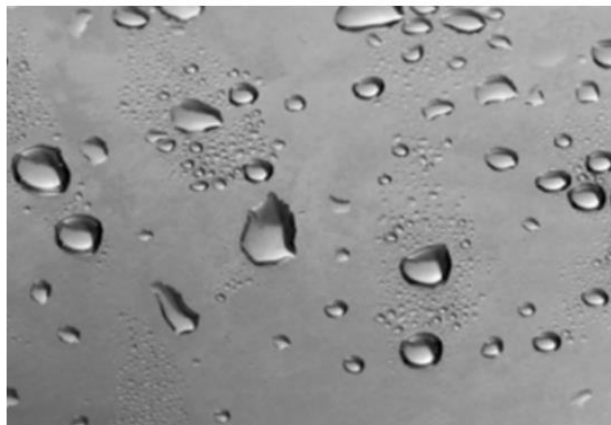


The Problem of Sweat

The Invisible Risk to the Cargo



Introduction

The Club continues to encounter claims associated with cargo damage caused by the presence of condensation, known as sweat, forming inside cargo holds, either on the cargo itself or on the vessel structure. To understand the problem of sweat, it is important to understand the concept of the Dew Point. The Dew Point is the temperature at which air is saturated with moisture, i.e., it is the temperature to which a given sample of air must be cooled for saturation to occur, with the result that water vapour in the air condenses.

The basic principle for avoiding the formation of sweat, is to maintain the dew point of the air within the cargo hold below the temperature of the hold structure and the cargo to prevent the formation of ship and cargo sweat. Ventilation is intended to replace warm, moist air in the hold with cooler and drier air. Two recognised principles for ventilation are the '*Dew Point Rule*' and the '*Three Degrees Rule*'. This risk alert explores the problem of sweat, its causes and the effective ventilation strategies to adopt to mitigate its impact.

Ship Sweat

Ship sweat is formed when the air within the cargo hold is cooled below its dew point through contact with the cargo holds steelwork. This could occur, for example, when a vessel loads in a warm climate and proceeds on a voyage to a colder climate; as the seawater and external temperature cool, the steelwork may be eventually cooled beneath the dew point of the warm moist air in the hold, causing sweat on the cold hold surfaces. The sweat may affect the cargo in a number of ways such as through direct contact with the hold bulkheads or by contact with the tank top, where sweat has accumulated after running down the hold bulkheads to the bottom of the hold. Sweat may also drip onto the cargo from above, having formed on the underdeck structure and the underside of the hatch covers. To minimise the possibility of ship sweat damage to cargo, dunnage must be used to keep the cargo clear of the tank top and away from hold sides and structural members. Where appropriate, cargo should be covered with waterproof sheeting to protect it from sweat dripping from above.

Cargo Sweat

Cargo sweat occurs when warm moist air is introduced into a hold and is cooled below its dew point by the cargo, such that condensation forms. This could occur, for example, when a vessel is on passage from a cold climate to a warmer climate and the holds are ventilated, introducing warm moist air. The warm moist air is cooled below its dew point by the colder cargo, causing condensation to form on the surface of the cargo.



To Ventilate or not to Ventilate

When heading from cold to warm climates, it is best to not ventilate the hold, as the introduction of warm outside air could cause sweat to form on the colder cargo. In these circumstances it is recommended that there is no ventilation, and that the temperature of the air within the hold be allowed to warm slowly as the vessel proceeds into warmer climates.

When heading from warm to cold climates, best practice is to ventilate and introduce the cooler air to the hold, this reduces the risk of the warmer moist air already within the hold being cooled below its dew point by the ship's structure, which is being progressively cooled by the colder seas and cooler air temperatures.

These premises form the basis of the **dew point rule** which is that, if the dew point of the air within the hold is higher than the dew point of the atmosphere, then ventilate. If the dew point of the air within the hold is lower than that of the atmosphere, then do not ventilate.

DEW POINT RULE

Dew point of air inside the hold > dew point of the air outside the hold – Ventilate

Dew point of air inside the hold < dew point of the air outside the hold – Do not Ventilate

In some instances, it may not be possible to take readings within the holds. In this case the “**Three Degree Rule**” can be used; this requires that, during loading operations, regular cargo temperatures should be recorded. Whilst on passage, if the atmosphere dry bulb temperature is at least 3°C cooler than the average temperature of the cargo when loaded, then ventilate the hold, if the temperature of the atmosphere is less than 3°C cooler than the average temperature of the cargo when loaded, then do not ventilate the hold.

3 DEGREE RULE

Atmosphere dry bulb temperature (Outside air) > 3° C cooler than the average temperature of the cargo when loaded – Ventilate

Atmosphere dry bulb temperature (Outside air) < 3° C cooler than the average temperature of the cargo when loaded – Do not Ventilate

General Rules

Effective ventilation is critical in managing condensation and preventing cargo damage. The decision on when to ventilate cargo holds requires careful consideration by the Master and officers.

The vessel should closely monitor and document the hold air dew point, the atmosphere dew point and the sea temperature, with recordings being taken on a regular basis. The dew point of the atmosphere can be ascertained by use of the wet and dry thermometers in the Stevenson Screen on the windward bridge wing, and by reference to a dew point table. It is important that any entry into holds is undertaken in line with the requirements of the vessels Safety Management System, with appropriate enclosed space entry procedures being followed at all times.

The dew point of the hold air temperature can be determined through use of a whirling psychrometer, a handheld device containing both a wet and dry thermometer. The psychrometer is spun by hand until the temperature of the wet bulb stops decreasing and is stable, successive readings should be taken until such time as the readings are consistent. The wet and dry temperatures are used to ascertain the dew point through reference to a dew point table. To ensure that accurate wet bulb temperatures are obtained, it is important to ensure that the muslin wick covering the wet bulb remains wet, with the reservoir being kept topped up with distilled water and the muslin wick covering the wet bulb being changed weekly. In some instances, it may not be possible to enter the hold to obtain wet and dry temperatures, if this is the case, so far as possible, wet and dry readings should be taken from the exhaust trunking.

A ventilation log should be maintained that clearly documents and records reasons for days when ventilation was not carried out, and this must be supported by photographic evidence of the prevailing weather conditions. Alongside the ventilation log, regular soundings of bilges should be undertaken, and a record of bilge soundings must be maintained. These records should be carefully logged as they may assist in defending a cargo claim by demonstrating that the vessel is being operated diligently, and adhering to best ventilation practice throughout the voyage.

Supportive Information

For further information on this or other Loss Prevention topics please contact the Loss Prevention Department, Steamship Insurance Management Services Ltd.

Tel: +44 20 7247 5490 Email: loss.prevention@simsl.com

Resources

- [RA113 – The Problem of Sweat](#)
- [Cargo Damage from Wetting, Sweat and Moisture Migration](#)
- [RA81 – Risk Issues in Respect of Soybean cargoes](#)
- [RA76 – Steel Cargoes](#)
- [A7256 SeaVenture - Steel Carriage, Ventilation and Good Practice \(pg12-13\)](#)
- [Steel Cargo Claims – Ventilation Practices](#)
- [Steamship Mutual - Guidelines for the Safe Carriage of Bagged Rice](#)
- [Rice - Protection Materials](#)
- [Stowage And Carriage Of MDF Boards](#)

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