

 PPECB	Ordinary Handling Protocol - HP15 - Refrigerated Road Motor Transport	HP15
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Responsible Person:	National Manager Cold Chain Protocols and Standards (Bernard Henning)	
Approver:	General Manager Coastal (Vijan Chetty)	
Department:	Operations - Cold Chain	

INTRODUCTION

Knowledge of the factors that influence product temperatures during transit and of the refrigerated trailer, is essential to operate a successful road transport concern. Some of these factors are:

- the performance of the refrigeration system.
- the load (commodities, amount, respiration rates, packaging, temperature at loading and loading patterns).
- Weather, ambient and very important, road surface temperatures during transit.
- length of the journey and whether the trailer and load were pre-cooled prior to loading.

It should be remembered that:


- The PPECB has the legal obligation to ensure that the very strict quality and hygiene requirements, as laid down by importing countries, are met.
- Refrigerated road motor transport (RRMT) is in the first place a transport unit and is essentially designed to maintain product temperature, therefore are not able to pre-cool or re-cool product which is not at the optimum temperature before loading. (Figures 1 and 2).
- Re-cooling products prior to shipping causes considerable problems in the ports, and if it can be done at all, may cause delays in shipping, rejection and product deterioration.
- In the case of quality loss and waste on the overseas market, the PPECB may be requested to submit a professional and accurate technical report to the relevant parties, in order to finalize insurance claims. To avoid such claims correct transport conditions must be maintained.

It is therefore absolutely essential and in the interest of the producer, the exporter, the importer and the carrier, that the minimum requirements specified in this document be applied at all times. Registration or certification of a RRMT is not a PPECB requirement and can be done by PPECB or any competent accredited organization, should it be required.

PPECB REGISTRATION/REQUIREMENTS

Should PPECB be requested to register a RRMT, the following requirements shall apply, and all relevant information will be captured on check list Q22.

1. A thermocouple (TC) wire with a H110T thermocouple male plug must be mounted in the delivery air inside the RRMT. The plug to be placed inside a waterproof box with a sliding lid mounted on the outside of the trailer. The other end of the TC wire must be installed in the airflow plus minus 300mm from the delivery air exit of the evaporator coil. Approximately 500mm as per working instructions of wire slack must be allowed for inside the box. An electronic thermometer will be plugged to this wire to obtain the "delivery air temperature" (DAT) from the outside of the trailer. This wire must be marked with a blue marker. The lid of the box to indicate **Delivery – Blue**.
2. A similar (TC) wire marked red must be mounted with one end in the return air i.e. in a position shortly before the air enters the evaporator plenum, and the plug end to be in the same box as the DAT plug. This is to obtain the "return air temperature" (RAT). The lid of the box to indicate **return – Red**.

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3. **The temperature control sensor (thermostat sensor) must be mounted in the delivery air** in the same position as the DAT thermocouple sensor. It must be noted that if the control sensor is mounted in the return air, in most instances will result in the DAT being up to 7,0°C lower than set point (thermostat setting). This means that perishable products in a RRMT that controls on return air, will be subjected to too low temperatures that will damage the product.
4. The temperature can be controlled in the “return air”, only when deep-frozen cargo is being transported.
5. Every refrigerated vehicle must have an externally mounted automatic temperature recorder. If this recorder has only one sensor, the sensor must be mounted in the delivery air in the same position as the DAT thermocouple and control sensor. If the recorder has more than one sensor, a second one can be mounted in the return air next to the RAT thermocouple. The recorder must have the ability to enable an on-site print (to produce an immediate print) i.e. a built in printer. The recorder must be kept clean, in perfect working order and must have paper in **at all times** when export perishable products are being transported. Not more than 1,0°C inaccuracy will be accepted.

It must be possible to easily read at least single degrees (1,0°C deviations) from the temperature chart.

Portable recorders are unacceptable due to their slow reaction time and in most cases their inaccuracy.

On completion of the trip a PPECB Assessor will record the temperature history of the journey and inform the exporter according to the service agreement with PPECB.
6. On arrival at the transfer depot near the port, a PPECB assessor will take relevant temperatures, check settings and condition of the refrigeration unit and insulated box onto Q20. If anything unsatisfactory is discovered, a warning form Q20 will be completed and signed by the PPECB assessor and the driver who will also receive a copy. If the trailer returns with the same faults, the certificate will be cancelled and the exporters informed.
7. Cargo must be loaded in such a way that carton holes etc. faces from front to back and not sideways, to prevent restriction of air flow through the cargo. (Refer to Figures 1 and 2), most optimum loading pattern.
8. Cargo must always be placed on pallets if the trailer does not have a “T-BAR’ floor. Failing to do this will result in the cargo coming into contact with heat being conducted through the floor from the hot road and mechanical horse. Restriction of airflow returning to the evaporator will also occur. (Refer to figure 3D).
9. Acceptable thermostat accuracy will be a maximum of 1,0°C below set point and 2.0 °C above set point. This means that on the heating cycle the DAT may not be more than 2.0°C above set point and on the cooling, cycle may not be more than 1,0°C below set point.
10. Refrigerated trailers must have a false bulkhead inside to prevent short cycling of air between the delivery and return airflow. Short cycling of the air will result in zero airflow to the cargo, especially at the door end.
11. The insulation must remain in perfect condition. Holes, cracks etc. will allow moisture to enter, making the refrigerated trailer much heavier and rendering the insulation useless.

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12. Loose panels and plates must be properly repaired and sealed to prevent physical damage to the cargo and breeding of unwanted living organisms etc. that will contaminate the cargo.
13. Missing refrigeration unit covers is unacceptable as exposure to harmful flying objects can cause a breakdown of the unit resulting in no cooling to the cargo.
14. All wheels etc. must be kept in good order to prevent en-route delays and possible accident, ultimately resulting in loss of revenue for many people.
15. The refrigerated trailer must be washed and disinfected before every trip. Avoid strong smells prior loading.
16. The trailer must be pre-cooled for at least four hours prior to loading, as especially fruit and vegetables will gain heat from the warm trailer at a rapid rate due to them being living cells and absorbing heat during respiration. This heat gained by the cargo and also the ambient heat and warm insulation within the refrigerated trailer can take some hours to be removed by the refrigeration system.

REFRIGERATION

The object of refrigeration is to maintain quality by lowering the commodity temperature so that quality deterioration and decay by micro-organisms are retarded. A refrigeration system removes heat from an object thereby rendering it cold. For example, if an object or substance is at a temperature of 15°C and is required to be lowered to 10°C, the refrigeration unit will have to remove 5.0°C heat from the object.

The quantity of heat is measured in kilojoules and defined as, the amount of heat required to raise or lower the temperature of 1kg of water by 1°C. Heat in its natural form always travels from a warm to a colder object or substance. The three most important sources of heat are:

- Environmental heat, surrounding heat inside & outside the refrigerated trailer.
- Heat caused by the respiration of the product, and
- Heat generated by the operation of the cooling system itself (defrosting & fan motors).

Most modern transit refrigerated vehicle units have **enough refrigeration capacity** to maintain desired product temperatures during transit, but they **lack enough air circulation** through and around tight loads to absorb all sources of heat. Load pattern must aid and not restrict air circulation.

Most mechanical refrigeration systems can provide heat to the storage compartment if the trailer is refrigerated travelling through sub-freezing conditions. In South Africa this does occur but not too often, but at times the ambient air is colder than the required load temperature. A properly designed system will also provide high relative humidity in the storage compartment, which at times needs to be as high as 95%.

A truck refrigeration system must have sufficient capacity to remove heat generated by the following sources:

- **Residual heat from the air inside the trailer**

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Pre-cooling of the refrigerated trailer and fast loading must therefore be practiced. Doors must be kept closed when no loading is taking place. Loading docks with effective seals to allow loading into and out of the refrigerated trailer is highly recommend.

- **Infiltrated heat from warm outside air through small holes and cracks**

The body and door seals of the trailer should be kept in a perfect condition.

- **Heat of respiration generated by all fresh fruit and vegetables**

Some products respire faster than others. The rate at which the products respire varies e.g. the type of product, the temperature of the product and stage of ripeness. The higher the product temperature, the faster it will respire, resulting in a higher quantity of generated heat. Correct loading will assist in the removal of generated heat (reduce respiration rate).

AIR CIRCULATION SYSTEM

Air circulation is necessary to move air through and around the load to enable heat to be absorbed and returned to the evaporator coil, where it is in turn absorbed by the gas in the coil and given off to the outside air via the condenser, assisted by the condenser fan. (Figures 1 and 2).

Since the refrigeration unit and air circulation fans are in most cases mechanically connected, an inoperative unit means no air circulation around or through a load. Defective air delivery ducts (older units) with large rips or holes in them, causes some of the circulating air to bypass the load and to return directly to the return air plenum. Excessively high loads will cause the air ducts or shuts to collapse against the ceiling which will restrict the delivery air flow.

Some of the newer series of refrigerated trailers are not fitted with air delivery shuts. Cold air from the blower is delivered directly in the plenum between the top of the pallets (load) and the ceiling. Air deflectors ensure an even air distribution to the sides and the door end. It is of paramount importance to leave at least a 150mm opening between the highest point of the load in any position and the ceiling.


It is important to note that features such as T-bar floors and ribbed inner walls will improve air circulation. Most trucks in this country however, have flat floors and walls, making correct loading of palletized product that much more important.

- **Flat walls**

If product is loaded against the side walls, heat that enters the insulation is in direct contact with the product and is conducted to the product instead of being carried away by the circulating air. A trailer with flat inner walls should be loaded so that air is allowed to pass between product and sidewalls. Also leave at least 150mm opening between the top of the load and the ceiling. (Refer to figure 3C).

- **Flat floors**

A large amount of the heat load is generated from the hot road, tyres and brakes. Hot air rises and the heat will enter through the floor. Too often frozen produce is loaded directly onto the floor. Without pallets or T-bars there will be no air circulation to remove heat at the bottom of the load,

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also the return air passage is blocked off which will restrict air delivery as well. With flat floors it is most important that pallets be used at all times whether it be frozen or chilled product. (Refer to figure 3D).

TEMPERATURE CONTROL SYSTEM

Accurate temperature control in a mechanically refrigerated system is a necessity to ensure correct product temperature during the journey. It includes a thermostat with heating and cooling cycle, defrost mechanisms, and fan speed control.

It is of paramount importance that the thermostat sensor is fitted in the delivery air stream when chilled cargo is carried. Wrong positioning of the thermostat sensor will cause severe cold or freezing injury in fruits, vegetables and flowers (chilled produce) within a very short period.

Some refrigerated trailers have two sensors, one in the delivery air and one in the return air. In some units a switch is used to select either one of these sensors. When transporting chilled produce, the chilled mode must be selected to ensure that the temperature will be controlled in the delivery air. When carrying frozen cargo, the frozen mode must be selected where the temperature is then controlled in the return air. The switch must be clearly marked "chilled" and "frozen" to modulation must not operate more than 1,0°C below set point. In the more modern units the concept of modulation is based on DAT/RAT. DAT is effected if RAT is too warm, which could result in a too low air delivery.

THE REFRIGERATED TRAILER CONDITION

The condition of a refrigerated trailer affects its capability to maintain the temperature of the products as much as its design features. Damaged wall and floor insulation allows excessive heat to be conducted especially if moisture is allowed to enter into the insulation, rendering it effectively useless. Damaged doors and door seals will have the same effect.

Some trailers have stainless steel plates fitted to prevent mechanical damage during loading and unloading. These plates must be properly sealed to prevent fungal and bacteria growth or insect breeding behind the plates. For these reasons, refrigerated trailers must be thoroughly washed inside with clean water at 80°C or warmer and containing an approved food grade disinfectant. **The refrigerated trailer must be cleaned and washed every time before loading.**

The cooling coil plenum must be opened and check before each trip to make sure that the coil is clean and free from any fungal growth or obstructions such as plastic, paper, or leaves.

Certain food products are highly susceptible to contamination by strong odours either by chemicals or other types of food (such as fish). If a load with an odour has been transported, the trailer must be washed and well ventilated, then closed again for at least two hours before being checked again.

Regular checks must also be made to outside insulation and skin (vapour barrier). This includes the roof. Twisting of the trailer could cause panels to come loose, or cracks to occur allowing water to enter the insulation.

The outside of the truck and trailer should always be as clean as the inside not only to improve reflection of heat, but also in the eyes of the client, a clean truck is almost sure to be a better advert than a dirty one. Remember maintenance and repairs can cost less than claims or lost revenue due to delivery of a product in a condition other than expected.

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HUMIDITY

The humidity or moisture content of the air surrounding the commodity is an important factor in maintaining quality during transport. Most perishable horticultural products require high a relative humidity of 85% to 95% to prevent dehydration and to keep them fresh and crisp when under cooling. That is to say that a high moisture level is required for certain commodities.

Relative humidity is simply a percentage figure indicating the amount of water vapour in the air, in relation to the saturation point of the air at a given temperature.

In mechanical refrigerated vehicles, moisture is constantly being condensed from the product to replace the moisture lost through absorption by the evaporator. The moisture then drips into the drip-tray and escapes to the outside of the trailer through the drainpipe.

This is vapour in the air surrounding the product, which has been condensed by the evaporator coil. This vapour must be replaced and can only be obtained from the product. For this reason some moisture loss must be accepted, but can be minimized by the following practices:


- **Thorough pre-cooling** of the product and the trailer to reduce the temperature differential between the product and the surrounding air.
- **Keeping the evaporator coil only a few degrees colder** than the desired transit temperature by perfect expansion valve and thermostat calibration, which should only be carried out by a competent refrigeration technician.
- **Controlling the air temperature at the air delivery side of the evaporator only**, for chilled product.
- **Thermostat accuracy** must be so that the temperature graph indicates as straight a line as possible, in other words the temperature variance between the cooling and heating cycle switching should ideally be no more than 1,5°C or more than minus 1,0°C from set-point.
- Use a refrigeration system, with **the largest cooling coil (evaporator) available**.
- **Waxing the product or using semi-permeable wraps** to reduce evaporation, but depending on the package, could restrict the amount of airflow through the package and also restricting the amount of airflow through the packaging.

PRE-COOLING THE PRODUCT

To maintain a fresh appearance, prevent decay and extend the shelf life of most fresh fruits and vegetables, it is necessary to start lowering the temperature and remove the field heat from the product as soon as possible after harvest. Any cooling completed before the product is at the shipping temperature, is referred to as pre-cooling.

Pre-cooling may include one or a combination of the following methods:

- **Room cooling** by utilizing the built in air circulation system in the cold store. This is a very slow process and optimum product temperature may never be achieved.
- **Forced air cooling** by forcing the cold air through the load making use of fans. Forced air cooling is very efficient, produces fast and even cooling throughout the stack and is cost effective.

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- **Pressure cooling** is in principle the same as forced air cooling, but is done in specially built cooling tunnels. This enables high throughput, very fast and even cooling, but cost effective for large volumes only.
- **Hydro cooling** by placing the product into direct contact with chilled water. A very fast and effective method, but requires skilled maintenance and operation.

Two additional factors that have a detrimental effect on product quality are:

- Refrigerated trailers which are not properly pre-cooled prior to loading.
- A certain amount of product is pre-cooled for some time, but other may have been harvested the day of loading with no pre-cooling. Part of the load will then consist of pre-cooled product and the rest un-precooled or warm product.

This practice occurs too often and should be more strictly controlled by the exporter or cold store operator. The ideal situation would be for the carrier to accept only properly pre-cooled products. For various reasons this is not always practical. A direct result of this is that the truck operator often bears the brunt, even although the exporter was to blame.

FREEZING AND CHILLING INJURY

Something that is very often overlooked is the heating cycle on the refrigeration unit in trailers. Commodities are often carried through an area where the outside ambient temperature is lower than the required carrying temperature of the product. (Especially avocados carried in winter through the Karoo in winter at subzero temperatures).


In this case the inside air might have to be heated. For this reason the heaters must be checked regularly to make sure that the operation is satisfactory. (Refer to figure 4).

Another factor, which very often contributes toward chilling injury, is when warm produce is loaded into the trailer. The delivery air temperature is then adjusted much lower than accepted, for the purpose of trying to pre-cool in a short time. The product closest to the evaporator coil will almost definitely have chilling injury, as it is subject to a temperature many degrees lower than the accepted carrying temperature. If chilling is observed in fruit on the top of pallets, it can be assumed that air was delivered at too low temperatures in the refrigerated trailer.

To prevent chilling injury, it is required internationally that the temperature be controlled in the delivery air for all chilled produce. It must be remembered that the return air is warmer than the delivery air due to heat absorbed from the product and heat leakage into the trailer. If controlled by the return air, the thermostat sensor will sense this warm air indicating to the thermostat that the load is too warm and full cooling is required. The delivery air could drop to a low temperature to cool this load and inflict chill injury to the product. Controlling on air delivery will allow air to be delivered at a temperature no lower than that which has been set on the thermostat and unless the thermostat is faulty, no chilling injury can occur.

LOADING

The exporter must ensure that the product is on temperature at the time of loading into a refrigerated trailer. Pulp temperatures of all pallets as well as pulp temperatures in the center of pallets in various

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positions (at least 5 pallets in a load) should be recorded at the time of loading on a log sheet and must accompany the truck to the port.

If products destined for the local market are loaded into the same refrigerated space as cooled export produce the local market fruit must also be precooled to, the temperature specified for the export produce and this temperature must be maintained during the trip.

Carrying out the following procedures will improve final outturn quality of the product: and minimize risks:

- Driver education. In addition to operating the RRMT, the driver should also take care of at least the following:
 - ✓ Stand by at the loading to ensure that the forklifts do not damage the load or the refrigerated trailer.
 - ✓ Check the product temperature during loading, capture temperatures and have it signed by the exporter or cold store operator.
 - ✓ Ensure that the pallet carton's holes are facing front and back. (Refer to figures 1 and 2).
 - ✓ Check refrigerated trailer at every off-loading point, and see that any fault or damage is repaired as soon as possible.
 - ✓ Ensure that the unit is functioning correctly. Trucks regularly arrive at their destination with the probe change over switch set on the frozen mode while carrying chilled cargo and thermostats set on minus 10°C instead of plus 10°C. These faults can be rectified before any damage occurs.

THE LOAD

There are many theories concerning the loading pattern inside the trailer. Attention must however be drawn to certain aspects.

- Where the vehicle is not fitted with a T-bar floor, loads must be placed on pallets at all times to create a passage for the air to return to the evaporator, and also to keep the load off the floor through which heat is conducted from the road. Maximum load height including the pallet must not exceed 2,1m. Leave at least a 150mm opening between the load and the ceiling. (Refer to figure 1).

It is probably correct to say that during summer, especially during the daytime, more heat enters the trailer from road heat than through the walls and roof. With the tremendous heat buildup on the roads, (as much as 65°C was recorded) a large amount of heat enters through the floor insulation. For this reason the load should not be placed directly on the floor and naturally an air return passage must be maintained. (Refer to figure 4).

- Loads must be kept away from the walls with not less than a 25mm gap to prevent heat from conducting to the load from outside. This will allow air down the sides, absorbing respiration heat from the product and outside heat that has permeated through the insulation.
- Pallets must be loaded with a minimum opening between pallets to force the air through the pallet by minimizing short circuiting gaps. (Refer to figure 3D).

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- When packing loose cartons without holes, a small gap must be maintained between them to allow air to pass around the sides of each carton. (Refer to figure 5).
- Stop and inspect the refrigerated unit at regular intervals during transit.

COMPATIBILITY OF MIXED LOADS

Mixed loads should not be shipped unless the commodities are compatible. Five important factors should be considered in determining the compatibility of products:

- The required **transit temperature**.
- Required relative **humidity**.
- Emission of physiologically active gases such as **ethylene**.
- **Odour** absorbing characteristics.
- Type of **packaging** and whether it can be packed in such a way that air circulation is satisfactory throughout the trailer.

Note: *Never mix different packaging in the same load. It will result in serious air circulation differences and temperature variation.*


OFF LOADING

On arrival at the transfer depot in the port, the PPECB assessor will log the following temperatures **(PP04.02-22F01):Q02**

- Air delivery and air return temperatures as indicated by the permanently installed thermocouples.
- The temperature indicated by the chart recorder, or in the case of too much variation, a copy of the chart must be made.
- The product pulp temperature in at least 3 positions (door, center, front) in the truck as well as.
- Pulp temperatures in the center of pallets.
- All relevant dates and times.

All these temperatures will be captured by PPECB and will be available to exporters. Loading temperature logs received from exporters (fax or email) will be completed at off-loading and returned to exporters for verification. The pre-shipment history will be compiled from this data should any problem arise or a claim be filed due to loss of quality.

CALIBRATION

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Ice made of fresh water not containing any impurities, must be crushed into small pieces and mixed with a small amount of cold water in an insulated flask.

An accurate glass mercury thermometer is placed into this mixture together with the temperature sensor of a thermostat, temperature recorder or portable thermometer. When the glass thermometer indicates 0,0°C, calibration or adjustments can be made to the instruments or the error must be noted and all readings corrected if the instrument cannot be adjusted. The ice water mixture should be stirred continuously during calibration. (Refer to TWI02)

The calibrated portable thermometer is then connected to the air delivery (chilled produce) or air return (frozen produce) thermocouple. The temperature control thermostat and temperature recorder must be adjusted so as to control and record the cooling air at the required temperature prior to every trip. Thermostat accuracy, temperature recorders, dial thermometers, etc. can be checked and calibrated in the same way.

SUMMARY AND RECOMMENDATIONS

Calculations can be done to determine whether a refrigerated trailer's refrigeration is adequate to maintain a particular product temperature when it has been loaded at temperatures higher than specified, but experience has proved that the only solution is to load pre-cooled products.

When an exporter insists on loading warm cargo into the refrigerated trailer, the operator or driver must explain that a refrigerated trailer is not able to pre-cool the product, therefore the operator cannot be held responsible if the product arrives warm (or too cold if controlled by integrated DAT/RAT system) at the discharge point. This will improve the cold chain with a better outturn of product and hence improved exporter demand.

There are a number of ways to contribute towards maintaining good quality standards, some of which are as follows:

1. Pre-cool trailers prior to loading.
2. Obtain and record product temperatures during loading.
3. Make sure that the product loaded first is not pushed up hard against the evaporator.
4. Load the product on pallets away from the side walls. (Refer to figure 3D).
5. Do not load higher than 2,1m including the pallet. Leave at least 150mm between the load and ceiling. (Refer to figure 1 and 2).
6. Allow at least 80mm space between the door and the last pallet for air circulation.
7. Product must be loaded so that the carton holes are facing front to back (i.e. along the length of the load).
8. Regular maintenance by experienced technicians will ensure optimum conditions and performance, this includes thermostat and chart recorder calibration checks.
9. Each driver should have an electronic thermometer and know its operation so that the delivery air, and return air temperatures and refrigeration performance can be monitored during transit.

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10. Obtain a PPECB certificate and always comply with the minimum specifications.

BUYING OR CONTRACTING REFRIGERATED TRAILERS

When buying a new refrigerated trailer, ensure that it is able to maintain the necessary product temperature during transit. Certain features should be noted:

- Preferable to have 50mm deep T-bar floor to allow for better air circulation.
- Grooved or fluted side walls allows for better air circulation around the load.
- False bulkhead with open bottom entry for air return.
- Curved air deflector at the base of the inside front wall.
- Strong and tough inner wall skins to prevent mechanical damage.
- Outer skin should be smooth and preferable white for best reflection of the elements. The sun and wind contribute a large quantity of the heat load. Reflection from the road surface as well as wheels and brakes also adds to the heat load. (Refer to figure 4).
- Refrigeration unit with a fan capable of circulating at least 0,944m/s of air against a 50mm water gauge static pressure.
- A large evaporator coil to maintain a high relative humidity and constant temperature.
- A solid state temperature controller (thermostat).
- Thermostat should have a changeover switch for delivery and return air control for chilled and frozen products respectively.
- Thermograph or temperature recorder to supply a continuous temperature history of the trip.

Thermocouples in the delivery and return air streams for checking of temperature and calibration of the thermostat.



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**For Optimum Transit Temperature Management,
Refrigerated Trailers Need These Features**

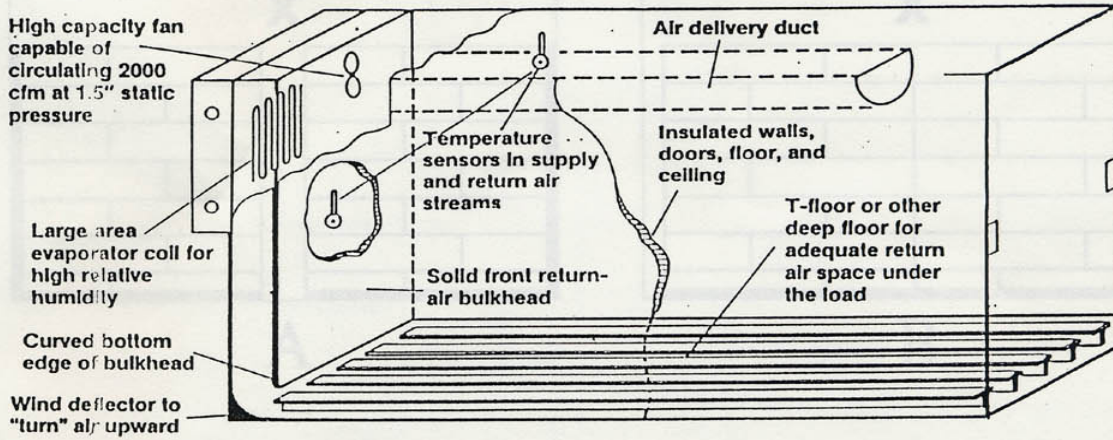


Fig. 1

TOP-AIR DELIVERY

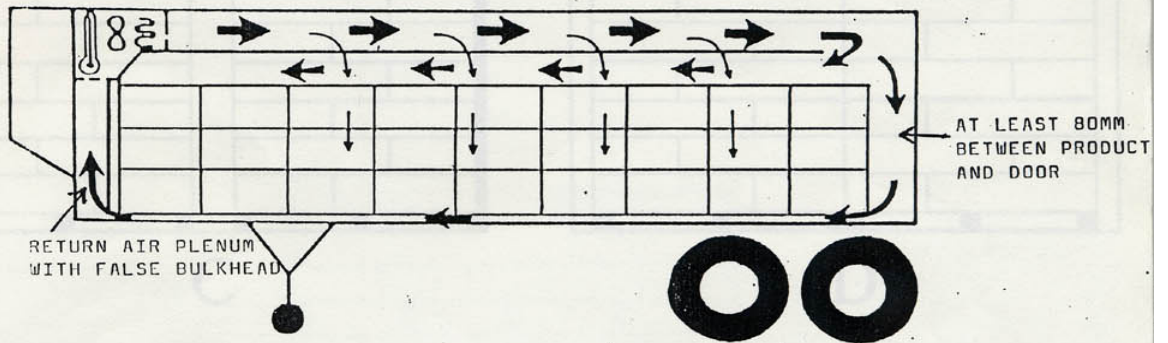
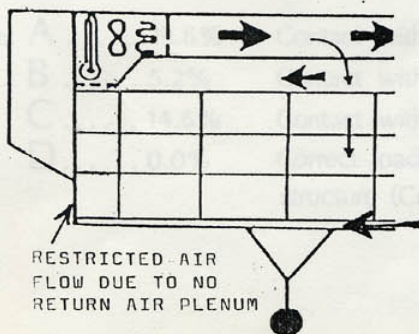


Fig. 2

AIR FLOW THROUGH PALLETISED CARGO





Responsible Person:

National Manager Cold Chain Protocols and Standards (Bernard Henning)

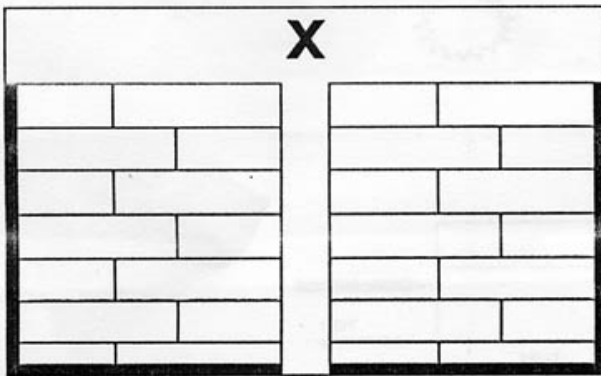
Approver:

General Manager Coastal (Vijan Chetty)

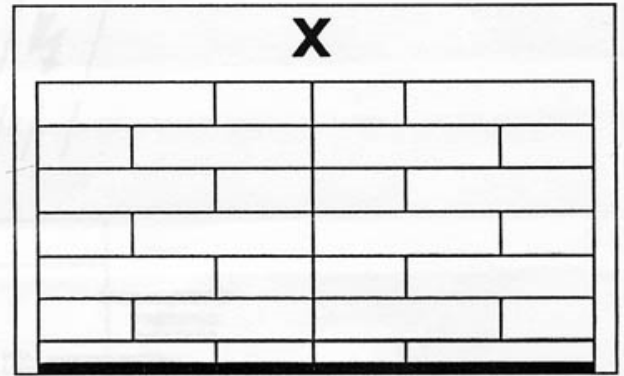
Department:

Operations - Cold Chain

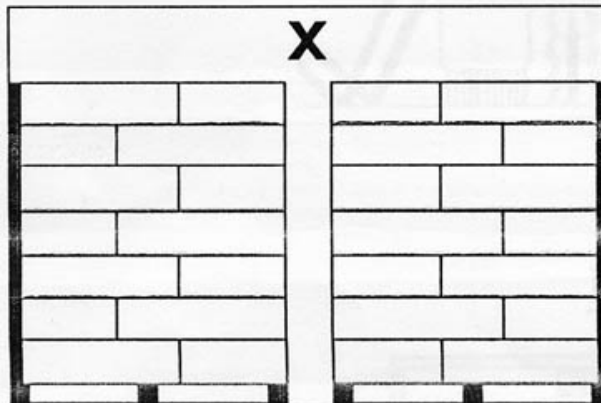
FIG. 3



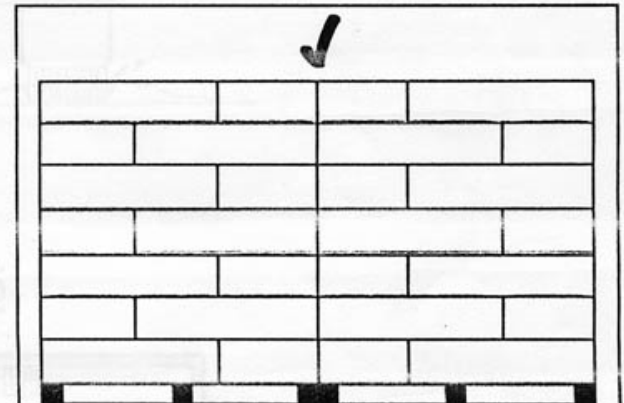
A



B



C



D

The above diagram shows the refrigerated box with cargo. The thick line indicates cargo in direct contact with the insulated surface and represents the following percentages:

- | | | |
|------------|-------------|--|
| Diagrams A | 19.8% | Contact with floor and sides (Side-loaded) |
| B | 5.2% | Contact with floor (Centre-loaded) |
| C | 14.6% | Contact with sides, but on pallets (Side-loaded) |
| D | 0.0% | Correct loading. On pallets and away from all insulated body structure (Centre-loaded) |



Responsible Person:

National Manager Cold Chain Protocols and Standards (Bernard Henning)

Approver:

General Manager Coastal (Vijan Chetty)

Department:

Operations - Cold Chain

FIG. 4

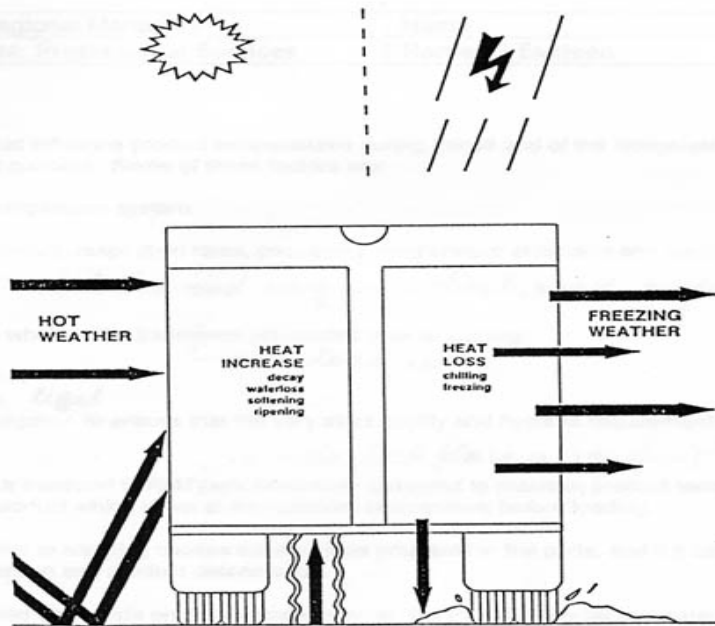
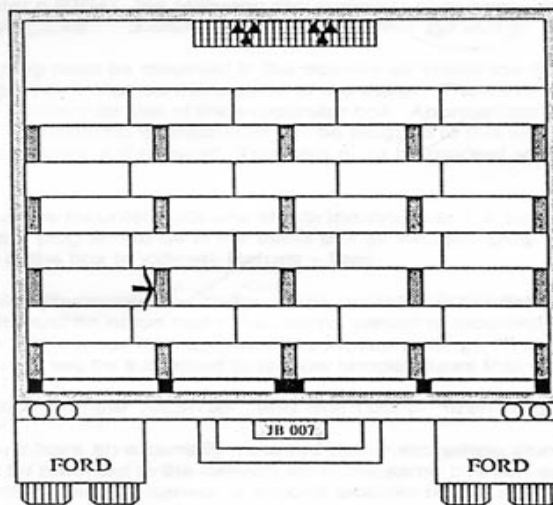


FIG. 5



Loose cartons should be packed as indicated for optimum air flow.
Arrow indicates openings between the cartons.