



# DRY BULK CARGO AND THE USE OF TEMPERATURE SENSORS

A SIMPLE TOOL FOR IMPORTANT WORK



**AS MANY READERS WILL KNOW, CARGO TEMPERATURE SENSORS CAN BE A VITAL TOOL FOR ASSESSING THE SUITABILITY OF CERTAIN DRY BULK CARGOES FOR LOADING AND ALSO FOR HELPING TO DETERMINE HOW THE CARGO SHOULD BEST BE CARED FOR WHILST ON THE VESSEL.**

**DEPENDING ON THE CARGO TO BE LOADED, KNOWING ITS LOADING TEMPERATURE MAY SERVE MULTIPLE PURPOSES. FOR HYDROSCOPIC CARGOES SUCH AS SOYA BEANS OR RICE, KNOWING THE LOADING TEMPERATURE OF THE CARGO WILL OFTEN BE USED TO DETERMINE WHEN THE CARGO SHOULD BE VENTILATED DURING THE VOYAGE, AS THE 3°C RULE PRESCRIBES THAT VENTILATION SHOULD ONLY BE CARRIED OUT WHEN THE EXTERNAL TEMPERATURE IS AT LEAST 3°C COOLER THAN THE AVERAGE CARGO LOADING TEMPERATURE<sup>1</sup>. FOR SOYA BEANS, MEASURING THE CARGO TEMPERATURE MAY ALSO BE USED TO ASSESS WHETHER THERE IS VARIATION BETWEEN LOTS, WHICH MAY INDICATE WHETHER SOME LOTS ARE ALREADY DETERIORATING.**

For other cargoes such as coal, knowing the loading temperature is important to ensure the safety of the cargo and the ship. As per the International Maritime Solid Bulk Cargoes (IMSBC) Code, coal shall not be loaded if its temperature is above 55°C. The reason for imposing a limit is that, if the cargo is above 55°C at the time of loading, the rate of the self-heating reaction once in the cargo hold is likely to reach a temperature point of self-ignition before the reaction can be slowed down by restricting oxygen levels. The IMSBC Code does not include any provision indicating average temperature values for coal as being acceptable, and so the carrier should be careful when accepting average temperature readings provided by the shipper.



<sup>1</sup> For more information on ventilation of hygroscopic cargo please see [Loss Prevention Insight on grain cargoes](#)

<https://britanniapandi.com/wp-content/uploads/2021/11/Britannia-Loss-Prevention-Insight-Carriage-of-Grain-and-Oilseed-Cargoes-11-2021.pdf>

Another example of a cargo for which an average loading temperature is required in order to ascertain whether it is safe to carry is direct reduced iron (DRI). The IMSBC code contains three schedules covering DRI cargoes: being DRI (A), (B) or (C). Past incidents involving DRI cargoes led to loss of life and total loss of ships, as the particular risks include the risk of overheating, and fire/explosion during transport. Therefore, the IMSBC Code requires that both cargo moisture content and temperature are monitored during loading and states that if the temperature exceeds 65°C, the cargo should not be loaded. The temperature readings must be recorded in a log for each cargo lot loaded and a copy provided to the master.

Also, for cargoes where the IMSBC Code does not directly stipulate a specific temperature limit, monitoring the loading temperature is still important in order to assess any associated risks in relation to the loading of the cargo. This is especially relevant for cement which can be loaded direct from the processing plant at a high temperature. This can be detrimental to cargo hold coatings and also has the potential to raise the temperature of fuel in fuel oil tanks adjacent to the cargo holds, to a temperature above the fuel's flash point. The temperature of the cement should be determined prior to loading and, where it is found to be above the flash point of fuel in adjacent tanks, it should be allowed to cool prior to loading. Furthermore, it is recommended that the cement is not loaded when at a temperature of 80°C or above, to prevent possible damage to the cargo hold coating.

The average loading temperature is determined by regularly measuring and recording the temperature of the cargo upon loading. It is best practice to record the temperature of cargo being loaded into in each hold individually, as the cargo could come from different stockpiles, or different levels from within the stockpiles and have different temperatures. So, it is not correct practice simply to measure the loaded temperature of cargo in one hold and apply the results to all holds.

There are various types of thermometers available on the market which can be used to measure the loading temperature of the cargo and Members will need to assess carefully the cargo to be loaded, to determine which model will best suit their operational requirements. Probably the most common is the infra-red thermometer, which are easy to use and cost-efficient. Most models allow for readings to be taken from a distance e.g. from the hatch coming without having to enter the cargo hold. However, they need to be used with caution, as they will only measure the surface temperature of the cargo. If measurements are taken during the day in a very hot and sunny environment, the surface will have been heated by the sun so could be higher than the cargo temperature below the surface.

Another type is the wired digital thermometer, which are also cheap and easy to use and is useful for measuring the temperature at depths of 30 to 50 cm below the surface. However, it requires the person to be close to the cargo to obtain a measurement, which may not always be practical. Thermal cameras can also be used. These provide the user with instant and continuous measurements of the entire cargo surface in a hold and can detect any potential heat pockets. Furthermore, they provide several features which can be very helpful for the crew in order to monitor the cargo temperature both during loading and the voyage and are now also available at an affordable cost.

**Irrespective of the type used, the thermometer must be regularly serviced and calibrated in accordance with the manufacturer's instructions. This will include checking batteries as required and making sure there is sufficient stock of replacement batteries onboard. It is recommended to have a reserve thermometer available should one malfunction. Furthermore, the ship's crew must be trained in how to use the thermometer and it is very important that they understand its limitations. Checking onboard calibration and service records together with the crew's understanding and use of the thermometer should be a fixed part of a Member's internal audit process.**

The cargoes listed in this article are just a few examples which highlight the importance of monitoring the cargo temperature during loading to establish both the correct cargo care during the voyage and whether the cargo is completely safe to load, but also to identify any potential underlying risks. However, obtaining accurate temperature readings of the loaded cargo is not always easy, requiring both the right equipment and skillset by the people involved.

The Loss Prevention Insight gives more detail on the carriage of grain and oilseed cargoes: <http://ow.ly/W30q30s8ITz>



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