consider fitting a sliding rubber acting directly on the coaming or, sometimes, on a

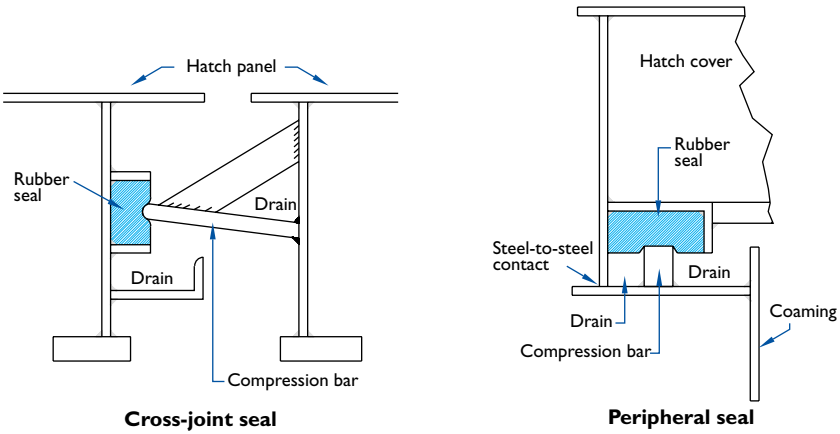



*Fig. 15. Seal arrangements—cross-joint seal (left) and peripheral seal (right and photograph)*

stainless-steel plate attached to the coaming (Fig. 16).

Fig. 17 illustrates typical cross-sections of rubber seals.

Cross-section (a) is of box-type rubber found in many applications. This seal employs a sponge core of natural rubber which has excellent resilience and strength. The outer 'box' of rubber can be either neoprene rubber for regular cargoes, or a nitrile rubber, more suitable for oil cargoes on oil-bulk-ore (OBO) vessels, for example. Typical sizes of such seals are about 80mm x 40mm or 90mm x 50mm with designed compressions of 10mm ± 3mm and 13mm ± 3mm respectively.

Cross-section (c) is an extruded hollow section which might be found on a side-rolling cover fitted to a bulk-carrier. In this case, the designed compression would be about 12mm ± 3mm.

Cross-section (d) is of a sliding rubber, suitable for container ships or vessels with large open hatchways, where coaming movement will be a problem. This type of seal allows more movement between hatch cover and coming than the box-type of seal. This type of seal will typically be about 70mm x 70mm, with a designed compression of about 12mm ± 8mm.

In addition to the familiar types of seal described above, various special seals have been developed which are designed to deal with specific operational problems. Examples of these are double-lip seals (cross-section (e)) which provide extra sealing capability for OBO hatch covers.

Another problem which hatch cover designers have tried to overcome is the design of cross-joints on lift-away covers where 'non-sequenced' operation is required. In conventional cross-joint design there is a necessary sequence to the removal of lift-away panels because of the overlap of the seals and drains in the

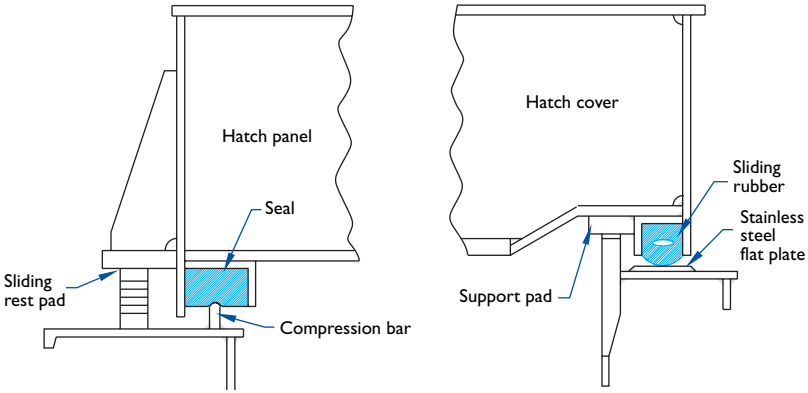



*Fig. 16. Sealing arrangements where coaming movements may be significant*

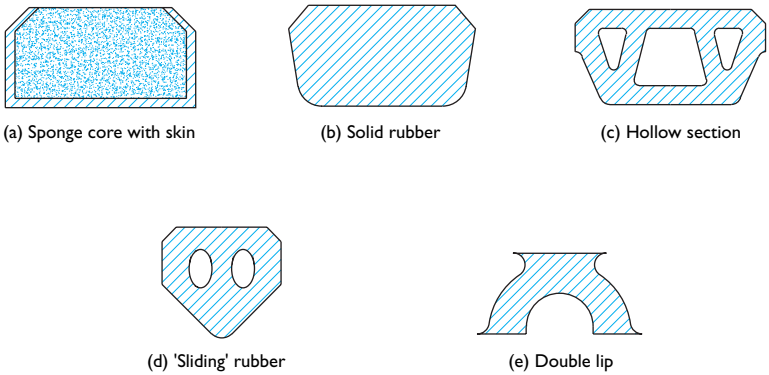



*Fig. 17. Typical cross sections of hatch cover seals*

cross-joint. Non-sequenced operation is extremely convenient if it can be achieved. One fairly recent development which aims to achieve this is the inflatable-type seal. In this design the seal consists of a thick rubber tube having within it two plastic tubes which can be inflated, causing the outer tube to pull back from the sealed position, or deflated, causing the outer tube to press hard against the counter packing on the opposite panel (Fig. 18).

Although desirable operationally, experience in service with this type of cross-joint seal has been mixed. The price of operational flexibility is a complex and easily damaged system which is expensive to keep serviceable.

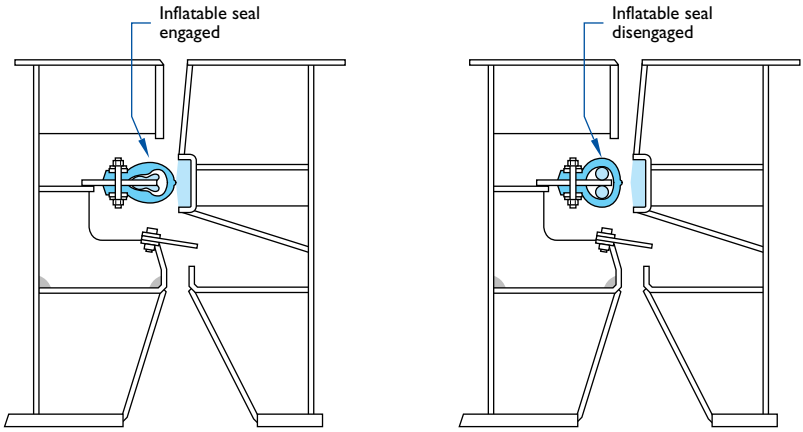



*Fig. 18. Inflatable seal*

A frequently asked question is 'at what stage should the seal be replaced?' Leaving aside tearing or accidental removal, the rate of ageing of the rubber depends on many factors, but a prime cause of early failure is over-compression caused by corrosion or breakdown of the steel-to-steel contact, which should exactly set the compression of the seal. When this control is lost, it is common for cleats to be over-tightened in an attempt to compensate – this leads to accelerated seal wear and can result in cleat fractures.

However, even on a ship where the seal compression remains accurately set up, the seal will eventually begin to harden and take on a permanent set. This is a groove in the rubber which is easily seen and measured when the covers are open.

A good rule of thumb for when the seal has reached the point of replacement is

**WHEN PERMANENT SET REACHES HALF THE DESIGN COMPRESSION REPLACE THE SEAL**

Failure to replace the seal at this time will jeopardise the weathertight integrity of the hatch covers because, with some compression remaining, the hatch covers may pass a hose test. If they do, however, they will still be prone to leakage when underway at sea. When the compression becomes small, water can pump across the compression bar or migrate through rust scale.

Owners, managers and superintendents should take note of the replacement rule. The use of hatch sealing tape (see chapter 3.8) does not change the rule.

## 2.6 DRAINAGE

Hatch covers are relatively large objects and even a well-maintained cover may experience some slight leakage through, say, a localised defect. In this case, the final line of defence is the drainage system.

Most covers that will be met in service have a double-drainage system (Fig. 15). Any water which gets past the first drain is captured by the secondary drain channel.

The peripheral drain channels are formed by the compression bar and the coaming upstand. This upstand is easily damaged by grabs and wires but should be kept in good order. The channels lead the collected water to drain pipes, one at each corner of the coaming.

Each drain pipe should be fitted with a non-return drain valve (Fig. 19). This permits water to drain freely onto the deck but stops water from the deck entering the hold. It is common to see these valves removed and a length of old fire hose attached to the drain pipe – this is reasonably practical, especially with cargoes that continually block the valves, but it cannot be recommended as anything other than an emergency measure.

The cross-joint primary drains are sloped to each side so that water flows to holes in the hatch cover side plates and then drains freely to the deck (Fig. 20).

The secondary drain channel leads any water to the peripheral channels.

Drainage channels and non-return valves require regular attention to ensure that they are kept free of obstructions.

Blockage of the drain channels, non-return valves or socks by cargo residues is, after defective seals, one of the largest causes of serious cargo damage. In addition to blockage by cargo residues, it is worth noting that excessive use of marine hatch sealing tape can also close off cross-joint drains and is not advisable.

Similarly, the use of high-expansion foam to achieve improvised additional weathertightness can, unfortunately, have the opposite effect as the foam expands to block the drain channels and drains.

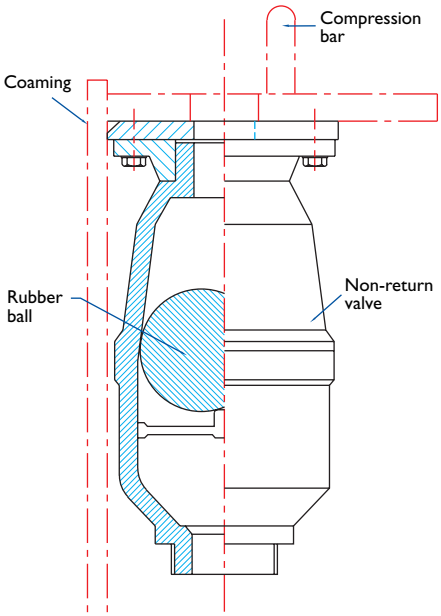



*Fig. 19. Hatch cover non-return drain valve*

*Fig. 20. Cross-joint of a corroded hatch cover showing the compression bar with drain channel below it and drain hole in the side plate*

## 2.7 SECURING

The cleats around the periphery of the hatch cover provide vertical restraint (stop the panel lifting) while permitting some relative movement between the coaming and the cover.

Except in the case of the lightest of hatch covers, the cleats do *not* pull the cover down, thereby compressing the seal. The weight of the cover will compress the seal, at a rate of around 5kN per linear metre of seal, until steel-to-steel contact is obtained either on the hatch cover side plates or on support pads (Fig. 16). The concept of the steel-to-steel contact accurately controlling the compression of the seal is centrally important to the achievement of weathertightness, as described in section 2.4.

The peripheral cleats may be manual, quick-acting, automatic (see section 2.1) or hydraulically actuated and of various hook or wedge designs.

In the case of quick-acting cleats, the resilience is provided by the rubber washer positioned between two steel washers. There is also a steel spacer washer inside the rubber washer which prevents over-compression of the rubber washer (Fig. 9).

If quick-acting cleats are over-tightened, the steel washers bottom out on the internal spacer and the resilience is lost. This can lead to cleat or hatch panel damage and must be avoided.

Cleats are also required on the cross-joints, where the panels meet. They control the cross-joint seal compression in a similar way to the peripheral cleats. Manually operated cross-joint wedges, screw cleats (Fig. 10) or quick-acting cleats are commonly seen and, if well maintained, are both simple and effective.

Torsion-bar operated automatic cross-joint seals are intended to be labour-saving, but experience suggests that they may not be reliably weathertight.

Various types of hydraulically operated swing seals are occasionally fitted, and are satisfactory when new, but they do not usually age well and are difficult to maintain.

Side-rolling covers are frequently fitted with an indirect cross-joint cleating arrangement, where wedge-shaped battening devices attached to the covers engage in coaming sockets, causing the panels to be forced together as they are lowered onto the coaming (Fig. 21).

The cross-joint seal compression depends entirely on these wedges working properly – any wear in the wedge or the mating wear plate must be made good otherwise the cross-joint can open.

## 2.8 LOCATORS

Virtually all types of hatch covers have restraints or locators fitted to them to absorb longitudinal and athwartships forces which they will experience due to ship motions at sea. These restraints may be quite small on hatch covers which do not carry any cargo on top and which are subject only to sea loads. At the other

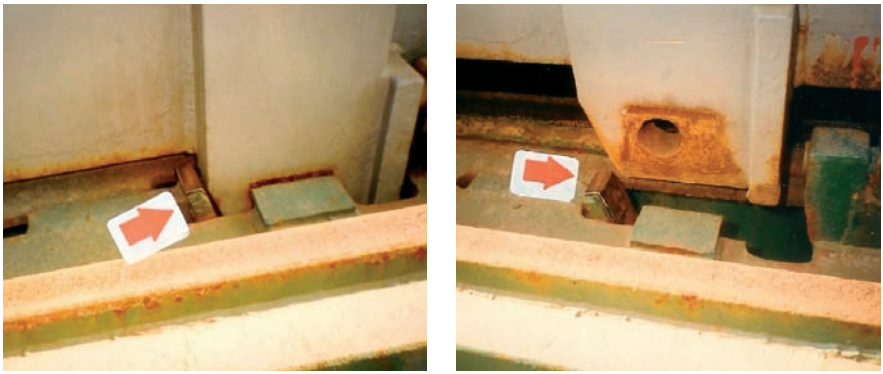


*Fig. 21. Battening device on side-rolling cover – engaged (left) and disengaged (right)*

extreme, container ships with many containers loaded on top of the hatch cover panel will have massive locators.

The difficulty is that the hatch opening does not generally stay in a flat rectangular shape when the ship is acting in a seaway – it twists and stretches back and forth as the ship rides over and through the waves and also changes shape as cargo is loaded into the hold and adjacent holds when in port. The extent of this coaming movement is most severe on ships having long and/or wide hatch openings.

The intention is for the locators to keep the seals and the hatch cover in the correct alignment with the compression bar/coaming. But there must be enough clearance in the locators to avoid the hatch covers picking up main hull forces when the ship is moving at sea (Fig. 22).

The design of locators is therefore complex, depending on the behaviour of the ship's hull, the type of hatch cover and the loads imposed on the cover.

*Fig. 22. Hatch cover locator, showing clearances*

## 2.9 PROBLEMS FROM NEW

Hatch cover systems are not easy to design or to construct and it would not be surprising to find some design problems in service. Generally these are identified early in the life of a hatch cover during the guarantee period and are rectified.

There are, however, aspects of the design and supply of hatch covers which have a negative impact on their in-service performance. For example:

- poor corrosion protection when new
- poor or inadequately sited hydraulic pipework and components
- accelerated seal wear due to poor design of the total system
- design to minimum scantlings.

The shipowner or manager can have a long-term effect on the above by specifying the quality it requires when commissioning newbuildings.

The crew, however, can only make the best of it and report back such basic problems to the owner or manager and to the hatch cover supplier's engineers.

*Poor corrosion protection when new*

Often, hatch cover manufacturers supply the covers to the shipyard in blasted and primed condition only – the shipyard then applies the finishing coats, sometimes after installation onboard the ship. All of the awkward places therefore can start life poorly coated and within the first few years will have started such a rapid deterioration that the crew will never catch up with it. The awkward areas include the cross-joint end plates, seal channels and the internal structure in general.

*Poor or inadequately sited hydraulic pipework and components*

In the harsh environment of a ship's weather deck, only hydraulic components of the highest quality will survive in the medium to long term. Cost cutting when specifying or purchasing will lead to very rapid deterioration of controls and valves and, as usual, will turn out to be more expensive eventually.

The steel cabinets which house the control are often surprisingly primitive – a tiny investment at the start of the ship's life in providing a reasonably weathertight cabinet would pay great dividends in the long term.

The siting of hydraulic piping affects, among other things, the ability of the shipyard to paint the pipes and the same is true for the crew which subsequently maintains the system. If pipes are run too close to plates or are inaccessible, then they will start off badly painted and will fairly soon require total replacement – despite being rather heavy-wall pipe.

*Accelerated seal wear*

There are many possible causes of accelerated seal wear attributable to design of the covers.

If it is assumed that the covers have been properly installed, then most of the problems of accelerated wear come from the following:

- unexpectedly large relative movement between hatch cover and coaming
- large vertical deflections of hatch cover corners – usually associated with double-skin covers, either due to solar heating of the top plating, causing the cover corners to bend slightly downwards, or when cargo (such as timber or containers) is loaded on top, causing the corners can bend upwards.

Cleats are usually fitted at, or near, the corners to try to manage these effects on double-skin covers. These cleats are often inaccessible, easily overlooked and are always heavily loaded. To reduce the extent of solar heating it is beneficial to paint double-skin covers a light colour, such as grey or silver.

***Design to minimum scantlings***

Commercial pressures on all concerned mean that new hatch covers are almost always built to the minimum scantlings required by the classification societies. However, bearing in mind the potential problems with the coating of new hatch covers, it will be no surprise that at 15 to 20 years of hatch cover life they will have lost a substantial amount of their original strength through corrosion, particularly of the underside structures. What this means in practice is that hatch covers, particularly at the forward end, can collapse under the force of seas coming aboard, potentially leading to total loss of the ship.

# *Chapter 3*

# OPERATION

## 3.1 SAFETY

All hatch covers, but particularly those fitted to dry cargo vessels, are potentially dangerous objects. They move quite quickly, very often with no audible or visible alarms to give warning of their movement. They are manoeuvred by heavily-loaded wire arrangements, hydraulic cylinders or chains and often make use of gravity, particularly when closing.

On container vessels with lift-away covers, extreme care should be taken when in the vicinity of a cover being lifted by a crane. At no time should personnel stand under the lifted cover.

Reference is made here to the recommendations given in the associated loss-prevention guide *Personal Injury Prevention – A Guide To Good Practice*.

The training of shipboard staff in the safe operation of hatch covers is imperative. By implication, such training is a requirement of the ISM Code and shipowners should ensure all crew likely to be involved in hatch cover operations are fully trained.

Additional safety recommendations specific to hatch covers include:

- ensure that all cross-joint cleats or wedges are disengaged prior to attempting to open the hatch covers
- do not climb onto moving hatch covers
- ensure that panels are secured in the open or stowed position prior to personnel working in the vicinity
- keep clear of moving covers
- use all means of communication available to ensure that all nearby personnel (crew and stevedores) know a hatch cover movement is imminent
- check the stowage area of the cover prior to movement, to ensure that there are no personnel lying injured (or asleep!) in that zone
- during maintenance at sea, ensure the covers are fully secured when open and that safety fences are rigged to prevent falls into empty holds
- do not put fingers under side plates when the panel is rolling
- side-rolling covers on bulk carriers when open, and paired hatch covers on which cargo can be secured with the other pair open, require safety fencing which should consist of portable stanchions with an upper and lower safety wire
- when using glues to repair seals, it is important to obey instructions on the glue packaging.

The hatch cover supplier's manual contains operating and safety instructions specific to the equipment fitted on the ship. Those persons onboard responsible for opening and closing of hatch covers must be required to read and understand the hatch cover operating and maintenance manual as part of the induction training when they first join the ship. It is not sufficient to be shown the operation.

On most conventional ships fitted with steel hatch covers, safe operation requires to least two crewmembers and an officer. Both the officer and crew are responsible for safety and the correct operation of all associated components.

## 3.2 CLOSING AND OPENING

Although hatch covers can be damaged and distorted due to impact by cargo or grabs, a common cause of panel deformation is failure of the operating gear or hitting an obstruction on the trackway. Always check that there are no obstructions along or across the trackway prior to closing the covers. If the panels are not closing evenly, stop the operation and call a maintainer.

It is very common for cargo residues from bulk cargoes such as iron ore, grain, coal or cement to solidify in the drain channels and the drain valves or socks (Fig. 23). Prior to closure, it is imperative that the peripheral and cross-joint drain channels and the trackways are scraped and swept clear, the drain valve should be checked for clear drainage and the canvas sock, if fitted, should be poked through with a marlin spike or a piece of broom handle.

Quick-acting cleats are occasionally left across the trackway, particularly the saddle type. Prior to closure check that all cleats are clear of the tracks.

In freezing conditions the hatch rubber tends to stick to the compression bar during closing. A non-organic grease or commercial glycerine should be spread on the compression bar prior to closure.

*Fig. 23. Blocked drain*

## 3.3 SECURING

Once the hatch cover has folded or rolled into the closed position and is down, ready for cleating, all of the cleats have to be correctly applied. This sounds like a statement of the obvious, but it is easy to miss cleats, especially at night in poor weather with the ship making ready for sea and probably with more than one crewmember involved.

Similarly:

- cross-joint wedges must all be present and all hammered home, starting with those on the centreline and working towards the sides
- if cross-joint bolts are fitted, they should all be applied and made tight
- on single-pull hatches, all of the eccentric wheels must be turned to the correct position to lower the hatch panels
- if hydraulic hook or wedge cleats are fitted, they must be checked for correct engagement
- the position of external locators in their sockets or wedges should be noted
- if cargo is to be loaded on top of the covers, check that the type and quantity of cargo proposed is within the loading limits of the covers, according to the manufacturer's manual
- also check that all crane jibs and derricks are properly secured to avoid any possibility of them becoming dislodged from their supporting crutches, causing them to fall and damage the hatch covers below.

## 3.4 COMMON PROBLEMS

*Hatch cover defects – top 10*

The top 10 hatch cover defects affecting claims for water damage are based on experience of very many hatch cover surveys and damage claims. In most cases, the cost of early remedial work to avoid possibly significant claims is not large.

1. Seal-rubber permanent set beyond the point of replacement (Fig. 24).
2. Seal rubber torn, displaced or missing – including the cross-joints (Fig. 25).
3. Poor quality or temporary seal 'fixes' (Fig. 26).
4. Wastage of steel support pads or coaming side plates – causes over-compression of seal and subsequent damage (Fig. 27).
5. Blocked drain holes in hatch covers and coaming corners (Fig. 23).
6. Wasted cross-joint drain channels.
7. Cross-joint cleating or alignment faulty.
8. Cleats and cleat-support stools wasted or missing (Fig. 29).
9. Wear on the centreline wedge devices on side-rolling covers – causes cross-joint to open when the ship is at sea (Fig. 21).
10. Holes in the steel plating caused by corrosion, possibly localised (Fig. 30).

*Fig. 24. Seal in very poor condition, showing permanent set*

*Fig. 25. Cross-joint seal*

*Fig. 26. Example of a temporary rubber attached to the compression bar to compensate for worn seal rubber*

*Fig. 27. Support blocks*

*Fig. 28. Cross-joint sealing arrangements*

*Fig. 29. Cleat and cleat snug in poor condition*

*Fig. 30. Localised severe corrosion*

Figs. 31 and 32 illustrate these defects on a folding hatch cover and a side-rolling hatch cover.

## 3.5 INSPECTION BY ONBOARD STAFF

In addition to surveys carried out by class surveyors or cargo interests, regular inspections carried out by the ship's crew are extremely valuable and should be planned. These inspections should include checks on the operation, the structural integrity and the weathertightness of the hatch covers. Records of these regular inspections must be kept and any remedial actions taken when defects are found – these will provide helpful evidence of diligent maintenance.

## 3.6 SURVEYS

An annual survey is performed by a classification society surveyor as part of class requirements and also by the load-line-assigning authority. The annual survey looks for significant changes to the hatch cover system since the last survey. The surveyor also checks the condition of seals, compression bars, tracks, cleats, stoppers and the panel structures themselves. Usually, this survey will be done while the ship is working cargo so conditions will not be ideal.

A special hatch cover survey is required at a maximum interval of five years, normally as part of the hull special survey. This survey is similar in scope to the annual survey but requires a hose test or equivalent and thickness measurements of plate and structural stiffeners.

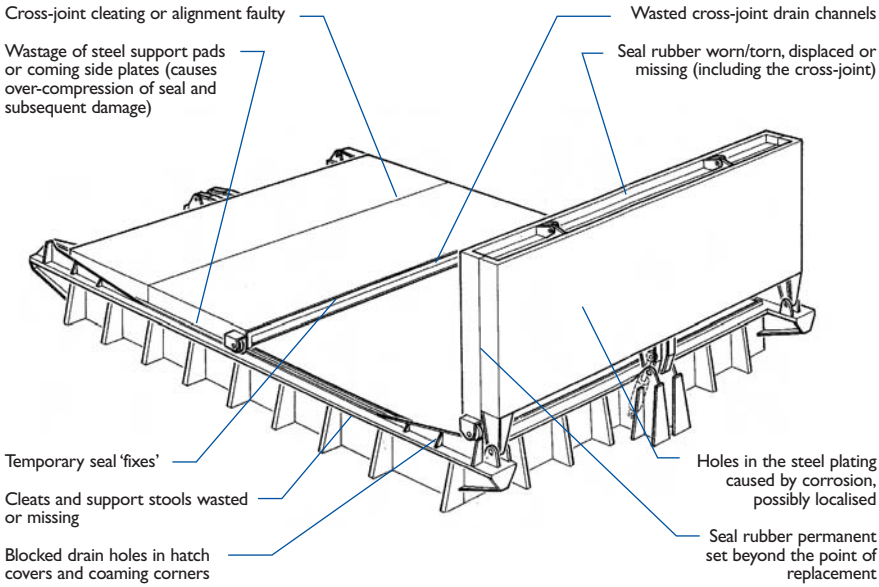



*Fig. 31. Identification of hatch cover defects – folding hatch covers*

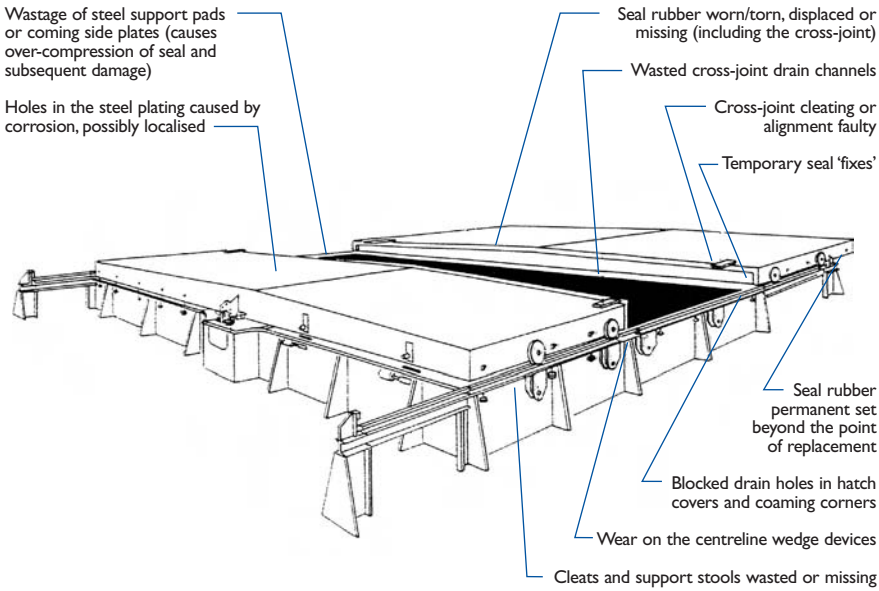



*Fig. 32. Identification of hatch cover defects – side-rolling covers*

At the second special class survey, probably at 10 years, a very thorough hatch cover survey should be conducted as this is the peak time for hatch cover defects.

Hatch cover surveys are also carried out from time to time by surveyors acting on behalf of charterers, P&I clubs or cargo interests. These are usually conducted before loading or immediately prior to departure or at 'on hire'. The surveys are primarily to ensure that the cargo is adequately protected against seawater ingress.

Cargo surveys prior to commencing discharge will reveal if the measures taken have been successful. If there is water ingress damage it will usually follow the pattern of the cross-joint and coaming seals.

However, some of the most important surveyors are the ship's personnel, who should know the hatch covers well and keep a close eye on them. The checklists given in appendix II are a useful means of recording the onboard surveys which should be made at every opportunity.

## 3.7 TESTING METHODS

Apart from testing the opening, closing and securing of the hatch covers, the surveyor will be primarily concerned to test the weathertightness of the hatch covers.

### *Chalk test*

Chalk tests are often called for because loading has been completed and a hose test could be a risk to the cargo. The condition of the seal is checked by spreading chalk on the compression bar and then closing the hatch. On re-opening, an absence of chalk at any point indicates a lack of contact.

Such tests have extremely limited value, as they say nothing of the amount of seal compression that exists, even where chalk is present.

It is not sufficient merely to 'kiss' the rubber with the compression bar – relative movements when the ship is underway in a seaway may well cause complete decompression of the seal if the contact is marginal (see chapter 2). Chalk tests are, however, of value for other closures such as watertight doors, masthouse doors and hold trunkway seals.

### *Hose test*

A hose test is a more rigorous and realistic test that would give more confidence as to the cover's ability to remain weathertight at sea.

A class hose test specifies a nozzle of 15–18mm in diameter and a water pressure of about 2 bar, with the jet of water aimed not more than 1 metre from, and directly at, every part of the sealing areas, moved at not more than 1 metre per 3 seconds, where the hatch covers are closed and cleated (Fig. 33).

Hose tests by cargo interests may be more severe, with cross-joint spaces fully flooded, for example.

There are some practical difficulties with the traditional hose test – for example, the surveyor has to go inside the hold to look for leaks, the source of


*Fig. 33. Conduct of a hose test*

which can be difficult to find; meanwhile, the application of the water jet on the deck above may not be everything that the surveyor might wish. Accumulation of water in the drainage system may also be difficult to detect. Also, a hose test may not be wise where hold is loaded and there is any suspicion of leakage which could cause cargo damage.

### *Ultrasonic test*

It was to overcome difficulties with chalk and hose tests that ultrasonic leakage detection equipment was introduced some years ago (Fig. 34).

*Fig. 34. Conduct of an ultrasonic leak-detection test*

In this case, a transmitter is placed in the empty hold or on top of the cargo stow, and an 'open-hatch' reading of the transmission strength at the coaming level is noted. Then, with the hatch covers closed, the detector is moved by the surveyor around the sides of the cover and the cross-joints and any leaks can be located. The severity of the leak is referenced to the open hatch reading. Any readings less than 10% of the open-hatch reading are considered to be satisfactory.

There are rules governing the use of such equipment for class purposes, in order to ensure that the equipment is up to the task and the surveyor understands the hatch covers being surveyed. The rules also cover the recording and reporting of results. Only type-approved equipment may be used on class surveys and only approved service suppliers can carry out the tests. The requirements are contained in IACS requirement UR Z17 (see appendix II).

Other, non-class surveys may be carried out using non-type approved equipment and non-approved operators, but increasingly this is becoming less acceptable.

*Neither the hose test or the ultrasonic test can replicate the conditions 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*

## 3.8 USE OF HATCH COVER SEALING TAPE AND OTHER TEMPORARY SEALANTS

There are various proprietary hatch-sealing tapes available throughout the world and they differ widely in type, application and cost. If such tapes are used it is vital that the manufacturer's instructions are followed.

The use of sealing tapes at the cross-joints of hatch covers is common, sometimes even being expressly called for by the shipper or charterer. On the face of it, this seems like a sensible additional precaution to enhance weathertightness (Fig. 35).

But there are negative aspects to using hatch sealing tape, such as:

- it can lead to a false sense of security
- the tape can wash off in heavy seas just when it is needed most
- if the tape is applied over cross-joint drain holes, any water ingress due to partial loss of the tape is trapped in the cross-joint
- complete sealing of the cross-joint is usually difficult because of the various cleats and other units across the joint
- the tape can cause deterioration and accelerated corrosion of the coating system at the cross-joint.

For these reasons, the use of sealing tape must never be allowed to introduce the idea that maintenance of the cross-joints is unimportant. The use of hatch sealing tape may also lead to suspicions on the part of the cargo receiver and/or the underwriter that all is not well with the hatch cover system.

Hatch-sealing tapes can be about as expensive as rubber seals but are discarded after one voyage. Depending on who is paying for the tape, it would seem to be much better value to invest in keeping the cross-joint seals, cleats and drains in good condition.

Another form of additional sealing encountered is high-expansion foam. This is injected as a thin liquid into cross-joints, the sides and ends of panels and into cross-joint drains, as well as any available aperture on the hatch cover – usually on the basis that more is better.

The liquid lives up to its name and expands greatly. Externally, the hatch cover appears to be well sealed against any possible water ingress. Unfortunately, this will not usually be the case.

The foam expands to fill all the internal voids around the periphery of the hatch cover and the cross-joints. This includes the drain channels. Then the ship starts to move in a seaway and when the water starts coming aboard, the dry high-expansion foam has little adherence to the coaming bar or other steel edges and will 'pump' water through the boundary into the drains – but because the drains are blocked with foam, the water goes into the cargo space and damages the cargo.

In a similar way to hatch-sealing tape, the use of high-expansion foam should not be seen as an alternative to regular diligent hatch cover maintenance. It is not cheap and, if used indiscriminately, is ineffective.

*Fig. 35. Example of application of sealing tape to a cross-joint*

## 3.9 CHECKLISTS AND REPORTING

The routine maintenance task which a shipowner assumes responsibility for when it undertakes to carry a cargo safely is onerous. The shipowner usually delegates this to the ship superintendent and, ultimately, the ship's personnel.

On a typical Panamax bulk carrier, the hatch cover steel surfaces to be maintained are larger than a football pitch. There are probably 200 cleats and over half a kilometre of rubber seal, about 100 wheels and sheaves and some 600m of hydraulic piping. Such a maintenance task is not going to be easy.

The best inspectors of a ship's hatch covers are the ship's own personnel (see section 3.5).

In addition to planned-maintenance procedures (see chapter 4.1), there is a need to develop a shipboard culture of close inspection of the hatch covers and coamings prior to loading and during discharge.

Three checklists are given in appendix I which are intended to assist in this close inspection. They cover:

- coamings
- panels
- closure.

See chapter 2 and appendix III for explanations of the terminology used in the checklists and the background to each. In addition, the onboard operating and maintenance manual is the indispensable guide to the hatch cover system.

It is clearly not sufficient simply to observe: the intention is to provide a means of reporting back any observed faults to the responsible person. The faults identified can then be remedied immediately or built into the maintenance plan. Records of repair and maintenance must be kept. Such records should include spares used, measurements taken and any other actions.

## 3.10 OTHER WATERTIGHT CLOSURES

Prior to departure from the loading port, a crewmember should be assigned to check that each hold access hatch has been closed and properly dogged down. They should also ensure that hold lighting is off and that no personnel remain in the hold. This should be done at the same time as the stowaway search is carried out. At the time of closing the hatch covers, any access or grain trimming hatches fitted in the panels should be closed and securely fastened.

On water-ballast hatches, when in ballast it is important that vents are open, whether these are in the coaming or the covers, or are separate vents. Failure to have the vents open when de-ballasting starts can, and does, lead to hatch cover collapse under vacuum. This is sometimes referred to as 'implosion' and the consequences can be catastrophic

# *Chapter 4*

# MAINTENANCE

## 4.1 ROUTINE UPKEEP AND MAINTENANCE IN SERVICE

The ships operators should insist that each ship runs a planned system of maintenance for the hatch covers which is kept fully documented – not least so that the shipowner can demonstrate that a diligent, ongoing and effective maintenance regime exists (for example, if it needs to demonstrate seaworthiness in respect of a cargo claim).

Guidelines for basic hatch cover maintenance will, among other things, develop a culture of close inspection of the covers and coamings prior to loading and during discharge of cargo.

The operating and maintenance manual supplied with the hatch covers contains information on routine maintenance, operation and safety issues. The manual details the greasing programme for various components, the care of wire ropes and fittings, if any, and details of the hydraulic system. Adherence to the requirements in the manual must form part of the planned-maintenance system and records must be kept, for example, of greasing.

Hatch covers present a formidable challenge to the maintainer. Like any other item of equipment on deck, they operate in a harsh environment and will deteriorate quickly through corrosion, misuse or wear unless proper maintenance procedures are adopted.

Apart from the environment in which hatch covers work – damp salt-laden air, water on deck, abrasive and dusty cargoes – there are other difficulties, including:

- availability of crew for maintenance
- difficulty of maintenance at sea, both on loaded voyages and ballast voyages, where hatches may not be able to be safely opened
- short turnaround time in port which reduces the opportunity for maintaining the awkward areas pressure to reduce or control costs may lead the owner or manager to delay expenditure (on replacement seals, other spares, paint and so on) for as long as possible.

It is clear from survey reports that minimising hatch cover maintenance is a major cause of defects, leaks and subsequent claims. Regardless of this, the responsibility rests entirely with the operator of the ship to carry out the required maintenance whatever the difficulties may be.

There are two main aspects to the maintenance of hatch covers in service:

- anti-corrosion activities
- routine maintenance of the system.

## 4.2 THE IMPORTANCE OF CLEATS AND SEALS

*Cleats*

Quick-acting cleats should be regularly inspected and replaced when the rubber washer becomes inelastic or splits, or when the cleat rod itself is bent or distorted.

The ship should carry a stock of spare cleats. Galvanised cleats have a longer life than steel cleats which have not been protected in this way.

Over-compression of the cleats, usually seen as difficulty in applying them, should be adjusted out as this shortens the cleat life and, potentially, the life of the seal rubber. It can also lead to fracturing of the cleat assembly when the ship is at sea.

Hydraulic cleats should be checked at sea to ensure that they are correctly engaged and, if necessary, adjusted to provide proper vertical restraint.

On side-rolling covers the battening devices which force the cross-joint closed should be checked for wear, as should the mating wear surface (see chapter 2.1). A temporary repair for wear is to weld in a thin steel strip until the surfaces can be built up by a ship repairer.

Cross-joint screw-type or bolt cleats require similar maintenance procedures to quick-acting cleats.

Cross-joint wedges should be replaced when they become bent or if the flat spring is lost. Any other repairs to this type of wedge will probably need to be done by shore-based maintainers.

*Seals*

Rubber seals can normally be expected to last about four to five years of normal service. They should be fully replaced when the permanent set reaches half of the designed compression. This will occur sooner if the seal is over-compressed for any reason or if it is inadvertently painted over.

The use of sheets of rubber glued to defective seals or the use of split rubber hose on the compression bar (Fig. 26) should never be accepted and is, in any case, not effective.

Replacing the seal is not as simple as it looks, but is not beyond the skills of a competent crew. Attention must be paid to the following:

- If the work is to be done at sea, then all necessary safety precautions must always be followed.
- If the seal channels are found to be corroded when the old seal is removed, serious consideration should be given to carrying out the work at a ship-repair

facility or using shore-based maintainers, preferably supervised by the hatch cover supplier's engineer. This is because the channel should, in this case, be grit-blasted and coated with a zinc-based coating (zinc to be compatible with the glue).

- The method of fitting of the seal is: moulded pieces first, then the straight pieces cut to the length required plus 3%. The additional 3% should be distributed evenly along the length when fitting the seal. So, for example, a 10 metre required length would be cut from the roll at a length of 10.3 metres.
- Joints must be cut square and smooth and should be glued using the correct glue for the type of seal (see manufacturer's manual). Glue with care (see chapter 5.1) on three sides of the linear seal. Sharp tools should not be used for seal installation.
- It is important that the end pieces or nosings are solid rubber of manufacturer's supply. The practice of simply cutting a short piece out of box rubber is inviting leakage. The sponge quickly deteriorates and water will soon pass through.
- The minimum length of any insert piece of seal should be 500mm.
- Only full linear lengths should be replaced in order to avoid 'steps' between new and old seals.
- If there is any friction between the compression bar and the seal, or the ship is operating in Arctic conditions, a non-organic grease or an industrial glycerine can be rubbed onto the seals.
- If the seal is being replaced then the compression bars should be chipped, ground and painted.
- If the compression bars are chipped and re-painted then any steel support pads should also be chipped and painted in order to keep the overall seal geometry correct.
- Seal compression should be measured on completion of the seal replacement.

## 4.3 CORROSION

Classification society rules for hatch covers envisage the service life of hatch covers to be about the same as the ship's service life, typically about 20 years. However, this life expectancy is based upon proper maintenance being performed. If hatch cover structures are not maintained, then their life may be as little as 10 years before major steelwork failure (Fig. 30).

Significant repair costs will be incurred when belated attempts are made to recover structural strength once deterioration has been allowed to progress. It is far better to achieve a longer life by adopting regular planned-maintenance regimes from early in the ship's life.

It is reasonable to expect the rate of corrosion of properly painted areas, particularly the underside of open-web hatch covers, to be low over most of the area. However, it will be significant – about 0.15mm/year – where coating breakdown occurs and particularly where there are high local stresses.

De-rusting, cleaning and painting the hatch cover top plates in fair weather on laden or ballast voyages is a good and useful activity but the areas which most need maintenance are the inaccessible and awkward areas.

On laden voyages it is not recommended that hatches should be opened at sea, though some cleaning and recoating of external fittings can be done.

The most suitable opportunity for examining the covers may be during ballast voyages, in fair weather when the covers may be opened. Safety should, however, be paramount, with open covers properly secured against movement and safety fences erected where necessary. Generally only one hatch should be open and worked upon at any time.

Anti-corrosion activities should not be attempted if the ship is rolling or pitching in a way which would render the operation unsafe. In any case, all such maintenance procedures must be planned properly.

The internal structure of open-web panels can be cleaned of cargo residues, de-scaled and re-coated. Double-skin or box-construction covers will generally be free of cargo contamination and easier to maintain.

At the same time, cross-joints and end panels can be de-scaled and re-coated. These are the areas least likely to be maintained in practice and are the zones most likely to leak in service. Therefore, any maintenance here will be very effective in improving the condition of hatch covers.

Depending on the time in port, the nature of the cargo and the availability of the crew, some maintenance can be done in port during the working of the cargo, provided this is permitted by local regulations.

## 4.4 KEEPING THE DRAINAGE OPERATIONAL

All of the drain channels should be swept prior to final closure, or blown with compressed air. The channels must be kept free of corrosion products in order to function correctly.

The drains in the corners of the coamings must be thoroughly cleaned and tested. This can be done with compressed air. Drain caps must be in position but not screwed on. The use of short lengths of discarded fire hose attached to the drain pipes with jubilee clips or similar to function as a ‘poor man’s’ non-return drain is not recommended, but it is a practical alternative to the non-return valve. Such a hose arrangement, however, will often flatten in service and can become stuck fast with cargo residues rendering it worse than useless.

## 4.5 OPERATING GEAR

Wires, bottle screws, sheaves and rollers should be oiled and greased in accordance with the recommended intervals in the hatch cover supplier’s manual or the planned-maintenance system.

Wires should be inspected at every operation and any change or problem should be reported to a competent person. Replacement should be in accordance

with the manufacturer's instructions or national standards – usually on criteria such as number of broken strands, reduction in diameter or physical deformation. Sheaves should be replaced when the wear in the groove is equal to or greater than 20% of the rope diameter.

Hydraulic cylinders are plated to withstand the worst of the marine environment but wear can be caused by cargo dust and residues which collect around the seals. The cleaning of these residues after loading is good practice.

On single-pull covers, the connecting chains or wires between individual panels should be inspected for stretching and replaced as necessary.

In general, all operating or moving gear should be kept clean and lubricated in order to avoid rapid deterioration.

Some items, for example link mechanisms, are often not easily accessible for greasing. Nevertheless, greasing is of considerable importance – any seizure of pins can have serious consequences.

## 4.6 SPARES

For the ship's operator or ship manager, budgets are always tight and expenditure on any spares is always a target for economies.

Therefore, when hatch cover spares can be obtained cheaper from someone other than the original equipment manufacturer, this may seem advantageous.

There are some spare items where the supplier is not particularly relevant, but it is recommended that specialised or critical spares are obtained from the original hatch cover supplier, where possible. The major suppliers have networks of service centres in major maritime centres world-wide, so availability should be assured.

Critical items include:

- cleats
- seals
- running wheels/bearings.

## 4.7 TEMPORARY REPAIRS

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

Often a temporary repair can be carried out which will alleviate the problem until more permanent repairs are possible. As long as the repair is such that it remains effective during the voyage or voyages ahead, then there is nothing wrong with this in principle. In practice, of course, there are real problems carrying out repairs during the limited time available in port and with limited resources of people 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

surprise defects which require emergency temporary repairs, but when surprises occur, as they can, then 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 and the type of glue, the cutting and fitting instructions and so on. In general, the minimum length which should be inserted is 500mm, 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 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 then experience suggests that 'do it yourself' inserts will never be satisfactory – the manufacturer's specified items 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 of the hatch cover system. Sometimes, what seems like a helpful remedial measure can bring into play some other unrecognised defects.

The rule then on 'quick fixes' is to try to avoid them by spotting trouble early. If a temporary repair becomes necessary for any reason, then the ideal solution is to call in a service engineer familiar with hatch cover repairs. If all this fails, then repairs using all of the information available in the supplier's operating and maintenance manual can be carried out by competent persons onboard (assuming that there is an adequate supply of spares onboard).

## 4.8 PERMANENT REPAIRS

There are practical limits to what the ship's crew can be expected to achieve when the ship is in service. For example, large-scale replacement of seals is not a practical proposition when at sea.

When significant effort is required, riding squads of maintainers can be arranged to work under the supervision of the ship's staff, possibly augmented by a hatch cover supplier's service engineer.

But when there is extensive damage of deformation to the structure of one or more hatch cover panels, it will need to be either repaired *in situ* by a competent ship-repairer during the course of the ship's time in port, or the panels may need to be removed ashore for repair or straightening. The ship repairer must be informed of the acceptable tolerances for the work in line with the hatch cover

manufacturer's recommendations. This will usually entail setting up a frame or jig to ensure that the panels fit exactly when they are replaced on board.

There needs to be considerable accuracy in the alignment and straightness of the hatch covers and the associated fittings (see chapter 2).

Shore labour may also be usefully employed where a significant amount of welding has to be done onboard, for example, replacing worn or damaged cross-joint wedges, repairing mechanical damage to the compression bars building up worn surfaces.

Any shore-labour employed must be made familiar with the onboard safety regime. In particular, they must be made aware of the dangers of working near the cargo and permits to work will be required, particularly for hot work. Proper procedures should be followed when hot work is undertaken.

# *Chapter 5*

# IMPLICATIONS OF POOR HATCH COVER CONDITION

Under the rules which govern the carriage of goods by sea there is an obligation placed upon the shipowner to *exercise due diligence* to make the ship seaworthy.

For example, the Hague-Visby Rules, article III, rule 1, state:

*The carrier shall be bound before and at the beginning of the voyage to exercise due diligence to:*
*(a) make the ship seaworthy;*
*(b) properly man, equip and supply the ship;*
*(c) make the holds, refrigerating and cool chambers, and all other parts of the ship in which goods are carried, fit and safe for their reception, carriage and preservation.*

One of the purposes of the foregoing chapters of this guide has been to describe how to avoid problems in meeting these responsibilities. In this chapter seaworthiness and cargoworthiness are considered and also means by which due diligence can be demonstrated.

The comments in this chapter are not in any sense a legal interpretation, but are given for general guidance.

## 5.1 SEAWORTHINESS AND CARGOWORTHINESS

The obligation to exercise due diligence, in respect of hatch covers, requires the shipowner to carry out the necessary checks, maintenance and any necessary remedial works so that the ship is seaworthy and cargoworthy at the start of the voyage. This would also include the cargo loading period if it can be shown that hatch cover defects could cause cargo damage at that time.

The checks which need to be carried out are not defined, but it is suggested here that the inspections by onboard staff which have been described in this guide (see chapter 3.5) would form part of that process. Similarly, where defects are found, the remedial works, whether temporary or permanent, should be correctly carried out (see chapters 4.7 and 4.8). It is the shipowner's responsibility to ensure any such works are properly carried out and the responsibility cannot be delegated to, say, a subcontractor.

It must also be demonstrated that the regular maintenance of the hatch covers has been done in accordance with the recommendations in the manufacturer's operating and maintenance manual which must be onboard.

It may be that a classification surveyor, for example, might survey the hatch covers of a ship and find them seaworthy prior to the start of a voyage, but the

hatch covers may not be in sufficiently good condition to carry a particularly sensitive cargo, for example cement or alumina (there are many sensitive cargoes).

Once the voyage has started, the shipowner continues to have responsibilities beyond those mentioned above. There is an additional responsibility to look after the cargo throughout the voyage:

The Hague–Visby Rules, article III, rule 2, state:

*Subject to the provisions of Article IV, the carrier shall properly and carefully load, handle, stow, carry, keep, care for, and discharge the goods carried.*

This 'carefully to carry' obligation includes a requirement that the shipowner and the master of the ship must understand the nature of the cargo carried and the extent of the precautions necessary to look after it.

Although there are some exceptions to liability under this rule, the shipowner can only begin to consider invoking them if he can demonstrate that he has taken all reasonable steps to exercise due diligence to prevent unseaworthiness.

## 5.2 RECORDS AND EVIDENCE

How does the shipowner demonstrate that it has exercised due diligence?

The burden to prove due diligence can be very difficult, but it can be achieved only if there are good systems in place onboard (and ashore) in respect of regular maintenance, inspection, repair, testing and all associated classification survey histories. Most importantly there needs to be a good record kept of all of these activities.

Records of remedial works and purchasing of spare parts also form part of this body of evidence. This would include invoices, work lists during dry-docking, and records of any other repairs or interventions.

The records of all hatch cover inspections, testing, maintenance and repairs should be part of the ship safety management system. This would naturally include records of any inspections by Flag State or class, as well as other interested parties, such as shippers or charterers.

If a ship has a regularly occurring problem with one or more of its hatch covers then it will be necessary for the shipowner to show that remedial steps were put in place to fix the problem and/or the crew were instructed to use extra care when operating or securing the covers. If this is not done, it may be found that the shipowner has not exercised due diligence.

## 5.3 USE OF SEALING TAPE OR OTHER SEALANTS

The use of sealing tapes at the cross-joints of hatch covers is common, sometimes even being 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 as described in chapter 3.8.

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 any leakage of water finds its way inevitably to the cargo rather than draining in the way the system designers intended.

**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.**

# *APPENDIX I*

# HATCH COVER SURVEY CHECK LISTS FOR WEATHERTIGHTNESS

| *1. Coamings* | *Yes* | *No (action required)* |
|---|---|---|
| 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 not corroded? | | |
| Is the extension of coaming plate forming one side of the water channel in good condition without thinning, bent from grab contact and a uniform height all around? (Record height – minimum preferred is 20mm) | | |
| Are the coamings free of any vertical rust staining which would indicate water leakage, especially at the cross-joints or split joints? | | |
| Are drains free of previous cargo and are there efficient means of closing, such as non-return valves? | | |
| Are cleats all in place and in good, free working condition? Are the under-coaming consoles in strong condition? | | |
| If the hatch panel side and end plates are in steel-to-steel contact to the coaming tops when closed, are they free of grooving or wear? | | |
| If the hatch covers are supported by chocks or support blocks, are they free of wear or damage? | | |
| Are the coamings free of corrosion and are the coaming brackets fully connected? | | |

| *2. Panels* | *Yes* | *No (action required)* |
|---|---|---|
| Are the side and cross-joint 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 (indicating misalignment)? | | |
| Is there *no* tipping to one side or any other deformation of the rubber seals? | | |
| 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 painted externally? Are they smooth and not pitted? | | |
| Are the undersides and internal structure of the hatch panels in corrosion-free condition and well painted? | | |
| Are the sides of the panels by the rubber seal retaining channel and where the edge lands steel-to-steel on the coaming tops 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? | | |
| Are secondary drainage channels in scale-free condition, of adequate depth and draining into coaming top water channel? | | |
| Are there *no* other deficiencies such as worn wheels, hatch cover end distortion, link-pin wear, hydraulic oil leaks, worn hoses, arm-pin wear or pontoon-cover-locating-guide wear? | | |

| *3. Closure* | *Yes* | *No (action required)* |
|---|---|---|
| Are the relative hatch cover panels in alignment, that is without one higher or lower than the next or skewed relative to each other? | | |
| Is the necessary steel-to-steel contact or support occurring properly? | | |
| Are the cleats correctly applied, that is applying a holding-down force? | | |
| Are the anti-lift bolts properly engaged and in sound condition, if fitted? | | |
| Are cross-joint wedges (where fitted) sound, with a degree of tension when closed and slotted in? | | |
| 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, corner rubber pieces, linear rubber? | | |
| Is there *no* evidence of use of hatch tape sealing at the joints? | | |
| Have closed hatch panels been subjected to and provided weathertight by<br><br>a) ultrasonic test<br><br>b) hose test using water pressure of about 2 bar pressure, through 15–18mm nozzle, aimed not more than 1 metre from the directly at, every part of the peripheral, cross-joint or split-joint seals? | | |

# *APPENDIX II*

# NOTE ON IACS UR Z17 (1997) PROCEDURAL REQUIREMENTS FOR SERVICE SUPPLIERS

Where an organisation provides ultrasonic hatch cover surveys the results of which are used by classification society surveyors in making decisions affecting classification, the organisation is subject to approval by the classification society in accordance with this unified requirement (UR).

The objective of the UR is to set basic standards for the conduct of surveys and the equipment used. Although it covers more than ultrasonic testing, it is such testing that is of relevance to us here.

As discussed in chapter 3.7, non-approved equipment and non-trained surveyors can be used to carry out ultrasonic tests (other than those required by class) but it is increasingly common for interested parties to require that the equipment used is type-approved and surveyors have undergone basic training so that results are comparable and the equipment reliable and repeatable in its performance.

The UR requires service suppliers to submit details of experience, technicians/surveyors, the equipment used, procedures, training programmes, checklists, record formats and quality assurance system.

Approved service suppliers will be issued by the relevant classification society with a certificate, with renewal being required every five years. This certificate can be cancelled if the service supplier fails to meet the requirements of the UR.

In the case of hatch cover ultrasonic testing, the surveyor must be able to demonstrate knowledge of the various types of hatch covers and their design features. The surveyor must have experience of the operation and maintenance of different hatch cover designs and must have undergone a practical training in the use of the (type-approved) equipment.

# *APPENDIX III*

# GLOSSARY OF TERMS

| *Term* | *Explanation* |
|---|---|
| Anti-lift bolt | A device, like a cleat, which prevents a hatch cover from lifting up. |
| Battening device | A device fitted between a hatch cover panel and the coaming which forces the cross-joint together. |
| Bell crank | A hydraulically operated mechanism which folds the second pair of covers in a four-panel folding hatch cover. |
| Box panel | Alternative name for a double-skin panel. |
| Box rubber | A seal constructed from a solid rubber box. |
| Bull wire | A wire, led to a winch or crane, which is used to pull hatch covers open or closed. |
| Butterworth cover | A small, hinged cover which closes a trunkway for Butterworth tank-cleaning apparatus. |
| Canvas sock | A short length of hose fitted to a drain pipe at a hatch corner. |
| Chalk test | A test for weathertightness of the hatch cover system which uses chalk rubbed on the compression bar to imprint on the seal. |
| Chocks | A general term for steel-to-steel supports or locators. |
| Cleat | A resilient bolt arrangement intended to restrain the hatch cover vertically. |
| Cleat wedge | A cleat which relies on a wedging action rather than behaving as a bolt in tension. |
| Coaming | Vertical steelwork around the edges of a hatch opening, part of the deck. |
| Coaming bar | A horizontal plate forming the top of the coaming structure. |
| Coaming-top water channel | The peripheral drain for any water which may ingress through the seal. |
| Coiling cover | A patented hatch cover design which rolls up a corrugated top plate to open the hatch (not usually fitted on larger ships). |
| Console | Alternative name for a crutch. |
| Compression bar | A steel bar fitted in such a way that it forces against the seal, providing a weathertight joint. |
| Corner pad | A shaped seal unit to go around right-angled or compound corners. |
| Cross-joint | The joint where hatch covers meet when closing. |
| Cross-joint bolts | Bolts fitted to keep the cross-joint fully closed at sea. |
| Cross-joint drain channel | A drain or gutter fitted to the cross-joint which leads any leaked water to the coaming drains. |

| | |
|---|---|
| Cross-joint wedge | A sliding wedge fitted at the cross-joint to keep adjacent panels in correct vertical alignment. |
| Cross-joint wedge bridge | A part of the cross-joint wedge assembly through which the wedge slides. |
| Crutch | A bridge-like unit which supports and guides a quick-acting cleat. |
| Design compression | The extent of deformation of the seal by the compression bar in the designed condition, measured in mm. |
| Dog | A wedge-type hand-operated closing device, usually fitted to doors and hatches. |
| Double-drainage system | A hatch cover drainage system which has two paths for water to flow, giving increased security. |
| Double-skin panel | Hatch cover panel in which both top and bottom surfaces are plated-in. |
| Dumb panel | The non-wheeled panel in a stacking hatch cover system. |
| Eccentric wheels | Wheels fitted to a single-pull hatch cover which can be rotated eccentrically to raise and lower the panel. |
| External cylinders | Hydraulic cylinders mounted outside the hatch covers, used for opening and closing the covers. |
| Fixed-chain drive | A fixed chain along which a hydraulic motor and sprocket can crawl, driving the associated hatch cover along the coaming. |
| Folding cover | Any variety of hatch cover which hinges and folds during opening. |
| Gasket | Alternative name for seal. |
| Grain hatch | A small, manually secured hatch fitted to the hatch cover, used during loading of grain cargoes. |
| Hatch rubber | Alternative name for seal. |
| Hatch-sealing tape | Any type of proprietary adhesive tape used to seal cross-joints externally. |
| High-expansion foam | Commercially available foam compound which expands during curing to fill voids. |
| High-lift cylinders | Hydraulic cylinders used to lift panels of stacking hatch covers during operation. |
| Hose test | A test for weathertightness of the hatch cover system using a water jet. |
| Hydraulic rack and pinion | A mechanism for driving hatch covers to the open or closed position which uses a hydraulic motor attached to the coaming to power a pinion which drives a rack fitted to the panel. |
| Inflatable canvas | A type of hatch cover which uses a double-skin canvas/plastic sheet, inflated by air to give a semi-rigid enclosure. |
| Leading pair | The first pair of a folding hatch cover to fold and stow. |
| Lift-and-roll cover | A hatch cover which is lifted by hydraulic jacks, or wheel lifts, and then can roll freely to a desired position. |
| Lift-away cover | A hatch cover which is lifted bodily off the coaming by a ship or shore crane to provide access to the hold. |

| | |
|---|---|
| Lifting lugs | Points of attachment on a hatch cover for lifting appliances to be connected. |
| Link mechanism | A hydraulically actuated linkage for folding hatch cover panel pairs, fitted between the panels. |
| Locator | A unit which maintains the hatch cover in its correct orientation in the horizontal plane. |
| Long-chain drive | A system for driving hatch covers along the coaming using a motor and chain drive at one end of the coaming, driving a chain which runs the length of the coaming. |
| Nitrile rubber | A type of rubber which is resistant to mineral oils. |
| Non-organic grease | A type of grease which does not attach the seal. |
| Non-return valve | A valve which will only pass fluid in one direction. |
| Nosing | A short length of rubber which abuts the adjacent hatch cover panel and is fitted at the ends of a cross-joint. |
| Open-hatch ship | A ship in which the hatch opening is in excess of 65% of the ship's beam and/or the length of the hatch opening is in excess of 75% of the hold length. |
| Open-web construction | A form of hatch cover construction also known as 'single-skin' construction. |
| Packing | Alternative name for the seal. |
| Panel | One unit of a set of hatch cover closures. |
| Peripheral drain channel | The drain channel fitted all around the coamings just inside the seal. |
| Permanent set or deflection | After the seal has been in service for some time, the rubber loses some elasticity and will have a permanent groove visible on the sealing face, measured in mm. |
| Piggy-back cover | Hatch cover arrangement where a wheeled panel carries another panel on top during travel on the coaming. |
| Pontoon cover | Alternative name for a lift-away cover. |
| Pot lifts | A hydraulic jack arrangement which lifts a wheeled panel up to its rolling level. |
| Quick-acting cleat | A cleat which is applied manually using a lever to provide the necessary locking. |
| Rack back | An opening operation in which the panels lift and slide simultaneously to release the seal from the compression bar. |
| Rack wire | A variant of the rack-and-pinion system in which only one panel is propelled by the rack system, the other being opened by a wire led from the driven panel. |
| Replacement rule | When the permanent set reaches half the design compression, replace the seal |
| Restraint | Alternative name for a locator |
| Scantling | A marine term for the size and strength of structural elements. |

| | |
|---|---|
| Seal | The flexible rubber fitted around the sides and cross-joints of a hatch cover against which the compression bar is forced, providing a weathertight seal. |
| Seal-retraining channel | The steel channel into which the seal is glued. |
| Sealing tape | See 'hatch-sealing tape'. |
| Side plate | Part of a hatch cover – the vertical plate which forms the outer edge of each panel. |
| Single-pull covers | A type of multi-panel hatch cover in which the panels roll along the coaming and tip into stowage. The panels may be driven by chain drive or pulled by wire. |
| Sliding rubber | A variety of rubber seal which can accommodate larger sliding movements tan a conventional seal. |
| Split-joint | The correct term for a cross-joint at which the panels separate, that is they are not hinged together. |
| Stacking cover | A type of hatch cover in which the individual panels may be stacked to provide various opening arrangements. |
| Steel-to-steel contact | The method of supporting the weight of a hatch panel while correctly maintaining the design compression of the seal. |
| Stowage hooks | Hooks which hold a folded hatch cover. |
| Stowage rails | Arthwartships rails upon which slide-rolling covers run and are supported in the open position. |
| Support pad | Steel pads on the coaming which make steel-to-steel contact with the hatch cover. |
| Swing seal | A cross-joint which is hydraulically actuated and swings on and off. |
| Trackways | The rails, fitted to the coaming, upon which hatch cover wheels run. |
| Trailing pair | In a four-panel set of folding covers, the second pair to open. |
| Ultrasonic test | A test for the weathertightness of a hatch cover system using an ultrasonic transmitter inside the hold and a detector outside the hold. |
| Ventilation flaps | Flaps sometimes fitted to the coaming for cargo surface ventilation. |
| Water-ballast hatch cover | A hatch cover which is designed to withstand the forces from water carried as ballast in the hold, particularly when the ship is moving in a seaway. |
| Waterseal | Alternative name for the seal. |

# INDEX

# HATCH COVER MAINTENANCE AND OPERATION

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by DAVID BYRNE CEng, BSc, MSc, FRINA, FCMS
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David Byrne served as a deck officer for nine years before gaining a BSc and then MSc in naval architecture. He worked in shipbuilding, ports and maritime research before joining hatch-cover manufacturer MacGregor in 1987 as technical manager and principal consultant. He led a management buy-out of the consultancy business in 1992 and this continues to grow, now as Maritime Sector Specialists Ltd based in Newcastle upon Tyne. The company provides specialist management and techno-economic consultancy to the marine sector worldwide, including innovative design and operations solutions. It also advises on claims and disputes and can provide expert evidence. The company is part of Oceanic Investment Corporation, which includes Burness Corlett & Partners and Three Quays Marine Services.

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