

Weatherdeck Hatch Covers

# Rolling Types for Combination and Dry Bulk Carriers



TECHNICAL INFORMATION H3

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# Rolling Types for Combination and Dry Bulk Carriers

Side-rolling and end-rolling hatch covers are popular for use on the weatherdecks of larger bulk carriers such as Panamax and Capesize types. In the case of ore/bulk/oil (OBO's) and ore/oil carriers, the covers are designed to sustain internal liquid loads. For open hatch bulk carriers (OHBC's), rolling covers of the piggy-back type are preferred as the deck allows little or no free space for stowing the covers when the hatches are open.

### Side-rolling hatch covers

Side-rolling hatch covers stow in a transverse direction while end-rolling types stow longitudinally.

The traditional side-rolling cover consists of two panels per hatch, each panel rolling sideways on a pair of transverse ramps, thus presenting a minimum obstacle when loading. In some cases both panels can be stowed together on one side to further enhance access when loading and unloading. This alternative reduces daylight opening by approximately 50%.

A single-panel type where the panel stows transversally or longitudinally is mainly used on very large ore carriers (VLOC's), with sufficient free deck area.

The covers open by lifting to the rolling position and rolling out by the drive mechanism. Drive systems of the rack and pinion, rack and pinion plus wire or chain drive types ensure efficient operation.

Specially developed sealing and securing systems and a superior structural design ensure that the rules and regulations of all classification

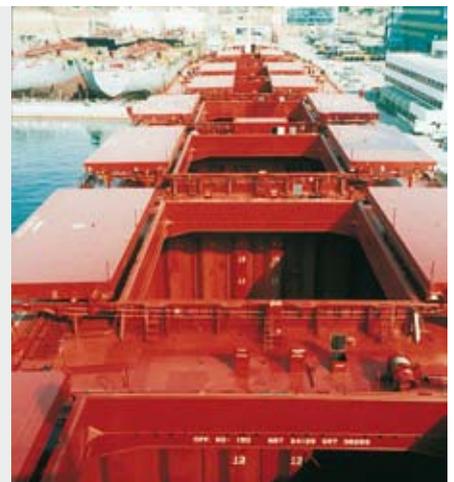
societies and international authorities are met.

The ship's hull and hatch coamings will deform in both harbour and sea conditions. These variables must be taken into consideration when selecting the type of hatch cover.

Hatch covers with an open web structure, with a flat or inclined top plate, are superior to a double-skin structure, allowing for torsion of the coaming. Also their thermal deflections are minimised. Where a clean underside is required, box beams or beams with slope plates can be used.

- Side/end-rolling weatherdeck hatch covers
- For single and double panel solutions
- Lifting either by hydraulic pot lifts or by Roll-up-Roll system
- Rack & pinion and chain drive types
- Manual, hydraulic or auto-cleating systems
- Special support pads for proper installation and to minimise friction and wear
- FlexSeal for reliable sealing
- Adjustable fittings (to compensate for wear)
- Components of high quality materials for long service life
- Standardised design
- Emphasis on improved safety
- 24h global service network

Consult us at the earliest stage of your project.



# Drive systems

Side-rolling hatch covers can have a variety of different drive systems. The two main options are rack and pinion, or chain drive. A combination of the two is also possible.

The chain drive type can either be a two-sided chain system or a system with a single chain arranged at one end only.

## Rack and pinion drive

Effective operation of the covers is ensured by a rack and pinion system with the drive to each panel provided by a slow-speed hydraulic motor. Located at the panel centreline, the motor is mounted with the shaft vertical at the coaming and engaged, via a pinion, with a rack, which is fitted to the underside of the panel. Guidance of the panels is by means of double-flanged wheels at one end.

To open a twin-panel cover, the cleats are first unlocked. The panels are then raised into their rolling position by the hydraulic wheel lifters. The hydraulic motor for one or both panels can then be operated. The pinions on the motors drive the panels to the open position.

Rack and pinion operation is extremely flexible, safe and easy to maintain, contributing to efficient cargo handling. The panels are separately controlled, can

be opened independently and stopped at any position during their operation.

The hydraulic motor is of a slow-speed piston type, and has a load control valve to prevent unintentional rolling.

## Rack-wire/rack-chain drive

On this twin-panel arrangement, the rack and pinion drive mechanism is fitted to one panel only, the second panel being simultaneously operated from the first by a permanently reeved wire or chain running over sheaves suitably arranged at the coaming. The system is driven by one hydraulic motor per pair operating both panels simultaneously.

## Chain drive

This system uses either a continuous chain on one side (one-sided drive) or on both sides (two-sided drive) to operate both panels of a twin-panel cover. The two-sided type is driven by a medium-speed hydraulic motor with a planetary gear and is mounted on the ship's deck at one side between the stowing ramps. The operating chains, which are guided along both of the transverse coamings, are connected cross-wise to the arms of both panels, giving simultaneous operation of the panels.

This cross-wise connection of the chains gives the system its biggest advantage

– the panels compensate each other when the vessel heels.

## Safety

Safety is of paramount importance for all MacGregor hatch covers. Today, all MacGregor bulk carrier hatch covers conform to the latest rules. However, the strength of the hatch covers is not the only factor enhancing safety. Several key elements must be considered to achieve a safe system, starting with important features like the ship's layout. Attention must be paid to hull movements and coaming deflections so that locators and support pads can be arranged in an optimal way.

Emphasis is put on features like improved support pads, long-life rubber seals and strong and flexible cleating systems. The locators are generally replaceable and adjustable.

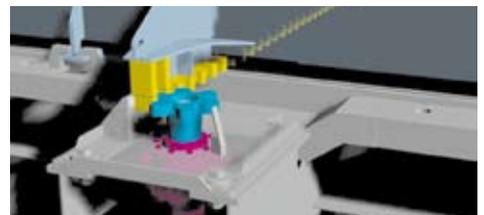
Due to their cargo, bulk carriers generally have higher corrosion rates than other types of vessels, so emphasis is placed on manufacturing either corrosion-free or easily replaceable components. Where these measures are not enough, the design allows sufficient corrosion margins.

Investing in safety improves the ship's life-time profitability.



A side-rolling hatch cover arrangement with chain drive

A rack and pinion drive



A chain drive arrangement



# Roll-up-Roll

Roll-up-Roll is a system which, when fitted to twin-panel rolling covers, enables the operation of both panel lifting and cleating to be performed simultaneously and fully automatically. Installed together with the rack and pinion or chain drive system, it greatly simplifies and speeds up the operation. The key components for the system are the hydraulically operated Roll-up-Roll mechanisms which are mounted outside the coamings at both ends of the meeting joint. Their function is to lift the covers up into the rolling position and to cleat the panels when lowered again. When the panels are opened, the mechanisms lift both panels simultaneously to the rolling position.

In this opening sequence, hydraulic pressure actuating the hydraulic cylinders for the Roll-up-Roll mechanisms cause the wheels to rise up inclined

tracks, thus raising the panels to the rolling position. At the same time, the wedge cleats are disengaged. The actions of uncleating, lifting and rolling are controlled by the hydraulic control system.

The closing, lowering and cleating sequence is the reverse of the opening procedure.

For one-side operation, the gaps in the rail tracks need to be bridged. This is achieved by manually operated rail flaps.

Compared to traditional lifting systems, the reduced number of hydraulic cylinders and items requiring maintenance for the Roll-up-Roll system provides a considerable saving in maintenance costs. In addition, the ship's crew is saved from the tedious job of cleating and uncleating the hatch covers.

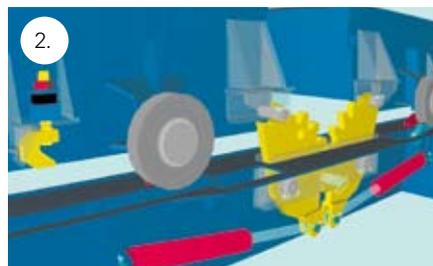
## Auto-cleating system

The Roll-up-Roll lifting system is used together with the MacGregor auto-cleating system. When raising the hatch covers, the cleats are simultaneously released. When closing, the covers are cleated at the same time as they are lowered, hence the name 'auto-cleating'.

## Self-locking Roll-up-Roll

A recent development of the Roll-up-Roll concept is the self-locking feature, taking away the need for manual locking of the cog segments with pins.

Another advantage of this is the ability to adjust the mechanism's end position. Due to this the rubber compression in the meeting joint can be adjusted, thus the tightness can be maintained for a much longer time.



1. The Roll-up-Roll system in the closed position, wheels lowered
2. The Roll-up-Roll system; the hatch covers are lifted to the rolling position by hydraulically operated cog segments
3. Self-locking Roll-up-Roll system: a geometrical lock mechanism secures the hatch covers in the closed position
4. The mechanism automatically opens as the hydraulic cylinders are activated
5. One cylinder Roll-up-Roll system in the closed position, wheels lowered
6. One cylinder Roll-up-Roll system; the hatch covers are lifted to the rolling position by hydraulically operated cog segments
7. The auto-cleating system automatically cleats and uncleats the Roll-up-Roll hatch covers



# Piggy-back hatch covers

Piggy-back hatch covers are used on bulk carriers when the available deck space is insufficient to accommodate folding, side-rolling or end-rolling covers.

This system always comprises two panels, with one panel being raised high enough for the other to roll underneath and to support the lifted panel on to its 'back'. Both panels can then be rolled back and forth.

The system can either be applied to a pair of hatches or to the two panels of a single hatch.

If the number of panels exceeds two, the system is called 'stacking', and special high lifters are needed.

The covers open by unclating and raising the upper panel high and then raising the rolling panel to the wheel track level. Both lifts are achieved by

hydraulic cylinders – double-action cylinders for the high lift and single action pot lifts for the low lift. A chain drive, a rack and pinion drive or internal traction electric drive connected to the rolling panel moves it to a predetermined position under the upper panel, then the upper panel is lowered on to the rolling panel. With the drive, both panels can then be moved back and forth between the usually fixed end stops, achieving a free opening of approximately 50%.

## High lifters

The standard high lifter system consists of four hydraulic cylinders. Reliable synchronisation of the cylinders is achieved through a system of flow distribution control valves.

For the stacking system, special high lifters are needed. These lifters are provided with a special automatic head,

which is always repositioned correctly for the next operation. The only manual function required is to select building or dismantling of the stack.

## Drives

The most common drive used for piggy-back covers is a chain drive, in most cases arranged on one side only. In special cases and depending on the arrangement, a rack and pinion drive can be used.

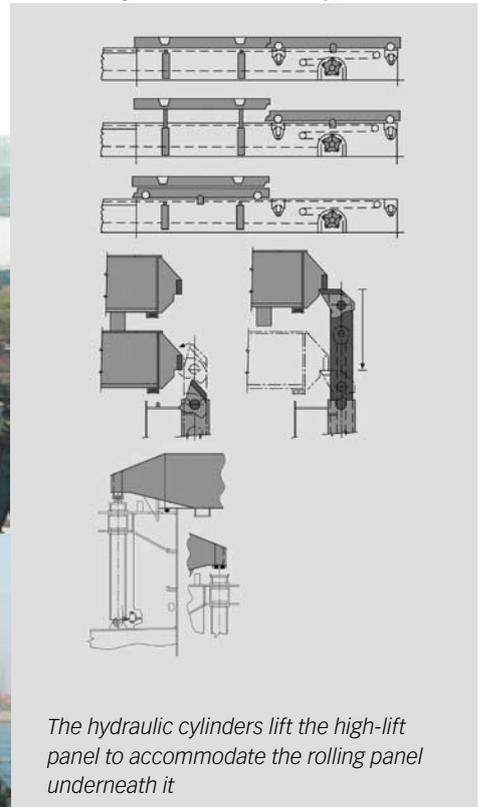
For very heavy panels, especially on open hatch bulk carriers, an internal traction drive system has been developed. Each wheel is connected to an electric motor/gear box system giving an extremely flexible and smooth movement.

*Piggy-back hatch covers are used on bulk carriers with limited deck space*



*An internal electric traction drive system for heavy-duty applications*

*High lifters of different types*



*The hydraulic cylinders lift the high-lift panel to accommodate the rolling panel underneath it*

# Standard features

## Rubber seals

Sealing between the hatch covers and the coaming is generally achieved by means of FlexSeal fitted to the panels which tightens against a compression bar on top of the coaming. The same type of seals is used at the meeting joints. In cases where relative coaming movements are large, sliding seals (Cat-Profile) acting directly on the coaming top are fitted. For OBO carriers, special oil-resistant seals are used.

## Coaming arrangement: support pads, restraints and locators

It is of paramount importance for the tightness of the covers that support pads, restraints and locators are arranged in an optimal way. On bulk carriers, all these fittings are located outside the seal to protect them from possible damaging contact with the cargo.

The strength of these items is as important as the strength of the steel structure, so that the panels can be secured even in the worst weather conditions when huge lateral sea loads have to be withstood.



*FlexSeal is a high-quality solid rubber seal – it keeps its original shape and maintains initial*

*tightness. The compression bar forces the sides of the FlexSeal against the walls of the perfectly weathertight fit. This also prevents the retaining channel from corrosion.*



*A general illustration of a coaming arrangement including the quick-acting cleat*

The transverse locators are replaceable and have shim plates for easy installation and adjustment possibilities after wear. The shims enable the crew to adjust the meeting joint rubber compression to the correct level.

## Quick-acting cleats

Manually operated quick-acting cleats are activated from above or below the coaming, depending on coaming height. For hatch covers designed for liquid cargo or water ballast loads, special heavy-duty cleats are used to minimise their number.

The length of the cleat bolts are determined by the relative movements between the hatch covers and the coaming, larger movements requiring longer bolts to give the necessary flexibility.

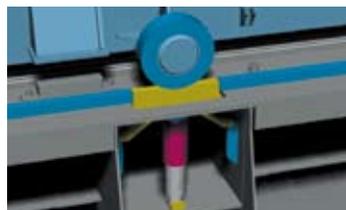
All cleats are made of special high tensile steels and are hot-dip galvanised to enhance corrosion resistance.

## Wheel lifters

The traditional wheel lifting system consists of one single-acting hydraulic cylinder for each wheel. The cylinder lifts a ram, which forms part of the



*Transverse locators ensure a weathertight meeting joint*



*A wheel lifter in rolling position*

wheel track, when raised. The cylinder is located 'upside-down' in order to prevent dirt collecting on the seals which can cause deterioration and hydraulic leaks. The system is designed in an 'open' way to make maintenance work on the cylinders easier and more accessible.

## Hydraulics

Specially designed and developed hydraulics ensure optimal control, operation and maintenance of the hatch covers, as well as easy installation.

The standard hydraulic system has one pump unit with double pumps feeding one circuit (2 x 50%), forming a constant pressure system. Normally only one hatch is operated at a time.

The pump units are optimised for space and maintenance accessibility. The overhead tank ensures efficient filling of the pumps.

The directional valves are mounted on a sandwich plate on the manifold. All control valves are ready mounted as cartridges, to minimise piping and potential leaks.

*The operating stand and the control valves*

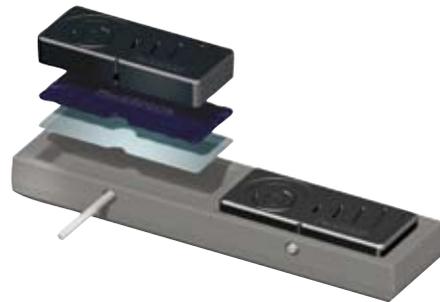


*A hydraulic pump unit*

# Optional features

## Flexipad/Lubripad/Polypad

It is not so much the high load on the hatch covers, but the highly corrosive environment on bulk carriers which causes higher than normal wear on standard steel-to-steel support pads. Using non-corrosive and non-sliding Flexipads or sliding low-friction Lubripads/Polypads ensures that the rubber compression remains correct for a considerably longer time compared with steel-to-steel pads.



Hatch cover bearing pads: a non-sliding Flexipad on the left, a low-friction sliding Polypad on the right

## Hydraulic cleating

Hydraulically operated cleats come in various types. The wedge cleat is usually operated by an individual hydraulic cylinder. Heavy-duty cleats are used for ballast water holds and on OBO carriers.

The wedge and the cylinder are mounted below the coaming.

Hydraulic cleating is less flexible than other types and relative movements should be checked.

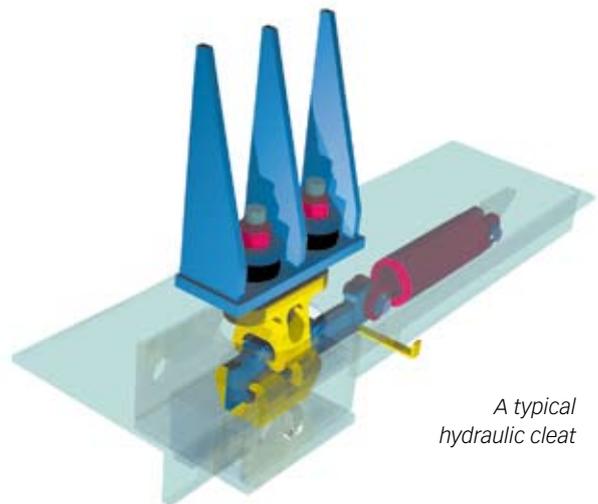
## Portable pump units

Emergency or auxiliary operation of hatch covers can be executed either by traditional hand pumps and wire pullers or by portable electric pump units, connected either to the on-board electric power system or to shore.

The portable electric pump unit makes operation easy, swift and safe, as the unit is connected directly to the control stand with quick-couplings including all safety enhancing valves active.



Portable electric hydraulic pump units for situations when the standard pump unit cannot be used



A typical hydraulic cleat



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