



University of the West Indies AC Policy Document

AC Policy

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Produced by: UWI Energy Conservation Project Office (ECPO), Energy Conservation Steering Committee and the UWI Technical Committee

Table of Contents

Executive Summary	4
1. Aim	5
2. Criteria to be met	5
3. Functional Air Conditioning	6
4. Comfort Air Conditioning	8
5. Energy and Replacement Issues	9
6. Aesthetic Considerations	10
7. External Organizations	10
8. Arbitration	11
9. Enforcement	11
10. Procedure	12
11. Approval	12
UWI AC Policy Appendices	13
Appendix 1A	14
Appendix 1B	15
Procedures for Application of Air Conditioning - Request and Installation	15
Background	15
Procedures	15
Contact your Department Head / Manager for:	16
AC Request Form	16
Request for Installation of Air Conditioning Form	16
A. The Need	16
B. Other Alternatives	16
C. Design Requirements	17
D. Funding of Air Conditioning Installations	18
Functional	18
Comfort	18
Source of Funds	18
I acknowledge the design requirements as being correct	19
Appendix 2	20
Guidelines for Air Conditioning Installation	20
1. Design and Selection of Air Conditioning System	20
2. Quotation Procedure	20

APPENDIX 3.....	21
Guidelines for Air Conditioning Operation	21
Heat Load Control.....	21
ACCEPTABLE TEMPERATURE RANGE FOR LABORATORY EQUIPMENT.....	21
SOURCES OF HEAT	22
Appendix 4A.....	24
Guidelines for Air Conditioning Maintenance – Servicing	24
Appendix 4B.....	24
Guidelines for Air Conditioning Maintenance - Repairs.....	24
Operational Guidelines for the installation of refrigerants	24
Introduction.....	24
Notification	24
Reporting.....	25
Testing & response of EMD	25
Operational Guidelines For The Commissioning Of Air Conditioning Units And Systems That Have Had Their Refrigerants Changed To Natural Hydrocarbon Refrigerant , for example Duracool R22a, In Departments, Offices And Facilities On The Mona Campus	26
Commissioning.....	26
Notification of change.....	27
Guidelines Providing Information on Internationally Preferred Measurement Parameters used in Testing, Measurement and Commissioning of Refrigeration and Air Conditioning Equipment.....	27
Measurement and Test Parameters	27
Energy Efficiency Ratings	28
Coefficient of Performance.....	28
THERMOSTAT SETTINGS.....	29
Appendix 5.....	30
Guidelines for Air Conditioning Ventilation Rate – Air Changes per Hour	30
Notes	31
End of Policy Document.....	31

Executive Summary

This policy document applies to all users of Air Conditioning (AC) systems on the Mona Campus. The aim of the University's AC Policy is to ensure that all requests for air conditioning and ventilating are addressed in a consistent manner paying particular attention and emphasis on energy conservation and efficiency. This AC policy seeks to promote the purchase and installation of energy efficient AC units with the best Coefficient of Performance (COP) and energy efficiency ratio (EER)¹ available at time of procurement. In addition, this policy will also promote proper maintenance, room insulation, energy management, optimum set-point temperature, usage optimization and aesthetic and environmental considerations.

Prior to procurement, all requests for air conditioning spaces are to be submitted to the Department Manager and Estate Management Department (EMD) for initial consideration. The request must be submitted using the specially created AC Request Form. All air conditioning procurement and installations are to be approved by the EMD. Additionally, the EMD will provide information on the technical criteria that AC systems must meet based on the User's brief. The following outlines how this policy will be enforced:

1. All request for AC must be submitted to the EMD prior to submission to the Bursary Purchases Department
2. The EMD must first approve an AC request before a purchase order can be generated
3. If a user installs an AC without prior approval of the EMD then the unit will be removed at the user's expense.

The Policy encourages that: Computerized Energy Management Control Systems, timing devices or signage are to be used or fitted to AC systems and configured/posted to limit, discourage and or restrict users from making changes to system's temperature settings and operating hours.

External organizations should consult with the Estate Management Department whenever the need for either a functional or comfort air conditioner arises.

Users may refer cases to arbitration only if a request for functional or comfort AC was denied by the Estate Management Department.

¹ See Appendix 4

1. Aim

The aim of the University's Air Conditioning (AC) Policy is to ensure that all requests for air conditioning and ventilating are addressed in a consistent manner paying particular attention and emphasis on energy conservation and efficiency. This AC policy seeks to promote the purchase and installation of energy efficient AC units with the best Coefficient of Performance (COP) and energy efficiency ratio (EER)² available at the time of procurement. In addition, this policy will also promote proper maintenance of AC systems, proper room insulation, energy management of AC systems, optimum set-point temperature, AC usage optimization and aesthetic and environmental considerations.

The Policy³ deals with requests for the provision of conditioned environments in teaching, research and administrative areas, functional and comfort requirements, Occupational Health and Safety issues, the aesthetic protection of building and consideration to the influx of solar energy into enclosed working spaces. This AC Policy is necessary as the results of the UWI Energy Audit, shown in Appendix 1A, indicated that there is a very large recurrent expenditure for electricity which is attributed primarily to Air Conditioner usage which accounts for 46% of the campus' electricity consumption. Therefore, there is an urgent need to implement a plan that will lead to the sustainable and efficient management of: AC procurement, AC installation, AC usage, AC servicing and AC retirement.

This policy stems from a directive given by the Mona Campus Bursar in her capacity of Chairperson of the Utilities Monitoring Committee and Director of the Campus Energy Conservation Project Office, to implement sustainable cost saving measures through the procurement, usage and management of AC systems that will lead to savings in electric utility bill.

2. Criteria to be met

All requests to install expand or upgrade air conditioning units will be assessed by the Estate Management Department (EMD) in accordance with the design factors noted herein and where necessary with the help of independent consultancy. The University identifies several critical categories of need for the air conditioning of building spaces defined by use, function and comfort level. Where justification meets with the following criteria, the EMD will recommend the installation, expansion or upgrading of the unit through procurement instruments for implementation in:

² See Appendix 4

³ Reference/Credit : University of Sydney, Australia

2.1. Installation:

- 2.1.1. Spaces where there is a clear case for the control of temperature and humidity,
- 2.1.2. Areas capable of efficiently retaining the cooled air
- 2.1.3. Spaces where the power capacity is adequate to support the cooling system,
- 2.1.4. Areas such as offices occupied by senior and other University executive staff,
- 2.1.5. Large common meeting rooms, lecture theatres, computer rooms and libraries,
- 2.1.6. Spaces where the indoor temperature will exceed 28°C for more than 15% of normal working hours in the summer or where the temperature exceeds 30°C for more than 72 hours per annum.
- 2.1.7. Laboratories with sensitive instruments and equipment that are required to operate to a given specifications.

2.2. Expansion or upgrading:

Planning and installation for Air Conditioning Systems will be given to the expansion or upgrading of spaces in locations where:-

- 2.2.1. There is an increase in equipment load resulting from increased work and or research activity.
- 2.2.2. There is an increase in human occupancy
- 2.2.3. Changes in the building structure has resulted in a marked change in the building's occupants comfort level
- 2.2.4. There are specified tolerances of activities housed in the space
- 2.2.5. Need has been established that the occupants require a more comfortable work environment.

Please see Appendix 1 for details on Procedures for Air Conditioning - Request and Installation.

3. Functional Air Conditioning

- 3.1. Air conditioning for functional (i.e. scientific and technical) use is to be limited to those instances where there is a clear case for the control of temperature and/or humidity and where this cannot be achieved by passive thermal control, such as shading and insulation. Please see Appendix 2.

- 3.2. Computer rooms, rare book library stacks, rooms housing specialised equipment, animal houses (research based), laboratories and administrative offices are examples of areas that may require air conditioning owing to function. In the selection and purchase of equipment, preference should be given to machines that do not require a controlled environment. However, where a controlled environment is essential for a piece of equipment which is to be located in an existing large room, consideration must be given to subdividing the space so as to provide a smaller area specifically for housing the equipment. This would not only reduce the size of air conditioning equipment, but would also avoid costly systems associated with areas such as chemical laboratories, where air recirculation is likely to be unacceptable. Please see Appendix 3.
- 3.3. It is preferred that request for cooling will be for whole facilities as opposed to an individual or several adjacent spaces, as multiple installations of individual air conditioning units have a significantly higher operating cost. Hence, consideration must be given to expanding an existing unit to accommodate a marginal increase in load. Additionally, at an undefined point, economy of scale regarding long-term energy consumption will favour the installation of a whole-building system retrofit as opposed to continued diverse individual unit solutions. Type of controls and communications interconnection with other building systems such as an energy management system which will allow, among other things, automatic scheduled AC start-up and shut-down operations, should also be a consideration.
- 3.4. Preference will also be given to air conditioner units that inherently have: a long useful life, very energy efficient operation based on current standards, little or no negative impact on power quality, little or no negative impact on the environment, pleasant appearance and acceptable noise levels, causes no damage to building surfaces and can be easily maintained and cleaned.
- 3.5. The total cost of justified air conditioning for functional reasons will be met from the users Departments' funds or other fund so designated using appropriate procurement instruments. Such funds are limited and may not always be available. When prearrangements have not been made for funds, and Users are not prepared to wait until funds are available in the future, then Users are to fund the installation themselves. The total cost is to include supply, installation, replacement if necessary and reinstatement of building fabric when the unit is removed. Funding for maintenance will be met from the users' or other funds so designated. Operating costs will be met from the University's utility budget.
- 3.6. Prior to procurement, the Estate Management Department will provide information on the technical criteria that AC systems must meet based on the User's brief. The EMD will also identify Occupational Health and Safety issues so as to ensure that required standards are met and wherever necessary discuss concerns with other relevant bodies, particularly in relation to the recirculation of air in chemical and biological laboratories.

- 3.7. The AC system must be installed such that it can be safely accessed for repairs and maintenance. An energy efficient and environmentally friendly refrigerant should be used in units and service work should be performed by appropriately licensed and trained personnel. Please see Appendix 4.
- 3.8. The Estate Management Department (EMD) is charged with the responsibility to ensure that the installation and / or upgrading of AC systems meet the criteria as outlined in sections 2.1 and 2.2. Additionally, the EMD should ensure that:
 - 3.8.1. The AC system is efficient and sized for maximum Energy Conservation.
 - 3.8.2. The AC system is installed for minimum health risk. Consideration being given to ventilation rates per person and correct air change per hour ratings. Please see Appendix 5.
 - 3.8.3. The AC system is made to operate within prescribed temperature ranges for maximum energy efficiency without sacrificing equipment and occupants' operating and comfort levels respectively.
 - 3.8.4. The AC system is installed in a properly insulated room.

4. Comfort Air Conditioning

- 4.1. Comfort air conditioning in University spaces set aside for University purposes (not leased or occupied by external organisations) will be approved only for those spaces which would otherwise have intolerable conditions for the occupants, and special areas where controlled environment is judged as being necessary. This is provided that passive thermal control, such as shading and insulation, is not effective or appropriate, either on architectural or structural grounds.
- 4.2. Rooms located under flat metallic roofs or concrete slab roofs, which cannot be successfully treated by various techniques of insulation and sun shading, which are utilized fully during the hot periods of the year, would be strong contenders for comfort air conditioning.
- 4.3. Where comfort conditioning is judged to be necessary careful consideration will be given to installing systems with the capacity to reduce indoor room temperatures to a maximum of approximately 5°C to 9°C below ambient. The minimum set point will be 22°C in the hot periods of the year and 26°C in the cool periods of the year.
- 4.4. Minimum and Maximum temperatures will be remotely and/or locally managed through the use or combination of automatic AC control systems and Building

- Energy Management System that can be programmed and reprogrammed to control the operation of AC systems over desired set point temperature range while taking operating hours and time of year into consideration.
- 4.5. The cost of air conditioning for comfort reasons of those areas where the University, on advice of the Estate Management Department, considers air conditioning to be essential will be met from the users Departments' funds using appropriate procurement instruments, provided funds are available specifically for that purpose. Please refer to section 3.5.
 - 4.6. In instances where users Departments' funds is not available, the user may Comfort air condition areas, which would be supported under this policy, with their own funds only if the full cost is met from these funds. In this instance full cost means the capital cost of the system required to meet technical and aesthetic considerations, maintenance and restoration of building fabric on removal.
 - 4.7. Comfort air conditioning of areas which would not be supported under this policy will not be agreed to, irrespective of the source of funding.

5. Energy and Replacement Issues

- 5.1. It is desirable that AC systems, including split systems and window units, are compatible with or supplied with an interface that will allow energy management control either remotely or locally.
- 5.2. Computerized Energy Management Control Systems, timing devices or signage are to be used or fitted to AC systems and configured/posted to limit, discourage and or restrict users from making changes to system's temperature settings and operating hours.
- 5.3. In locations where central AC is provided and section 5.2 is enforced, then a portable unit should be provided to cool spaces that may be used, from time to time, outside of operating hours. If usage outside of operating hours is frequent then the installation of a split system may be considered.
- 5.4. Air conditioning plant or units serving rooms that are no longer being used for purposes which justify air conditioning under the policy will either be removed or deactivated.
- 5.5. When any unit becomes unserviceable, the unit to replace it will be subject to the same criteria used to assess requests for new installations. Please see Appendix 1.

6. Aesthetic Considerations

Facades of buildings within the University which are of special architectural and historical merit will be referred to as “protected facades”. One should contact the Estate Management Department in order to ascertain if a façade is a protected facade.

- 6.1. Window air conditioner units or other mechanical apparatus must not be located on or about the protected facades. In some instances it might be necessary to install a split system or central system.
- 6.2. Where window units are acceptable both on aesthetic and functional grounds, an ‘inboard’ model shall be installed, unless space considerations prohibit.
- 6.3. In the case of an externally sponsored research project, the full cost of the acceptable installation designed to meet both functional and aesthetic considerations must be met from the research funds.
- 6.4. Where plant is located in proximity to a building, architectural aesthetic considerations are to be addressed by Estate Management Department.
- 6.5. See Section 8 for arbitration

7. External Organizations

External organizations, commercial or non-commercial, which are occupying space within University buildings, or buildings on a University site, may air condition spaces for either functional or comfort condition reasons, provided they meet the full cost of the installation and comply with the University’s Grounds and Buildings Premises concerning location of equipment and the Estate Management Department concerning this AC Policy. In this instance full cost means the capital cost of the system required to meet technical and aesthetic considerations, recurrent maintenance costs and restoration of building fabric on removal. Additionally, Section 6 of this policy also applies.

- 7.1. External organizations should consult with the Estate Management Department whenever the need for either a functional or comfort air conditioner arises.
- 7.2. The impact of an External organizations added AC load to the Campus’ overall energy demand (KVA) should be taken into consideration when deciding on appropriate AC system, hence the need for consultation with the Estate Management Department.

- 7.3. Upon consultation with the Estate Management Department, The University will decide on how the relevant sections of this AC Policy apply to said external organization and enforce accordingly.
- 7.4. Should the need for arbitration arise then the University's Grounds, Building and Premises Committee should be consulted
- 7.5. See section 8 for arbitration

8. Arbitration

This AC policy is intended to be as fair and transparent as possible and appreciates that the need for arbitration may arise from time to time should request for functional or comfort AC is denied by the Estate Management Department. Consequently, the University's Grounds, Buildings and Premises Committee is empowered with the responsibility to hear such cases as the committee so desires.

- 8.1. Users may refer cases to arbitration only if a request for functional or comfort AC was denied by the Estate Management Department.
- 8.2. Users should submit the same request that was submitted to the EMD for arbitration.

9. Enforcement

It is very important that this AC policy is properly circulated to all prospective and current users of AC systems in order for it to be effective.

- 9.1. Users must at least get the approval of the Head of Department before submitting a request for AC.
- 9.2. Users must submit all requests for air conditioning to the Estate Management Department prior to submission to the Bursary Purchases Department for generation of a Purchase Order.
- 9.3. If a request for an AC system does not have the approval of the EMD or the arbitration committee then a Purchase Order should not be created. The requester should be referred to the EMD for its approval.
- 9.4. If this policy is breached in any way then the User and Department responsible for the breach should be reported to the EMD and the Grounds, Building and Premises Committee who are both charged with the responsibility of enforcing this policy.

- 9.5. The EMD has sweeping powers to remove AC systems that are in breach of this policy at the users cost.
- 9.6. This policy applies to all users of AC systems on the Mona Campus

10. Procedure

All requests for air conditioning spaces are to be submitted to the Department Manager and Estate Management Department for initial consideration before sent to Bursary –Purchases for a Purchase Order. All air conditioning procurement and installations are to be approved by the Estate Management Department. The detailed procedures are set out in the appendices:

- 10.1. Appendix 1B. Procedures for Air Conditioning - Request and Installation
- 10.2. Appendix 2. Guidelines for Air Conditioning Installation
- 10.3. Appendix 3. Guidelines for Air Conditioning Operation - Heat Load Control
- 10.4. Appendix 4A. Guidelines for Air Conditioning Maintenance Servicing
- 10.5. Appendix 4B. Guidelines for Air Conditioning Maintenance Repairs
- 10.6. Appendix 5. Guidelines for Air Conditioning Ventilation

The University will not approve payment for installation or work (maintenance) carried out on AC units or cooling units by persons who are not at least NEPA or HEART NTA Level II certified contractors or technicians.

11. Approval

- 11.1. This policy was approved by Grounds, Buildings and Premises Committee on the advice of Senior Executives of the University.
- 11.2. Signed: _____
- 11.3. Name: _UWI, Mona Campus Bursar _____
- 11.4. Date: ___March 9th, 2010_____

UWI AC Policy Appendices

Appendix 1A

UWI Energy Audit

Estimated Electricity End Use (kWh) Consumption Breakdown

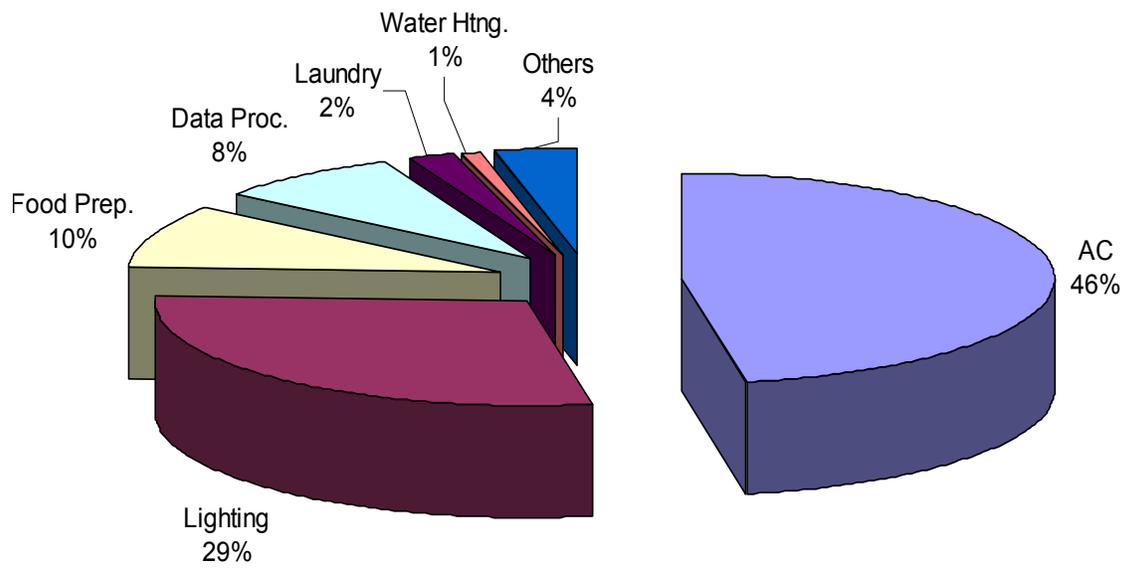


Figure shows the estimated electricity consumption breakdown at UWI, result from energy audit

Appendix 1B

Procedures for Application of Air Conditioning - Request and Installation

Background

The University has promulgated this Air Conditioning Policy as direct response to the Campus Bursar's directive to implement sustainable cost saving measures through the procurement, usage and management of AC systems that will lead to savings in electric utility bill. In addition, this AC policy seeks to ensure that all requests for air conditioning are dealt with in a consistent manner. The policy deals with such matters as air conditioning for functional and comfort reasons, Occupational Health and Safety requirements; installation protected building facades, maintenance, efficient operation and procurement.

University policy charges the Estate Management Department (EMD) with the responsibility for the approval of air conditioning requests and arranging major installations. However, the responsibility for arranging installations, such as window or split units, which may breach the University estate and architectural codes, must be approved by the Grounds, Buildings and Premises Committee.

The procedures relating to approval of air conditioning requests have been devised to reduce the processing time.

Procedures

1. All requests for air conditioning installations are to be endorsed by the relevant Head of Department. Requests are to be submitted to the Department Manager / Head by use of the form "Request for Installation of Air Conditioning Form included in this policy document.
2. EMD will evaluate the request against the policy and advise the originator accordingly.
3. The EMD may, if so desires, consult with other bodies when making a determination on an AC request.
4. EMD will arrange for all air conditioning installations.

Contact your Department Head / Manager for:

1. Clarification of the procedures.
2. A copy of the current air conditioning policy.
3. A copy of the “Request for Installation of Air Conditioning” form.

AC Request Form

Request for Installation of Air Conditioning Form
(Please note: This Form should be made available online)

Instructions: Please complete document by filling in the blanks and circling the appropriate response in the sections relevant to you. Assistance in completing some sections may be provided upon request to the Estate Management Department.

Building.....
Building No.
Room No (s).....
Department/Service/Centre/External Organization.....
.....
Name of person requesting Air Conditioning
.....
Position in organization.....
Extn

A. The Need

What is the intended use of this space and why is air conditioning necessary?
.....
.....
.....
.....
.....

B. Other Alternatives

Are there other spaces with suitable air conditioning that could accommodate the function or piece of equipment?

If YES state room No (s).

.....
If NOT SURE indicate if you require an inspection by the Estate Management
Department
If NO indicate

C. Design Requirements

1. Size of Room

Length.....

Width

Height

2. Window size

Height

Width

3. Window orientation (circle one) [North] [South] [East] [West]

Are the windows shaded? YES/NO

If YES by what?

4. How many people work in that room?

5. Number of lights.

6. Number of Personal computers

7. Number of other Electronic equipment

8. Are there any fume cupboards in the room? YES/NO. If yes how many?

9. Number of laboratory animals

.....
10. Number of other heat producing sources

.....
Photocopier.....

Refrigerator.....

Dishwasher.....

Oven

Other.....

11. Temperature requirements..... 0oC +/-..... 0oC

12. What governs conditions? (circle as appropriate)

[Human Comfort] – [Electronic Equipment] – [Books] – [Artifacts]

[Laboratory Animals] – [Instruments] –

[Other].....

13. Is outside air flow rate critical? YES/NO

Why?.....

14. Is air filtration requirement critical? YES/NO

Why?.....

15. Will there be any chemical, radioactive or biological hazards in the rooms?

If YES state what type.....

.....
16. Are there any other occupational, radioactive or biological hazards in the rooms?

If YES state what type.....

.....
17. Operational hours of the room: Hours.....Day(s)- -..... -.....

18. Other comments or information.....

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

D. Funding of Air Conditioning Installations

Functional

All costs including supply, installation, reinstatement and replacement will be from Users Departments' funds or other funds so designated provided specific funding is available. If Users have not prearranged funds and cannot wait until the next program, they may fund the installation themselves.

Comfort

The costs of installations necessitated by human comfort criteria will be funded from Users Departments' funds or other funds so designated provided specific funds are available. Where the criteria are met, but no funding is available the costs of installations can be funded by the User?

Source of Funds

Is the work Department funded? YES/NO

Is the work User funded? YES/NO

If YES (State Account Code)

.....

I acknowledge the design requirements as being correct.

Principal User of Room

Signature.....

Date

Head of Department

Signature.....

Date

I recommend the work as requested

Estate Management Department

Signature.....

Date

Appendix 2

Guidelines for Air Conditioning Installation

1. Design and Selection of Air Conditioning System

Design and selection of any air conditioning system will depend mainly on the following factors:

- I. Outdoor design conditions
- II. Indoor design requirements of the space as nominated by the User.
- III. Internal heat gain from equipment and people.
- IV. External heat gain depending on space location and building structure.
- V. Requirements of statutory authorities.
- VI. Approval given by the Estate Management Department, the grounds, Buildings and Premises Committee and/or other affected tenants for any interference with the fabric or services of the building. The User shall nominate the contractor, design requirements, equipment heat load, etc of the space and advise the chosen contractor and the Estate Management Department for final inspection.

2. Quotation Procedure

All quotations must comply with the University's "Purchasing Policy, Guidelines and Procedures", and be obtained in a form deemed acceptable by the University.

APPENDIX 3

Guidelines for Air Conditioning Operation

Heat Load Control

This section is directed as a guideline to the Estate Management Department in their scrutiny of request for functional and comfort air conditioning. It also serves as a means of informing users on how their request for air conditioning will be partly assessed so as to ensure transparency.

Estimating the heat loads for buildings, laboratories and other facilities is crucial in the design of air conditioning capacity. In addition to the normal heat gain calculations for the building skin, the room heat gain from lighting, equipment and people, the ingress of sunlight must also be considered. Lab equipment must also be considered from two aspects, (1) Lab Equipment operating environment temperature range and (2) lab equipment heat load contribution. Laboratories also tend to have greater lighting loads (2-3 watts /ft²) in comparison to offices (1-2 watts/ft²).

ACCEPTABLE TEMPERATURE RANGE FOR LABORATORY EQUIPMENT

Equipment	Range (°C)	Remarks
<i>Most instruments</i>	15–38	<i>Below 85% RH</i>
<i>Electron microscope</i>	20–24	<i>45% RH ± 10%; Rate change not to exceed -15°C per hour; no drafts</i>
<i>Scintillation counter</i>	13–30	<i>Below 85% RH</i>
<i>Research microscope</i>	21–25	<i>50% RH optimum; no drafts</i>
<i>Microtome</i>	—	<i>Depends on use</i>
<i>Spectrophotometer</i>	18–30	<i>Rate change not to exceed -17°C per hour; 50% RH or less</i>
<i>Gas chromatography/mass spectrometer (GC/MS)</i>	10–30	<i>20–90% RH</i>

SOURCES OF HEAT (Reference/Credit – ECPO, UWI)

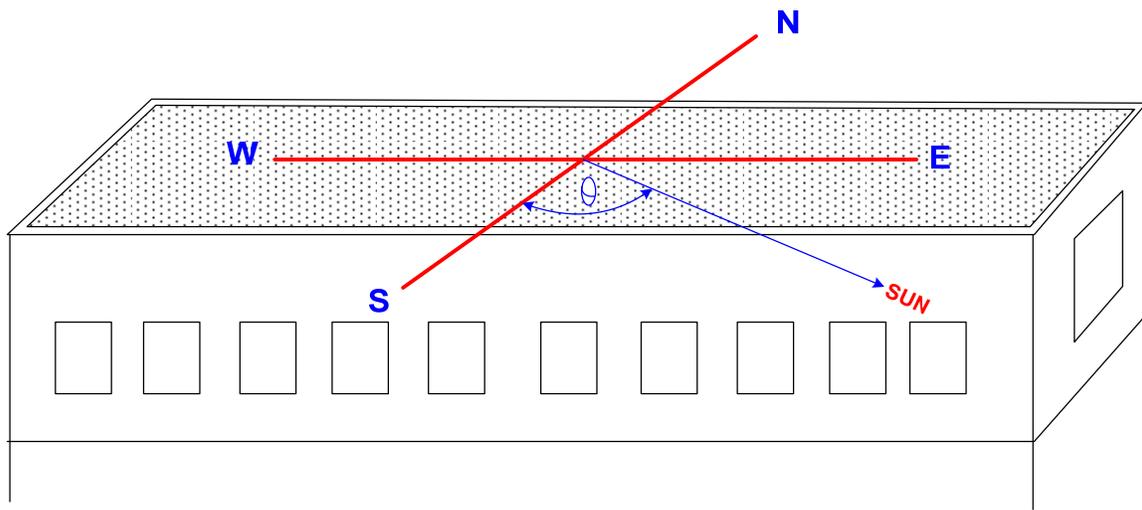
A building's envelope continuously interacts with the outside environment; the ambient temperature, solar radiation, wind and rain. The performance of the envelope therefore has a strong influence on the indoor environment and comfort conditions. We can observe how the outer environment influences inner envelope and therefore the way in which the air conditioning systems are closely interrelated.

Each component of the building's envelope will contribute to the overall HEAT LOAD of the building; the heat load will guide the design requirements of the air conditioning system performance, minimize energy costs and improve comfort.

The **heating load** is defined as the amount of energy required to maintain a comfortable temperature inside the building envelope in comparison to the outside temperature. That is, how much heat is required to replace the heat being lost from the environment? Thus, when designing a good heating system it is important to determine the correct **heat load** to ensure maximum heating efficiency with minimum installation and running costs.

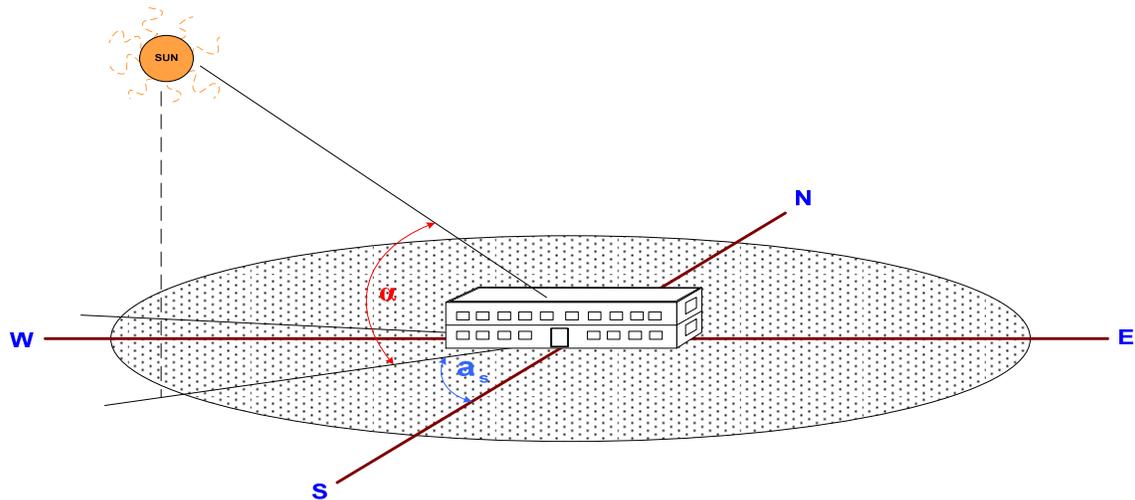
1. Heat load is due to solar heat gain through windows, infiltration of outside air, and the internal loads of people, lighting and miscellaneous equipment.
2. Reducing solar heat gain through windows is clearly one of the keys to reducing energy costs in buildings with a large number of windows such as an office building.

Record the Physical Orientation of the Building With Respect To The Characteristic Points

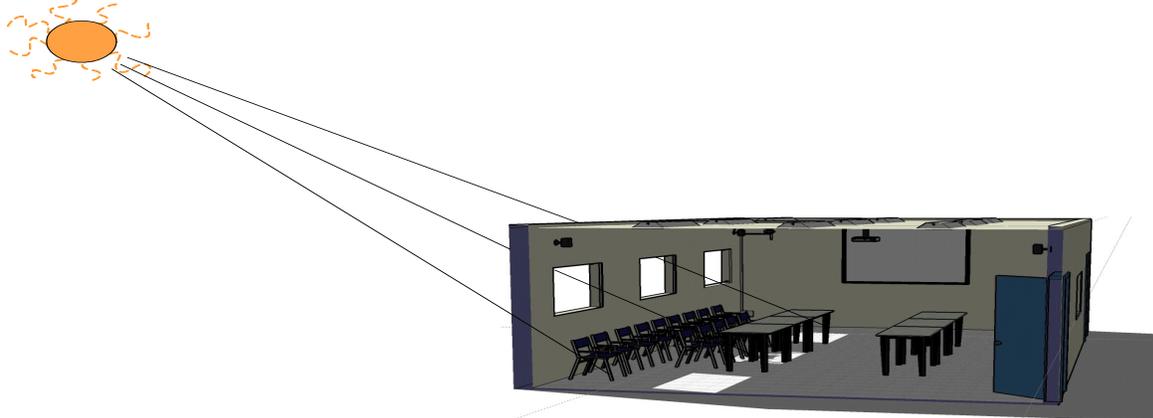


The envelope of a building is comprised of the surfaces that separate the inside from the surrounding environment in which the building is located.

- a) ***Record The Building's Orientation With Respect To Jamaica's Latitude And Longitude And The Sun's Position In The Sky For Selected Times During The Year***
- b) ***Monthly Orientation of The Sun In The Sky Relative To The Mona Campus Jamaica***
- c) ***The Length of Time The Surface of The Building Intercepts Solar Radiation***
- d) ***Calculate The Monthly Average Total of Direct And Diffuse Radiation On The***
 - a. ***Vertical Walls of The Building***
 - b. ***On The Roof (Horizontal) of the Building.***



Orientation of Sun In Sky Relative To Window And Door Openings In The Building



Appendix 4A

Guidelines for Air Conditioning Maintenance – Servicing

The servicing of AC units should be carried out in accordance with the schedules and protocols as agreed to at time of purchasing the unit. The user should therefore make service requests to their respective AC supplier or other suitable qualified persons or organizations which may or may not include the EMD.

Appendix 4B

Guidelines for Air Conditioning Maintenance - Repairs

Operational Guidelines for the installation of refrigerants

(Reference/Credit – ECPO, UWI)

Introduction

This section will define the working relationship between the Energy Conservation Project Office (ECPO), The Estate Management Department (EMD) and the Consultant/ Contractor; it will act as notification of, operational procedures for a phase of the implementation of energy conservation measures related to the change of refrigerant in Air Conditioning Units to Hydrocarbon Refrigerant. It is desirable that this procedure be carried out whenever an AC unit is serviced especially when the unit is re-gassed. AC contractors or technicians carrying out the refrigerant change-out exercise must at least NEPA or HEART NTA Level II certified.

Notification

In order to ensure the smooth implementation of any project at the University, it is necessary to contact the EMD and Department Heads or Managers and inform the relevant parties of any work that will require their cooperation. Hence, the following must be adhered to:

- *Work plan*

The work plan must be designed to provide step-by-step instructions for the implementation of project deliverables and managing the project.

The contractor must provide the ECPO and the EMD with a work plan inclusive of timelines. This work plan may be of a general format in the initial planning stage of the project. However, fourteen days prior to the start of any particular section of the implementation of an energy conservation measure, the work plan must be detailed.

- *EMD and ECPO*

Notification of installation of equipment or systems must be given to the EMD and ECPO by the contractor three days prior to accessing any department on the Mona Campus to carry out work on the implementation of an energy conservation measure. The EMD and ECPO will, in turn, make the necessary arrangements to facilitate the work that is to be done. Departments will be contacted prior to the arrival of contractors.

Reporting

In addition to the standard Consultant/Contractor reporting, the following is requested: Date of change; Condition of AC unit: - Age of unit, Functional Condition, Requirement of maintenance/repair, non-functional.

Where occasions call for these types of disclosure, special reports must also be submitted to the ECPO and the EMD. These reports include, but not limited to, unusual findings, bad practices, bad/unprofessional installation (parts or system), and incidents of damage to AC Units.

Testing & response of EMD

After receiving from Contractor/Consultant the declaration of the completion installation of an Ac Unit, the testing phase of the project will commence and is to last for a period of sixty days that will also enact a Defects Liability Period . During this period, the relevant parties, customers or stake holders will contact the EMD regarding the operation of the installed measure in order to lodge complaints or make any observations and comments regarding the operation of the measure

- *Complaints*

Department complaints regarding the performance and operability of the AC unit must be lodged with the Estate Management Department. Once a complaint has been logged, EMD will notify contractors of any complaints received. Contractors are expected to respond to all complaints within four hours. Once the contractor has visited the site, carried out the investigation and made the assessment, the contractor must communicate his findings to the EMD and ECPO no later than four hours after assessment has been made. A written report must be submitted within 2 days of the investigation and assessment.

Operational Guidelines For The Commissioning Of Air Conditioning Units And Systems That Have Had Their Refrigerants Changed To Natural Hydrocarbon Refrigerant , for example Duracool R22a, In Departments, Offices And Facilities On The Mona Campus

Commissioning

After the units have been correctly tested by the Contractor and have met the initial approval of the (EMD) Estate Management Department and the ECPO (Energy Conservation Project Office), the Contractor must make the call for commissioning to be carried out on the identified installed measure and equipment. A commissioning team will be formed, which will include, but not limited to, members of the ECPO Management Team, members of staff of the Estate Management Department with the technical responsibility for the particular installed measure and equipment the Department Heads or Managers and technical representatives of the Consultant and Contractor responsible for the installed measure and equipment.

The commissioning procedures will be carried out with the aim of confirming through a defined procedure of inspection, authentication validation and tests, the correct performance and functionality of the equipment under consideration in relation to its basic performance specification. On completion of the commissioning procedures on the installed measure and equipment, a joint report on that result of the commissioning procedure must be submitted within seven days to the ECPO by the Consultant/Contractor and the personnel of the EMD responsible for the installed measure and equipment.

After the installed energy conservation measure and equipment have been commissioned, there a Defects Liability Period will be declared on the measure and equipment. The Estate Management Department and the University must now take ownership of the

particular Energy Conservation Measure and equipment and enact those responsibilities to ensure sustainability. The ECPO will no longer have the responsibility for managing aspects of the Energy Conservation Measure.

Notification of change

Once the AC Unit has been commissioned and meets the correct operational and performance standards acceptable to all the parties involved and meets the required standards of installation and operation and has completed its Defects Liability Period, the relevant parties will be issued with a Notice of Change document by the Estate Management Department (document which indicates that the change has occurred and is complete and issues precautionary instructions). This document, issued by the EMD, will indicate the conclusion of installation of that particular installed measure and equipment and also give notice of the handover to the department and will outline important data pertinent to the change carried out; operational data and guidelines for correct and proper functionality of the equipment or system.

Guidelines Providing Information on Internationally Preferred Measurement Parameters used in Testing, Measurement and Commissioning of Refrigeration and Air Conditioning Equipment

The Estate Management Department recommends that the parameters related to a functioning Air Conditioning Unit working in optimum conditions in the correct environment be observed, recorded and measured:

1. Date of Commissioning
2. Department
3. Location
4. Tags and Markings
5. Manufacturer and Name of Unit
6. Type Number/ Serial Number
7. Name Plate Specifications: Volts, Current, Power, Energy and Tonnage.
8. COP (with Measured and supporting data)
9. EER (with Measured and supporting data)
10. Short Descriptive Statement on condition of AC Unit

Measurement and Test Parameters

Energy Efficiency Ratings (Ref: Modern Refrigeration and Air Conditioning. Althouse et al).

The performance of vapor compression refrigeration cycles is limited by thermodynamics. These AC and heat pump devices move heat rather than convert it from one form to another, so thermal efficiencies do not appropriately describe their performance. The Coefficient-of-Performance (COP) does, but this dimensionless measure does not enjoy wide use like the dimensional Energy Efficiency Ratio (EER).

Coefficient of Performance

The cooling effect in Btu values in a refrigeration cycle compared to the Btu equivalent of the energy put into the system is called the coefficient of performance. Coefficient of performance (COP) is the ratio of output divided by input. In refrigeration work, the output is the amount of heat absorbed by the system. The input is the amount of energy required to produce this output.

For example, if one pound of refrigerant has an effective latent heat of 50 Btu, and the compressor pumping energy is equivalent to 10 Btu/lb., the coefficient of performance is 50 to 10 or 5:1.

The heat input by the compressor is less than the electrical energy put into the motor. The motor is not 100% efficient, and there are also compressor friction losses. Usually, the overall coefficient of performance will be approximately 60% of the theoretical COP. The actual coefficient, then, is approximately 3:1, rather than 5:1.

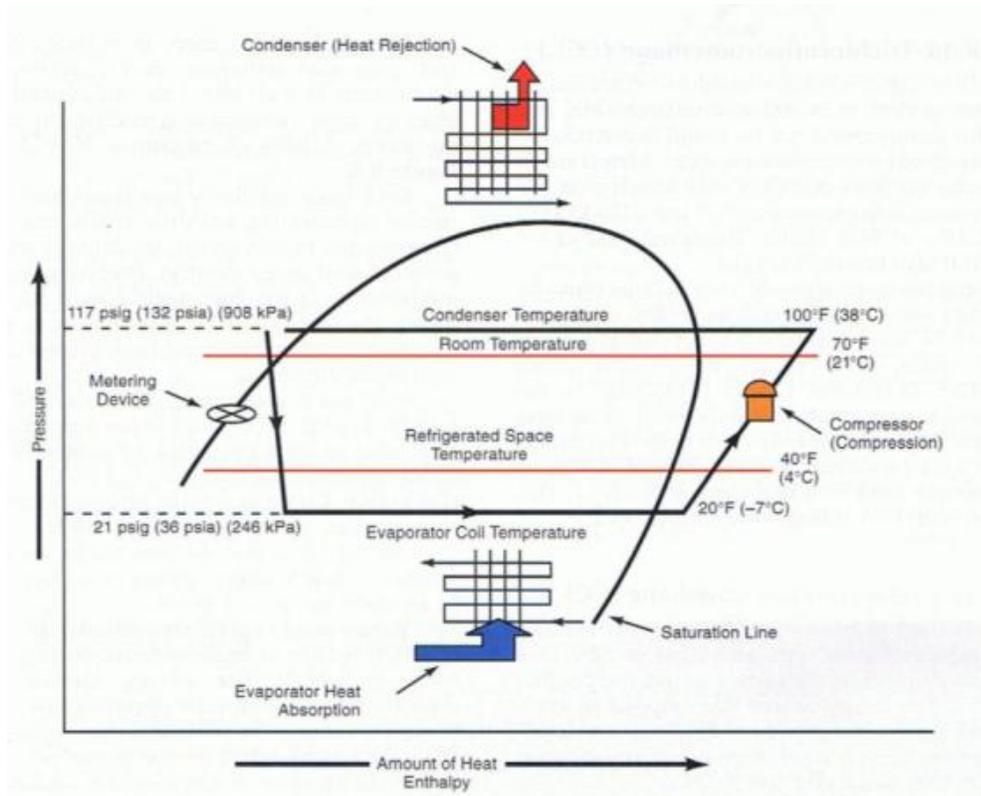
This means, for example, that three times more heat would be obtained from a heat pump by using the compressor than by using electricity to produce the heat. This explains the advantage of a heat pump. It also explains why hot gas defrost is used in some large systems. The cost of the extra piping and valves is soon recovered in the savings in cost of defrosting.

Therefore the two factors that will determine the coefficient of performance (COP) of the Natural Hydrocarbon Refrigerant – Duracool 22A, in a selected size of AC Unit, are refrigerating effect and heat of compression. COP is therefore expressed as:

$$\text{Coefficient of performance} \\ \text{COP} = \frac{\text{kW refrigeration effect}}{\text{kW input}}$$

COP is therefore a rate or measure of the EFFICIENCY of a refrigeration cycle in the utilization of EXPENDED ENERGY during the compression process in ratio to the ENERGY ABSORBED in the evaporation process.

Typical refrigeration cycle with temperature of one evaporator and condenser shown in comparison to refrigerated space temperatures



Measurement Summary

1. Coefficient of performance	$\text{COP} = \frac{\text{kW refrigeration effect}}{\text{kW input}}$
2. Energy efficiency ratio	$\text{EER} = \frac{\text{Btu/h refrigeration effect}}{\text{Watt input}}$
3. Power per Ton	$\text{kW/Ton} = \frac{\text{kW input}}{\text{Tons refrigeration effect}}$

$$\text{COP} = 0.293 \text{ EER}$$

$$\text{kW/Ton} = 12 / \text{EER}$$

$$\text{kW/Ton} = 3.516 / \text{COP}$$

$$\text{EER} = 3.413 \text{ COP}$$

$$\text{EER} = 12 / (\text{kW/Ton})$$

$$\text{COP} = 3.516 / (\text{kW/Ton})$$

THERMOSTAT SETTINGS

AC units which have had the refrigerant changed must be set operate to keep the room temperature between 22°C and 24°C degrees. This is the optimal temperature for our

tropical climate and should provide a comfortable working environment selected to be consistent with the climate zones outlined by the bureau of standards, Jamaica.

Appendix 5

Guidelines for Air Conditioning Ventilation Rate – Air Changes per Hour

The EMD must ensure that the AC Systems are installed to comply with minimum health risk; also, consideration should be given to Ventilation Rates per Person and correct Air Change per hour.

Air Change per Hour

Assembly Halls	4-8	Hospitals	- Sterilising	15-25
Bakeries	20-30		- Wards	6-8
Banks	4-8	Kitchens	- Domestic	15-20
Bathrooms	6-10		- Commercial	20-30 Min
Battery Charging Rooms	6-8	Laboratories		6-15
Bedrooms	2-4	Laundrettes		10-15
Billiard Rooms *	6-8	Laundries		10-30
Boiler Rooms	15-30	Lavatories		6-15
Cafes & Coffee Bars	10-12	Lecture Theatres		5-8
Canteens	8-12	Libraries		3-5
Cellars	3-10	Living Rooms		3-6
Churches	1-3	Mushrooms Houses		6-10
Cinemas & Theatres *	10-15	Offices		6-10
Club Room *	10-12	Paint Shops (not cellulose)		10-20
Compressor Rooms	10-20	Photo & X-ray dark rooms		10-15
Dairies	8-10	Public House bars		10-15
Dance Halls *	8-12	Recording studios		10-12
Dye Works	20-30	Recording Control rooms		12-25
Electroplating Shops	10-12	Restaurants		8-12
Engine Rooms	15-30	Schoolrooms		5-7
Entrance Halls, Corridors	3-5	Shops & Showrooms		8-12
Factories & Workshops	8-10	Shower Baths		15-20
Foundries	15-30	Stores & Warehouses		3-6
Garages	6-8	Swimming Baths		10-15
Glasshouses	25-60	Toilets		6-10
Hairdressing salons	10-15	Welding Shops		15-30

* Increase by 50% where heavy smoking occurs, or if the room is underground

⁴ Ventilation rate (litre/s) = (Volume(m³) x Air Changes per Hour) / 3.6 . If the space is crowded a higher ventilation rate should be obtained by calculating on a per person basis.

⁴ (REFERENCE: The Knowledge Centre – Ventilation Requirements)

Notes

End of Policy Document