



# STANDARD CARGO

SETTING THE STANDARD FOR SERVICE AND SECURITY

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## BULK CARGOES – HOLD PREPARATION AND CLEANING

### INTRODUCTION

As part of the Loss Prevention programme, the Standard Club publishes *Standard Cargo* series as a means of focusing on best practices in the carriage of cargo.

This publication is aimed at helping masters, ships' cargo officers, shore superintendents and chartering managers understand the requirements of hold preparation before loading bulk cargoes. Such awareness will assist in preventing claims for cargo loss, cargo contamination, additional survey costs, delay to ships, and in preventing disputes over offhire and charterparty issues.

Preparation of a cargo hold is not just a question of sweeping, cleaning or washing down the hold. There are a number of matters to consider, and failing to adhere to good practice can result in substantial claims. A lack of knowledge, often originating in chartering or commercial departments, can also be the underlying cause of major claims.

The first reference source for the carriage of bulk cargo should be the International Maritime Solid Bulk Cargoes Code (IMSBC), issued by IMO. It was revised and reissued in 2009. It is a requirement that a copy of the Code should be onboard a bulk carrier, and the revised Code is mandatory under SOLAS from 1 January 2011. Nothing in this *Standard Cargo* guide is intended to differ from the advice given in the Code, and the advice given in the Code should always be the first point of reference. It has not been possible to include preparation advice here for all bulk cargo, and the IMSBC should therefore be consulted whenever any question arises.



^ Coal loading



^ Coal discharge



^ Washing down a cargo hold

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## SAFETY MANAGEMENT SYSTEM/ OPERATIONAL GUIDANCE

All bulk carrier officers should have clear guidance and instructions available onboard their ship. There should be guidance on:

- preparation of holds
- carriage requirements of bulk cargo
- safety aspects of bulk cargo carriage etc (liquefaction, heating, hazardous gases, oxygen depletion, entry into enclosed spaces)

The commercial and chartering departments are critical in getting the hold cleaning process right. If the problems that the master and ship face are not fully understood and the ship is asked to do the impossible, accidents and claims will result. The operational guidance given in the safety management system should address this issue.

The latest revision of the International Maritime Solid Bulk Cargoes Code, issued by IMO (2009) must be onboard.

## BULK CARRIER CONSTRUCTION

Bulk carriers come in all sizes, from the smallest ships of only a few hundred tons deadweight to the largest of over 360,000 tons, 340 metres or more in length, 63 metres in beam and with draughts of 23 metres. Many of the problems relating to hold preparation are common to all bulk carriers. However, the size of holds in capesize, panamax and handysize bulk carriers do present problems when changing cargoes.

There are cargoes that stain; for example, petroleum coke (petcoke) requires the holds to be cleaned very well after carriage. Some cargoes require the holds to be 'grain clean' or 'hospital clean' (for example, silver sand which is used for making glass), and some cargoes require all traces of the previous cargo to be removed.

### Hold structure

The conventional bulk carrier has a box construction with large frames, usually smooth hopper sides fore, aft, port and starboard. The underdeck and coaming frames are situated high up and are often impossible to get to physically, as are the high ship side frames. These frames can retain traces of old cargo: corrosion, scale and residues of previous cargo can collect and fall, and contaminate the next cargo.

Some bulk carriers, including many smaller coastal-type ships, are built with box holds. This means that the hold sides are 'boxed' in with smooth steel sides, making discharge and cleaning much easier as there are no frames. These box holds, however, often have adjacent ballast tanks that may be prone to water leakage through grab damage.

The ship structure, including ladder rails, stanchions, rungs and pipe protection fittings, can become damaged during discharge. Any such damage should be noted and repaired on a continuing basis so that steel fittings torn from the ship's structure by grabs or bulldozers do not contribute to cargo contamination. This can also result in damage claims to shoreside discharging and conveyor machinery and equipment. The sheer size of the holds is a factor that often prevents a good hold-cleaning operation from being performed.

In addition, the following can cause contamination of the next cargo:

- grab damage to steel fittings and protection brackets
- loose bulkhead or tank top rust scale increased by damage from grabs or cargo
- grab damage to hold ladders or hold fittings
- tank top and ballast side tank integrity jeopardised by grab damage
- tank top, double bottom and side tank access lids damaged by bulldozers and grabs



^ Hold ladders should be in good condition



^ Hold ladders should be in good condition



^ Hold ladders should be in good condition

## MASTER'S DUTIES

The master will be given voyage orders as part of the charterparty agreement. He will be advised to present his ship at a port within a laycan that may require the ship's holds to be cleaned to a certain standard. That standard in the voyage instructions or charterparty should be clear and unambiguous. Those instructions should also be within the capabilities of the ship and resources onboard. If the instructions cannot be carried out because of, for example, voyage limitations in time or weather, then the master should inform the owners and charterers so that alternative arrangements can be made. The master has an obligation to deliver the cargo in the same apparent condition as loaded.

The master should not succumb to taking risks to comply with the charterparty instructions if the safety of the ship or personnel is put at risk.

Where there is a requirement to load to a stringent or high standard of cleanliness, masters of ships with generally poor to moderate condition of holds should be particularly alert to report the nature of the hold condition to owners. To upgrade a hold from poor condition to one clean enough to receive a grain cargo requires considerable time and resources. The task should not be underestimated. Otherwise, holds can be failed, cargo contamination claims can arise and charterparty terms can be violated.

The master should:

- clarify instructions if necessary
- make sure that he is aware of the extent of the required hold cleaning
- ensure that correct equipment and materials are available onboard
- advise charterers of the hold cleaning schedule and progress
- keep records of hold cleaning progress (weather and work logs)
- consider sending photographs of the cleaned holds to the charterers and owners on completion or where difficulties arise, as this can be helpful

## CASE STUDY A – CLEANING HOLDS – ALLOW SUFFICIENT TIME OR IT WILL BE COSTLY

A 24-year-old panamax bulk carrier was chartered out for a single voyage time charter to load barley in a Black Sea port in the Ukraine. The voyage orders from the head charterers gave the following instructions to the master based on the charterparty terms.

“On arrival at the load port, vessel to be clean, swept/washed, dried and ready in every respect and in all compartments to receive charterer’s cargo to local surveyors’ and/or competent authorities’ satisfaction – failing which the ship to be offhire and owners to take immediate steps to expedite cleaning as fast as possible including the use of shore labour. If ship fails inspection the bunkers consumed and extra directly related costs to be for owner’s account until ship has been passed in all loading holds.”

The ship left the last port having discharged a cargo of petcoke. The voyage to the next loading port was four days. Poor weather hampered the hold cleaning by the crew. It is evident that for a ballast voyage of this short duration, taking account of the age, size of ship and the last four cargoes, four days to carry out hold cleaning ready for grain was not going to be sufficient. The master advised the owners of this fact. The sequence of the previous four cargoes had been petcoke, coal, coal, bauxite. As a guide, with a normal crew complement who are experienced, organised and have the correct equipment, it will take one day to clean a hold of a panamax bulk carrier, although drying the holds will obviously take longer and will normally require the hatch lids to be opened to air. Holds with previous cargoes such as petcoke or bauxite may take longer to achieve a grain clean condition. The cleaning time will also be longer if the vessel encounters heavy weather, if access to the deck is restricted, if hatch covers cannot be opened or if the use of crane or davit winches to lift out cargo residue is restricted.

An inspection took place on arrival at the load port and all seven holds were rejected because of the presence of residue and dust from previous cargoes, and remaining water in the holds and bilges.

The following day, shore cleaning gangs attended the ship and six days later, the ship was again presented to the surveyor. Again, the ship failed for similar reasons plus the fact that loose rust scale was present on the tank top. It was found that the cleaning gangs did not have sufficient personnel or equipment (15 persons for a 24-hour operation, when 30 people would have been more appropriate); they

did not use high-pressure wash-down guns; and used only cold water without chemicals.

The charterers decided to send the ship to another port for another cargo, and a day later, the grain surveyor again found the holds unfit to carry cargo. Another set of shore cleaning gangs came aboard to clean the holds and three days later, the holds were finally passed as clean and dry, and ready to load. It is worth noting that even on the survey which the ship passed, there was evidence of petcoke staining on the hold bulkheads.

The claim from the charterers was that the ship was not ready to load under the terms of the charterparty and that there was a loss because the first cargo of grain could not be loaded. The claim amounted to some \$400,000.

A benchmark for considering a ship grain clean is given by the US Department of Agriculture: “To be considered fit the holds must be clean, dry, free of odour and infestation, and otherwise suitable to receive and store grain insofar as the suitability may affect the quality, quantity or condition of the grain.” (This definition is similar to that of the National Cargo Bureau.)

### LESSONS:

- owners’ chartering departments should have a good understanding about what can practically be achieved in hold cleaning and having the ship ready to load
- owners’ operations departments should be consulted by their chartering departments as to the condition of the ship and the time required to get the holds cleaned
- owners’ operations departments should have a good understanding of what is required in terms of personnel and equipment to carry out an efficient hold cleaning operation
- owners’ management should train personnel and institute guidelines for chartering departments about hold cleaning procedures
- masters must take a robust stand when asked to carry out hold cleaning operations that are patently unrealistic. Masters should not be forced into taking undue risks over hold cleaning in trying to comply with unrealistic laycan dates
- masters should ensure that good records, with photographs, are maintained for hold cleaning operations, particularly for sensitive cargoes

## DECK OFFICER OF THE WATCH/CARGO OFFICER DUTIES

During the cargo watch, as well as the normal duties expected of an officer of the watch (OOW), the cargo officer should:

- monitor the ballasting operations



^ Finishing the discharge of an iron ore cargo

- monitor the discharge to ensure that the grabs and bulldozers are not causing damage to the holds, tank tops and frames. Rough or bad grab or ‘dozer’ handling should be reported to the terminal authority and stopped
- OOW should remain especially vigilant where cargoes are sensitive to water damage



^ Cargo of urea contaminated by paint and rust scale flakes from hatch cover underside

### CASE STUDY B – KEEP A VIGILANT CARGO WATCH – THIS CANNOT BE OVEREMPHASISED

A ship loaded a full cargo of aluminium hydroxide in Australia for discharge in the USA. The ship was equipped with box holds, which allowed for easier cleaning and inspection before loading.

At the discharge port, at the same time as the ship was being unloaded, seawater ballast was being taken onboard. It was later found during the discharge that 500 tonnes of the cargo was water damaged by the ballast, which was confirmed to come from a hole measuring 100mm x 20mm in the hold/ballast tank steel plating. The hole was most likely to have been caused by stevedore grab damage in the discharge port.

The cost of damage to the cargo was put at around \$150,000.

### LESSONS:

- cargo watch on deck should monitor stevedore grab handling and damage. Crane drivers should be advised to take care not to damage ship structure
- cargo watch on deck should monitor ballast operations
- cargo watch on deck when the ship is carrying water-sensitive cargoes should identify the potential for water to leak from a crack or damage in the hold plating following grab damage
- consider gravitating ballast, to reduce pressure on ballast tank structures
- a rigorous sounding regime should be maintained in port

### MAINTENANCE OF HOLDS

Hold maintenance should be included in the ship's planned maintenance as part of a formal inspection and defect reporting system. In addition, after every discharge and after each cleaning, holds should be formally inspected by a competent person. This inspection should be recorded, with photographs. This record of the hold status is useful for providing a specification for repair and for dry-dock periods.

### Planned maintenance system and hold inspection regime to include:

- holds framing – damaged and 'tripped' brackets
- hold bulkhead coatings – to be in an acceptable condition as required by owners and by the particular trade
- condition of hatch covers, trackways, compression bars, channel drainage, hatch rubbers, cross and side cleats. Hatch drain valves should be operational
- hatch and hold vents and watertight lids, including access hatch lids, to be in a sound condition, with undamaged rubber packing and closing cleats and dogs to be operating freely



^ Maintenance of hatch cover vents is essential

- hopper sides and indents paint coating: damaged areas to be repaired
- attention to tank top damage and indents
- tank top double bottom or side tank access lid damage. If double bottom lids are removed to inspect the tanks, they must be properly refitted. The condition and the fitting of the gaskets must be checked by a competent person, and nuts should be screwed down securely and pressure-tested before the next cargo is loaded
- hold ladders, platforms and hand rails should be in a sound and safe condition
- checks on hold piping, air vent and water ballast sounding lines, and piping protection brackets
- bilge wells, including bilge covers, strum boxes, and bilge well valves, including non-return valves should be in a clear and sound condition. Bilge systems are an increasing cause of wet damage cargo claims. Non-return valves must be checked to ensure they are fully operational. They should be included in the planned maintenance system and formally checked every three to four months, operations permitting. Bilge lines should be blown back to confirm the effectiveness of the valves
- bilge high-level alarms should be checked
- lights and light fittings should be checked as operational. There have been claims, including some of high value, where the ship and the cargo have been in jeopardy after the hold lights were left on and/or the lighting wiring was in poor condition, leading to fires in the cargo hold or the ladder trunking. All hold lighting circuits should be disarmed prior to loading.



^ Hold lights left on can cause fires in bulk cargo

**After each cargo hold is cleaned and prepared a formal inspection should be undertaken as detailed above.**

### Fire fighting systems – if fitted

- fixed hold fire extinguishing systems, such as CO<sub>2</sub> lines, should be blown through with compressed air and checked to ensure they are free of dust and debris

Defects should be repaired promptly. All tank or hold damage that affects the hold integrity must be repaired. This includes side and double bottom fuel and ballast tanks.



^ Check the tank top indents after discharge and after cleaning

### CASE STUDY C – GOOD INSPECTION AND MAINTENANCE AT DRY DOCKING IS COST-EFFECTIVE

In 2008, a 20-year-old panamax bulk carrier loaded a cargo of cement in Taiwan for the USA. The ship was not loaded to her marks and for some reason, the master considered it necessary to take additional water ballast for the voyage across the Pacific. During the voyage, it was decided to carry out a ballast water exchange as provided for in the ballast management plan.

This ship's double bottom ballast tanks were connected with the upper wing tanks by a ballast trunking. Therefore, the upper wings had to be filled through the double bottoms, pumping ballast water up the ballast trunking into the upper wing tanks.

During the ballast water exchange, water seeped into one of the holds containing a full cargo of cement, through a corrosion hole in the trunking between the double bottom and the upper wings. It was found the next day after filling the upper wing tanks that one ballast wing tank was not full – so more ballast was pumped in. There was no consideration given as to why the upper wing tank had become slack.

On arrival at the discharge port, the draft survey appeared to show that there was more than 1,000 tonnes of 'cargo' onboard than loaded. Of course, this was not the case and that extra weight was seawater ballast in the cargo hold. The 1,000 tonnes of seawater and 11,000 tonnes of cement combined to make a substantial 'cement box'. This cement lump in the hold took over six weeks to dig out and the claim amounted to more than \$2m, excluding offhire and ongoing ship operation costs.

It was found that there were no:

- proper ballast tank inspections undertaken under the planned maintenance system
- proper checks during the voyage of the ship's watertight integrity. Daily tank and bilge soundings must be maintained
- understanding of the risks associated with pumping seawater ballast under pressure when carrying a water-sensitive cargo
- proper instructions and guidance to the masters and officers about cargo carriage – neither in the ISM nor operational procedures

### LESSONS:

- proper, diligent and recorded ballast tank inspections must be carried out and form a part of the ship's planned maintenance system
- ballast tank inspections should form the basis of a dry-docking defect list
- a proper system of inspections and checks must be carried out to assess the integrity of ballast tanks after hold cleaning and during the ballast voyage
- bulk carrier inspections should include all parts and areas where water ballast can get into cargo holds: bilge systems, manhole covers, and tank top and bulkhead welds
- proper guidance should be given to masters and officers with respect to cargo carriage and ballast water management
- advice and training should be given that pumping ballast can cause extreme pressures on the tank structures and fittings such as manhole lids, even when tanks are fitted with class-approved air vents. Consider only gravitating water ballast so as to reduce pressure on the tanks and manhole lids
- ship's procedures should always include rigorous checks on the ship's watertight integrity, including daily tank and bilge soundings, bilge alarm tests, checks on sounding pipe caps and inspections of spaces not often visited, including cofferdams and void spaces

### SAFETY

Hold cleaning, and operating high-pressure water wash guns at sea in a moving ship, is a hazardous operation. All personnel must be trained and clearly advised as to their tasks. A permit to work system should be operating and a 'tool box' talk should take place before work begins.

These safety concerns should be addressed:

- hold cleaning operations to be authorised by master and chief officer. Bridge to be contacted and kept informed
- work permit system in place
- master should carry out risk assessments in poor weather (enclosed space precautions to be taken in closed hatches)
- all personnel to wear correct personal protective equipment (PPE)
- all personnel to be aware of the dangers and of their duties
- only experienced and trained crew to use high-pressure wash guns
- airlines and hoses should be in good condition
- if chemicals are used, safety data sheets must be consulted and precautions taken
- all equipment to be checked before use and confirmed to be in good condition
- all ladders and accesses to be in sound condition
- all portable ladders to be properly secured
- proper lighting to be used
- proper communications to be available between those in the hold, on deck and on the bridge
- lifting equipment must be in good condition

### HOLD CLEANING

Before loading a bulk cargo, the master has usually to declare that the ship is ready to load as per the charterparty requirements and charterer's and owner's instructions. Copies of the charterparty should be placed onboard so that the master is able to see exactly what are the ship's obligations. The master can have this declaration accepted only when the holds have been inspected and accepted. For this to happen, the master needs to know how clean the holds have to be to meet the charterer's requirements. This will depend on the previous cargo, the next cargo, local regulations and specific cargo interest requirements.



^ Hold with bauxite stains



^ Hold cleaning using a maxi-jet wash-down hose



^ Hold cleaning with maxi-jet hold cleaning equipment



^ Residue of previous ore cargo caught in the frames



^ Reaching into the corners to clean residue cargo in the upper frames

#### a. Cargo contamination problems

Whatever the previous cargo, all holds should be swept clean, and loose scale and rust removed. When reloading the same cargo commodity, there is a tendency to leave the holds unswept. In general terms, this is not good practice since the residual cargo can hide damage to the hold or tank top. Traces of previous cargoes, such as sulphur, sulphur traces in coal cargoes and some fertiliser cargoes may corrode bare steel plate.

It is recommended that holds are swept clean after every cargo and the residues removed or, if reloading the same cargo type, placed to one side so that a tank top and hold inspection can be carried out. Large amounts of cargo remaining onboard may not only cause outturn problems, but hide damage to the tank top plate.

The level of cleanliness of the hold required will vary from port to port, and shipper to shipper. As a general rule, if nothing specific is stated, a double sweep, with a saltwater wash followed by freshwater wash, is a sensible option.

In order to avoid delays or offhire of the ship, hold cleaning requires proper planning.

#### b. Problems stemming from previous cargo

The holds will be declared unfit for loading if any residue of the previous cargo, other debris or substances, dunnage residue or a need for repair or hot work is found.

**Action:** Sweeping and removing all residues, followed by a thorough wash-down using high-pressure air or water cleaning equipment.

#### c. Cargo stain

Cargo stains are not acceptable if they rub off and risk contaminating the next cargo.

Surveyors give coal and petcoke stains particular attention because these can blister and peel the paint work if the hold starts to sweat.

**Action:** Coal and petcoke stains can be removed by using spray jet systems for applying chemicals from the tank top. The choice of chemicals must be carefully considered, as odour and caustic effects will affect the next cargo. High-pressure cleaning can be used to access small areas in the lower parts of the holds.



^ Paper pulp with petcoke staining

#### d. Rust, rust scale and paint flaking

All areas affected by rust and flaking paint will be checked by the surveyor. The holds will be declared unfit if loose rust or paint flaking is found.

**Action:** Loose rust and paint flakes should be removed using high-pressure air or water cleaning equipment. The areas are then to be cleaned and scraped.



^ Surveyor scraping off loose paint

#### CASE STUDY D – REMOVE ALL LOOSE PAINT AND RUST SCALE

In 2009, a two-year-old bulk carrier with boxed holds loaded a cargo of granular urea in bulk from the Caribbean for discharge in a European port. At the load port, the holds were initially failed for cleanliness because of excessive paint and rust scaling on the tank tops, and residues and staining from the previous clinker cement cargo. The holds required additional cleaning and after 24 hours, they were passed as clean.

At the discharge port, the cargo was discharged and when inspected in the warehouse, it was found to be contaminated by a considerable quantity of small pieces of paint and rust scale. Some of the rust scale was as large as 2cm square and was clearly identified as coming from the ship's holds. A dispute therefore arose between the shippers and receivers of the cargo.

#### LESSONS:

- proper resources (time, personnel and equipment) must be placed onboard to carry out cleaning and maintenance, and prevent claims. Proper planning and support by management chartering and operational departments to allow time for cleaning holds will prevent claims
- proper instruction and guidance from the company on the level of cleaning necessary will prevent holds being rejected because of poor cleanliness
- regular maintenance of holds is necessary to ensure that rust scale is removed and coatings remain in good condition. This will prevent delays and avoid holds being rejected as unfit
- proper inspection and management from ashore will reduce these problems



^ Loose rust scale will result in the hold failing the cleanliness survey

#### e. Unsanitary conditions

If a hold is found to contain animal filth, bird droppings, faeces or sewage, it will be rejected.

There must be no evidence of rats or rat droppings. If this is suspected, specialist assistance and probably fumigation will be required by the local authorities who should be notified accordingly.

**Action:** Holds must be thoroughly checked and any unsanitary conditions treated appropriately. If any sewage is found, it must be identified and the source found. It should be stored onboard properly before being discharged ashore.

#### f. Wetness

All holds must be dry. If the holds contain water or leaking water, the vessel will be declared unfit. Bilges and bilge wells must be dry.

**Action:** If water remains in the hold after a wash-down, it must be mopped up or air-dried. If water is leaking into the hold, steps must be taken to repair the leak.

#### g. Odours

All grain storage areas must be odour-free. This includes odour from paint and cleaning chemicals.

**Action:** Hatches must be left open, weather permitting, so fresh air can circulate, or ventilation can be used if fitted, in the affected area. Time has to be allowed to remove odours.

#### h. Infestation

Holds will be declared unfit to load grain if three or more insects, dead or alive, are found in one hold. The holds will also be declared unfit if larvae or unhatched insect eggs are found. Under the Australian Quarantine Inspection Service rules, there must be no bugs: any found will result in the hold failing the cleanliness survey.

**Action:** Holds may need to be fumigated prior to being accepted. This can be a costly and time-consuming operation. Special attention must be given to exposed areas such as under hatch covers, hatch coamings, access ways and bottom areas of the bulkheads, slopes and tank tops.

All adjacent spaces to the holds, (for example, mast houses and storage spaces) should be inspected to ensure that they are also infestation-free.

#### SURVEYOR'S INSPECTION AND REQUIREMENTS

Prior to loading grain, all ships are usually subject to a survey by an approved independent surveyor. The surveyor will require the ship's particulars, and details of at least the last three cargoes carried. He will then inspect the holds for cleanliness and infestation, and the presence of any material that could lead to infestation or contamination.

When the surveyor is satisfied, he will issue the ship with a certificate to confirm that the holds are clean. However this is not a guarantee that the holds are perfectly clean and that no cargo claim will result.



## HOLD CLEANING IN BULK CARRIERS – GRAIN

In the dry bulk trades, there are essentially five grades of hold cleanliness:

1. hospital clean, or 'stringent' cleanliness
2. grain clean, or high cleanliness
3. normal clean
4. shovel clean
5. load on top

**Hospital clean** is the most stringent, requiring the holds to have 100% intact paint coatings on all surfaces, including the tank top, all ladder rungs and undersides of hatches.

The standard of **hospital clean** is a requirement for certain cargoes, for example kaolin/china clay, mineral sands including zircon, barytes, rutile sand, ilmenite, fluorspar, chrome ore, soda ash, rice in bulk, and high grades of wood pulp. Generally, these high standards of cleanliness will only be met by vessels trading exclusively with such cargoes. It will rarely be required in the tramp trades.



^ To be accepted for some dry bulk cargoes, the holds need to be hospital clean

**Grain clean** is the most common requirement. A ship will be required to be grain clean for the majority of bulk and break bulk cargoes, such as all grains, soya meal and soya products, alumina, sulphur, bulk cement, bauxite, concentrates, and bulk fertilisers. Some ports and shippers may allow a different standard of cleanliness.

**Normal clean** means that the holds are swept clean, with no residues of the previous cargo, and washed down (or not, depending on charterer's requirements), that is, cleaned sufficiently for taking cargoes similar to or compatible with the previous shipment.

**Shovel clean** means that all previous cargo that can be removed with a 'Bobcat' or a rough sweep and clean with shovels by the stevedores or crew. The master should clarify what standard is expected.

**Load on top** means exactly what it says – the cargo is loaded on top of existing cargo residues. Usually, this means 'grab cleaned'. This standard will commonly be required where a ship is trading continuously with the same commodity and grade of that commodity. This will typically occur when a ship is employed under a Contract of Affreightment to carry, for example, a single grade of coal over a period. With such a trade, there is no commercial need for holds to be cleaned between successive cargoes, and each cargo is simply loaded on top of any remaining residues from the previous cargo. With load on top, guidance may be necessary for the master on any cleaning requirements, including the use of bulldozers and cleaning gangs.

## Grain clean

The most common cleanliness requirement for bulk carriers is that of grain clean.

The usual instructions a master of a tramping conventional bulk carrier will receive, particularly if his ship is unfixed for next employment, is **Clean to grain clean on completion of discharge**. This guideline is aimed at the majority of bulk carriers engaged in the carriage of 'usual' bulk cargoes in conventional ships, which are cleaned to a grain clean standard. As noted above, there are certain cargoes, such as kaolin, which require the higher standard of cleanliness or hospital clean.

The industry accepted definition of **grain clean** is provided by the National Cargo Bureau (NCB).

*"Compartments are to be completely clean, dry, odour-free, and gas-free. All loose scale is to be removed."*

The definition is clear:

1. all past cargo residues and any lashing materials are to be removed from the hold
2. any loose paint or rust scale must be removed
3. if it is necessary to wash the hold, as it generally will be, the holds must be dried after washing
4. the hold must be well ventilated to ensure that it is odour-free and gas-free

What is 'loose scale'? It is important to differentiate such scale from oxidation rust (i.e. light atmospheric rusting). Loose scale will break away when struck with a fist or when light pressure is applied with a knife blade or scraper under the edge of the scale. Oxidation rust will typically form on bare metal surfaces but will not flake off when struck or when light pressure from a knife is applied.

Generally, the presence of hard-adhering scale within a hold is acceptable in a grain clean hold. The scale should not fall during the voyage or during normal cargo operations.

Countries apply different standards to what constitutes an acceptable amount of loose scale or loose paint. While in some countries, no such material is permitted, the United States Department of Agriculture permits a single area of loose paint or loose scale of 2.32 sq m, or several patches that in total do not exceed 9.26 sq m, before a hold is deemed to be unfit. In practice, the hold should be free of loose scale as each surveyor's interpretation of the required 'standard' may vary.



^ Flaking paintwork under the hatch coaming can result in a hold failing the grain survey



^ These holds are unlikely to pass a grain survey, as they are heavily pitted with rust scale and embedded with coal staining



^ Residue of previous cargo will result in the hold failing the inspection to load grain



^ Loading grain



^ Hold of a bulk carrier that is grain clean and ready to load



^ A full cargo of grain



^ Hold of a bulk carrier that is grain clean and ready to load

## Swept clean or shovel clean

The quantity of cargo residues remaining in a hold at the completion of discharge may vary considerably, for a variety of reasons. The master may have control over some of these; for example, after discharging a steel cargo, it may be possible to persuade the stevedores to remove lashing materials, which will greatly assist the crew in their hold cleaning. Often a charterparty will specify that the ship is to be redelivered 'swept clean' or 'shovel clean'. If it is 'swept clean', the stevedores at the discharge port should sweep the holds before completion of discharge in order to minimise the remaining residues; if it is 'shovel clean', the stevedores need do no more than discharge cargo that can be easily accessed with a mechanical shovel or a Bobcat.

If a ship is redelivered with holds that are shovel clean, several tonnes of cargo, might remain in each hold. This must all be swept up by the crew and brought on deck for disposal as permitted. Hold cleaning and cargo removal might take weeks, depending on the amount remaining onboard and available resources.

During the sweeping operation, care should be taken to ensure that:

1. any residues that may be trapped in places such as accessible pipe guards, access ladder trunkings, behind frames and frame knees, are removed
2. hatch cover undersides, if not boxed in, are swept to remove any residues that have accumulated under the covers
3. hatch coamings, hatch trackways, hatch access ladders and internal ladder spaces are cleaned
4. during this sweeping process, the hold bilge wells should be opened and cleaned to remove any residues that may have fallen into them

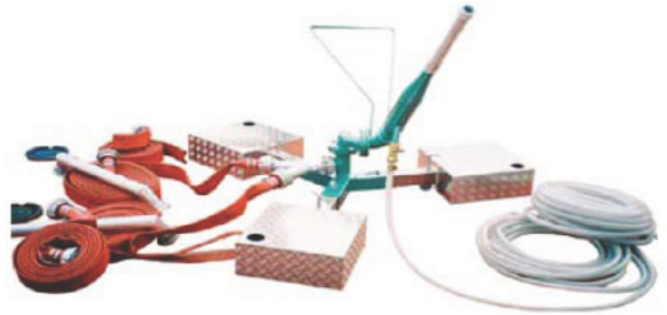
The parts of the hold that crew can access for cleaning may be limited, particularly in the larger handymax, panamax and capesize ships, because of the dimensions of the holds. Some high-level access may be possible only with scaffold towers, if these can be safely rigged. Even with such equipment, there will still be areas that are inaccessible.

### HOLD WASHING-DOWN

Once sweeping and removal of the residues has been completed, the next task with most bulk cargoes is to wash down the holds and hatch covers with seawater.

This seawater may be delivered from hoses at the pressure supplied by the deck fire main, or from enhanced delivery systems such as the Stomme Combi-Jet or Maxi-Gun. The Combi-Jet is capable of delivering a water jet over a distance of 30m to 40m, while the Maxi-Gun delivers to a range of 60m to 80m.

When washing down, the crew should take care to ensure that the upper reaches of the holds are washed thoroughly to dislodge any residues that may be trapped in the upper structure, behind pipe guards, on cross deck structures, etc. This is particularly important in parts of the hold that are physically inaccessible. During the wash-down, loose paint or rust scale will be dislodged, particularly where the water is delivered by an enhanced delivery system such as a Combi-Jet or Maxi-Gun.



^ Stomme Maxi-Gun wash-down gun with 7-10 bar of air pressure giving approximately 100 tonnes of water an hour. This is suitable for cargoes such as cement and petcoke

Depending on the nature of the previous cargo, this wash-down may be sufficient. With certain cargoes, residues or staining may remain even after a thorough wash-down. To remove these, it is necessary to use targeted chemicals.

For cargoes such as coal and petcoke, which leave staining, it is often necessary to use heavy-duty alkaline detergents, which are applied as an emulsion, need time to take effect and are rinsed away with seawater. More than one application will be needed to remove stubborn stains. If using chemicals for cleaning, reference should be made to the safety data sheet concerning safety precautions and handling.

A common test in countries including the USA and Australia is for the surveyor, wearing light-coloured gloves, to run his hand across the hold bulkheads. If there is any discolouration of the gloves, the hold fails the cleanliness survey.

For cargoes such as cement and cement clinker, which often leave a sheen of residue on surfaces such as the sloping plates of the upper hopper tanks, it is necessary to use diluted acids to remove those residues. The most common acid is hydrochloric acid, which is also known as muriatic acid. The diluted acid is applied directly to the residue, given time to take effect and then rinsed away. Where residues are tenacious, many applications of acid may be required or the residue may have to be physically scraped away.

When scale and rust has been removed by a high-pressure water wash, it is prudent to check the holds a few days later, since water caught behind paint and scale can later dislodge rust scale. The holds in any event should always be checked again before arrival at the load port to ensure that no previous cargo residue has been dislodged by the ship's movements and vibrations.

Steel-plate manhole covers should be removed to allow access to the lid recess below, and container fittings on the tank tops, ladder recesses and platforms must be thoroughly cleaned.



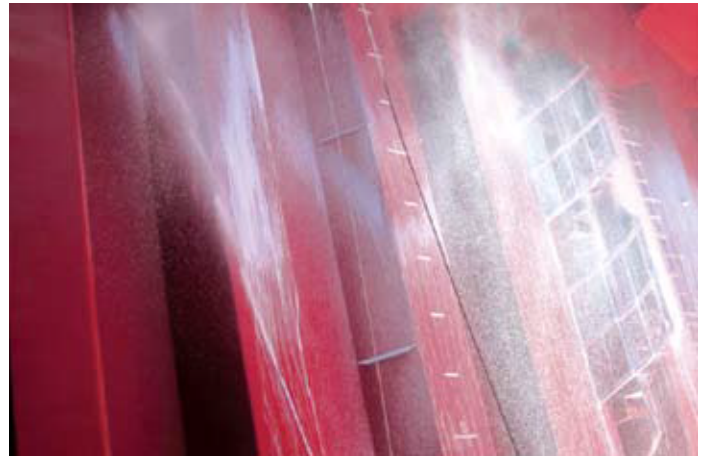
^ Cleaning under the coaming



^ Cleaning under the coaming



^ The Stromme Maxi-Gun provides powerful cleaning from tank top level



^ Applying the prewash



^ Hold cleaning after carriage of a petcoke cargo



^ Applying the prewash

### USE OF CHEMICALS

Any discolouration of the hold coating can easily become permanent if not properly cleaned after each, or every second, cargo.

The use of chemicals is becoming more common. Studies have indicated success in protecting the paintwork (and thereby allowing easier cleaning of cargo residue), breaking down the cargo residue, or cleaning and degreasing after cargoes such as petcoke or coal, ahead of a full seawater wash down. The chemicals should be washed off before they can dry.

#### Prewash chemicals

The use of a prewash can protect the paint coating of the holds and allow for a much easier cleaning after cargoes which are liable to stain. The prewash coating is applied in the same way as the cleaning chemicals (see below) and dries off as a clear protective film. This is then washed off after discharge. Such prewash chemicals are also known as 'fat cargo slip'.

The prewash prevents the cargo adhering to the hold surfaces. Prewash is less effective on rough, uncoated surfaces such as the hold tank top. Application in a handymax ship takes about three hours per hold. Prewash protects the paintwork and can reduce time required for painting in preparation for the next cargo.



^ Applying the prewash



^ Applying the chemical after discharge and before full wash-down. Using a spray wet foam allows the chemicals longer to dry and so has a better cleaning effect



^ High-pressure water cleaning of a small bulk carrier hold with a height of 8m, after a cargo of road salt



^ Loose rust and scale must be removed

### Cleaning chemicals

There are a number of products available and the manufacturer's instructions for mixing proportions and the safety precautions should always be followed. If the recommendation is to use only freshwater to apply the chemical, this should be followed, otherwise the application may be ineffective. Equally, without use of the proper equipment, the application may not work.

The chemicals are usually applied using special equipment including:

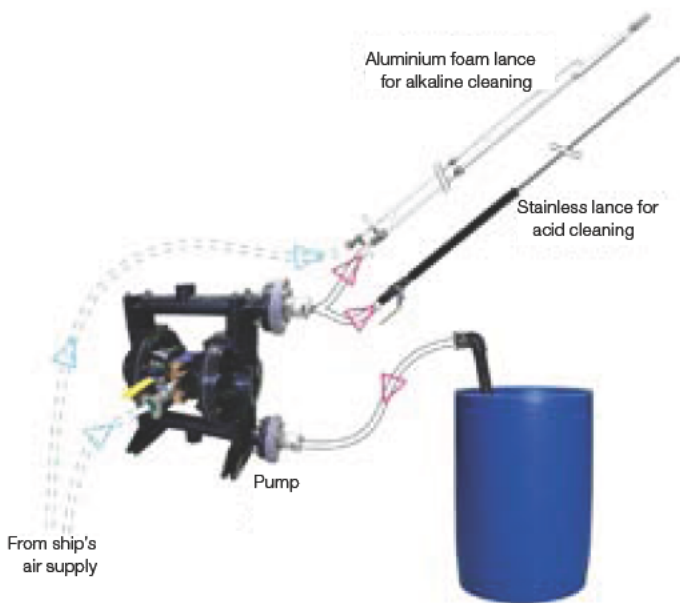
- chemical tank
- mini-jet with air pressure of about 7 bar
- lance with foam nozzles and extensions
- personal protective equipment (PPE)

After leaving the applied chemical on the bulkhead for a prescribed time, the chemicals are washed off using a full seawater wash. The operation should always be finished with a freshwater wash.

Always check the manufacturer's guidance on compatibility with paint systems. Always check with the charterer and/or shippers regarding compatibility with the next cargo.



^ Using the chemical cleaning lance



### Limewashing

Hold structures must be protected against aggressively corrosive cargoes, for example salt and sulphur. Limewashing is used as a protective coating before loading such cargoes. Limewashing is a physical barrier application – so the thicker it is, the better the protection, but the more difficult it is to remove.

Effective barriers against corrosive cargoes are:

- paintwork in good condition
- limewashing
- hold block

The more intact the paintwork, the less limewash or hold block is required.

A typical voyage instruction for loading sulphur, for example, will be:

*“The ship to be presented for loading with holds clean/swept/dry/limewashed and free from residues of previous cargoes, suitable in all respects to receive bulk sulphur to the satisfaction of shippers and charterers. Hatch covers to be in a satisfactory condition to ensure watertightness.”*

Lime (or calcium hydroxide) is manufactured from crushed and powdered limestone. The problem with limewash is that it is difficult to remove, posing a similar problem to a light cement residue. An alternative is ‘hold block’, which is a transparent and environmentally friendly product.

**Lime mixture:** prepare 200 litre empty drums with about 50/75kg of lime plus 2.5kg of sugar. Fill the drum with hot or warm freshwater and mix thoroughly. A handymax bulk carrier will use about 1,200kg to 1,500kg of lime. For a ship without paintwork intact, 600kg of lime can be used in a 10,000 cubic metre hold. The mixing quantities will vary according to the condition of the paintwork and other factors. The master should always ensure that he has sufficient lime onboard.

**Lime application:** The mixture is to be applied with a roller or a spray to a height as calculated by the stowage factor. A thicker coat is then applied to those parts of the hold lacking good paint covering, such as the tank top. Special attention paid to areas behind frames and to inaccessible places. No bare metal should be visible. Sometimes a second coat may be applied if, during drying, rusting is visible through the limewash, as this may stain certain cargoes.

**Lime coating removal:** Use high-pressure water washing and possibly caustic or citric acid cleaning chemicals.

**Hold block:** The supplier should be consulted for the application rates, which depend on the hold condition. The hold block is easily removed using the manufacturer’s hold wash.

### Freshwater rinse

Once the wash-down is judged successful and all residues have been removed, the holds and hatch covers should be rinsed with freshwater to remove any dried salts that have become deposited in the hold structure as the seawater previously used has dried.

The degree of a freshwater rinse or wash depends on the nature of the next cargo to be loaded.

Some shippers, surveyors, or terminals, for example, when loading fluorspar, will carry out a silver nitrate test to ensure that the hold is free of all salt deposits.

If the following cargo is to be steel, it is important to remove all chlorides in the hold as any sweating may produce saltwater, which could affect the steel.

### Disposal of bulk cargo – wash down residues

Care should be taken when disposing of both cargo residues and wash down water to ensure that the requirements of MARPOL 73/78 Annex V are strictly followed.

MARPOL 73/78 Annex V requires that all ships of 400gt and above have an approved Garbage Management Plan and a Garbage Record Book. An amendment that came into force in August 2005 stipulates that cargo residues are treated as garbage. Cargo residues that remain onboard after discharge are thus included in the definition of garbage, and need to be disposed of outside Special Areas (as set out in MARPOL 73/78), and as far away from the nearest land as mandated by the MARPOL regulations. (“if it floats – outside of 25 miles; if it sinks – outside of 12 miles”).

The Garbage Management Plan should include minimisation of cargo residue wash-down water and its discharge. Any cargo residues and wash-down water disposals or discharges should be recorded as Garbage Category 4 in the Garbage Record Book, and the entries should include start and stop positions.

MARPOL 73/78 permits exemptions from these regulations where safety may be compromised.

MARPOL ANNEX I – Regulations for the Prevention of Pollution by Oil.

Annex V Reg. 1(1) of the Marpol Convention confirms that if a substance is defined or listed in other Annexes then Annex V does not apply. For a cargo such as petcoke which has a high hydrocarbon content (you can see the oil sheen when washing down this cargo), the hold washings would fall under the requirements of Annex I and can only be discharged in compliance with it.

Annex I Reg 1(1) defines oil as “petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products...”

Annex I Reg. 1(2) refers to oily mixture as “a mixture with any oil content”.

Annex I Reg. 2(1) states “Unless expressly provided otherwise, the provisions of this annex shall apply to all ships.”

Therefore Annex I applies to all ships and hold washings containing petroleum products should be disposed of accordingly. Unfortunately, the Annex is not completely clear and was not written with petcoke or other hold washings in mind.

Annex I Reg. 9(1) “Control of Discharge of Oil” sets out that “any discharge into the sea of oil or oily mixtures from ships to which this Annex applies shall be prohibited except when the following conditions for dry cargo ships are satisfied;

From a ship of 400 tons gross tonnage and above other than an oil tanker and from machinery space bilges excluding cargo pump-room bilges of an oil tanker unless mixed with cargo residue:

- the ship is not within a special area (see Annex I Reg. 10)
- the ship is proceeding en route
- the oil content of the effluent without dilution does not exceed 15ppm; and
- the ship has in operation equipment as required by Reg 16 of this Annex”. This refers to 15ppm oily water filtering equipment which is not fitted to dry cargo ships for use with cargo washings

Because of the large quantities of water used in hold washing and relatively low amounts of petroleum content the washings are unlikely to exceed 15ppm; but it would be prudent to take a sample of effluent and ensure that the content is less than the 15ppm, and then dispose of the washings in compliance with MARPOL – outside of 25 miles and not within a Special Area.

### Washings containing hold cleaning chemicals

Such chemicals could in themselves be pollutants. If a substance falls within Annex 1 (Oil) or Annex II (Noxious Liquid Substance), then the washings will have to be disposed of according to the Annex requirements. Check with the suppliers if in doubt.

Cleaning holds within, or close to, port limits may also require local regulations to be followed with respect to the disposal of hold washings. Always check with local agents. It may be necessary to retain the washings onboard or dispose of them ashore using road tankers or to approved facilities. Only approved companies should be used for the disposal of hold washings, and the correct paper work and receipts should always be retained for a minimum of two years.

### DRYING HOLDS

When the wash-down is completed, the crew should mop up any pools of water that may have collected in tank top indentations and other areas. If the ship is fitted with mechanical ventilation, this should be run to aid the drying process for the rest of the hold. Bilge wells must be dry before being shown to a surveyor.

Almost inevitably, some ship sweat will form on the internal structure of the hold in the interval between completion of cleaning and the hold inspection. Ship sweat should not in itself be a reason for holds to fail an inspection. The inspector may require any excessive quantities to be wiped dry during the inspection, but having satisfied himself that the source of the moisture is ship sweat and not water ingress, the surveyor should accept the hold as clean.

### BILGE WELLS

It is customary to cover bilge well cover strainer plates with burlap and cement around the perimeter, or there may be a bolt down system. Some cargoes, such as zircon, andalusite, titanium slag or chrome ore are contaminated by cement or cement dust. In these cases, the burlap should be positioned using marine tape.

Kraft paper can be considered for certain cargoes to prevent dust and silt.

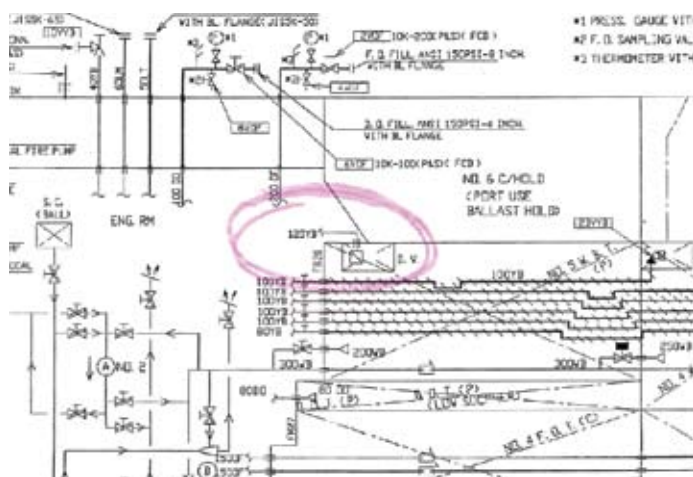


^ Bilge plates covered with burlap and ready to load grain

### BILGE LINE TESTING

One of the most important tasks in hold preparation is to ensure that the bilge wells, lines and valves are in a clean and operational condition.

The bilge lines must be tested by a competent person (under the supervision of the cargo officer) to ensure that the non-return valves are functioning correctly and not allowing any flow back of water into the holds. The bilge high-level alarms must also be tested and confirmed as operational.



^ Get to know your bilge and ballast system.



^ Check that bilge wells are clean and dry, and that strainers and strum boxes are cleaned



^ Check that the bilge suction is operational



^ Pneumatic non-return valve

## INTERNAL WATER INGRESS

Water ingress into the holds when carrying cargo is a common cause of cargo damage. This can be the result of poor hatch cover integrity, or water ingress back through the bilge and ballast system.

- check the bilge and ballast/eductor system non-return valves
- check that high-level alarms are operational
- consider blanking off bilge and ballast lines if washing-down empty holds when remaining holds contain water-sensitive cargoes
- check the integrity of ballast and fuel oil tank manhole lids
- ships with holds that are also used for seawater ballast must have the ballast lines blanked off and tank top manhole lids securely fitted with gaskets in good condition



^ Water ingress via a faulty bilge valve will cause cargo damage

## PAINT SYSTEMS

The more glossy the paint, the easier it is to clean. Epoxy coatings appear to be the most common paint used for holds.

If the holds need painting, sufficient time should be allowed to cure and dry the paint. Unless advised otherwise by manufacturers, seven days should be adequate in a well ventilated hold. Some cargoes such as processed grains are susceptible to taint from uncured paint.

Stains from petcoke are difficult to remove from some types of paints. The coke appears to be 'burnt' into the paint and a second high-pressure cleaning with brushing is often required.

What you can do:

- reduce the impact pressure of the cargo on the sides of the hold when loading, if possible
- use high-pressure washing with chemicals
- use cherry-pickers to give crew direct or closer access to the hold sides (in port only)
- protect the hold paint before loading, with a prewash or barrier chemical. Check that such chemical is compatible with any food stuff cargoes



## FUMIGATION

Charterers and shippers may require the cargo to be fumigated. If this is to be done during the voyage or before or after loading, full and clear instructions should be received from the charterers and shippers. These instructions should refer to product data sheets and the correct procedures and safety advice, application dangers, method of handling, and requirements for personal protective equipment and monitoring equipment. Refer to IMO Recommendations on the Safe Use of Pesticides on Ships. Always carry out a risk assessment.

A qualified fumigator should be engaged by the charterers when fumigation is to be done in port.

All spaces should be padlocked and sealed to prevent anyone from entering the space. No-one should enter a space that has been fumigated until after it has been thoroughly ventilated. It is recommended that an expert chemist declares whether the space is safe to enter. If the cargo requires ventilation after fumigation, advice should be sought from fumigation experts in respect to crew safety.

## CASE STUDY E – GRAIN CARGO, WET AND HEAT DAMAGED

A four-year-old bulk carrier loaded a part soya bean meal/grain cargo at a South American port before proceeding to a second port to complete loading, for discharge in the Mediterranean.

After leaving the first load port, water was found in two of the cargo hold bilges. The ship was not carrying any ballast water. These bilges were pumped out and the following day a similar quantity of water was found in the hold sounding pipes. This continued for a few more days until the bilge lines were blanked off.

At the discharge port, a surveyor investigated the cause of water ingress into the cargo holds and concluded:

- a butterfly valve on the bilge and ballast pump line was faulty and leaking
- all the pressure gauges on the eductor system were defective
- one of the non-return bilge suction hold valves could not close properly because a rag was blocking the valve
- butterfly valves on the bilge line did not seat or close properly
- no non-return valve was fitted to one of the hold suction lines – a defect that presumably stemmed from the time the vessel was built
- there were no bilge high-level alarms fitted

On arrival at the discharge port, a significant amount of cargo was found to be damaged. Not only was the cargo wet damaged, but it was affected by heat. It was then established that in addition to the damaged wet cargo, three of the cargo holds were located above double-bottom heavy fuel oil tanks. The heavy fuel oil was being heated via steam lines in the bunker tanks as is normal, but it was found at the time of the survey that the steel tank top in these holds was at a temperature above 50°C, which was more than enough to cause damage and even in danger of making the grains self-combust, especially if damp or wet. It was also concluded that some of the steam lines in the fuel oil double bottoms were defective.

The total cost of the claim for the damaged cargo amounted to more than \$300,000.

## LESSONS:

### Bilge and ballast systems

- ship officers should be aware of the way in which the bilge and ballast systems of their ship function. Many incidents are caused by a lack of knowledge of how the bilge and ballast and eductor systems operate or where the bilge and ballast systems are common
- bilge and ballast systems with remotely actuated valves should be routinely checked to ensure that they are operating correctly. Often, mimic boards indicate that valves are closed when they are in fact open or partially open, and vice versa
- test before each loading that high-level bilge alarms are fully operational
- it is recommended that hold bilge high-level alarms are fitted even if this is not mandatory
- regular, daily bilge and ballast sounding is good practice. Always check the watertight integrity of the ship
- bilge and ballast systems, including the effectiveness of bilge non-return valves, must be checked. These items should be included in the ship's planned maintenance system
- when water is found in the holds, systematic investigations must be carried out immediately to identify where it is coming from, and support and advice should be given by shore management
- technical managers should be familiar with the systems onboard
- Management of Change procedures on taking over a new ship should include checking of the bilge and ballast systems

### Fuel oil tanks

- masters and officers must be aware of the location of the heated fuel oil tanks
- masters and officers should monitor the tank top temperature above the fuel oil tanks as this can affect the integrity of certain cargoes – particularly grain cargoes
- fuel oil temperatures can be monitored on the fuel oil transfer pumps
- masters and chief engineers should manage the fuel oil onboard to reduce heat damage to cargoes loaded in holds above heated fuel oil tanks
- heat only fuel oil tanks in use



^ Soya bean meal damaged by wetness and heat



^ Soya bean meal – discharge near completion with bulldozers in the hold



^ Soya bean meal – discharge near completion with bulldozers in the hold

## CASE STUDY F – GRAIN CARGO – THE COST OF FAILING AN INSPECTION

A time-chartered, handysize bulk carrier was fixed to load a full cargo of bulk grain. The previous cargoes had been cement clinker, logs, concentrates, wheat, petcoke and sulphate. The hold condition on arrival at load port was required to be:

*“clean, swept, washed down by fresh water and free from insects, odour, residue of previous cargo (incl. coal petcoke, clinker)/loose rust scale/paint flakes etc. dried up and ready to receive charterers’ intended cargo subject to shippers’/relevant surveyors’ inspection. If the ship fails hold inspection by shipper/relevant surveyor, the ship to be placed off hire until accepted in all holds, and any extra costs/expenses/time included stevedores’ stand-by and/or cancelling charges, therefrom to be for owners’ account”.*

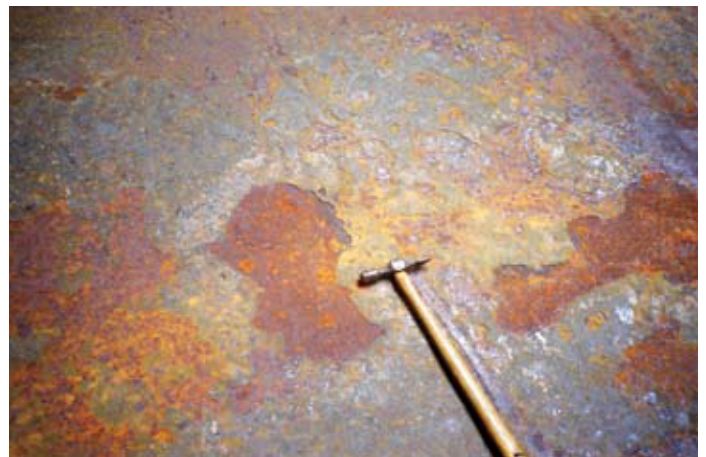
The grain was to be back-loaded at the same port as the clinker was discharged. On completion of the clinker discharge, the vessel went to an anchorage for the holds to be cleaned. After some days, the master sent a message to the voyage charterers advising that the holds were clean and ready for loading. The charterers accepted the notice, took delivery of the ship and hire commenced. After a two-week delay, the ship was brought to the load berth and failed the pre-loading grain inspection. The charterers advised that their grain surveyor had identified loose rust, paint and previous cargo residues in all holds and hatch covers, scale on the tank tops and loose limewash on the bulkheads.

The vessel was placed offhire by the charterers, and the owners were required to arrange hold cleaning. This required the use of shore labour over several days. Equipment used included five cherry-pickers and four water-blasting machines, requiring 18 men. Cleaning costs were in the region of US\$120,000.

There was a dispute between the charterers and owners over the failure to inspect the ship while it was waiting for the berth and over a requirement that the tank tops needed machine scaling to remove all rust scale, including hard scale.

### LESSONS:

- management must take a close interest in hold cleaning
- take photographs
- officers must fully understand what level of cleanliness is required for various cargoes
- an independent survey can be useful to confirm if the ship is ready to load – particularly if there is a long waiting time before loading



^ Loose scale must be removed from the tank top before grain loading



^ Using cherry-pickers to clean the undersides of the holds

### HOLD INSPECTION

Time should be available after completing the hold cleaning to repair any damage to the hold fittings and coatings, and for paint to cure hard and for paint odours to dissipate after any touch-up repairs.

When holds are inspected, the master or chief officer should accompany the inspector with two or three crew members bringing brushes, shovels, rags and a bucket so that any minor problems that the inspector finds can be immediately remedied while he completes his inspection of that hold.

### CHIEF OFFICER INSPECTION

On completion of hold cleaning, the chief officer should carry out a 'surveyor's inspection' in this way:

1. go down the vertical ladder, stopping to inspect the underside of the upper deck and the hatch end coaming as soon as they become visible. Look all round, using a strong torch if necessary, to check that all horizontal surfaces are clean. Proceed down the ladder, inspecting the bulkhead on each side and the adjacent parts of the ship's sides
2. from the tank top, climb accessible pipe guards and inspect surfaces for residues and rust scale. Check behind frames, pipes and pipe guards. Walk around the sides and ends of the tank top, inspecting the bulkheads and ship's sides. Walk over the tank top, listening for indications of loose rust scale
3. climb the sloping ladder slowly, inspecting all visible surfaces. Stop at the top, inside the hold, to inspect the underside of the upper deck and the hatch end coaming
4. check the insides of any deck houses for grain and insects. Be aware that some crews have been known to collect grain residues in sacks to sell at subsequent port calls. Storage of that sort will almost certainly attract insects
5. If insects are found in grain residues in a hold, clean the residues as thoroughly as possible. Spraying the area with a good-quality insecticide may solve the infestation but do not try to 'bomb' a hold with Lindane (now banned in some countries) or similar preparations. It is rarely effective and if surveyors such as representatives of the Australian Quarantine and Inspection Service notice the 'bomb' residues on the tank top, they will be suspicious
6. be aware that washing a hold will tend to lift hard scale, the effect not being noticeable until the water has dried. Rust scale should not require chipping to remove, before a hold is accepted for grain
7. open and close hatch covers several times before starting to clean, to shake off residues and loose rust as much as possible
8. pay particular attention to hold number one. This is often the most difficult to clean because of its shape and additional structural members. Most surveyors will start a grain survey in that hold, and if it passes, less attention may be given to the remaining holds
9. check bilge wells are dry

### Chief Officer: notes and hints on surveyors' inspection

1. non-government surveyors are usually paid for each job, not for the time taken to do a job. Anything that speeds up a survey is appreciated. So be prepared
2. the chief officer, boatswain and a crewman with a hand brush, hand scraper and bucket should accompany the surveyor, so that any spot cleaning can be carried out while the surveyor is in the hold
3. hatch covers should be at least halfway open if the weather looks like rain; otherwise they should be fully open. The surveyor will probably ask for cover sections to be 'tented' so that undersides can be inspected. The inside of the hatch coaming will also be inspected from the deck
4. ensure that the access hatches at each end of every hold are open. The surveyor may go down the vertical ladder and walk up the sloping ladder
5. bilge wells must be open for inspection



^ Residue of previous cargo falling into hold after hatches have been opened a few times

### REASONS FOR FAILING HOLD INSPECTIONS

Most ships fail hold inspections as a consequence of cargo residues, loose paint or rust scale being found in the upper, less accessible parts of the holds, or as a result of previous cargo debris falling from the hatch covers during the ballast voyage. In order to avoid such failures, officers are advised to take every opportunity to clean the upper parts of holds and frames with suitable access equipment such as cherry-pickers. Alternatively, if it is safe to do so grain, fertilisers and similar cargoes can be swept off the underdeck beams before the start of discharge.

This is of particular importance when trading to countries such as Australia, where the Australian Quarantine Inspection Service operates a zero tolerance policy, under which detection of a single particle of certain previous cargoes or other contaminants will fail a ship, and the consequences of that failure may be significant. The possible sanction for a loaded cargo is that it will be quarantined, and discharge in Australia will not be permitted. Examples of contaminants that may incur such sanctions are the presence of a single grain of substances such as cereal, peas, beans, stock feed, rice, animal-based contaminants such as faeces and feathers, soil and sand.

If a grain ship fails the survey and the load berth is not required for another ship, then the ship may be allowed to stay alongside. This is more likely in small ports that have restricted wharf grain storage, because only enough cargo for the current ship is held at the wharf. Ports with larger storage will hold cargo for several ships, and if the next ship in line is available, then the failed ship has to leave the berth. Some ports have general purpose or layby berths that can be used for cleaning holds. Shore labour does not usually have to be used to clean a grain ship that is alongside; there are exceptions, for example, in Melbourne. If the ship is a handysize, handymax or panamax, cherry-pickers will be required. There are local ship cleaning companies in most ports.

## HOLD CLEANING EQUIPMENT

Hold cleaning is time-consuming. To minimise time spent on the task, it is essential that the ship is suitably equipped. Equipment should include good-quality brushes and brooms, suitable scrapers, 'manhelps', receptacles for removal of residues from the holds, heavy-duty hoses and nozzles, enhanced delivery systems such as the Stromme Combi-Jet or Maxi-Gun, spray foam equipment, paint, protective and cleaning chemicals, and where appropriate, high-level access equipment such as a scaffold tower or cherry-pickers.

This requires a minimum pressure flow from the general service pumps and the air compressor, with the dimensions of the deck pipes affecting the process. Pressure drops should be calculated and simple and cost-effective improvements such as increasing the diameter of water and compressed air couplings should be evaluated.

High-pressure cleaners of 350 to 500 bar should be part of the standard equipment onboard any bulk carrier. These are useful if not essential to clean the holds properly.

Hot-water cleaners although not commonly used are reported to make the wash-down operation more effective and may obviate the need to use chemicals.

## VARIOUS CARGOES – HOLD CLEANING REQUIREMENTS

### Coke – general

There are various grades of coke. Some of these are not difficult to clean, while others can result in significant discolouring of the hold paint which may mean a failed hold inspection.

Coke is a solid carbonaceous residue derived from low-ash, low-sulphur bituminous coal, from which the volatile constituents are removed by baking in an oven without oxygen at high temperature. Coal-derived pitch coke (pencil pitch) is a high-purity carbon residue manufactured by the distillation (coking) of coal tar pitch from bituminous coal, and can produce staining on the hold bulkheads.

Calcined coke is a hard, brittle substance, shiny and oily in appearance, and rich in carbon with very low ash content.

See section on disposal of wash-down residues.

### Green delayed petcoke

Green delayed petroleum coke, commonly known as petcoke, is a carbonaceous solid derived from the refining process of crude oil. This type of coke is high in carbon content and produces persistent staining of cargo holds. It is sometimes called green coke or raw coke.

Calcined petcoke is heated up to 2,000°C, which removes almost all residual hydrocarbon and moisture.

Cleaning after cargoes such as coke and calcined petcoke is less of a problem than pitch coke, which has some characteristics similar to those of green delayed petcoke. If loading petcoke that stains, the loading stevedores should be advised not to aim the coke via the loading chute directly at the hold bulkheads. This will reduce the impact on the bulkheads and the amount of cleaning required.

Onboard cleaning equipment, including chemicals, can usually remove all the staining; however, the staining on the tank top may be more difficult to remove. Additional high-pressure cleaning with chemicals and brushing may be required.

It should be remembered that in many ports, even petcoke inspections can be stringent. Specifications often require that the holds are clean, dried, and free of scale, loose rust and any other foreign materials or residue of previous cargo, whether on tank tops, bulkheads, hatch coamings or underside of hatch lids. Painting of the holds is typically not required, but surveyors will look for cleanliness, paint and rust blistering, cargo residues and potentially loose paintwork.



^ Discoloured hold after carriage of petcoke

## CASE STUDY G – PETCOKE CLEAN – USING SHORE CLEANERS. KNOW WHAT'S GOING ON

A claim arose over which party was responsible for carrying out the hold cleaning of a panamax bulk carrier following a cargo of petcoke. The charterers had engaged a shore cleaning company to carry out hold cleaning. The main issue was to decide who was responsible for ensuring that the holds were 'swept clean' after discharge and who was responsible for ensuring that the bilges were cleaned out after the wash-down. The charterers maintained that the crew should have ensured that the holds were swept clean before the wash-down began so that minimal debris was washed into the bilges; the owners maintained that the cleaning and washing of the holds, including the sweep-down and cleaning of the bilges, was the duty of the charterers' agents, in other words the cleaning company. The crew neglected to carry out proper monitoring of the cleaning process, with the result that the hold bilges were full of residue cargo. The problem resulted in delays and offhire, the ship missing the laycan for the next charter, and additional cleaning costs.

The charterers gave the cleaning contract for nine holds to a shore cleaning company. The nine holds were cleaned with high-pressure (800–1,000 bar) water cannons. The holds each had a surface area of about 2,000 sq m. The cleaning was carried out in port and the oily and dirty wash-down waters, required disposal ashore – to be collected by barge or road truck using a certified waste collector.

The equipment and cleaning gang included:

- one high-pressure water wash unit (800–1,000 bar) with hoses
- two certified operators
- one cherry-picker
- one supervisor
- two people assisting mobilisation
- submersible pump with hoses, deck portable generator and electric power cables

The cleaning company specified that the cleaning would take place subject to the following: washing waters (petcoke/water), no chemicals, sediments max 1%, no solvents, no emulsions, no detergents, no PCBs, flashpoint > 60°C, SG lower than 1, no toxic components.

The ship was to provide:

- access to the ship for personnel and material
- cleaning of the surfaces that need to be treated
- prior cleaning of areas unreachable by high-pressure lance and sweeping the holds before wash-down cleaning started
- cranes to load the cherry-pickers on and off
- electricity 220 volts AC

During the process between three and four teams were used, cleaning took four days and costs reached \$220,000. Wash-down water disposal costs were \$20,000.

If shore cleaning gangs are used, the ship must collaborate with the shoreside workers. Ensuring that the holds are at least shovel clean, and ensuring that the bilge well suction keep out most of the wash-down silt, is important.

### LESSONS

- the charterparty should clearly state who is responsible for what in respect of cleaning. It may specify or exclude various cargoes. A copy of the charterparty should be onboard
- the master's voyage instructions should be clear and specific, and give guidance as to:
  - what communications are needed and whom he should contact about hold cleaning
  - what his crew's responsibilities are
  - the cleaning gang's responsibilities
- officers should always monitor the shore cleaning gang's progress and adherence to good practice



^ Ready for survey

### Met coke

Metallurgical coke, or met coke, is manufactured from blends of bituminous coal in a heated distillation process resulting in a non-melting carbon used mainly in the manufacture of steel.

#### Before loading

Remove all solid residues, sweep clean and flush with seawater. Paint protection is not usually required.

#### After discharge

- remove all solid residues, sweep clean; the application of chemicals diluted with
- freshwater may be required to dry bulkheads
- seawater cleaning before the application of chemicals may reduce the effect of the chemicals and should only be done if heavy cargo deposits are present
- cleaning is completed by flushing with freshwater, working from the top down

### Bulk cement and clinker

This guide is relevant to cement carried in conventional bulk carriers, rather than in pressurised and specialised cement carriers.

The transport of cement and clinker accounts for some 5% of the dry bulk trade. It can require heavy cleaning after carriage. The usual problem with conventional ships is that the areas high above the tank top, which are difficult to reach and clean, get covered with cement dust and cargo residue.

Clinker is the main ingredient in cement production. Clinker loading and hold cleaning is similar to cement, except that clinker does not contain a binding agent and thus does not harden to the same degree that cement does.

### Cement

Cement may have a temperature of 110°C when leaving the production site and can sometimes be loaded at up to 80°C. Temperatures as high as 100°C have been recorded and this can lead to problems with the hold coatings, and potential dangers with the fuel oil double-bottom tanks. Cement is often exported from regions with low sea temperatures and discharged in warmer areas with high air humidity. After being loaded, the powder volume of cement can contract by as much as 10% once it has settled. In these conditions, water vapour can condense, and solidify the cement, particularly on the surface, not only under the main deck areas but in other parts of the cargo holds.

Often when loading cement, a ship will be fully ballasted when first alongside, and the top side ballast tanks are dropped as loading progresses. This can produce sweating on the top hopper side plating, which allows the cement dust to adhere, and become difficult to remove.

The point at which water vapour condenses in the atmosphere is called the dew point. When the incoming air or the steel has a lower temperature than the cargo in the holds, this allows the surrounding air to cool and produce vapour which condenses. As the wet cement dust dries on the hold frames, it hardens and poses a major cleaning problem. This is often only overcome with determined manpower, efficient wash-down equipment and chemicals. Ballasting of cold water adjacent to (warm) cargo holds can have the same result.

The problem can be reduced in some cases by good ventilation, weather permitting.

### Cement cargo in bulk can:

- solidify when wet
- retain heat for a considerable period when loaded warm
- easily stick to non-smooth surfaces
- be affected or contaminated by residues of previous cargoes. These may reduce the cement's binding capacity
- produce considerable dust – causing problems in the upper parts of the holds

### Cement cargo hold preparation and cleaning before loading:

- the holds (sides and tank top) and bilges must be completely dry
- cargo holds should be clean and odour-free. Residues from previous cargoes such as sugar and fertilisers may cause problems and result in a failed hold inspection. A small amount of sugar can seriously degrade a cement cargo – ensure that the hold is completely free of previous sugar cargo residue
- the hold air should be dry ahead of loading; use dehumidifiers if on board for several days before loading
- condensation during the voyage should be avoided
- cold water ballast should be avoided if possible in tanks adjacent to holds being loaded
- all holes and indents on the tank top and bulkheads and all scupper holes should be dry and clean. Consider covering manholes and recesses with plastic sheets and masking tape
- if the climate is warm and humid, the hatches should be closed once discharging has been completed, so that a dry atmosphere can be maintained inside the holds
- the bilge, bilge wells and tank tops should be cleaned thoroughly and dried before loading. Cement getting into damp bilges and bilge wells can build up trouble. Clogged bilge lines with hardened cement can be a major problem
- bilge well strainers and bilge well lids must have clear drain holes, and be clean and free of debris

- non-return valves in the drain and bilge system must be checked and confirmed as operational. Claims have arisen where the non-return valves have allowed water to flow into the holds via the bilge line system. When this occurs with a cement cargo, the result can be extremely expensive and time-consuming. It could be necessary in such cases for the bilge lines to be replaced
- the bilge wells must be protected using good-quality hessian that is firmly in place so as to allow water to be drained in an emergency
- good cleaning equipment must be available
- chemicals to dissolve hardened cement may be required
- crew should be equipped with personal protective equipment

Remember: after carrying a sugar cargo, the hold must be cleaned to a very high standard. Sugar residue will contaminate a cement cargo.

#### Paint protection

- Use of paint protective chemicals such as prewash products can assist the cleaning after discharge



^ Enclosed loading of cement produces dust throughout the hold

#### General precautions against dust:

- all accommodation, mast houses/store rooms and vents should be shut
- wire drums and electrical boxes on deck should be covered and closed off
- pilot ladders should be covered
- air conditioning should be on recirculation
- deck scuppers should be blocked

#### During loading:

- the atmosphere in the cargo holds should be kept as dry as possible; hatch cover lids should be closed when the holds are not being loaded or discharged – particularly if there is a possibility of rain
- the main deck, hatch covers and any exposed piping should be cleaned with compressed air, this may be forbidden in certain ports by anti-pollution regulations

#### After loading – before departure:

- if possible, main deck, hatch coamings and covers should be swept and cleaned by compressed air, and given a good sweep before washing down
- hatch coaming trackways, drainage channels and drain holes should be cleaned and free of cement if possible weather permitting. Blocked drain holes and channel bars will become clogged with hard cement in heavy weather or rain

#### After discharge:

- cement dust should be dry-cleaned using brushes, removing the majority of cargo residues from the tank top and bulkheads
- crew or stevedores should follow up in the cargo holds when the discharge is almost completed. Cargo residues should be collected and filled into the grabs for landing. 'Shovel clean' means that the stevedores discharge only what they are able to get into the grabs without sweeping
- bilge wells should be dry and free of cement dust
- cargo hold bulkheads, hatch cover undersides and hatch comings should be cleaned by compressed air and covers should be swept
- remove all solid residues, sweep clean and flush with seawater, using high-pressure hoses. After dry-cleaning, the holds must be cleaned by high-pressure air/water. Chemicals and high-pressure cleaning pumps can be used when necessary
- if hard residues are not removed by conventional high-pressure hoses using seawater, it may be necessary to call in a professional cleaning company, which can use acids to remove the persistent hardened cement. Hard cement residues, if not removed during the high-pressure wash, can be removed by high-pressure cleaning machines or acid cleaners. Hydrochloric (muriatic) acids must be handled with care and advice should be sought from the hold paint manufacturers. The acids are harmful to the human body, and may eat into hold paint. The recommended dilution with freshwater is 1:5. Stronger dilutions may be necessary, but this may result in pitting the hold steel. Again, always check with manufacturer's recommendations

The chemical mix should be applied using only a stainless steel lance kit connected to a pressurised mixing tank or an air-driven pump, either made from stainless steel or polypropylene, both with wetted parts made of Teflon. The chemical mix must be removed before it dries, working from the bottom up. This is most easily done from tank top level with Maxi-Gun or Combi-Jet. The cleaning operation is always completed by flushing with freshwater to remove salt residues, working from the top down.

The volume of chemicals used must be monitored and guidance sought from the manufacturers. Chemical splash suits, chemical gloves, boots, helmets with visor and breathing mask must be worn. Material Safety Data Sheets should always be consulted.

**After cleaning:**

- all areas should be flushed with freshwater
- to avoid blocking the bilge system, portable diaphragm pumps may be used to remove the washings
- the bilges and tank tops should be cleaned thoroughly before washing the holds. The bilges should be flushed for a minimum of 30 minutes before drying the tank top to ensure that they are not clogged by cement. Clogged bilge lines with hardened cement can be a major problem
- all valves in the drain/bilge system must be checked

Only the most powerful cleaning equipment will remove hard layers of cement. Normal ship's cleaning equipment might look adequate but often fails, particularly in terms of completing the work in a timely manner. Practical experience with chemicals has been mixed and there is a danger that they can adversely affect paint systems and ancillary equipment such as bilge pumps.

Recently, some ships have begun the practice of applying special barrier chemicals in the holds before loading. These protect the steel and paint from the cargo and make the cleaning process easier. They need to be applied in a controlled way and always according to the manufacturer's recommendations. Some chemicals are reported to be difficult to remove and may cause problems when cargo holds are repainted.



^ Crew digging out cement from the hold frames

**CASE STUDY H – LOADING CEMENT – MAKE SURE YOU CLEAN UP AFTER LOADING**

A handysize bulk carrier loaded a full cargo of cement in the Far East during the northern winter, using an enclosed loading system. This meant that the hatch covers were closed and a loading chute was fed through a manhole in the closed hatch top, with the cargo pumped under pressure into the hold.

En route to the loading port, after the holds had been cleaned, the hatches were watertight-tested using ship's fire hoses and found to have no leaks.

The master noted that the length of the loading chute only just fitted into the hold by 60 cms. This meant that the cement cargo was being fed in from the top of the hold, producing a considerable amount of cement dust onto the top frames, hatch trackways and hatch coaming drain holes.

The hatch cover drain holes were not taped over before the start of loading. It should be the practice – weather permitting – to clean the trackways and hatch cover coamings after loading, using compressed air if port regulations allow. This clears the drain holes and water channels of dirt and cement dust.

During the Pacific voyage, this ship was weather routed, heavy weather (over Beaufort 9) was encountered and seawater entered the hatch trackways. The water mixed with the cement and all the drainage channels to the forward two hatch coamings were blocked with hardened cement. As a result, water entered the holds and damaged the cargo. Sealing tape was ineffective in such heavy seas. Sealing tape should not be considered as a primary barrier to water ingress.

The claim submitted, including the cargo damage, disposal of the cargo and associated costs, was over \$650,000.



^ Heavy weather and seas on the foredeck



^ Loading cement using a closed loading system

## LESSONS

- masters should confirm that weather routing advice takes account of the water-sensitive nature of the cargo carried. Masters should let it be known when they have reservations
- stevedores and charterers should be approached when incorrect loading equipment is used
- before loading cement or other dusty cargoes, the coaming drain holes should be taped over to prevent the entry of dust. Tape should be removed before blowing down
- after a closed loading operation, the trackways should be cleaned if possible and cleared to free the drain holes, (if the weather allows). Masters should advise their owners and charterers of this requirement



^ Hardened cement in the hatch coaming trackways

### Anthracite coal

Anthracite coal is also known as hard or stone coal. It has a low ash content with low volatility and a high BTU (British Thermal Unit) content.

#### Before loading

Remove all solid residues in the hold, sweep clean and flush with seawater. Cargo residues should not be allowed to accumulate, otherwise hold bulkhead staining may result. If the same cargo is carried continually, consideration should be given to hold cleaning after every fifth consecutive cargo.

- bilge well strainers and bilge well lids must have clear drain holes, be clean and free of debris
- all valves in the drain/bilge system must be checked and confirmed as operational. There have been claims where the valves have allowed water to flow into the holds via the bilge line system. Coal residues can prevent the valves from operating fully
- the bilge wells must be protected using good-quality hessian firmly in place so as to allow water to drain

#### After discharge

- remove all solid residues and sweep clean
- coal dust should be dry-cleaned using brushes, removing the majority of cargo residues from the tank top and bulkheads
- the crew or stevedores should follow up in the cargo holds when the discharge is almost completed. Cargo residues should be collected and put into the grabs for landing
- cargo hold bulkheads, hatch cover undersides and hatch coamings should be cleaned by compressed air, and covers should be swept
- after removing all solid residues, sweep clean and flush with seawater using high-pressure hoses

### Bituminous coal

Bituminous coal, also known as soft coal, is usually black, although dark brown grades are found. It exhibits a relatively high level of plasticity, volatility and low ash content, making it ideal for coking.

The hold cleaning procedure is similar to that for anthracite coal except that cargo residues should not be allowed to accumulate, and high-pressure hose cleaning is recommended after every second consecutive cargo, unless the ship is on a long-term charter. Bituminous coal cargoes can result in hold staining.

The holds may require additional cleaning, even with light chemicals, when some cargoes are to be loaded after bituminous coal, such as grains and fertilisers. The use of a prewash to protect the paintwork in the hold could be considered if the subsequent cargo to be loaded is of a sensitive nature, such as grain or fertilisers.

Chemical splash suits, chemical gloves, boots, helmet with visor and safety goggles must be worn when cleaning.

Check the Material Safety Data Sheet as issued by the producer.

### Bauxite

Bauxite is one of the world's most abundant minerals and is strip-mined in many places. Nearly all is processed into alumina for aluminium production. Bauxite contains iron-bearing clay or red mud, which often leaves stains on the hold paint that can prove difficult to remove.

#### Before loading

Remove all solid residues, sweep clean, and high-pressure wash with seawater. Depending on the previous cargo and the condition of the paint coating in the holds, chemical cleaning may be required.

#### After discharge

Remove all solid residues and sweep clean; the application of chemicals diluted with freshwater may be needed to dry bulkheads. Seawater cleaning before the application of chemicals may reduce the effect of the chemicals and should only be done if heavy cargo deposits are present. Cleaning is completed by flushing with freshwater, working from the top down.

### Manganese ore

Manganese ore is mined on all continents except North America and is often found in combination with iron. Manganese is mainly used in the production of steel, to prevent corrosion. It is also used in various states of oxidation as pigments and may cause discolouration of the hold paint coating and the paintwork on the maindeck and superstructure.

#### Before loading

Remove all solid residues, sweep clean and flush with high-pressure seawater wash. The use of a prewash to protect the paintwork from staining can be considered.

#### After discharge

Remove all solid residues and sweep clean; the application of chemicals diluted with freshwater may need to be applied to dry bulkheads. Seawater cleaning before the application of chemicals may reduce the effect of the chemicals and should only be done if heavy cargo deposits are present. Cleaning is completed by flushing with freshwater, working from the top down.

### Salt

Salt is an aggressive product on steel and paint. It contains about 3% moisture and is very hygroscopic.



### Before loading

To protect the hold steel paint or limewash, the holds can be washed with proprietary products such as hold block. Studies have concluded that 100% paint protection is a good deterrent against the corrosive effects of a salt cargo.

### After loading

On completion of loading and during carriage, the hatches should be sealed, and excessive condensation avoided. A major ingress of water into the holds can cause a loss of stability. Salt is water-soluble and in the event of water ingress into the hold, there is a risk of loss of ship stability as the salt dissolves and causes the cargo to shift.

Do not ventilate.

### After discharge

If the holds have been limewashed, the dried limewash can be difficult to remove. Acid-based cleaners and muric acids or caustic soda are reported to be useful to remove limewash.

Limewash (calcium hydroxide) is powdered limestone, predominantly calcite. It is difficult to remove when dry and therefore a thinner dilution of limewash is preferable – subject to it protecting the steel or paintwork. 40kg of calcium hydroxide to every 200 litres (drums) of hot or warm water will produce an adequate wash. 2.5kg of granulated sugar can be added to the mix to make it easier to remove. The mix can be applied with brushes or paint spraying equipment.

After cleaning the limewash with saltwater hoses, it should be hosed down with freshwater.

### Soda ash

Soda ash is a dry, powdery white, dusty bulk cargo used in several industries, the main one being glass manufacture. It is commonly known as sodium carbonate. The cargo must remain dry at all times.

A hold inspection before a ship is to carry soda ash is stringent, exceeding that required for the carriage of grain. The hold should be hospital clean; it should be watertight, dried, clean in all respects, and free of scale, loose rust and all foreign materials or residue of previous cargo, on tank tops, bulkheads, hatch coamings and undersides of hatch covers. Painting of holds is typically not required, but the paintwork needs to be in good condition. Surveyors will look for cleanliness, paint and rust blistering, cargo residues and potentially loose paint edges. Physical contamination is a primary area of concern. Soda ash is ruined if it comes into contact with oil.

The following is a typical instruction sent to a ship about to load a cargo of soda ash:

*“Contamination is a problem when carrying soda ash. The ship should not have carried chrome or chrome products, such as ferrochrome, chrome ore, bagged chrome and chrome manganese within the past six months to a year. No previous cargo residues or staining on any surfaces of the holds to include tank tops, bulkheads, ladders, side pockets, container sockets of the under sides of hatch covers if applicable. No loose or flaking paint on any surfaces of the hold. No bubble rust, loose rust or painted rust that maybe chipped or scraped on any surfaces of the hold. Ventilation ports/fan spaces if applicable must be checked for possible loose rust or paint chips that might fall onto the cargo. Hold may not be chemically washed due to potential contamination and should only be cleaned with fresh water (high pressure).”*

It is unacceptable to have:

- loose and flaking paint with cargo residues visible
- paintwork not adhering firmly to the steel bulkheads
- loose flaking paint, paint covering bubble rust
- paintwork stained
- rust scale
- rust spots/surface rust
- residual cargo

It is important for ships to have maintained their cargo holds in good condition before loading soda ash as the requirements of hold preparation are of a high standard.

**Precautions.** This cargo is very dusty, and machinery, equipment and accommodation spaces should be protected from the dust. Personnel should wear personal protective equipment on deck, including goggles and dust filter masks.



^ Loading soda ash. Note good condition of the hold paintwork



^ Soda ash being loaded through hold access in the deck during adverse weather

## Sulphur

Bulk sulphur (whether formed solid, crushed lump or coarse grained) can be highly corrosive when in contact with water, and so the hold paint coating needs to be in a good condition. It is usual to limewash the holds to protect the steel structures. There are proprietary products, such as hold block, designed for preparing holds for carrying sulphur.

If the hold steelwork is not protected, contact with wet sulphur can turn the yellow sulphur into a black jelly-like substance, called ferrous sulphide. If this is exposed to air, usually on discharge, it oxidises and can create sufficient exothermal heat to start a fire.

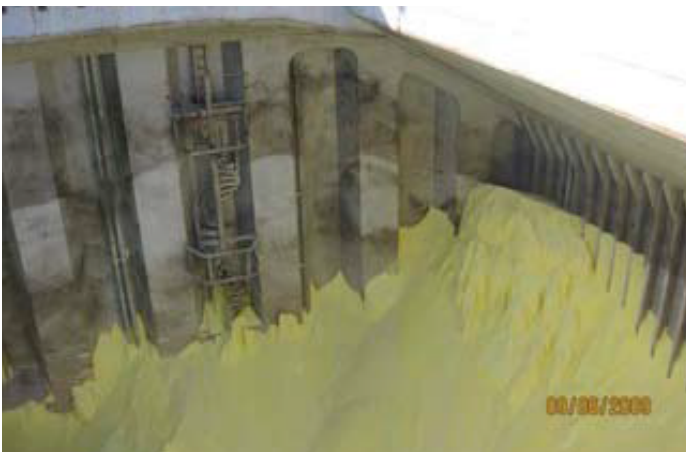
The holds should not be washed with seawater, but should be thoroughly cleaned and washed with freshwater. The hold tank top should be rust-free. The holds are usually required to be cleaned to a grain standard, with no previous cargo residues, and no rust scale or flaking paint.

The sulphur is often loaded with a light water spray, which helps to bind the cargo into bigger lumps, or it can be loaded from shore stockpiles, which can be wet from rain, so the bilges need to be monitored during the voyage and pumped out. The bilges need to be protected by being covered with burlap to allow drainage. Some experts suggest a light limewash or hold block of the bilge lines. Hold block the bilge wells with a thicker coat than the tank top. Caustic soda (alkaline solution), to neutralise the acid drain water, can be placed in the bilge well. Use only the eductor for pumping out the bilges and run to sea at least 15 minutes after pumping is completed. During the voyage, monitor the ph value of the bilge well water.

Cleaning after carriage is important, since residues can create corrosive mixtures (sulphuric acid) and damage the steel structure in the holds.

Some sulphur is prilled before being shipped: that is, it is coated to block its corrosive effects; however, when the commodity is loaded, the prilling breaks down, exposing the raw sulphur. Prilling reduces the risk of corrosion but does not remove it.

Note the safety precautions associated with the carriage of sulphur as set out in the IMBSC Code, including personal protective equipment and the extinguishing of lighting inside holds. A strict 'no smoking policy' should be in force on deck during carriage.



^ Sulphur cargo



^ Finishing off a sulphur cargo – note the indents in the tank top

Although surveyors may check and inspect the holds before loading and comment on the limewash or hold block, it is the master's responsibility to ensure that the ship's structure is adequately protected.

## Fertilisers

Granular fertiliser cargoes have been rejected – particularly in Australia and New Zealand – when even a few remnants of a previous grain cargo have been found on top of the bulk stow.

## Woodchips

Woodchips are susceptible to contamination from excessive scale, cellulose material and carbon cargoes, such as coke and coal.

## After loading

Certain cargoes, including fine mineral ores, silver sand and andalusite should be covered with plastic sheeting to protect them from any deposits that may not have been removed from the upper hold frames.

## Before arrival

Weather and other conditions permitting, it is prudent to inspect the cargo before arrival at the discharge port. Small amounts of residue from the previous cargo can be dislodged from the upper frames.

**APPENDIX 1**

**Hold cleaning: Cleanliness guide – changing from one cargo to another**

**Hold Cleaning Matrix for Change of Cargo**

(Always check with cargo interests/charterers for confirmation. and with IMBSC Code).

**KEY** Y: Required N: Not required

**Note:** This is only a guide and masters and owners should check the charterers’ and shippers’ requirements. The end use of the product may require a higher state of cleanliness than normally expected. The list is not exhaustive – check with the IMBSC Code.

- A. Hospital clean, or stringent cleanliness
- B. Grain clean, or high cleanliness
- C. Normal clean
- D. Shovel clean
- E. Load on top

Last cargo	Next cargo	Hold cleaning		Remarks Cleanliness level: A, B,C,D,E
		Washing	Sweeping	
Coal	Coal	N	N	C/D Check with charterers
	Iron ore	N	Y/N	C. Check with cargo interests. Depends on amount of remaining cargo
	Bauxite	Y	Y	C. Check with charterers
	Petcoke	N	Y	Check with cargo interests. Depends on amount of remaining cargo and the future use of the petcoke
	Alumina	Y	Y	A. Clean to the highest standards
Mineral sands Ore/Coal/Coke	Mineral sands	Y	Y	A/B. Clean to a high standard If after different cargo – A. (Clean to a high standard)
Alumina	Alumina	Y/N	Y	C. Check with cargo interests
Iron ore	Iron ore	N	Y/N	D. Check with cargo interests
	Coal	Y/N	Y/N	C. Check with cargo interests. Depends on charterers’ requirement
	Bauxite	Y	Y	Check with cargo interests
	Petcoke	N	Y	Check with cargo interests
	Alumina	Y	Y	Requires careful sweep, A. Hospital clean
Bauxite	Bauxite	Y	Y	Check with cargo interests
	Iron ore	Y	Y	Needs to be carefully swept
	Coal	N	Y	Check with cargo interests
	Petcoke	Y	Y	Check with cargo interests. Depends upon charterers’ requirements
	Alumina	Y	Y	Check with cargo interests, A. Hospital clean
Petcoke	Petcoke	N	Y/N	Check with cargo interests
	Iron ore	Y/N	Y	D. Shovel clean. Check with charterers
	Coal	Y/N	Y	
	Bauxite	Y	Y	Check with cargo interests
	Alumina	Y	Y	A. Hospital clean, check with cargo interests
Iron ore	Grain	Y	Y	B. Grain clean
Coal		Y	Y	Charterers’ requirements are important. Clean to grain clean.
Bauxite		Y	Y	Charterers’ requirements are important. Clean to grain clean.
Petcoke		Y	Y	Charterers’ requirements are important. Clean to grain clean.
Grain	Grain	Y	Y	Check with cargo interests
	Coal	Y/N	Y	B. Check with cargo interests as sweeping and washing may be required
	Potash	Y	Y	
	Phosphate	Y	Y	
	Sugar	Y	Y	
	Petcoke	Y	Y	Check with cargo interests Check with charterers. NB. When loading at Richards Bay, regardless of previous cargo, washing is needed because of strict hold survey
	Coal	Y	Y	Check with cargo interests
	Cement	Y/N	Y/N	C. Check with cargo interests
	Iron ore	Y/N	Y/N	C. Check with cargo interests
	Coal	Y/N	Y/N	C. Check with cargo interests
	Petcoke	Y/N	Y/N	C. Check with cargo interests
	Salt	Y/N	Y	Clean limewash. Check with cargo interests
	Cement	Sugar	Y	Y
Fertiliser		Y	Y	B/C. Check with cargo interests
Sugar	Cement	Y	Y	A. Check with cargo interests

NOTE: The above table is only a guideline. Masters should always check with cargo interests as there may be commercial reasons why additional cleaning is required.

**APPENDIX 2**

**Hold wash cleaning matrix – non-grain bulk cargoes**

**KEY** X: Required (X): Recommended, but not 100 % required

CLEANING OPERATION	Coal		Coke				Ore		Corrosive		Other		
	Bituminous	Anthracite	Green delayed petcoke	Calcined petcoke	Met coke	Pitch coke (pencil pitch)	Bauxite	Manganese	Sulphur	Salt	Lime	Clinkers	Cement
<b>CHEMICALS</b>													
Alkaline cleaners	X	X	X	X	X	X	X	X	X				
Acid cleaners											X	X	X
Bleaching chemicals	X		X										
Paint protectors	X		X			X	X	X	X	X		X	X
<b>EQUIPMENT</b>													
Chemical applicator	X	X	X	X	X	X	X	X	X		X	X	X
											X	X	X
Water jets/Combi	X	X	X	X	X	X	X	X	X	X	X	X	X
Powerful water jets or maxi-jet	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)		(X)	(X)	(X)
High-pressure cleaning	X	(X)	X	(X)	(X)	X	(X)	(X)	X		X	X	X
Diaphragm pump	X	X	X	X	X	X	X	X	X	X	X	X	X
Protective equipment	X	X	X	X	X	X	X	X	X	X	X	X	X
Service air compressor	X	X	X	X	X	X	X	X	X	X	X	X	X



^ Maintaining the paint work reduces claims



^ Cleaning the holds requires resources

## APPENDIX 3

### 1. Hold preparation checklist

#### General

- hold bilge pumping and line arrangements understood
- standard and extent of hold cleanliness and preparation for the next cargo is known from charterers, shippers, owners, charterparty, IMSBC Code
- instructions from charterers are clearly understood
- ensure ship has sufficient water for a freshwater wash-down; additional freshwater can be taken in the fore or aft peak tanks. (A panamax bulk carrier requires about 20/25 tonnes of freshwater per hold for freshwater wash-down)

#### Pre-washing

- holds swept thoroughly after discharge of previous cargo and residues removed. Residues left on deck are kept covered to reduce dust and pollution risk
- holds and internal structures checked for damages
- bilge wells/strum boxes are cleared of cargo spillage. Bilge cover plate fitted in good order
- hold bilge sounding pipes and temperature pipes are free of debris
- do not wash holds where adjacent holds are not free of cargo, or if the bulkhead in the adjacent hold is not clear of cargo (as there is a potential risk of water damage/ingress)
- the bilge line to be blanked off from the engine room for holds with cargo during washing
- bilges of holds with cargo to be sounded frequently during washing
- before pumping out bilge water, ensure MARPOL and local regulations are not violated
- fixed fire extinguishing lines should be flushed out with air to remove dust and residues

#### Post-washing

- the non-return valves in the bilge well are to be checked and operational
- bilge wells should be dry. Strum box and bilge cover plate should be clear and secured
- bilge cover plate should be covered with burlap and secured
- open and inspect the valve/seat of each hold bilge valve in engine room and ensure it is free of cargo residues and debris
- open and inspect main bilge line valve in engine room and ensure it is free of cargo residues and debris
- ensure all valves on the hold bilge line are effectively shut to prevent water ingress into holds from fire and general service pump, ballast and eductor pump, etc. Valves should be closed, with measures in place to ensure that they stay closed (visible signs)
- ensure that all manhole lids on the hold tank top and ballast line blanks in ballast hold are watertight and oil-tight
- ensure that ballast well manhole and ballast line blanks are tight
- ensure that high-level bilge alarms are operational
- ensure that the stool spaces are drained of water. (Stool spaces may contain water in ballast hold through cracks in stool bulkhead). Ensure that stool manhole lids are closed tight
- ensure that connection pipe and ballast trunking from top-side tank to double bottom are not leaking into hold
- ensure that the gland packing of extended spindles for double bottom tank valve passing from top-side tank through cargo hold into double bottom are free of leaks

#### Cleanliness/preparation – specific cargo may require additional measures

- remove all previous cargo residues, loose rust and scale. Ensure that loose rust on under-side of hatch covers is removed
- after salt water washing, final rinse should be with freshwater. Wash holds with freshwater alone if required by the charterparty or for the type of cargo
- check for hairline cracks on internals and plating after the holds are washed and cleaned
- ensure that holds are ventilated and dried. The hold should be inspected very closely for infestation, especially when grain and grain products are to be loaded
- carry out a hose test of hatch covers and access hatch covers and vents before loading
- check ventilation systems and their closing arrangements
- on completion, the chief officer should inspect the hold to ensure its condition is satisfactory in all respects for loading
- the master should inspect the holds for confirmation of cleanliness prior to presenting the holds for survey
- hold bilges should be sounded daily at sea, weather permitting – the responsible officer should monitor this
- bilges must be pumped out dry as required
- bilge sounding/temperature pipes must be closed watertight

#### Prior to loading

- confirm that everything meets the requirements of charterers and shippers

#### After loading

- avoid carrying ballast in double bottom and top-side tank in way of holds with cargo, unless unavoidable, for example, for stability reasons
- ventilate the cargo hold as necessary. Compare the dew point of the hold and of the outside air to avoid damage from ventilation
- fuel in tanks in way of cargo holds to be managed. Fuel oil heating in tanks in way of cargo holds should not exceed 5°C above the required transfer temperature
- monitor and record the fuel oil temperature



^ A clean hold – hospital clean

## APPENDIX 4

### Australian stowage requirements for vessels loading grain

A Certificate of Fitness to Load Grain will be issued by a marine surveyor, approved by the shipper and ship owner or operator, before a ship begins loading, subject to the following requirements being observed. A Certificate of Stowage may be issued on completion of loading at each port.

#### Definitions

- 1.1 'Grain' means seed or grain of any of the following kinds: barley, canola, chickpeas, dried field peas, faba beans, lentils, lupins, oats, sorghum, soybeans, split vetch, whole vetch, wheat
- 1.2 'Marine Surveyor' under these requirements means a person with the following minimum qualifications and experience:
  - (a) Certificate of Competency as Master Class 1 (Unrestricted) or its equivalent, and
  - (b) (i) Inspected at least 10 vessels for suitability to load prescribed grain or prescribed goods for consumption over a maximum period of two years while in the company of a marine surveyor having the qualifications referred to in paragraph (a); and
  - (b) (ii) in the three years prior to the proposed survey, he or she must have surveyed at least 10 ships for suitability to carry prescribed grain or prescribed goods for consumption(Note: compliance with (b) (i) is taken as compliance with (b) (ii), if applicable)

#### Cleanliness and dryness

All spaces to be loaded with grain must be thoroughly clean and dry, free of odour, gas or fumes and in every respect fit to receive grain cargo.

In particular:

- 2.1 The holds and compartments must, if necessary, be swept, washed or otherwise cleaned and dried. If loose rust scale is present this must be removed to the Surveyor's satisfaction
- 2.2 The vessel must be free of infestation by insect pests of stored products or grain. If necessary, spraying or fumigation of the cargo spaces shall be carried out to eliminate the infestation
- 2.3 The holds and compartments, including the hatch covers, coaming ledges, deck beams, frame knees, brackets, horizontal surfaces, pipe casings and wood sheathing shall be free of all residues of previous cargoes which could contaminate the grain
- 2.4 Wood structures such as tank top or fuel tank sheathing shall be completely dry

#### Bilge spaces and bilge wells

- 3.1 Bilge spaces and bilge wells shall be clean, dry and free of odour
- 3.2 Bilge space and bilge well suctions are to be tested to the surveyor's satisfaction. Where this is not possible the Master must supply a certificate stating that the cargo hold bilge pumps and non-return valves are operating satisfactorily

#### Grain Tightness

- 4.1 All tank-top and fuel tank sheathing must be grain tight. Where the condition of the sheathing renders this impracticable, the sheathing must be covered with hessian, polyethylene, paper or other suitable material to prevent the ingress of grain
- 4.2 Bilge spaces and bilge wells must be covered with hessian or similar porous material after inspection, in such a manner as to prevent the entry of grain into the bilge space or well, but to permit the entry of water
- 4.3 'Tween deck and other scuppers must be covered with hessian or similar porous material in such a manner as to prevent the entry of grain into the scupper opening but to permit the entry of drainage water

#### Deep Tanks. Wing/Feeder Tanks

- 5.1 When grain is to be loaded into liquid cargo tanks, one suction pipe in each cargo tank must be effectively sealed with hessian or other similar porous cloth, so that it is grain tight but not watertight. Where not already fitted a sounding pipe must be provided
- 5.2 Other pipes leading into the tank are to be blanked off, if necessary, to the Surveyor's satisfaction, to ensure that the cargo tank cannot be accidentally flooded during the intended voyage and a certificate to blanking off must be provided by the Master or Chief Engineer, upon request by the Surveyor

#### Hatch Covers

- 6.1 Pontoon hatch covers are required to be in good condition and sound tarpaulins must be available for weather deck hatches
- 6.2 Patent hatch covers and hold access hatches must be in good condition with closing appliances and sealing arrangements in good order
- 6.3 The Surveyor must be satisfied following a visual inspection that the hatch covers and access hatches may reasonably be considered as watertight. If not so satisfied the Surveyor shall withhold issue of the Certificate until any deficiencies are rectified to his satisfaction

#### Tankers and OBO Vessels

- 7.1 Tankers (not having bilge wells) must be provided with boxes constructed around stripping suctions in accordance with Australian Maritime Safety Authority requirements. Such boxes shall be grain tight but not watertight. Limbers or openings, properly covered with hessian or similar porous cloth, must be provided to permit entry of water. The total area of such openings must be at least six times the cross sectional area of the stripping line pipe
- 7.2 All pipelines to cargo spaces must be thoroughly cleaned or blown out
- 7.3 All pipelines, except stripping lines, must be blanked off
- 7.4 All cargo carrying spaces must be completely clean, dry, odour and gas free
- 7.5 All loose scale must be removed to the satisfaction of the Surveyor

#### Bagged grain

A vessel loading bagged grain shall comply with the requirements for bulk grain. In addition, if considered necessary by the surveyor, bitumenised paper (or equivalent) and/or dunnage shall be used to protect the cargo.

The above stowage requirements were adopted by Australian licensed grain shippers, the principal shipping agents and Australian marine surveyors after consultations in 2009.

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