

Carriage of Bagged Agricultural Cargoes

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Introduction

Agricultural cargoes include crops and commodities such as wheat, rice, oilseeds and nuts. One of the largest exported agricultural cargoes shipped globally in bags is rice.

Agricultural cargoes are hygroscopic, meaning that they have a moisture content that can interact with the air. If the air in the cargo hold has high relative humidity in comparison with the moisture content of the cargo, then the cargo will absorb moisture from the air. Conversely, if the air has low relative humidity in comparison to the moisture content of the cargo, then the cargo will release moisture to the air.

This briefing serves to assist Members with the carriage of bagged hygroscopic cargoes by discussing the various risks associated with them, and how to reduce the risk of claims by the use of best practise methods during the loading, carriage and discharge of such cargoes.

Why Do Problems Arise?

Issues can arise with these cargoes due to the environmental conditions within the regions they are loaded and discharged. Poor handling and carriage of the cargo can also lead to problems.

Some of the issues encountered with bagged agricultural cargoes, however, are directly due to the inherent moisture content of the cargoes.

Moisture Content & Stowage Life

The moisture content and temperature of the cargo affects how the cargo behaves. As a general rule, the

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higher the average moisture content and the higher the loading temperature, the less time the cargo can be stored without the risk of cargo damage.

A Master might not ordinarily be notified of the moisture content of the loaded cargo, but such information may be available on commercial documents. The Master can request the average moisture content from the shipper, which may also become good evidence should future claims arise. As the Master gathers this evidence he should share this at the time with all parties. Conversely, if the actual average moisture content is not made known, or is not available until loading is completed, then the Master can simply record that the requested information was not available at the time of commencing loading.

Self-heating

High moisture content can accelerate mould growth in agricultural cargoes, which in turn can lead to self-heating.

Oxygen depletion

Excessive moisture and the metabolic processes within some agricultural cargoes can lead to oxygen depletion in the hold. This can make cargo holds and adjacent spaces hazardous. As such, the ship's SMS procedures regarding enclosed space entry should be followed when entering ships holds containing such cargo.



Figure 1: Bagged rice cargo covered in damp Kraft paper.

What Causes Cargo Damage?

This section outlines some of the common causes of claims to bagged agricultural cargoes.

Ship's sweat

A common issue with bagged agricultural cargoes is wet damage due to ship's sweat.

Ship's sweat is the condensation which occurs when warm moist air in the holds comes into contact with the colder steel work of the vessel. This most commonly occurs when a vessel loads cargo in warm humid climates, then transits to an area with lower temperatures. The steel work of the vessel cools down due to the ambient temperatures. When it cools below the dew point of the air trapped in the hold, sweat will form on the vessel's exposed steel. This moisture then drips down, wetting the cargo and encouraging mould growth.



Figure 2: An example of ship's sweat

Cargo sweat

If the Master decides to ventilate after loading cargo in colder climates and sailing into warmer climates, then the opposite will occur. The warm moist air entering the hold will be cooled below its dew point, and sweat will form. However this time the sweat will gather on the cargo itself. Therefore in this situation it is important that the holds remain sealed and no ventilation takes place.

Water ingress

Any ingress of water into the ship's holds can cause damage. Therefore it is important to ensure that the hold's hatch covers are weather tight.

Further information on hatch cover testing, can be found in North's loss prevention briefing.

Cargo infestation

Some agricultural cargoes are susceptible to infestation from storage pests and insects. Fumigation is routinely required for these cargoes.

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Insects in the cargo can cause an increase in the cargo temperature and can physically damage the cargo. Additionally, any dunnage used in the hold should be free from insects or pests. Dunnage should be checked and certified as free of infestation.



Figure 3: A cargo of rice with insect infestation.

Masters should check the type of fumigant that is to be used. The use of fumigants such as Methyl Bromide should not be accepted for a vessel whilst on passage. Methyl bromide is a toxic substance. Because it dissipates rapidly to the atmosphere, it is most dangerous at the fumigation site. Its use is now being phased out under the Montreal Protocol, however some parts of Asia still use it.

For more information on fumigation, see the IMO recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds.

Shortages and pilferage

Incorrect tally work during loading or discharge and cargo spillage due to damaged / substandard bags are among the main reasons for reported cargo shortages.

It should be noted that moisture losses in the cargo are in fact minimal and usually cannot account for large weight losses.

Bagged cargoes are easily damaged, often by:

- Rough handling by stevedores.
- The use of cargo hooks.
- Overloaded cargo nets.
- The use of wire slings.

Even small holes in the bags can cause cargo to be rejected or cause spillage leading to shortage claims.

Cargo pilferage is common in many ports, particularly in West Africa for imported rice cargoes. Occasionally bags will be cut open and various means adopted to conceal the stolen cargo as the thief departs the vessel.

Therefore, it is important for tally clerks and ship's crew to remain vigilant and keep accurate records. If any suspect behaviour is noted, photographs or videos should be taken and times recorded, the Master should also note protest.



Figure 4: Cargo spillage due to poor handling

Load Port

In many regions claims are common place, in particular for shortages. Wet damage claims can result in much larger claims. Therefore the Master and the crew must protect the ship by ensuring preparations prior to loading are correct and that they are alert to issues during loading operations.

The following section will concentrate on vessel actions before and during loading

Hold cleaning

Before arriving at the load port, the Master should ensure that the vessel's holds are suitably cleaned in line with the requirements of the charter party or shipper's instructions.

This may include:

- All previous cargo residues removed.
- Check holds for any signs of insect infestation.
- Wash the cargo holds down with fresh water; any chloride residues from salt water washing should be removed.
- Ensure bilges are cleaned and covered with burlap.

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- Bilge non return valves tested and confirmed as fully operational.
- Ensure hold ventilation is operational and well maintained.
- Ensure hold fire detection and prevention systems are operational and maintenance is up to date.
- Ensure sounding pipes or temperature sampling pipes are clean and clear.
- Hatch coamings and drainage channels should be clear of debris.
- Any tank lids in the holds should be fully secure.

Appointment of surveyors

Members carrying such cargoes should consider appointing a suitably qualified and experienced surveyor, in particular for trades such as the South East Asia to West Africa bagged rice trade.

The surveyor should be able to assist with testing to ensure that hatches are weather tight for the intended voyage.

A surveyor will also be able to get the cargo temperature upon loading; this can then be used by the Master when ventilating using the 3 degree rule.

The independent surveyor should also be capable of conducting a full and accurate draft survey for the vessel. The results of the draft survey should be retained on board.

It may also be appropriate to appoint an independent tally clerk for cargo loading. Independent means that this should not be a joint venture with the charterer or shipper.

Cargo delivery

In many regions of the world moisture can be introduced into the cargo during its period of storage or transportation prior to loading. For example in South East Asia, rice is commonly transported to barges in trucks. These trucks are often open-topped and can be exposed to rainfall. The barges used alongside the vessel are often not weather tight and can expose the cargo to more wet damage as their holds are often lined with timber which remains damp from previous wet weather. Crews should take photographs of all barges used during loading.

If there is evidence of wet damage, photographs and accurate records should be taken and any wet bags should be rejected.

A weather eye

The crew should closely monitor the weather forecast and current weather situation at all times. If rain is due or likely, weather watchers should be posted. The ship's radar can be used to see incoming squalls. In the event of rain, cargo holds should be covered immediately. If during rain the barge or truck delivering the cargo remains uncovered, or the bags are left uncovered on the quayside, this should be recorded by the crew, and any wet bags should be rejected.

Hooks and slings

The use of cargo hooks should not be allowed and the ship's crew must be vigilant to the stevedores using these. If the use of hooks is seen the crew should request that the practise is stopped. The crew should also monitor any slinging arrangements in use, ensuring these are appropriate for bags and that they are not overloaded. In either event, photographic or video evidence and accurate records should be made.

Stowage and dunnage

As previously discussed, it is common for ship's sweat to occur inside the cargo holds.

It is therefore extremely important that the bagged cargo does not come into contact with the ship's structure. This is achieved using dunnage. Dunnage not only keeps the bags clear of the vessel's structure, but also allows room between the lower hoppers and tank tops for the condensation to run off to the bilges.

In many parts of South East Asia, in particular when loading bagged rice, one method employed for dunnaging is the use of bamboo sticks with bamboo matting and / or Kraft paper or plastic sheeting

The effectiveness of this method is limited due to the components being very thin and prone to sagging and tearing. Therefore the application of bamboo dunnage must be well monitored to ensure that the bagged cargo will remain separated from the vessels sides and tank top to allow moisture run off throughout the intended voyage.

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Figure 5: Bamboo and bamboo matting used for dunnage can be too thin and unsuitable

Another very common method found in particular in Asia utilises expanded polystyrene foam alongside plastic sheeting, and is particularly common for bagged rice cargoes. In this method, thin sheets of the foam are secured directly to the ship's hull between the frames and hatch coaming. From there, plastic sheets are then used everywhere else.

Experience shows that this method is not particularly effective in preventing moisture related issues. It does not provide an effective thermal barrier for any temperature differential between the hold and the outside air and so therefore does not stop ship's sweat; the condensation merely transfers to the inside of the polystyrene foam / sheeting.

If the application of the materials around the hold is inconsistent, the holds' framework remains exposed, as shown below and therefore the cargo sits in contact with the ship's steel in these areas.



Figure 6: The polystyrene and plastic sheeting technique has proven unreliable.

Dunnage is more effective in the form of dry timber planks in a lattice formation or wooden pallets on the tank top with the first layer running fore and aft and the next layer athwartships. This should then be covered with Kraft paper or plastic. A similar arrangement should be in place for the sides of the hold. This should enable the stowed bags to be kept a minimum of 5cm from the steel surface. This arrangement allows any build-up of condensation to run off effectively. Transverse bulkheads may require less dunnage as they are not as affected by the changes in temperature outside the vessel, however dunnage is recommended on engine room bulkheads and any transverse bulkheads adjacent to ballast tanks or HFO tanks that may affect the temperature.

Timber arrangements such as this, whilst certainly being the most effective, will potentially cost more, and are often less favoured by charterers. As previously discussed there is also a risk of infestation of the dunnage itself, and it should be certified and suitable. Considering the importance of good dunnage arrangements in the carriage of bagged hygroscopic cargoes, it is suggested the Master formally protests if they have concerns about the dunnage arrangements and / or materials used. Should the charter party state that dunnage will be applied "to the satisfaction of the Master", then all efforts should be made by the crew, alongside a suitably experienced surveyor to ensure clear supervision is given and records of this are maintained throughout.

Ventilation channels

There is some advice advocating the use of ventilation channels within the cargo stow. Ventilation channels are purpose made channels inside the cargo block. This usually consists of two channels running fore and aft, and two channels athwartships.

The main purpose of the channels is to increase the surface area of the stow to allow warm air to rise and then be removed during natural ventilation. However there is little evidence to demonstrate the effectiveness of the channels.

If shippers or charterers insist on the use of ventilation channels, then the Master should obtain written instructions to this effect.

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Figure 7: Wet Kraft paper and bamboo dunnage

Sealing

Upon completion, the hatches should be closed and secured properly with the charterers and shippers representatives in attendance. Ideally, the hatches should be sealed and seal numbers recorded. The Master should ensure he understands any fumigation and charterers / shippers instructions received.

Record keeping

The crew should keep full records of the entire process, including officials and superintendents that have visited the vessel, and take photographs or videos of any issues. If in doubt, the Master should be ready to issue letters of protest where applicable.

Rain letters

Masters are strongly advised to avoid loading or discharging bagged agricultural cargoes in the rain. Where a ship owner is asked to load cargo in circumstances that might cause damage to that cargo, there is a risk that complying with this request might be considered imprudent and/or hazardous. A rain letter is a letter of indemnity provided by the charterer which allows the owner to recover from the charterer in the event of wet damage through rainfall.

Masters are advised to contact their P&I club before agreeing to such terms.

On passage

Wet damage claims often start life during the sea passage. Be this through the formation of ship's sweat, or cargo going mouldy due to its inherent moisture, it is

important that the Master keeps accurate records and details of the passage. These may include:

- Weather conditions on the passage.
- Temperatures.
- Ventilation conducted.
- Cargo checks performed.
- Bilge and tank checks.
- Any concerns regarding the cargo's condition.

The Master should also ensure they follow any reasonable instructions given by the charterer, including any fumigation requirements.

Ventilation

Owing to the issues of sweat on the vessel's steel work, it is advised that the Master ventilates the cargo holds only as appropriate.

Maintenance

Ventilator closing appliances are often exposed on deck and easily become corroded. They need to be kept in good condition so that they can be opened and closed with ease.

Surveyors for cargo interests often suggest that the vessel cannot have ventilated properly when they find ventilators in poor condition and difficult to operate.

- The closing mechanism should always be checked to ensure an effective seal.
- Ventilators should be clearly marked to show when they are in the open or closed position (unless obvious), and also indicate which hold they serve.
- Fans for mechanical ventilation should be checked for operation before loading, in order to be sure that the fans operate in correct direction.



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When to ventilate?

Before ventilating, the Master should consider any fumigation requirements, or other charterers' / shippers' instructions.

To know when to ventilate, crews have two methods available to them.

3 degree rule

This rule states that when the outside air temperature is 3 degrees lower than that of the temperature of the cargo upon loading, you should start ventilation.

As this rule is very simple, it is the preferred method for calculating when to ventilate.

The outside dry bulb temperature can be read from the bridge Stevenson screen dry bulb thermometer. However, if possible, it should be read near to a vent for the hold.

It is important that the Master gets accurate readings of the cargo's temperature during loading. Should the vessel be delayed at the discharge port for a prolonged period it may be worth the Master taking a new cargo temperature and using this when deciding when and if to ventilate.

Dew point rule

According to the dew point rule, ventilation should commence when the dew point of the outside air is lower than the dew point of the hold air. As such, the Master needs to calculate the hold air dew point, and compare it to the outside air dew point.

Whilst this sounds simple, it is the more complex method of assessing when to start ventilation and is open to more errors as well.

The dew point is obtained by taking the reading of a dry and wet bulb thermometer, for the outside dew point, this is usually obtained using the bridge mounted thermometer mounted behind a Stevenson screen.

However taking the dew point inside the holds is more difficult. It is often not possible to take an accurate wet and dry temperature in the hold headspace due to potential oxygen depletion, fumigants, or even due to the holds being officially sealed. As well as this the restriction of space in the hold could cause further issues. Accessing the hold for this purpose also introduces ambient air into the headspace and thus invalidates the measurement. Therefore, it is more accurate and easier to conduct the 3 degree rule in many cases.

When not to ventilate

The Master should always follow any written fumigation requirements or reasonable instructions from the charterer's / shipper's when deciding whether to ventilate or not.

However, there are often questions raised about stopping ventilation due to other circumstances encountered on passage.

Here we will investigate some of the common situations in which ships have stopped ventilation whilst on passage.

Rain

In the case of rain, Masters should carefully assess the situation and be fully familiar with their vessel's ventilation arrangements. They should assess how much water ingress can be expected by those vents. They should also consider how heavy the rain is and if the forecast shows it could become heavier. If they are left in any doubt, it could be wiser to suspend ventilation on the basis that if they do not and the cargo is damaged by rain water ingress, it may be difficult to defend in the event of a claim. If however the Master suspends ventilation for the rain, and properly records this in the ventilation log, they may be able to show they have acted in a prudent manner.

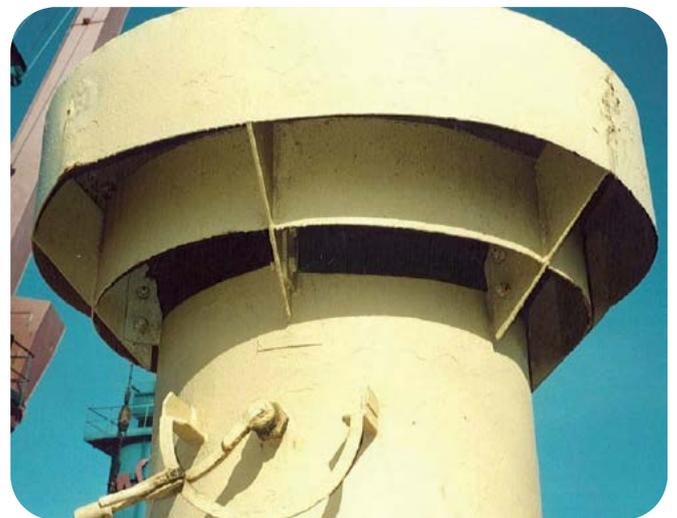


Figure 8: A vessel's mushroom vent

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Bad weather

It is a similar situation stopping ventilation during periods of heavy weather when shipping spray.

A Master must be familiar with the vessels ventilation arrangement and assess the risk of water ingress. If they believe there is a risk of water ingress, then ventilation should be stopped and accurate records made of this action.



Figure 9: Some ventilation heads can expose the hold to ships spray depending on their design, position and height on the vessels deck.

Mist and fog

The presence of mist or fog should have no bearing on the ventilation, and Masters should simply continue to apply either the 3 degree rule or the dew point rule regardless of fog.

Hours of darkness

It has been common practise to stop ventilation at night. This is sometimes down to the belief that the formation of dew at night will affect the cargo. However this is incorrect, as long as the application of the dew point rule or the 3 degree rule, (whichever is being followed at the time) dictates to ventilate, then ventilation should go ahead.

However, a possible issue with ventilation at night is that the crew's ability to judge the severity of rain or shipping spray in the hours of darkness may be impaired. Furthermore, there may be insufficient crew available to assist with the closure of ventilation in a timely manner.

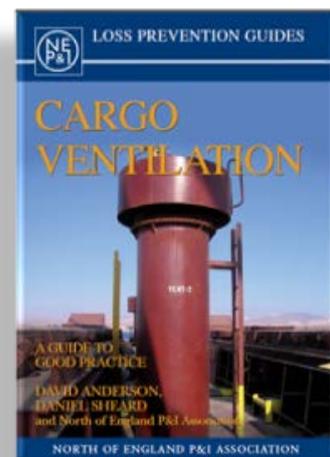
Ventilation logs

Whilst on passage, it is important that accurate records of ventilation are kept. A ventilation log should be filled in and should include the data relevant to the method employed (dew point or 3 degree rule).

In the event of a claim these records serve as valuable evidence. It is therefore important that this record is accurate. If entry into the hold is not possible due to fumigation or other safety reasons, the Master should not simply input an inaccurate hold dew point into the log. The Master is not required to record hold dew point temperature when using the 3 degree rule. Recording inaccurate temperature in the ventilation log in the event of a claim will raise the question of its accuracy.

There is an example of a suggested ventilation log in appendix 1 of this briefing.

For further information on ventilation of cargoes, refer to North's Loss Prevention cargo ventilation guide. Members can download this publication in the Members area on the North website.



Bilge and tank records

A record of tank and bilge levels should be maintained whilst on passage, noting the times of any pumping operations. Regular manual soundings of tanks and bilges can provide an early alert in the event of water ingress or other abnormalities.

Discharge Port

As with the loading port, it may be appropriate that the Master appoints an independent surveyor.

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The independent surveyor should conduct a full and accurate draft survey for the vessel. It is important that the surveyor arrives prior to cargo operations commencing to ensure that they can accurately determine the drafts before discharge starts.

Again, it may also be appropriate to appoint a tally clerk for cargo discharge in particular for West African ports when discharging bagged rice. They can ensure that discharge figures are correct, and assist in the gathering of important evidence to assist in the event of a claim.

Opening the holds

When opening the hatches with the surveyors, the Master or his representative should be present.

If the holds are sealed, the seal numbers should be confirmed by all parties at this stage before opening.

Good quality photographs should be taken at all stages including of the cargo surface prior to discharge.

Outturn reports

The surveyors should produce outturn / tally reports. Often the cargo interests and Master's appointed surveyor's reports will not tally. The Master is advised against signing the cargo interests' outturn report. However, if they come under pressure to sign such reports they should contact their P&I club or their local P&I correspondent for advice.

Bills of Lading and Letters of Protest

The Master and his crew should remain vigilant to the risk of cargo damage throughout cargo operations.

Wherever possible, the Master should ensure that damaged or wet bags are rejected before loading. This highlights the importance of appointing competent and independent surveyors and tally clerks.

If clean bills of lading are required, Masters should reject any cargo that would mean they need to clause the bill of lading. Otherwise, the Master should clause the mates receipt and bill of lading as required should the cargoes pre shipment condition require it.

If any issues are noted during load and discharge operations, the Master should issue a letter of protest. Letters of protest are important evidence if any future cargo claims arise, if they are produced alongside other

supporting evidence as outlined in this briefing then together they are considered strong evidence.

Masters should ensure that the letters are drafted clearly and that they outline the exact situation at the time. Wherever possible, letters should be acknowledged by a person representing the port or cargo receivers. The Master can consider sending the letters to all interested parties on a daily basis should they deem it necessary.

Should the Master require assistance at either the load or discharge port, he should contact the P&I club's local correspondent.



Figure 10: Damaged cargo should be rejected at the load port.

Cargo operations should be closely monitored to ensure that only the cargo for that port is discharged to prevent short cargo quantities being landed.

Charter Party

Members should be fully aware of the risks to bagged cargoes from stevedore damage and condensation when allocating responsibility for the loading, stowage and discharge of the cargo in the charter party. This includes considering the provision of adequate and appropriate dunnage.

As well as stowage, the vessel's ventilation system should be accurately described in the charter party and any vessel limitations with regard to ventilation made clear. Limitations within the systems, such as lack of mechanical ventilation, in particular on trades where ships sweat is to be expected, should be acknowledged and understood by all parties involved.

For more advice and assistance Members should contact North for assistance.

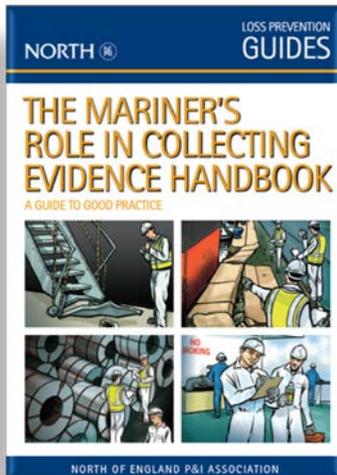
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Summary

During the loading, carriage and discharge of bagged agricultural cargoes, the Master should ensure that good records are maintained and that they retain all possible evidence to protect the ship.

Photographs, signed letters of protest, statements of fact, shipboard documentation and any other documents are useful evidence. In the event of claims such documentation and evidence has great weight placed on it.

North's Loss Prevention Guide entitled "The Mariner's Role in Collecting Evidence" is a useful source of information in this respect. Members can download this publication from the Members area on the North website.



Further Information

North's loss prevention briefing on hatch cover testing can be [found here](#).

IMO MSC.1/circ.1264 - Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds can be [read here](#).

Should further information be required please contact the loss prevention department: loss.prevention@nepia.com

Thanks to [CWA](#) for providing assistance with this briefing.



Refrigerated Containers

Appendix I - Example of Suggested Ventilation Log

A blank Excel version of this log is available by emailing loss.prevention@nepia.com

Ventilation Log		Ship: Amber Nectar	Voyage Number: 007 JB	Port From: Santos	Date Sailed: 12 April 2016	Port To: Dalian	Date Arrival: 23 May 2016	Length of voyage (days): 42							
Cargo type: Soya Beans		Average moisture content on loading - obtain from shipper before loading (actual - NOT 14% maximum)						12.6% %							
		Cargo temperature on loading - this temperature will not change during the voyage													
		Hold #1 30 °C	Hold #2 30 °C	Hold #3 30 °C	Hold #4 31 °C	Hold #5 30 °C	Hold #6 30 °C	Hold #7 31 °C							
Date	Temperature Outside Air °C	Temperature Difference	Ventilator Position	Temperature Difference	Ventilator Position	Temperature Difference	Ventilator Position	Temperature Difference	Ventilator Position	Temperature Difference	Ventilator Position	Temperature Difference	Ventilator Position	Notes	
12 April	0800hrs	29 °C												No ventilation Fumigation	
	2000hrs	27 °C													
13 April	0800hrs	29 °C												No ventilation Fumigation	
	2000hrs	27 °C													
14 April	0800hrs	28 °C												No ventilation Fumigation	
	2000hrs	26 °C													
15 April	0800hrs	26 °C	-4	Open	-4	Open	-4	Open	-5	Open	-4	Open	-4	Open	Start 0900
	2000hrs	22 °C	-8	Open	-8	Open	-8	Open	-9	Open	-8	Open	-8	Open	
16 April	0800hrs	25 °C	-5	Open	-5	Open	-5	Open	-6	Open	-5	Open	-5	Open	Light rain Stop 0945 - Heavy rain + spray Start 2100
	2000hrs	21 °C	-9	Open	-9	Open	-9	Open	-10	Open	-9	Open	-9	Open	
17 April	0800hrs	24 °C	-6	Shut	-6	Shut	-6	Shut	-7	Shut	-6	Shut	-6	Shut	Stop 0700
	2000hrs	20 °C	-10	Open	-10	Open	-10	Open	-11	Open	-10	Open	-10	Open	
18 April	0800hrs	29 °C	-1	Shut	-1	Shut	-1	Shut	-2	Shut	-1	Shut	-1	Shut	Start #4#7 2030
	2000hrs	28 °C	-2	Shut	-2	Shut	-2	Shut	-3	Open	-2	Shut	-2	Shut	
19 April	0800hrs	°C													
	2000hrs	°C													
20 April	0800hrs	°C													
	2000hrs	°C													
21 April	0800hrs	°C													
	2000hrs	°C													

Three-degree rule - for ventilation of hygroscopic agricultural cargoes only - Ventilate if the temperature of the outside air is at least 3°C less than the cargo temperature on loading.

Note 1: Ventilation at night - Ventilate if the temperature of the outside air is at least 3°C less than the cargo temperature on loading.

Note 2: Ventilation during rain - if the three-degree rule is okay and the ship has mushroom type vents then it might be possible to ventilate - see North LP Ventilation Guide.