



AMBIRAD

HEATING AND VENTILATION SOLUTIONS

Application Guide

Train Care Depot

AMBIRAD

AIRBLOC

NORDAIRNICHE

BENSON



Application Guide

Train Care Depot Heating

This guide aims to help those responsible for designing, building, refurbishing or maintaining train care depots, to reduce operating costs and improve comfort and safety, by introducing cost-effective energy efficient heating into their premises.

Whether it is a train maintenance shed, bogie drop or wheel lathe shed considerable energy resources can be expended on delivering an adequate solution to providing comfort in these traditionally hard to heat environments

This guide advises on the selection, design and operation of the most appropriate heating system.

AmbiRad has substantial experience having heated train depots across the whole of the UK

The Climate Change Levy

The Climate Change Levy (CCL) became effective from 1 April 2001. After wide consultation an energy tax was considered the best way of 'promoting' reductions in energy use and achieve the Government's commitments in reducing greenhouse emissions.

The CCL levies 0.541* pence per kWh on electricity; and 0.188* pence per kWh on gas consumption; which equates to a 20% increase on the average gas bill and generally escalates year on year. This means that rail establishments now need to consider how best to reduce the burden of the energy tax. Investment in energy efficient heating can substantially contribute to minimising the impact of the levy.

A correctly designed and installed energy efficient heating system, can reduce gas consumption by up to 65% depending on the application and provide many other benefits .

Table 1 CO₂ emissions per unit of delivery

| Fuel | CO ₂ (Kg/kWh) |
|-------------|--------------------------|
| Natural gas | 0.19 |
| Oil | 0.27 |
| Coal | 0.30 |
| Electric | 0.52 |

* Rate as of 01.04.14

Requirements of the Building

The ways in which traincare depots are utilised, often intermittently and at irregular time intervals, make the efficient use of energy extremely difficult. Therefore, consideration must be given to selecting a heating system that offers flexibility of operation at optimum efficiency.

The following represent some of the prime considerations when assessing the impact of any heating solution in a traincare environment:

- > Train maintenance sheds are invariably very long and narrow with large constantly opening doors at each end, thus notoriously difficult to heat and even more difficult to keep warm
- > The doors often occupy the full width of the building and may be left open for many hours a day, thus creating a wind tunnel effect and cold air at high velocity is drawn through the shed. This means that air infiltration can severely disrupt comfort conditions within the interior. A heating system needs to be able to sustain a comfortable environment in these conditions and especially provide rapid recovery once the doors are closed. Air curtains over or to the side of the doors, either ambient or heated can mitigate the issue of air infiltration at the doors.
- > Maintenance is frequently carried out at night thus compounding the inhospitable climatic conditions and with partial occupation, it is therefore important for efficient use of energy, that the heating system can be easily and effectively zone controlled
- > The mass of a train is considerable, thus when a cold and wet train enters the shed it creates a cold sink, the heating system needs to be able to provide rapid response to changed conditions.



Factors to be Considered

Energy and fuel considerations

Natural gas is, on balance, the most efficient environmentally friendly practicable form of energy. Although slightly less efficient at the point use than electricity, natural gas produces nearly 2¾ times less 'greenhouse' emission in its overall production (see table 1), and is on average only one quarter of the cost. Therefore natural gas clearly is the most cost-effective, clean fuel, for train depots

Heating Systems

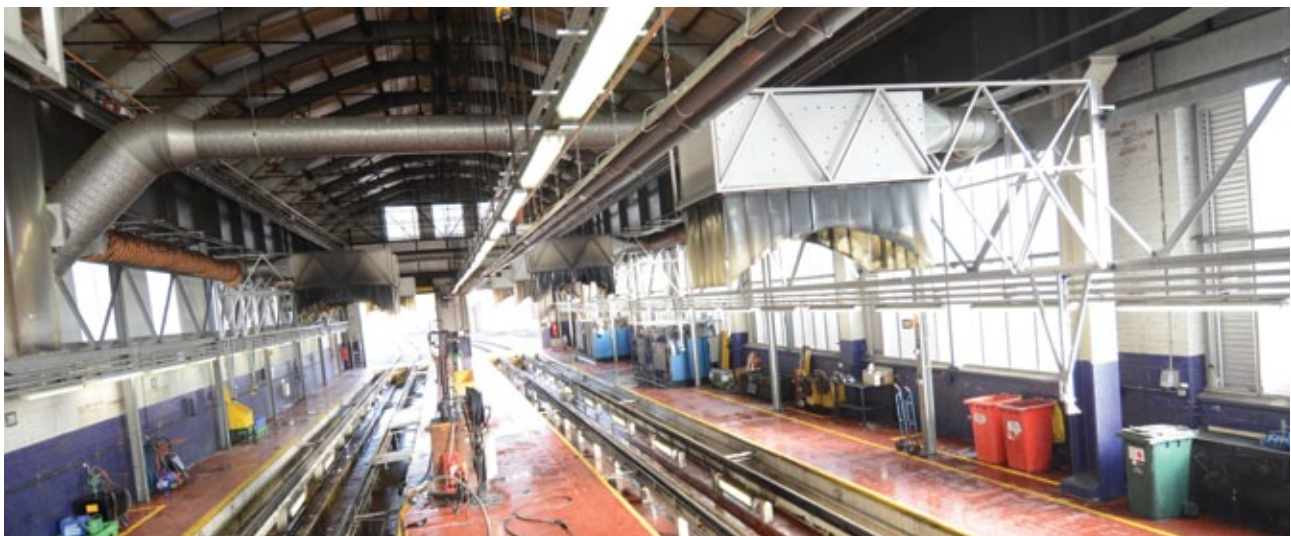
Comparison of Heating Systems for Train Care Depots



"Radiant is one of the best schemes for handling rail shed heating. It is inordinately expensive to heat the sheds otherwise. Economy and energy efficiency are a big part of the equation" Gary Thompson of C Spencer, a main contractor on many rail shed heating projects.

Available Radiant System Options

- > **Nor-Ray-Vac System**
 - Continuous gas fired radiant system, designed specifically for the building it is required to heat
- > **VSX Radiant Tubes**
 - High output radiant tube for extremely high mounting, spot heating scenarios and very high air change rate situations
- > **Vision / VS HB Radiant Tubes**
 - Individual radiant tube heaters
- > **Sonning System**
 - Warm air recirculating radiant system with no moving parts to maintain at high level within the heated area
- > **Sonning² OHA System**
 - Partial recirculating products of combustion radiant system with no moving parts to maintain at high level within the heated area



| Feature | Nor-Ray-Vac | Sonning | Sonning ² OHA | VSX | AB Air Curtain |
|-------------------------------|-------------|---------|--------------------------|-----|----------------|
| Blanket heat coverage | ✓ | ✓ | ✓ | | |
| Linear heating between tracks | ✓ | | ✓ | | |
| Overhead Door Heating | | | | | ✓ |
| Rapid response | ✓ | | ✓ | ✓ | ✓ |
| External heater unit | | ✓ | ✓ | | |
| Zonable along track length | ✓ | | | | |
| Plant room required | | ✓ | | | |
| Fuel - natural gas or LPG | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fuel - Oil | | ✓ | ✓ | | |
| Suitable for heavy wash areas | ✓ | | | | |
| Spot heating | | | | ✓ | |

Technologies in Application

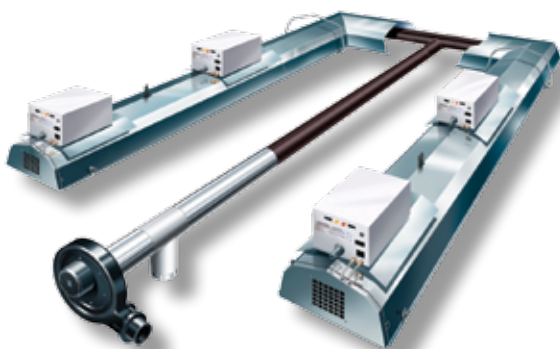
Radiant Heating

The primary source of radiant energy in the natural environment is the sun. By standing in the sun's rays a feeling of warmth is experienced, whilst in the shade it feels considerably cooler. Radiant heat warms all solid objects and surfaces in its path.

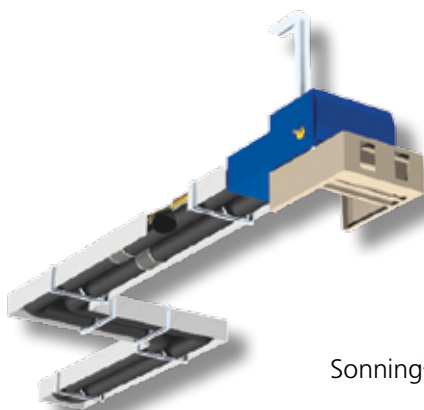
Radiant heat is transmitted in the form of electromagnetic vibrations or waves, which are emitted by a hot surface, travel in straight lines, just like light, and are absorbed by cooler solid objects on which they fall.



VSX Series



Nor-Ray Vac



Sonning² OHA

AmbiRad has exploited this concept in its energy efficient radiant heating systems. Radiant tube heaters, mounted overhead, produce infrared radiant heat that is directed downward by a reflector. The infra-red heat passes through the air without heating it and falls on people, floors and equipment below creating a comfortable all-round radiant warmth at low level, without wastefully heating the whole volume of the building or the roof space. Because radiant heat can be controlled directionally, only the occupied areas of the building need to be heated, which enables considerable energy savings to be realised.

The objective of a radiant heating system is to ensure that the people in the building are comfortably warm. After all, without people that need for heating any building becomes largely superfluous. The human body experiences a sensation of comfortable warmth when it is giving heat to its surroundings. If the body emits too much heat it feels cold. Conversely, if the body cannot emit sufficient heat it feels too hot. By the correct application of a radiant heating system comfort levels can be optimised. Radiant heat warms objects and surfaces, increasing the mean radiant temperature and reducing the body's loss of heat to its surroundings. In addition by eliminating air movement, convective loss of heat from the body will also be reduced.



Application Guide

- > Inspection Sheds
- > Maintenance Sheds
- > Bogie drop sheds
- > Wheel lathe sheds
- > Cleaning sheds
- > Stores areas



AmbiRad Installations Include:

- > New Cross Gate Depot
- > Hull Botanic Gardens Depot
- > Etches Park Rail Sheds
- > Edge Hill Rail Depot
- > Bounds Green Depot
- > Selhurst Depot
- > Orient Express Rail Depot
- > Neville Hill Depot
- > CTRL Bogie Drop & Stores
- > Translink Depot, Belfast
- > Bombardier/Virgin Rail Shed
- > Haymarket Rail Shed
- > Polmadie Traincare Depot
- > St. Philips Marsh Rail Depot



Benefits of Radiant Heat

- > Savings between 25 – 65% of fuel costs can be achieved
- > Achieves a comfortable environmental temperature with approx. 5°C lower air temperature – ideal for manual working conditions within a train shed
- > No movement of air – thus, dust and airborne particles are not moved around
- > Rapid response to changed conditions – short preheat time required to achieve comfort conditions
- > No products of combustion within the building - all products of are discharged to atmosphere
- > Economical in operation
- > Minimum maintenance – few moving parts
- > When large doors are opened, the primary heat source being radiant is not lost to atmosphere, as is the case if warm air was the primary heat source
- > Eliminates condensation and moisture by directly heating the building fabric and other surfaces
- > Reduced stratification – minimises roof fabric and ventilation losses
- > By design systems can be controlled easily to provide varying zoned temperature and operating times
- > Radiant heaters can be mounted at very high level, still providing comfort at floor level

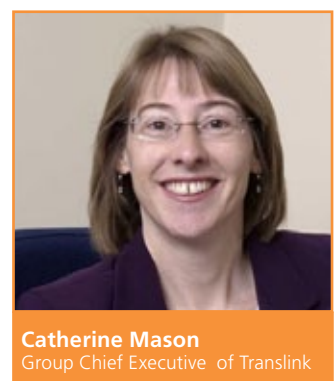


Translink

Case Study

"Heating rail maintenance sheds effectively and economically is a challenge many train companies are now facing with confidence" Catherine Mason, Group Chief Executive, Translink.

AMBIRAD
HEATING AND VENTILATION SOLUTIONS



Catherine Mason
Group Chief Executive of Translink

Background

A state of the art train cleaning building has won a prestigious Gas Innovation Award for its efficient heating and design. The award was given by Phoenix Gas Supply and Invest Northern Ireland in recognition of the innovative use of natural gas to achieve energy savings and low CO2 emissions.

Translink's new £11.4m Train Care Facility, at Fortwilliam just outside Belfast, is 170m long, 30m wide and 10m at the roof apex, with five tracks that can accommodate two trains each. Trains are brought in daily for interior cleaning.

The constant opening of doors, entailing a high level of air exchange, together with the regular introduction of many tonnes of metal at external ambient temperature, demanded a super-efficient heating system to maintain a comfortable environment for operatives.



Mott McDonald, consulting engineers, specified Nor-Ray-Vac gas-fired continuous radiant tube heating from AmbiRad. Nor-Ray-Vac provides even low-intensity warmth in large space buildings and is known for its performance and economy. The system, installed by Ellis and Pettis of Belfast, totals 500m in length and comprises

23 burners in linear formation, sectioned in to three control zones. Over the wet wash bay, all burners and reflectors were supplied in stainless steel to prolong the life of the heaters.

Low operating costs are achieved by concentrating the heat at low level, where it is most needed, without heating the volume of air in the building. Rapid response times reduce running costs still further. Such flexibility means that warmth is felt by people in the building within minutes of start-up on cold mornings – no fuel is wasted bringing the air to a comfortable temperature. Additionally, since the AmbiRad radiant system burns fuel at the point of use, there are no distribution losses to take into account.

Installation Summary

- > Translink have invested in a Nor-Ray-Vac continuous radiant tube heating system.
- > Constant open doors demanded efficient heating systems.
- > 500m in length and comprises 23 burners in linear formation, sectioned in to three control zones.
- > Low operating costs are achieved by concentrating the heat at low level

Technical Information

- > Area: 5,100m²
- > Height: ave height 9m
- > Volume: 45,900m³
- > Heaters: 23 NRV linear heaters



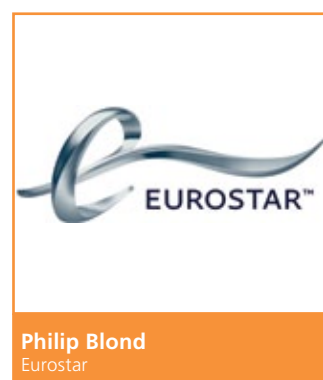


Channel Tunnel

Case Study

"Nor-Ray-Vac continuous radiant heating provides good heat coverage, with no build-up of condensation which is essential for the safety of our workers". Philip Blond of Eurostar

AMBIRAD
HEATING AND VENTILATION SOLUTIONS



Background

In a turnkey heating solution from AmbiRad, Nor-Ray-Vac continuous radiant tube heaters, combined with specially commissioned high-velocity over door air curtains, are helping maintain comfort conditions for employees working on trains that service the new Eurostar high speed rail link between London and the Channel Tunnel.

The maintenance buildings in Temple Mills, Stratford, are part of the £5.2bn London and Continental Railways (LCR) engineering project, the UK's largest civil engineering project and the only major railway line to be constructed in Britain since 1899. The new line has cut journey times from London to Paris to just 2h15m.

Two buildings at the Temple Mills depot are heated by Nor-Ray-Vac radiant heating – the stores and the bogie drop area. In the main maintenance shed, Nor-Ray-Vac burners were installed close to the entrance/exit doors.

Up to eight 400m long trains can be accommodated in the 24,840m² main shed at any one time, all under cover. Internal temperatures are protected by specially-built Airbloc air curtains. Project consultants Rail Link Engineering specified a high air duty not available on any off-the shelf products. Airbloc was the only air curtain manufacturer to take on the challenge of producing air curtains to this unusual spec. To maintain comfort temperatures around the open doorways, Nor-Ray-Vac continuous radiant tubes were also fitted above.

In the 3,100m² bogie drop area, where just part of the train is worked on while 90% of it remains outside the building, an 18 burner Nor-Ray-Vac continuous radiant system was installed over the main working area, suspended at either seven or 11 metres.

The Nor-Ray-Vac continuous radiant tube heating provides low intensity warmth which can be zoned to ensure only those parts of the building being used are heated.

Installation Summary

- > Eurostar have invested in Nor-Ray-Vac continuous radiant tube heaters, combined with specially commissioned high-velocity over door air curtains.
- > Provides low intensity warmth
- > Good heat coverage
- > No build-up of condensation
- > Rapid response to changed conditions

Technical Information

- | | |
|-----------|-----------------------------------------------------|
| > Area | 1 x 24,840m ² 1 x 3,100m ² |
| > Heaters | Nor-Ray-Vac system Airbloc Door Heaters |





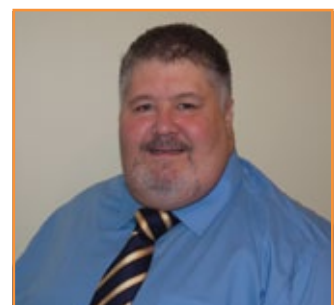
Orient Express

Case Study

"The Nor-Ray-Vac heating systems are so flexible in design, making them ideal for us as an installer as it helps us tailor the installation to the exact design brief"

Mike Ashby, Company Director, Multigas Services Ltd

AMBIRAD
HEATING AND VENTILATION SOLUTIONS



Mike Ashby
Multigas Services Ltd

Background

Stewarts Lane railway depot in Battersea has been providing maintenance and stabling for the South East of England's rolling stock since 1862 and was, at one point, the largest locomotive capacity in the Southern region. The facility has provided a service to London and its southern arterial rail system through two world wars, the steam days, nationalisation, electrification and privatisation. Having stabled the Royal Train, one of the depots main uses today is for the maintenance of the prestigious Orient Express.

After the installation of a Nor-Ray-Vac system in the high bay and main locomotive shed at Orient Express 28 years ago, the system now needed to be replaced. Orient Express approached Mike Ashby of Multigas Services Ltd and asked them to assist with the replacement of the existing and also an additional two areas that were previously unheated.

Entrance and exit doors often occupy the full width of the building and may be left open for many hours a day. When doors are open at both ends, a wind tunnel effect is created, cold air at high velocity is drawn into the shed. Keeping the shed warm enough for employees to work comfortably is compounded by the often north-south alignment of the tracks, which allows very little sunshine to warm the interior.

AmbiRad were able to offer the ideal heating and most effective and economic heating solution. Blanket heat coverage was not a necessity in the rail shed as only the areas where personnel are working needed to be heated. When operatives are working on one part of the train, zoning enables all other parts of the radiant heating system to be switched off. Over time this produces considerable fuel economies and cost reductions.

Economy and effectiveness were the two key criteria specified to be answered when selecting the heating system for the rail maintenance shed. AmbiRad replaced the old system with the latest Nor-Ray-Vac series system which was happily received by the client due to the past financial benefits of this type of heating system within a train depot environment.

The project was completed in three stages:

Phases One and Two are where the complete rebuild of the carriages takes place for the Orient Express trains and were previously unheated bays. Phase One, an area of; 41m x 15m and 7m high saw the installation of Nor-Ray-Vac system consisting of 6 x 24kW burners with one flue discharge. Phase Two, an area of; 30m x 15m and 7m high saw the installation of a Nor-Ray-Vac system consisting of 6 x 18kW burners with one flue discharge.

Phase Three was the high bay and main locomotive shed where the steam locomotives are maintained on a regular basis. The Nor-Ray-Vac system was an exact replacement of the original to minimise the installation costs. The client was more than happy to replace the old system with the latest NRV series having experienced the financial benefits of an efficient radiant heating system within a train depot environment. The high bay of area; 30m x 20m and 12m high a Nor-Ray-Vac system of 10 x 18kW burners with one flue discharge was installed going around the perimeter of the bay, below the crane beam. The main locomotive of area; 77m x 15m and 7m high received a Nor-Ray-Vac system consisting of 18 x 18kW burners arranged in three zones with two flue discharges.

The Nor-Ray-Vac system combusts the fuel at the point of use enabling maximum efficiency with no distribution losses and has rapid response to changed conditions. It is uniquely designed to accommodate the building constraints and required zoning for the method of working within the shed. The flexibility of the radiant heating system meant that specific areas can be heated as required by the work patterns within the shed, keeping staff warm.

The client employed the services of Multigas Services Ltd to undertake the complete new and replacement works. Orient Express now benefits from a radiant heating system capable of maintaining the depot at a comfortable environment well into the late 2030's.

Installation Summary

- > Venice Sempion Orient Express invested in a Nor-Ray-Vac continuous radiant tube heating system
- > Suspended from the roof, the continuous radiant tube heating system emits infra-red rays that warm only objects and people in their path
- > Low operating costs are achieved by concentrating the heat at low level
- > A heating system with flexibility in design – tailored to the exact requirements of the design brief
- > No movement of air – thus, dust and airborne particles are not moved around
- > No distribution losses – fuel utilised at the point of use

Technical Information

Phase 1

- > Area 41m long x 15m wide
- > Height 7m
- > Volume 4305m³
- > Heaters 6 x 24kW NRV burners with one flue discharge

Phase 2

- > Area 30m long x 15m wide
- > Height 7m
- > Volume 3150m³
- > Heaters 6 x 18kW NRV burners with one flue discharge

Phase 3 – High Bay

- > Area 30m long x 20m wide
- > Height 12m
- > Volume 7200m³
- > Heaters 10 x 18kW NRV burners with one flue discharge

Phase 3 – Main Loco Shed

- > Area 77m long x 15m wide
- > Height 7m
- > Volume 8085m³
- > Heaters 18 x 18kW NRV burners with two flue discharge



Brodie Engineering

Case Study

"The flexibility of the Nor-Ray-Vac radiant heat system meant that specific areas can be heated as required by the work patterns within the shed, keeping staff warm."

Nick Winton, AmbiRad Nor-Ray-Vac divisional manager

AMBIRAD
HEATING AND VENTILATION SOLUTIONS

brodie
ENGINEERING

WRD Brodie

Background

Kilmarnock based Brodie Engineering provides innovative design installation and general repair solutions to both main and light railway sectors. The former chief civil engineers plant maintenance depot at Kilmarnock has received a major renovation in recent years. Due to large, frequently opening doors it was extremely difficult to heat and even more difficult to keep warm. The existing train repair shed was 85m long x 37m wide comprising four rail tracks with specific work stations, there was no existing heating in the shed and there was a requirement to heat specific work areas.

AmbiRad were able to overcome these issues by installing a comprehensive Nor-Ray-Vac system. 13 NRV burners were arranged in six temperature zones and three flue discharge points, suspended at 4.9m to provide blanket heat coverage to the specific working areas. The new heating system will also avoid the significant wasted energy associated with heating vast internal spaces suffering from fluctuating temperatures.

The Nor-Ray-Vac system is uniquely designed to accommodate the building constraints and required zoning for the method of working within the shed. The flexibility of the radiant heat system meant that specific areas can be heated as required by the work patterns within the shed, keeping staff warm.



Installation Summary

- > Brodie Engineering invested in a Nor-Ray-Vac continuous radiant tube heating system
- > Suspended from the roof, the continuous radiant tube heating system emits infra-red rays that warm only objects and people in their path
- > Low operating costs are achieved by concentrating the heat at low level
- > A heating system with flexibility in design – tailored to the exact requirements of the design brief
- > No movement of air – thus, dust and airborne particles are not moved around
- > No distribution losses – fuel utilised at the point of use

Technical Information

- | | |
|-----------|----------------------|
| > Area | 85m long x 37m wide |
| > Height | average ht of 6m |
| > Volume | 18,870m ³ |
| > Heaters | 13 NRV burners |





Nortek Global HVAC UK Ltd

Fens Pool Avenue
Brierley Hill
West Midlands DY5 1QA
United Kingdom

Tel: **01384 489 250**
Fax: **01384 489 707**

ambiradsales@nortek.com
www.ambirad.co.uk

AMBIRAD **AIRBLOC** **NORDAIRNICHE** **BENSON**

Registered in England No. 01390934. Registered office: 10 Norwich Street, London, EC4A 1BD

Nortek Global HVAC is a registered trademark of Nortek Global HVAC Limited. Because of continuous product innovation, Nortek Global HVAC reserves the right to change product specification without due notice.