1. INTRODUCTION

The requirements listed below are basically a summary of the most important design and approved specifications of the vessels and equipment already in use. It therefore does not alter or change any specifications stipulated by other national or international authority.

2. BASIC REQUIREMENTS

All vessels, refrigeration equipment, containers, control and recording systems must comply to the specifications of a recognised international classification society such as Lloyds.

3. REQUIREMENTS FOR VESSELS

3.1 Air distribution systems

3.1.1 **Temperature maintenance**: Cold air must be delivered at the specified temperature to each and every container containing perishable cargo or requiring temperature control. A maximum of ±0,5°C deviation from the specified temperature is permissible in delivery air at the entry port hole of each container.

3.1.2 **Air circulation** rate based on the empty volume of the container shall not be less than:

Chilled produce : 60 complete air changes/hr
Frozen produce : 30 complete air changes/hr

3.1.3 **Fresh air supply** must be adjustable within the range from no intake at all (0%) to a maximum of one complete air renewal every two hours (100%). Fresh air inlet and outlet arrangement must not allow any cross-tainting.

3.1.4 **Taint barriers** must be in a sound condition to avoid any cross-tainting between different compartments.

3.1.5 **Relative humidity (RH)** of the cooling air to be maintained at 85 ±5% unless otherwise specified.

3.2 Refrigeration system

Under tropical conditions, with an ambient air temperature of +40°C, RH of 55% and sea water temperature of 32°C the refrigeration plant will be capable of maintaining all air delivery temperatures within ±0,5°C from the specified temperature in all chilled containers at all times. It must also be capable of maintaining the air return temperatures within ±0,5°C from the specified temp in all deep freeze containers.

3.2.1 With the whole plant operating, to fulfill the following two functions at the same time:

- to maintain a return air temperature of minus 20°C in deep freeze containers.
- to cool down the return air from 27°C to minus 0,5°C in fruit containers shipped at a pulp temperature of minus 0,5°C within 12 hours after shipment

3.2.2 With one refrigeration unit as stand by:

- to maintain minus 0,5°C in all fruit containers and minus 25°C in deep freeze containers.

3.3 Electrical Power supply

Conventional and Container vessels, refer to Q10 survey form:

- All vessels carrying integral containers must have sufficient power supply to plug points when carrying integral containers.
- Sufficient spares must also be available onboard vessel, if so required.

3.4 Automatic control system

Control systems shall include the following equipment:

- Brine temperature control
- Liquid expansion to evaporators
- Thermostatic control of delivery air temperature for air coolers and hold conditioners

The brine temperature in the four delivery brine mains is controlled by electronic controllers which control the capacity of the compressors. The controllers to cover the range from +20 to minus 40°C.

3.5 Instrumentation

A datalogger is installed to monitor, measure and record each individual container return air temperature, each air cooler delivery air temperature, temperatures from the refrigerating machinery and alarms for high/low temperatures, gas pressures and failures of running compressors and pumps. Two typewriters and two alarm print-outs are included. A manually operated monitor is required with a sensor in each return air duct to analyse and indicate the CO_2 content.

Electronic data loggers to be installed on each container vessel. Information to be supplied promptly to the Board.

All temperatures must be recorded at least every 4 hours until conditions have settled and every 8 hours thereafter for the remaining duration of the voyage.

All temperature logs must be returned as soon as possible after being requested by the PPECB.

3.6 Calibration

All temperature control and recording equipment must be calibrated at 0,0°C at least once every 6 months unless the system is self calibrating.

3.7 Hold insulation

All insulation must be kept clean, dry and intact at all times. This includes insulation in bulkheads, air ducts and hatch covers.

3.8 Cleanliness

All equipment and materials such as cooling coils, ducting, air intake pipes must be kept clean at all times to avoid micro cross contamination.

4. DESIGN REQUIREMENTS FOR CONTAINERS

4.1 Uniformity of shape

The internal and external uniform shape of the container must remain as new without bulges.

4.2 Construction

4.2.1 Floor

A floor consisting of T-section construction, of a minimum height of 40mm, must be provided. The floor must be able to withstand the stresses caused by a forklift truck maneuvering a pallet into place.

The space between the T-sections not to exceed 50mm at any place.

Original form and designed load bearing strength must be maintained at all times.

4.2.2 Door battens

Battens, 12mm deep shall be provided on the doors. They are to be vertically disposed, be pitched at 200mm and be stopped not more than 75mm from the top and bottom door seals. The width of their top surface shall be not less than 25mm.

4.2.3 Door seals

Door seals must be intact and provide an air tight seal at all times.

4.2.4 Air delivery opening shall be 70mm deep for the full internal width of the container. The top edge of the slot to be not more than 100mm above the top surface of the floor. It must allow for unobstructed air flow.

4.2.5 Air return opening should not be less than 70mm deep, for the full internal width of the container. It must allow for unobstructed air flow.

4.2.6 Cargo loading protection

Provision must be made for adequate protection to the side walls for the full internal length of the container. This protection shall not reduce the internal width specified in section 4.1.

4.3 Heat leakage

The maximum heat leakage values specified as follows may not be exceeded at any time. The heat leakage of the roof shall be equivalent to 75mm of material of a thermal conductivity not exceeding 0,024 Kcal/m2/h/°C.

Container type	Max heat leakage Kcal.h/per °C
20’ fruit container 20’ reefer container 20’ “combi” container	40 23 23

4.4 Air leakage

The maximum air leakage shall not exceed 8.5cu meters/hr at 25mm swg internal pressure.

4.5 Insulation integrity

The insulation shall at all times be dry (contain no moisture), intact (no separation) and be without any holes or cracks. When such insulation is bounded to the walls, roof or floor such bounding shall at all times retain its integrity.

5. REFRIGERATION REQUIREMENTS FOR INTEGRAL CONTAINERS

5.1 Refrigeration

Refrigeration requirements for integral refrigerated containers also apply to the requirements for container vessels as specified in par. 3.

5.2 Relative Humidity

The evaporator surface must give a maximum temperature difference of 5°C between the mean container temperature and the mean evaporating temperature when the cargo is in equilibrium at 0°C and the ambient temperature plus 38°C to retain a relative humidity between 85% to 95%.

5.3 Defrosting

Defrosting must be automatic and may be initiated by a differential air pressure switch or a timer switch and must include a manual override switch.

5.4 Minimum air circulation rate

Minimum rate of air circulation with frost-free coils must be 60 changes per hour of the empty volume of the container against a static pressure difference across the empty container of 30mm swg at sea level and 15°C. The fan is to circulate at least 75% of the specified rate of air circulation at the point where defrosting is initiated. Extreme uniformity in temperature is required within each container. The temperature variation within the container when cooled to carrying temperature, should not exceed plus or minus 0,5°C.

5.5 Air temperature control

Air delivery temperatures to the container must be controlled within the range minus 25°C to plus 20°C when operating in any ambient temperatures between minus 10°C and 38°C.

The temperature of the air entering the container is to be controlled to plus or minus 0,5°C in the range minus 5°C to plus 20°C for chilled cargo.
In order to meet the requirements of delivery air temperature control in chill mode, it is essential that the compressor runs continuously and capacity control must therefore be fitted. Capacity control is therefore likely to be either by hot gas by-pass, suction throttling or with cylinder unloading.

Provision must be made to prevent air delivery temperature falling below 1°C of the specified optimum carrying temperature for the specific product as stated in the temperature instruction letter to the Master of the vessel and outlined in the General Loading and Carrying conditions compiled by the Board in the event of failure of the electronic controller.

For deep frozen cargo the temperature is controlled on return air at a maximum of minus 25 plus or minus 1°C.

If the delivery air controller is used for frozen temperatures, an upper limit safety device is required.

Electronic control equipment must be capable of maintaining the level of accuracy stated when located in the machinery compartment. Resistance thermometers to be of the appropriate standard to ensure minimum errors in the range minus 2°C to plus 2°C.

5.6 Fresh air ventilation

The rate of fresh air introduction is to be a minimum of one change every two hours based on the empty volume of the container. The fresh air must be introduced before the cooler to ensure that cooled air is introduced into the container. The air inlet to be adjustable (completely shut-off type). The CO_2 sampling point to be fitted to the return duct.

5.7 Temperature recording

Requirements as per paragraph 3.4 also apply.

5.7.1 Chilled cargo

The sensing elements of the temperature recorder and control must in the case of chilled cargo be positioned in the air delivery. An external test facility must be provided.

Temperature recording equipment must monitor the temperature of the air entering the container and must be accurate to plus or minus 0, 5°C over the range of minus 5°C to plus 20°C. A facility must be provided for remote monitoring of temperatures at a control point.

5.7.2 Deep frozen cargo

The sensing elements of the temperature recorder and control should preferably be positioned in the air return.

The temperature recording equipment must monitor the air return with an accuracy of +1°C in the range minus 5°C to minus 30°C.

6. SANITARY ASPECTS

All containers shall be designed and built to allow easy internal cleaning.

All containers are to be taint free. They shall be tested according to BS 3755 or equivalent national standard.

7. CERTIFICATION

A certificate of approval of performance and safety is required for both the container and the refrigeration plant from a recognised classification society.