FreightBestPractice

Department for Transport

Buyers' Guide to Refrigerated Transport Equipment

Guide

1 Introduction

Typically the capital cost of refrigerated transport equipment may account for less than 50% of its whole-life cost when maintenance and other operating expenses are taken into account. As a result, accurate specification of equipment will, over time, result in greater operational efficiencies, which can ultimately save you money.

1.1 The Aim of this Guide

This guide aims to help you understand the operational advantages and disadvantages of a range of refrigerated transport equipment, helping you make an informed decision on what equipment will suit your business needs.

1.2 Who Should Use this Guide?

The guide is designed for use by fleet managers, transport managers and freight operators, particularly in the food industry, who currently use or are planning to use refrigerated transport equipment.

1.3 How to Use the Guide

The guide is divided into four sections that summarise the key considerations to take into account when buying refrigerated transport equipment:

Drive and System Types

Use this section to gain an understanding of how each of the different systems work.

Comparison of Available Systems

Use the table in this section to compare the operational advantages and disadvantages of each system and the vehicles most suited to the system.

Additional Considerations

Use this section to make sure you are aware of the other factors that you need to consider when specifying and purchasing a system.

Further Information

Use the information in this section to learn more about how Freight Best Practice can help you to access other information and advice.

"The temperature-controlled distribution sector is undoubtedly at the more specialist end of commercial road transport and, as such, the equipment needs to be of the highest standard.

This guide is a tremendously useful initiative by the Department for Transport which will assist newcomers and existing operators in the cold chain industry to address many of the key issues involving equipment selection."

Liam Olliff, Company Secretary, Transfrigoroute (UK)

Further assistance is available from Transfrigoroute (UK). Contact details are at the end of the guide.

transfrigoroute UNITED KINGDOM

2 Drive and System Types

This section of the guide looks at each system separately and provides information on how they work:

Cryogenic (Liquid Nitrogen)

A cryogenic system works using liquefied gas that is carried in a vacuum-insulated storage vessel on the vehicle. The gas is automatically injected into the insulated box at the rate required to maintain the correct operating temperature.

Independent Diesel Engine

This system uses an engine built into the refrigeration unit, which drives the compressor with an integral or remote evaporator. It can be powered by two types of fuel: red diesel, which is the most widely used, or white diesel, which has less environmental impact. An optional particle filter and catalyst can clean the exhaust emissions from a separate engine run on white diesel. In combination with modern common rail diesel engines, the emissions could be reduced by over 90%.

Direct Drive

There are two types of system that can be used - the alternator drive and the v-belt drive:

- **Alternator drive** - this system uses an alternator, driven by a belt from the main traction engine, which generates power to drive an electric motor in the refrigeration unit. The refrigeration compressor is either directly coupled to this electric motor or is driven by it via a v-belt. Fan motors and the control system are also fed from the alternator output. When using a semi-trailer, tractor units must be fitted with an alternator
- **V-belt drive** - this system drives the refrigeration compressor directly from the vehicle engine and is connected by pipework to the other parts of the refrigeration system. The fans for the evaporator and condenser are fed by a 12 or 24 volt DC current from the truck, with a total efficiency of battery and alternator of less than 50%

Eutectic System (Mains Electric Drive)

This system is constructed from hollow tubes, beams or plates filled with a eutectic solution[1]. The system is mounted in the insulated box and used to release 'cold' stored within the eutectic fluid to maintain the correct box temperature.

[1]Eutectic solution is a mixture in such proportions that the melting or freezing point is as low as possible, with the constituents melting or freezing simultaneously.

3 Comparison of Available Systems

The table below compares the different systems and highlights the operational advantages and disadvantages of each one and the vehicles most suited to the system.

Table 1 Optional Advantages and Disadvantages of Different Systems

Type of system/drive	Suitable vehicle types	Operational advantages	Operational disadvantages
Cryogenic (liquid nitrogen)	Rigid >3.5 tonnes Semi-trailers	Low noise, independent of tractor unit, easy to control, rapid pull-down, no direct emissions, low maintenance, long life	Can be expensive and energy intensive, with limited supply locations and additional maintenance requirements. Requires infrastructure development for CO_2 supply
Standard independent diesel engine (red diesel)	Rigid >3.5 tonnes Semi-trailers	Independent of tractor unit and able to operate while vehicle parked, electric stand-by (allowing operation when parked with diesel engine turned off)	Heavy and noisy* with additional maintenance requirements and high sulphur, particulate and SO_2 emissions
Separate independent diesel engine (white diesel)	Rigid >3.5 tonnes Semi-trailers	Independent of tractor unit and able to operate while vehicle parked, electric stand-by (allowing operation when parked with diesel engine turned off)	Heavy and noisy* with additional maintenance requirements. With optional particle filter and catalyst up to 90% less exhaust emissions
Alternator drive (truck engine)	Rigid >3.5 tonnes Semi-trailers	Low additional drive operating cost, no direct emissions, reduced weight, compact size	Lack of independent operation
V-belt drive	Rigid <3.5 tonnes	Low additional drive operating cost, reduced weight, compact size, low emissions	Lack of independent operation and use limited to vehicles up to 12-15 tonnes
Eutectic (mains electric drive)	Rigid <3.5 tonnes Rigid >3.5 tonnes	Low noise. Simple and safe system mainly for deep-frozen distribution	Heavy, requires base power supply for charging, has limited range and requires additional maintenance

*With noise encapsulation and modern CDI diesel engines, the noise can be reduced by up to 10 dB(A) or 90%.

Additional Considerations

When specifying refrigeration systems there is also a range of operational factors you should consider:

- **Vehicle size** - different systems are better suited to certain sizes of vehicle so you will need to make sure that the system is appropriate for the vehicles you currently have or will be purchasing
- **Type of use** - the variety of goods that you intend to carry in your vehicle, and therefore the temperature range that the refrigeration unit needs, should be understood. For example, if you move a variety of goods, a trailer with two separate compartments and a dual temperature system may suit your needs but will reduce volume capacity
- **Distance travelled** - the nature of the journeys will also help determine which refrigeration system is best suited to your needs. For example, a separate diesel drive unit will be most suited for use in semi-trailers, especially for long distance and international work
- **Location of use** - noise or level of emissions may be an important factor in choosing a system. For example, eutectic systems have the lowest carbon dioxide and carbon emissions and can be a good choice for relatively short, local delivery use in built-up areas
- **Running costs** - the purchase price of the system will have an influence on your decision, however do not forget to take into account the running costs and balance these against the refrigeration performance. It is important to compare system performance on a like-for-like basis. BSI Publicly Available Specification PAS 62, Refrigerated transport - Procedure for determining performance and calculating energy efficiency, is a standard test method that will ensure comparable data

- **Back-up** - the extent and reliability of the support offered by the manufacturer or dealer can be an important consideration. If it is reliable, there is less risk to cargo in the event of a mechanical problem
- **Loading practices and airflow management** - airflow and its distribution within the temperature controlled cargo is the single most important element in accurate temperature control. Correct specification of refrigerated equipment and air distribution system, along with careful pallet stacking and loading, will prevent air distribution problems caused by restrictions to air passages through excessive or uneven loading height
- **Temperature measurement equipment** - it is important to specify an effective method of monitoring air temperature to ensure that the chilled or frozen status of a properly pre-cooled load is maintained at the correct temperature. The most effective method is to have two sensors in the vehicle chamber: one below the cooling unit to measure return air temperature, and the other in the ceiling of the chamber about three quarters of the way down the length of the chamber
- **Temperature measurement verification** - there is a need to establish an equipment accuracy verification procedure for temperature indicators and recorders used for transport, storage and distribution of chilled, frozen, deep frozen or quick frozen products and ice-cream. Contact Transfrigoroute (UK) for the code of practice of verification procedures. Contact details are at the end of this guide
- **Refrigerated system pre-trip checks** - a fully comprehensive pre-trip check by a qualified refrigeration technician can take as long as two hours, causing equipment downtime costs. Advanced electronic or electro-mechanical sensors are able to keep a constant 'watch' on key component functions and maintenance-related areas in seconds. This can significantly reduce time and cost

Transfrigoroute (UK)

Transfrigoroute (UK) is an organisation with members from both operational and equipment supply sides, dedicated to improving standards in the temperature-controlled transportation industry. It offers expertise and advice regarding the safe transportation of perishable goods. Visit the website at **www.transfrigoroute.co.uk** for further details or for further assistance contact Liam Olliff by e-mail at secretary@transfrigoroute.co.uk or on 01326 569657.

Further Information

Technical information on refrigerated transport bodies and refrigerated units is available on the UK Environmental Products Information Consortium (UKEPIC) website at **www.ukepic.co.uk**.

You may find the following publications from the Freight Best Practice programme particularly relevant:

- Fuel Management Guide
- Truck Specification for Best Operational Efficiency
- Key Performance Indicators for the Food Supply Chain
- Report on the comparison of carbon and carbon dioxide emissions from a range of road transport refrigeration units
- Home Delivery Key Performance Indicators Final Report

The Freight Best Practice programme provides a wide range of free information to help you improve the efficiency of your operations. Guides, case studies and DVDs are available on topics such as fuel management, vehicle specification and telematics. A full list of the publications available can be obtained from either the website at **www.freightbestpractice.org.uk** or the Hotline on **0845 877 0 877**.

Disclaimer: While the Department for Transport (DfT) has made every effort to ensure the information in this document is accurate, DfT does not guarantee the accuracy, completeness or usefulness of that information; and it cannot accept liability for any loss or damages of any kind resulting from reliance on the information or guidance this document contains.

This publication has been reproduced by Freight Best Practice and the information contained within was accurate at the date of initial publication (2005).

Freight Best Practice publications, including those listed below, can be obtained FREE of charge by calling the **Hotline** on **0845 877 0 877** or by downloading them from the website **www.freightbestpractice.org.uk**

Saving Fuel

Fuel Management Guide

This is the definitive guide to improving the fuel performance of your fleet. It gives step-by-step explanations of the key elements of fuel management, how to measure performance and how to implement an effective improvement programme.

Developing Skills

Proactive Driver Performance Management Keeps Fuel Efficiency on Track

This case study shows how Thorntons implemented a highly effective driver incentive scheme combining in-cab driver monitoring, service delivery levels and accident rates.

Equipment and Systems

Truck Specification for Best Operational Efficiency

A step-by-step guide to the process of correctly specifying an efficient and 'fit for purpose' vehicle.

Operational Efficiency

Home Delivery: Meeting the Needs of Customers and the Environment

Describes a trial performed in Nottingham by Royal Mail Group Plc that offers an innovative, environmentally friendly solution to address the problem of failed deliveries.

Performance Management

Fleet Performance Management Tool

This PC-based spreadsheet tool has been designed to help fleet operators improve their operational efficiency using key performance indicators (KPIs) to measure and manage performance. The KPIs include costs, operational, service, compliance and maintenance.

Public Sector

Efficient Public Sector Fleet Operations

This guide is aimed at fleet managers in the public sector to help them improve operational fleet efficiency.

May 2007.

Printed in the UK on paper containing at least 75% recycled fibre.

FBP1014 © Queens Printer and Controller of HMSO 2007.