AIR CONDITIONING POLICY FOR FIXED AND PORTABLE UNITS

For use in (clinical areas): ALL TRUST DEPARTMENTS
For use by (staff groups): ALL TRUST STAFF
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Status: Review

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WEST SUFFOLK HOSPITAL NHS FOUNDATION TRUST
AIR CONDITIONING POLICY FOR FIXED AND PORTABLE UNITS

INTRODUCTION

This document sets out the West Suffolk NHS Foundation Trust (hereafter referred to as ‘the Trust’) Policy for managing fixed and portable air conditioning units

Driven by apparent rising summer time temperatures, the Trust recognises that, with the increase in use of diagnostic, medical and other electronic equipment, coupled with growing patient and staff expectations, an increase in requests for air conditioning is inevitable.

In common with all NHS Foundation Trusts, West Suffolk Hospital Foundation Trust is under Ministerial direction to reduce its energy consumption. Responding to this and other environmental pressures, the Trust has committed to adopting an environmentally friendly approach across the whole range of its activities and recognises that air conditioning is energy intensive and impacts significantly on revenue costs.

The Trust is also keenly aware that the uncontrolled proliferation of air conditioning may put the electrical services infrastructure of our sites under stress, with a real potential for failure of our electrical supply arrangements.

The Trust has determined, therefore, that a formal policy and procedure is required to ensure that summer time environmental cooling is applied in a logical, controlled and appropriate manner.

F Gas Regulations - After a long process through the European Parliament the F-Gas regulations became law when they were published in the EU Official Journal in June 2006. They entered into force on 4th July 2006 with much of the regulation applying from 4th July 2007. In 2014 this regulation was updated and the EU introduced a new regulation on the use of fluorinated greenhouse gases (F gases) like hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6).

The objective of the regulation is to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol. The regulation addresses containment, use, recovery, destruction, reporting, labelling, training and certification.

The use of HFCs in new equipment was banned in 2001. From 1 January 2015 the use of ‘recycled’ and ‘reclaimed’ HFCs to top up or service existing equipment is also banned. However air conditioning equipment may contain HFCs if it was either:

- Manufactured in the EU before 2001
- Imported from outside the EU

1.0 AIMS OF POLICY
The aim of this policy is to:

1.1 Raise awareness of the environmental and financial costs of air conditioning and promote the adoption of other space cooling techniques.

1.2 Ensure those procuring diagnostic, medical and other electronic equipment consider building services implications at an early stage and consult with the appropriate technical department(s).

1.3 Ensure that the Trust operates a fair and consistent process in assessing requests for the installation of equipment and services for reducing summer time temperatures in its properties, by introducing a formal, standardised option appraisal process.

1.4 Ensure that the building services infrastructure of Trust properties is not put at risk by the uncontrolled introduction and use of air conditioning.

1.5 Ensure techniques employed to provide reduced summer time temperatures are those that are as environmentally friendly as possible and generate least revenue cost to the Trust.

1.6 Ensure a strategy is developed for centralising cooling services.

1.7 Ensure that environmental controls for heating and cooling are employed to maximise energy efficiency on existing plan controls and new building design to provide a comfortable environment for all within the hospital.

1.8 To explore alternative technology for providing comfort cooling other than air conditioning plant i.e. natural ventilated buildings on new design schemes.

1.9 To ensure compliance with the current F Gas regulations.

Whilst the term ‘Air Conditioning’ is more correctly applied to combined temperature and humidity control, any space cooling process based on mechanical refrigeration will be referred to as air conditioning throughout this Policy.

2.0 OBJECTIVES
2.1 To provide environmental conditions consistent with activities.

2.2 To safeguard site and local electrical supplies ensuring they have adequate capacity and ‘head room’ to meet existing day-to-day loads.

2.3 To ensure the availability, accuracy, and reliability of medical and associated equipment, is not compromised, either by excessive temperatures, or by changes in temperature.

2.4 To be sensitive to the Trust’s responsibilities for limiting environmental damage and reduce our carbon footprint.

2.5 To follow and adhere to ‘best practice’ design solutions.

2.6 To account for energy consumption within the Trust’s properties.

2.7 To ensure compliance with the current F-Gas regulations.

3.0 REASONABLE TEMPERATURE

What an individual considers to be a reasonable temperature varies from person to person.

The HSE states that:

‘The law does not state a minimum or maximum temperature, but the temperature in workrooms should normally be at least:

- 16°C or
- 13°C if much of the work involves rigorous physical effort

A meaningful maximum figure cannot be given due to the high temperatures found in, for example, glass works or foundries. In such environments it is still possible to work safely provided appropriate controls are present. Factors other than air temperature, ie radiant temperature, humidity and air velocity, become more significant and the interaction between them become more complex with rising temperatures.

The Workplace (Health, Safety and Welfare) Regulations 1992 lay down particular requirements for most aspects of the working environment. Regulation 7 deals specifically with the temperature in indoor workplaces and states that:

‘During working hours, the temperature in all workplaces inside buildings shall be reasonable.”

Individual ability to lose body heat and to sweat will affect the perception of comfort. Comfortable temperature will also be affected by such factors as workload, the requirement to do physical work may necessitate having lower temperatures or a greater airflow. At the same time, patient environments may require higher ambient temperatures. This is particularly true where patients are required to undress or where elderly patients may be sensitive to lower temperatures. Because British weather can be so variable, ambient temperatures may be high on occasions.

Installing of building temperature controls for the odd hot day is not considered to be reasonable practical.

Where the consequences of an error caused by extremes of temperature can be severe, then there is a legal requirement to control such temperatures:
The Legal Requirements in Relation to Temperature Workplace Regulations are
• Requirement to exceed minimum temperature within workplace 16°C (or 13°C if person physically active.)
• Requirement to provide a reasonable temperature.
• Requirement for a room thermometer to be available.

Management Regulations
• Requirement to carry out risk assessments on significant risks & to implement precautions controlling risks.
• Requirement to assess pregnant workers, (this will include a temperature assessment)

Display Screen Equipment Regulations
• DSE equipment not to produce excessive heat, (generally not an issue with modern equipment.)
• Adequate levels of humidity to be established and maintained.

Air conditioned buildings use far more energy than naturally ventilated buildings as additional energy is required for the refrigeration of air and to power the pumps/fans which circulate cooled air throughout the building. The process of cooling air within buildings therefore has a significant impact on the environment and is expensive in terms of capital investment and ongoing running costs. The Trust is committed to reducing its carbon footprint under agreed carbon management plans. Therefore it has adopted a policy of not installing air conditioning systems where suitable levels of fresh air, odour removal and reasonable thermal comfort can be achieved by means of natural ventilation. Air conditioning or active cooling will only be considered as a last resort and requests for such installations will be judged on their merits.

4.0 PROCESS

4.1 In the first instance the Estates Department will respond to requests by asking the ‘requester’ to complete a proforma application form (see appendix 2), which once completed must be forwarded to the Estates Manager.

4.2 The Estates Manager will consider the appropriateness of the request. Alternative options for air conditioning will be reviewed, these include;
• Heat reflective glass / coatings
• Fans

The Risk Office will also be consulted during this phase for advise and guidance.

4.3 If the decision confirms that an alternative solution to air condition has been made, the ‘requester’ will have a right of appeal to the Trust Executive Group (TEG) should he/she disagree with the view reached.

4.4 If the requirement is endorsed, the Risk Office, in conjunction with the ‘requester’, will liaise with the Estates Manager (for existing buildings) or Capital Projects Officer (for new building design) and examine options for changes to the space, relocation and/ or other administrative solutions.

4.5 If a solution cannot be provided by process 4.4, a technically competent officer will carry out a formal option appraisal exercise and will make recommendations to the Estates
Manager, or a nominated member of that group. The option appraisal documents will be shared with the ‘requester’.

4.6 The Estates Manager will assess the impact those recommendations make upon the existing local and site engineering infrastructure.

4.7 Provided the impact can be accommodated, Estates Officer(s) will establish the supply, installation, running, and maintenance costs of the recommended solution, including any additional works required within the space to ensure it complies with the Carbon Performance Rating permitted under current building regulations. Estates Officers will factor in a cost to provide energy metering and adequate controls of any air conditioning equipment that may be required.

4.8 The Estates manager will advise the ‘requester’ and their appropriate general manager of these costs for funding approval. No work can proceed until the funding is approved.

4.9 If the ‘requester’ wishes to proceed with the installation, he/she will be required to source the necessary funding – both for the initial supply and installation costs and for the subsequent annually recurring maintenance charges. The form in appendix 4 is for use in confirming approval for the work and for the virement of funding between the ‘requesters’ Directorate and Estates.

4.10 Where user controls are fitted, the ‘requester’ shall pledge that he/she will operate any equipment installed under this policy with due care and practice ‘good housekeeping’ with respect to its operation. The Estates Manager will provide guidance on this aspect.

4.11 The ‘requester’ shall notify the Estates Manager if or when there is a change of use of the treated space and/or a change in any medical or electronic equipment installed within it.

Appendix 1 shows a flow chart of this process.

5.0 POLICY LINKAGE

5.1 This Policy is to be considered as devolving from the Trust Sustainability Development Steering Group.

5.2 All commitments and obligations of the Trust Sustainability Development Steering Group.

5.3 The Estates Manager will report each instance of the completion of an air conditioning option appraisal to the Trust Sustainability Development Steering Group, effectively providing feedback into the Environmental Performance monitoring process.
6.0 TECHNICAL CONSIDERATIONS

6.1 Air Conditioning must be recognised as energy intensive, costly and exceptional.

6.2 An option appraisal exercise shall be undertaken to establish a suitable strategy to meet requesters requirements; The Officer conducting the appraisal must seek clinical advice to ensure that requirements have been fully expressed and are mutually understood.

The appraisal shall consider: -

The elimination/reduction of heat gains from local services and from adjoining spaces; Solar shading; Increasing air movement; Enhanced natural ventilation; Mechanical ventilation; Air Conditioning and combinations of these options.

The appraisal shall be conducted in accordance with the Government’s Good Practice Guide 291, ‘A Designer’s Guide to the Options for Ventilation & Cooling’. Abstracts from the Checklists and Option Appraisal Worksheet are attached as appendices to the Policy.

The Guide makes reference to complementary design resources published by the Chartered Institute of Building Services Engineers and others and these documents, together with NHS design notes and memoranda, shall be consulted in determining options.

6.3 The design process must consider the whole of the space and must include passive measures able to reduce temperature. For air conditioning, the overall Carbon Performance Rating, taking any proposed air conditioning burden into account, should be no greater than the standards published or referenced within Part L of the Building Regulations (Conservation of fuel and power, 2016). Mechanical ventilation systems should similarly comply with these standards.

6.4 Consideration must be given to relocating the user function to a building with installed chilled water services, capable of supporting their need.

6.5 Any controlling thermostats shall be installed and adjusted so as to provide the maximum permissible (summer) temperature in the space.

6.6 Appropriate controls must be installed to match occupancy and/or use of any heat generating equipment. Where feasible, automatic occupancy sensing shall be employed, giving on/off or ‘setback’ (variable fan speed) control when not occupied.

6.7 If an existing system contains R22 refrigerant, the whole unit will require replacing. In 2015, it was made illegal to use R22 refrigerant to maintain or repair air conditioning units, so the cost to replace a contaminated air condition unit with R22 refrigeration will be more significant than just a repair.

6.8 The Health Technical Memorandum 03 (HTM-03) Specialised ventilation for healthcare premises. Part A - Design and installation and Part B Operational Management is the guidance document to be used to assess when, where and how to install temperature control systems.
7.0 RESPONSIBILITIES

Chief Executive

The Chief Executive has ultimate responsibility for providing healthcare services and for the Trust’s Environmental Performance. The Chief Executive discharges those responsibilities by ensuring robust management arrangements are in place and work effectively to achieve a proper balance between environmental needs and their cost.

Estates Manager

The Estates Manager has overall responsibility for providing appropriate environmental conditions in which, to best deliver healthcare. The Manager is responsible for:

- Establishing and maintaining an organisational framework for the management of the environment;
- Ensuring that the Trust sites’ Engineering Infrastructure is both safe and reliable;
- Ensuring that clients of the Facilities Directorate are given best possible service and advice.

The Estates Manager is responsible for ensuring technically competent officers undertake the option appraisal process stage under this Policy.

The Estates Manager is responsible for the overall management of the optional appraisal process and with assisting ‘requesters’ to an understanding of the appraisal. In order to achieve this, the Estates Manager will ensure that competent officers undertake the appraisals and that the appraisals are complete, factual and fair.

The Estates Manager is responsible for assessing the impact of the recommendations of the appraisal process on the electrical infrastructure and carbon impact on the particular site. The Estates Manager will make safeguarding of both normal & emergency electrical supplies a priority and will prepare any business case as may be required to reinforce the services infrastructure to meet the outcome of the option appraisal process.

If the ‘option appraisal process finds in favour of installing temperature control systems then the requesting manager / Head of Services will be responsible for obtaining funds to carryout the work by submitting a business case for approval by the capital strategy group.

8.0 Policy Review

The Estates Manager will conduct a review of the Policy, including, its application and report any recommendations.

This Policy is to be reviewed every 3 years by the Estates Manager or nominated Officer or sooner if there is any significant change to the regulations. The revised policy is then to be presented to the Trust Sustainability Development Steering Group (SDSG) and the Health & Safety committee.
Request Head of Department With General Manager Approval

Estates Manager

Is ‘Admin’ solution available?

Option Appraisal Undertaken

Can Infrastructure accommodate load?

Costs Established and Advised to the ‘requester’

Costs Accepted?

‘Requester’ pledges ‘Good Practice’

Installation Proceeds

TEG Consider Appeal

General Manager Appraisal with ‘requester’

Head of Department Refer to Estates

Implement Solution

Yes

No

Yes

No

‘Requester’ Exercises Right to Appeal

PROCESSES COMPLETE

Source: Estates Department

Status: Review

Issue Date: April 2017

Valid Until Date: March 2020

Document Ref: PP(17)176
Application to Request Works to Reduce Working Environment Temperatures

Department/Function

Site

Building

Floor

Space(s)

I/we request works to control the working environment temperatures in the spaces indicated above.

The room(s) face North/South/East/West and the sun falls on our windows between ________and ________________ each day.

The space is used for _____ days per week.

The space is used between ______ and ______ each day (Please provide further information if hours are variable).

We propose to procure and locate the following diagnostic/analytical medical/electronic (or other heat generating) equipment in the area:

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

We require cooling because:

____________________________________________________________________________________________

____________________________________________________________________________________________

Name of Officer Submitting Request

Job Title

Ext. No.

Endorsed by Head of Department (signature)

Date
**OPTION APPRAISAL SCHEME**

**Appendix 3**

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**Option Appraisal**

The option appraisal will be a staged iterative process, attempting to balance user requirements and the constraints of cost and environmental performance. The process will consider users’ thermal, aural and visual comfort and air quality requirements, appropriate to the activities in the space and in the building. Where choices may impact on patient welfare, a clinical risk assessment is to be undertaken to inform the option appraisal process.

**Stage 1. Assessment of User Requirements**

User requirements must be established in accordance with the following diagram:

- Is close control of Humidity Required?  
  - Y
  - N

- Does the space need to be sealed against noise or pollution?  
  - Y
  - N

- Are there high internal heat gains?  
  - Y
  - N

- Will it be acceptable for temperatures to exceed 28 Deg C for a few hours each year?  
  - Y
  - N

- Only Ventilation Needed
- Cooling May Be Needed But humidification not required
- Only then Might Full Air Conditioning be needed
OPTION APPRAISAL SCHEME
Appendix 3

Stage 2 – Option Appraisal Checklists

These checklists present information on aspects of building services engineering and environmental control in a standardised way. They are referred to by the Estates Officer undertaking the Option Appraisal as part of the process.

The options cover a number of techniques, some of which are only appropriate for ‘new build’ situations and are unlikely to be feasible for existing accommodation.

1. Assessment of the Space

- Relationship – Adjacent spaces or services transiting the space may be contributing heat gains.

- Shape – Narrow or deep plan. Single or double sided. Natural ventilation can meet comfort criteria for narrow plan and double sided spaces.

- Windows – Glare & Heat Gain will need to be controlled by some form of shading.

- Mass – Heavy structures can attenuate heat gains. During prolonged warm weather, structure must be cooled at night.

- Insulation – Insulation is good for winter and summer operation, reducing peak heating and cooling demands.

- Shading – Shading devices can reduce direct solar gain through windows. The most effective devices are external.

2. Natural Ventilation

Occupants have a broad tolerance to naturally ventilated buildings, they understand them, they have individual and immediate control (openable windows) and generally accept the peak summertime periods when control is lost on temperature and relative humidity.

- Heat gain - Heat gain in the space should be less than 40W/m² to meet comfort criteria. The source of any heat gain may be re-locatable, e.g. consider remote compressor/condenser for refrigeration equipment.

- Single sided – Single sided ventilation is effective for widths up to twice the floor-to-ceiling height. Horizontal pivoted and vertical sash windows have good ventilation capacity. Side and top/bottom pivoted windows are less effective.

- Cross flow – Cross flow ventilation is effective for widths up to five times the floor-to-ceiling height; spatial layout must not restrict cross flow of ventilation air.

- Stack – Effective for widths up to five times the floor-to-ceiling height but stack must be generous to minimise pressure loss. Can achieve sufficient air movement during still summer peak conditions. Stairwells and atriums can generate stack forces.

- Wind tower – Effective, but wind pressure is not completely predictable. Needs complex control to maintain comfort criteria.
3. Mechanical Ventilation

- Simple extract – Simple extract system has low capital and energy cost but needs to be run in mixed-mode, i.e. natural ventilation must be available to give high airflow rates for summertime operation to obtain adequate air movement. Source of make-up air needs to be considered to minimise draughts and dust/pollution ingress.

- Supply & Extract – Ducted system will permit heat recovery, filtration and humidification. Fan speed control will minimise fan energy and allow turndown for minimum winter ventilation.

- Hollow core – Moving air *through* the structures (as opposed to moving air *across* the structure) has the potential to use the mass of the building fabric for heat exchange. With nighttime ventilation, cooling is stored and used the following day to cool the supply air before passing it to the space. In winter, waste heat gains can similarly be stored and reused.

4. Mixed-Mode Systems

Different systems are used at different times of the year. This type of operation may confuse building occupants unless it is clearly explained what they should be doing at particular times of the year in terms of opening and closing windows.

Mixed mode systems offer improved environmental conditions without the need to operate ventilation fans throughout the year.

- Assuming the space is relatively air tight, mechanical ventilation, with exhaust air heat recovery, may be used to provide minimum fresh air during the winter months.

- Spring and Autumn natural ventilation will allow free cooling.

- Summer operation is by natural ventilation, with mechanical ventilation for night-time cooling.

5. Displacement Ventilation

Displacement ventilation is based on the concept of an ideal airflow pattern. Instead of turbulence and mixing, flow is unidirectional with reduced spreading of contaminants. Air is introduced at low velocity and at a temperature slightly lower than the room target temperature and creates a ‘pool’ of fresh air. At local heat sources (people or equipment) the air temperature naturally rises. The natural buoyancy of this heated air gives rise to air currents drawing up the conditioned air thus removing pollutants and heat to high level, where they are extracted.

- Displacement Ventilation functions better in spaces with larger floor to ceiling heights. Minimum height for effective utilisation of technique is 3m. At this floor to ceiling height, Cooling loads of 40 W/sq m are achievable.
6. Static Cooling Systems

Chilled building fabric elements are employed to offset heat gains of the order of 70 to 140 W/sq m.

- Chilled ceilings employ radiant panel(s) integrated into the total ceiling design; Lighting, smoke detection, partitioning must be taken into account. The maximum cooling load to be handled is of the order of 70 W/sq m.

- Chilled beams can be of the static (passive) type, offering cooling loads of up to 100 W/sq m., using natural air buoyancy effects, or fed from a primary air system (active beam), offering cooling loads of up to 140 W/sq m.

- Can be applied in conjunction with displacement ventilation (see above) but may disrupt the desirable airflow patterns of dv. Hence cooling capacity is not additive.

- Condensation can be a problem with static cooling systems. Internal moisture loads and moisture from outside air are very variable and openable windows should be sealed. Inevitably, avoidance of condensation requires reducing the cooling capacity of the installation at or near the dewpoint temperature of the space.

7. Distributed Cooling Systems

- These are local room units, which contain the refrigeration machine in its entirety or are 'split' between a room unit and a condensing unit located outdoors.

- Can also include more elaborate arrangements; such as cassettes or variable refrigerant flow units, where several rooms are served from a single condensing unit.

- Fan coil units utilise a centralised system, using water as the means of distributing cooling and/or heating. Capable of dealing with cooling loads in excess of 100 W/sq m. Maintenance costs may be high due to numbers of units each with fan, filters and controls. Fan noise levels and aesthetics must be taken into account.
8. Conventional Air Conditioning

- Capable of dealing with large cooling loads in excess of 100 W/sq m. Cooling is distributed by air supply. Duct sizes can be matched to suit cooling loads.
- Year-round humidity control can be achieved.
- High standards of air cleanliness can be achieved.
- Large plant/air distribution space requirement.
- High capital, energy and maintenance costs.

9. Portable Air Conditioning

Portable Air Conditioning units are self-contained portable systems for cooling single rooms. Most are on wheels to allow units to be easily moved to other rooms.

- Portable air conditioners need venting kits installed almost the same way as window air conditioners.
- No permanent installations required.
- Most use typical household 13A power and require no special wiring or outlets.
- Considerations on condensate water need to be taken into account for maintenance (e.g. Fully Self-Evaporative, Gravity Drain and Condensate Pump or Manual Removal).
- Do not offer the cooling capacity of fixed units and take longer to cool areas.
## Option Appraisal Worksheet – Ventilation & Cooling

### ENERGY CONSUMPTION

<table>
<thead>
<tr>
<th>System Type:</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
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<tbody>
<tr>
<td><strong>Fan energy</strong></td>
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<tr>
<td>Fan installed load (W/sq m)</td>
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<td>Number of fan hours during occupation per year</td>
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<td>Number of fan hours for night cooling per year</td>
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<tr>
<td>Annual fan energy (KWh/sq m)</td>
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<td><strong>Pump energy</strong></td>
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<td>Annual chilled water pump energy (KWh/sq m)</td>
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<td>Annual condenser water pump energy (KWh/sq m)</td>
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<td>Annual other pump(s) (KWh/sq m)</td>
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<td>Total annual pump energy (KWh/sq m)</td>
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<td>Annual chilled water pump energy (KWh/sq m)</td>
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<td>Annual condenser water pump energy (KWh/sq m)</td>
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<td><strong>Annual running costs</strong></td>
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<td>Electrical (fan and pump) energy (KWh/sq m)</td>
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<td>Electrical (refrigeration) energy (KWh/sq m)</td>
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<td>Gas (humidification reheat) energy (KWh/sq m)</td>
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<td>Gas (refrigeration) energy (KWh/sq m)</td>
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<td>CO2 Emissions - gas</td>
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<td><strong>Other issues</strong></td>
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<tr>
<td>Space Requirement</td>
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<tr>
<td>Resultant quality of the internal environment</td>
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Completed by (Print name) .............................................  Date:........................................
Authorisation to Proceed With Works to Reduce Working environment Temperatures

This form is to be used when Directorates wish to proceed with works and/or the installation of equipment designed to reduce working environment temperatures.

Part A – To be completed if the installation requires on-going maintenance and energy resources to operate.

I can confirm that I have been provided with a quote for works to reduce working environment temperatures - details as follows:

Location of installation: __________________________

Annual running costs of installation: £_______________________
(maintenance and energy costs)

I hereby give authorisation for the amount identified above to be transferred from my budget on a recurrent basis.

Cost Centre: _______________  Account Code: _______________

Authorised by:

Name:
Signature:

Part B – Only complete if your Directorate is funding the installation costs.

Ventilation and air conditioning units will generally be classified as capital expenditure with installation funded through the Trust’s capital programme. However, some smaller installations may fall under the £5,000 capital threshold and be funded from revenue. In this instance, Directorates will need to fund the installation costs in addition to any costs falling within Part A.

I hereby give authorisation for my budget to be cross-charged with the installation costs of the above identified air conditioning unit (one-off costs)

Installation costs: £_______________________ (as supplied by Corporate Infrastructure)

Cost Centre: __________________

Authorised by:

Name:
Signature:

Please forward this form to:

Estates Department
West Suffolk Hospital
Hardwick Lane
Bury St Edmunds
Suffolk
IP33 2QZ
9.0 Document Control

<table>
<thead>
<tr>
<th>Original Author:</th>
<th>Mr T. Bird, Estates Technical Support Officer.</th>
</tr>
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<tr>
<td>Other Contributors:</td>
<td>Mr I. Stuchbury, Estates Manager</td>
</tr>
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