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FACT SHEET 5/98 November 1998

REFRIGERATION DEFROST CYCLE OF A SHIPPING INTEGRAL CONTAINER

INFORMATION FOR SHIPPERS, PACKERS, SHIPPING LINES AND THEIR AGENTS

Modern electronically controlled refrigerated shipping containers are fairly complex in their control circuitry and require specially trained service personnel to check and verify the many features and operational cycles.

Should technical details of the **"Defrost Cycle"** be required, reference should be made to the **Manufacturers Operation and Service manual**.

A refrigeration unit's evaporator coil is the part which effects the heat transfer from the circulating air within the container to the refrigerant circulated within the refrigeration system. The finely controlled flow of cold refrigerant gas inside the evaporator coil provides the desired supply air temperature as selected with the "set point" temperature.

"Set points" close to 0º C or below will produce evaporator coil temperatures below 0º C and moist air from the container will form frost on the air side of the evaporator coil. The more moisture carried by the warmer air returning from the container, the more frost (ice) will build up on the evaporator coil surface. This ice will eventually restrict the airflow through the evaporator coil and therefore reduce the refrigeration capacity of the container.

To rectify this condition, periodic defrost cycles are required to clear the evaporator coil from this ice. The defrost cycle is initiated either by electric heaters mounted under the evaporator coil, or by circulating hot refrigerant gas from the unit's compressor through the coil. The entire coil is heated up to a temperature that triggers the defrost termination thermostat to terminate the heating.

During this defrost heating process the refrigeration unit's air circulation fans are stopped to avoid the circulation of hot air through the container. ***See Fig. 1***

The heaters will remain on for the desired time (approximately 30 - 40 mins.) to melt the ice build up. Before the refrigeration cycle resumes some machinery control systems will remove the residual heat in the coil by pulsing liquid refrigerant to the evaporator before the circulation of air. ***See Fig. 2***

It is important to ensure the drains, collection pan and evaporator coil are cleaned and free of debris during the pre-trip inspection (PTI) of the reefer machinery. At least one defrost cycle should be completed in accordance with the machinery manufacturers instructions at the time of PTI.

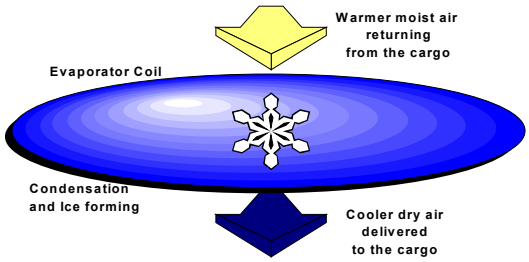

Fig. 1 Air flow through evaporator coil

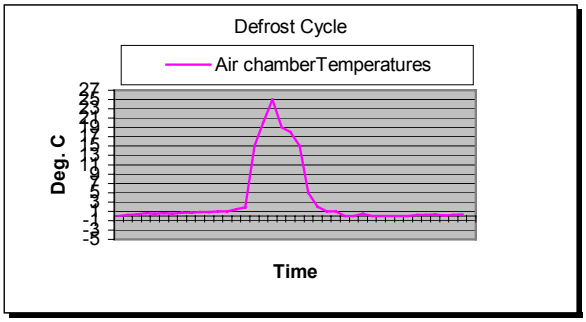

Fig. 2 Temperatures recorded in evaporator chamber at defrost

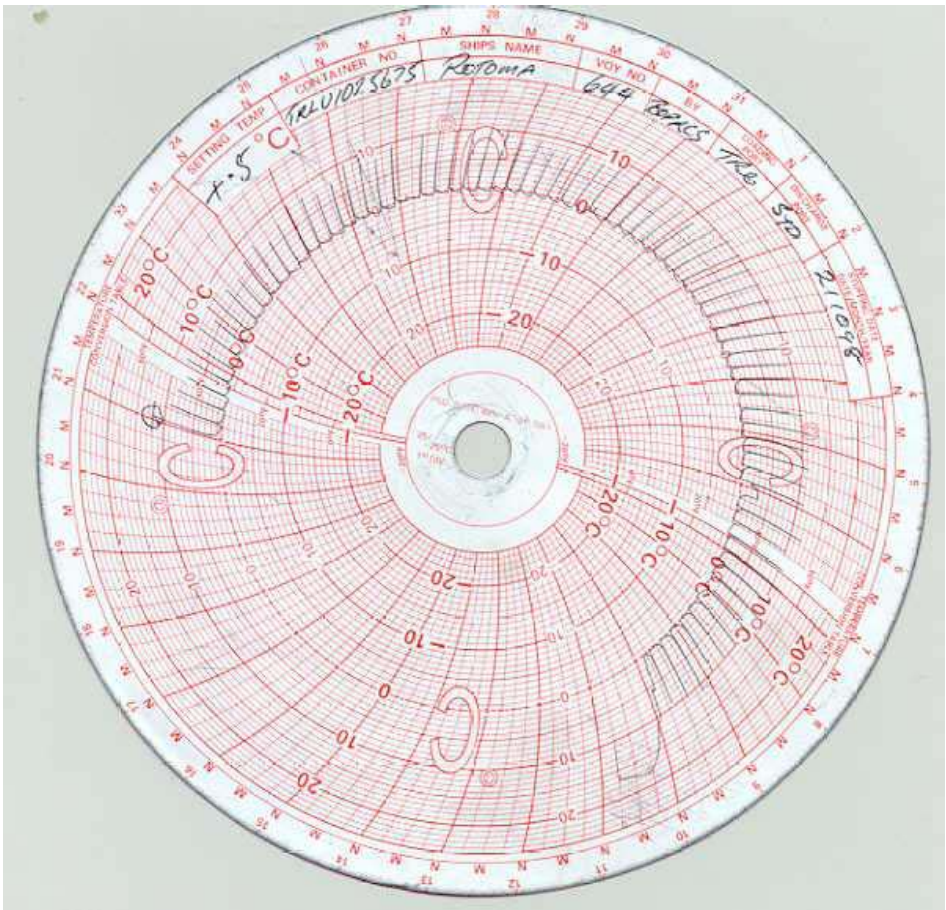

Fig. 3 Partlow chart recording return air of a chilled commodity with normal 6 hourly machine defrosts cycles.

Conditions that can adversely affect the normal defrost function of a reefer container.

1. Product packed in a moist or wet condition
2. Excessive ventilation or air exchange setting
3. Refrigeration machinery operating in high humid and tropical heat
4. Product received and packed above carriage temperature
5. Small or short On and Off power periods
6. Packing the container while reefer machinery operating
7. Poor or restricted air flow - over packed containers
8. Defrost intervals too short or incomplete operation
9. Leaking or damaged gaskets or door seals
10. Defective defrost thermostats

Defrost intervals are normally set to operate automatically, determined and selected by the operator at 3hr, 6hr, 12hr and 24hr on the controller setting. The machinery can also be set into manual defrost at any time to overcome major icing of the evaporator coil. An example of regular 6hr defrosts recording on the Partlow chart ***see Fig. 3***.

Chilled fruit or vegetables carried at or near 0 deg C continues to respire and give up moisture during the refrigeration process. This moisture can collect as ice in the evaporator coil. This drying effect will vary according to the produce and packaging method. Ice topping of cartons and humidity control systems have an effect on the defrost process.

During the initial operation and product "pull down" the machinery will be under considerable workload. To overcome possible capacity problems and to achieve full refrigeration effect, in most instances reefer machinery is set to initiate early defrosts by the unit's design software, before a "regular function" is established. If the sensors detect that the temperature of the container is still outside the "set point" of that container, it is likely that the unit will attempt further defrost cycles.

WARNING Should repeated defrost cycles continue, the unit would be unable to maintain product temperature. Further investigation must be carried out to ascertain the problem.

A normal defrost cycle does not heat the cargo - only the evaporator coil and the immediate air chamber is heated. There will be no measurable effect on the cargo temperature as the warmed air is cycled through.

It is recommended that the defrosting operation is part of the monitoring procedures at the railhead, cargo depot, sea terminal and on board the vessel. Reefer personnel should be aware of the relationship between defrost intervals and refrigeration capacity, so that product temperature can be maintained accurately. Ships staff should closely monitor the defrosting cycle in the early stages of the voyage and when significant climatic changes are experienced on route.

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