0001c Design Checklist - Mechanical

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Table of contents

List of tables

No table of figures entries found.

List of figures

00 Design Principles

0.01 Main considerations

It is a requirement to undertake the 00 PLANNING AND DESIGN/0001R - DESIGN REFERENCE and GLOSSARY OF TERMS information into all aspects of design, detailing and delivery when developing the content here within. Clear demonstration of adherence to these requirements is part of the services and will be called upon at key points in the project and during at the discretion of the Department of Education (DoE).

0.02 Cooling policy

Thermal comfort and indoor air quality policy

The linked Thermal Comfort and Indoor Air Quality Policy document supersedes the existing DG55 Cooling Policy.

This policy in its current form is an interim document, which shall remain valid until the review of the Educational Facilities Standards and Guidelines (EFSG) is completed, as they relate to thermal comfort and indoor air quality is completed.

DG55 Thermal Comfort and Indoor Air Quality Policy

Thermal comfort and indoor air quality performance brief

The attached Thermal Comfort and Indoor Air Quality Interim Performance Brief document is intended to be read in conjunction with the Thermal Comfort and Indoor Air Quality Interim Policy.

This performance brief is applicable to New Capital Projects which may include both new buildings and refurbishment components.

DG55 Thermal Comfort and Indoor Air Quality Performance Brief

Cooler classroom program (CCP) guidelines

The attached Cooler Classroom Program (CCP) Design Guideline details the methodology to be adopted to achieve the required thermal comfort and indoor air quality in existing permanent learning spaces and libraries forming part of the School Infrastructure NSW Cooler Classrooms Program.

The Guideline is to be read in conjunction with the Educational Facilities Standards and Guidelines (EFSG) suite of information to aid in the planning, design and use of NSW Department of Education school facilities.

School Infrastructure NSW Cooler Classrooms Guidelines

Any enquiries in relation to Cooler Classroom Program (CCP) Guidelines may be sent to schoolinfrastructure@det.nsw.edu.au

0.03 Heating

Scope

Heating to the following school rooms and functional spaces may be required to maintain an in room ambient temperature between 19 °C and 22 °C:

- All teaching spaces
- Libraries and resource centres
- Administration and staff office areas

Electric heating must be preferred over gas heating. Where gas heating is considered, it must be approved by SINSW Sustainability.

The heating services must meet the requirements of Section J of the BCA, and may include any or all of the following:

- Convection heating by flued gas convectors (requires approval)
- Convection or warm air heating through ductwork and terminal air fittings
- Radiant heating using flued radiant gas heaters (requires approval)
- Reverse cycle operation of air conditioning
- Heating incorporated into evaporative cooling units (i.e. heating, ventilation and cooling units)
- Hydronic radiant heaters
- In slab heating (requires a slab and screed, so a life cycle costing must be undertaken before this is considered).

Project Heating Strategy

A heating strategy must be developed for each project to ascertain and set out the most appropriate heating system or systems to be included in the project.

The need for active heating equipment must be minimised by employing passive sustainable design principles (eg. Solar heat gain, thermal mass storage etc). Where active heating systems are required, they must be designed from a “Whole of Life” perspective to provide:

- Value for money
- fitness for purpose
- long term reliability
- minimal maintenance requirements
- low maintenance costs

Specifically heating equipment must:

- Support sustainable design principles including reducing energy consumption and long-term carbon emissions.
- Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed
- Be vandal and tamper resistant

Documentation

Designers must produce the following documentation for all projects:

- Heating system strategy including Whole of Life analysis.
- Sketch plans.
- Construction drawings.
- Trade-based Specification.
- Work-as-executed drawings.

Provide construction and work-as-executed drawings in industry recognised CAD file format.

All drawing sets must include:

- Site plan (1:500 or 1:1000).
- Equipment and any associated pipework/ ductwork layouts (1:100).
- Plant room detail and sections (1:50).
- Power and control schematics (NTS).
- Equipment schedules (NTS).
- Drawings must be drafted in CAD file formats such as AutoCAD and Revit.

Design approach

Head designer or equivalent must ensure effective co-ordination between disciplines.

At sketch plan stage:

- Locate and estimate the size of the plant rooms in consultation with the architect.
- Design appropriate heating system.
- Co-ordinate with other disciplines for provision of water supply, tundish for drain, power supply, structural openings, etc, associated with heating system.
- Prepare a Whole of Life, life cycle cost analysis as required.
- Prepare estimates as required.

Equipment Life-Cycle Cost Calculations

For new schools and when replacing or updating major heating components, a simple life-cycle cost should be calculated. This must be based on Life Cycle Cost considerations following over a period of time, e.g. 20 years and/ or the life of the asset.

As part of the Whole of Life analysis, the life cycle costs must consider the following:

- Capital cost of the asset.
- Capital cost of any supporting/ enclosing structure (plant rooms/ platforms) and/ or servicing equipment (e.g. access ladders etc).
- Multi-service integration and interface - provision (and costs) of any supporting services (e.g. power, gas tanks etc).
- Reticulation of ductwork, flues, piping and of cables, if applicable.
- Resource (water/ power/ gas etc) consumption costs. Based on; 1 year, 5 years, 10 years and / or 20 years.
- Maintenance required and cost of this maintenance.
- Frequency, nature and costs of capital upgrades needed over the life of the asset to maintain fitness for purpose.
- Cost of disposing of the asset or its components.

The following must also be considered:

- Provision for expansion of plant and equipment (if a likely possibility).
- Life span of the asset.
- Accessibility for servicing.

Refer to 00 PLANNING AND DESIGN/0001R DESIGN REFERENCE

Design Conditions: Interior Spaces

Winter: 19° CDB +2° C

Noise criteria:

- NR 35 within the conditioned space.
- 55dB(A) at 1 metre from Plant Room/ enclosure.

Refer to 00 PLANNING AND DESIGN/0001C DESIGN CHECKLIST - ACOUSTICS

Select the appropriate heating solution for the individual school to meet the following criteria:

Must comply with all BCA requirements.

- Suit the areas served.
- Represent the best Value for Money in the Whole of Life assessment.

Gas convection heaters

- Flued fan forced heaters
- Locate to maintain minimum distance from furniture blinds, etc, as recommended by the manufacturer

Alternative heating

Flued induced draft horizontal tube overhead radiant gas heaters

Could be effective in certain situations such as:

- large spaces and/ or spaces with large volumes (must have minimum clear ceiling height of 3.5 metres)
- areas with high air changes

Ducted warm air heating

- Requires high volume of outside make up air.

- May be suitable where flame sources or heaters with very hot components in an environment with dust and fumes could create a flammable or combustible environment.

Reverse cycle air conditioners

- Use only where air conditioning is installed for air cooling.
- Use only when convection or radiant gas heating is not possible.
- In areas of extreme temperature ensure the selected equipment can perform on cold winter mornings when maximum heating is needed.

Heating Cooling and Ventilation Units

- Heating can also be incorporated into evaporative cooling units to form a heating, ventilation and cooling unit.
- Consider only when evaporative cooling is installed.

Hydronic radiant heating

In cold climates it can be an economical and highly effective form of central heating.

Involves heating water in a boiler, and then pumping it through piping to panel radiators or convectors positioned in rooms. Heat is transferred directly from these to the room air. In-slab (‘floor coil’) systems are also available.

- Provide individual control valves to each panel to allow individual rooms or zones to be heated independently, enabling running costs to be substantially lowered.
- Panel radiators can provide effective heating for rooms with higher ceilings
- Silent radiant heat distribution has no air movement making them suitable where dust and fumes could create a flammable or combustible environment.
- Offer flexibility as further radiators or convectors can be added to a system as required, provided there is adequate boiler capacity.
- Generally, have a good response time
- Low maintenance requirements.

In slab heating

- In slab radiant heating can be very effective as it uses the thermal mass of the floor to heat air in the occupied zone at low level.
- Slow response time.
- These systems require a slab, screed topping and under slab insulation. The Life Cycle Costing shall be undertaken before this is considered.

- In slab and space temperature sensors are required for control of systems.
- Where used in reverse cycle mode in cooling, dew point sensors are required to prevent condensation on floor surface.

Controls

- Provide local control switch with pre-selected timer for all heaters.
- With the exception of systems with a longer response time (e.g. In slab heating, hydronic radiant heating etc), heating controls are to be set up in such a way that they cannot be left on in an unoccupied room for greater than ten minutes.

Design guide drawings

Figure 01: Gas Heaters

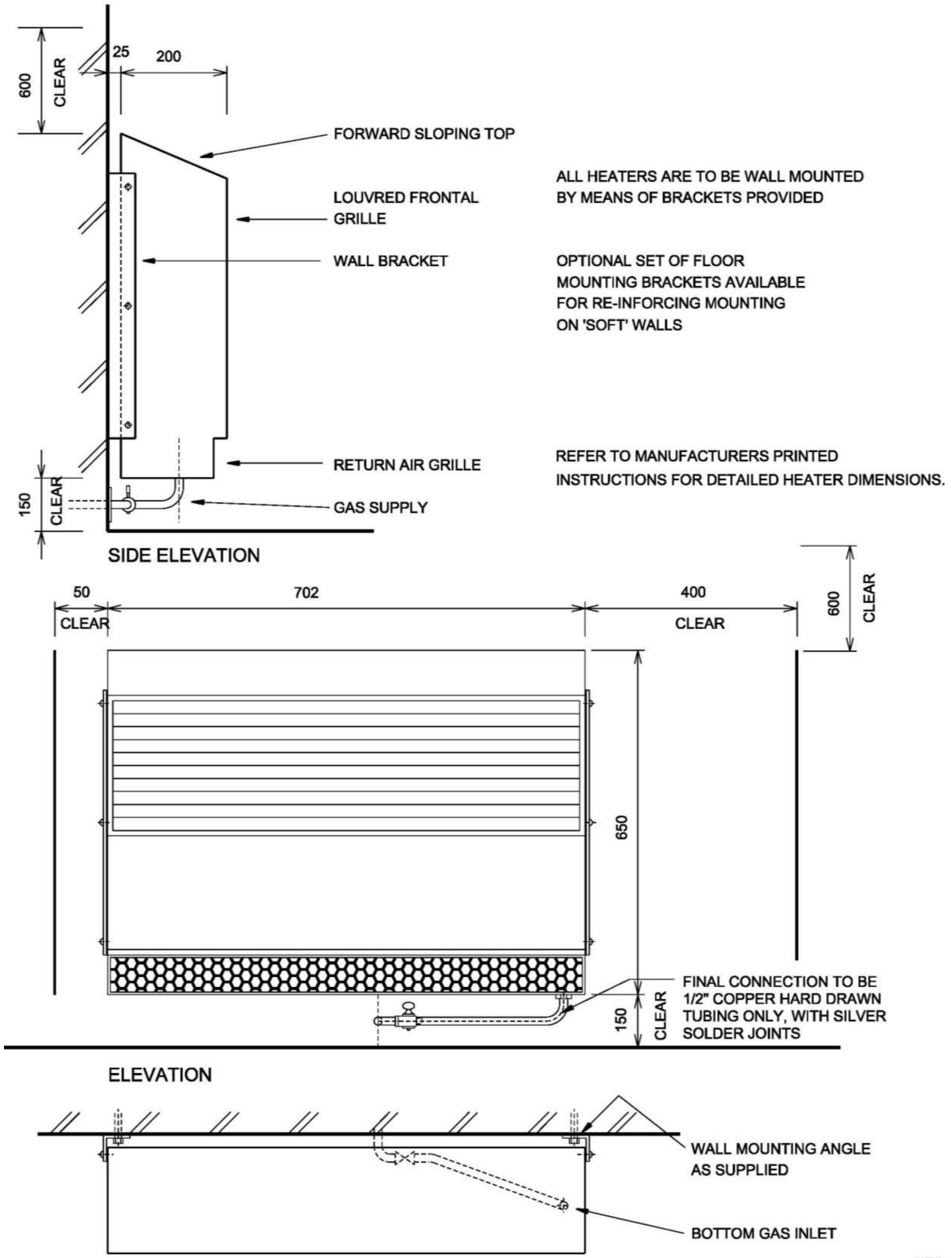


Figure 02: Grille, Wall Hung Radiant Heater – Primary

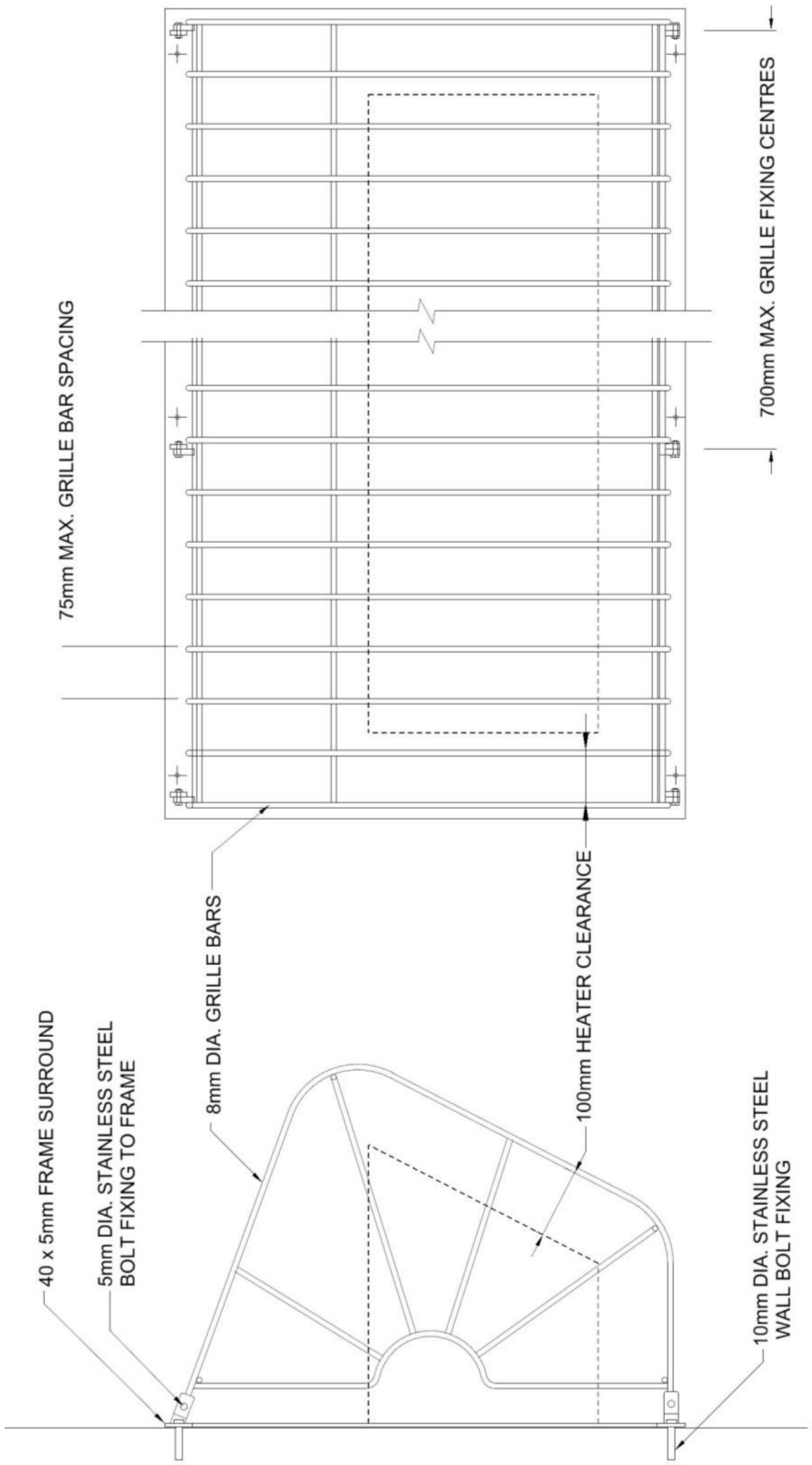
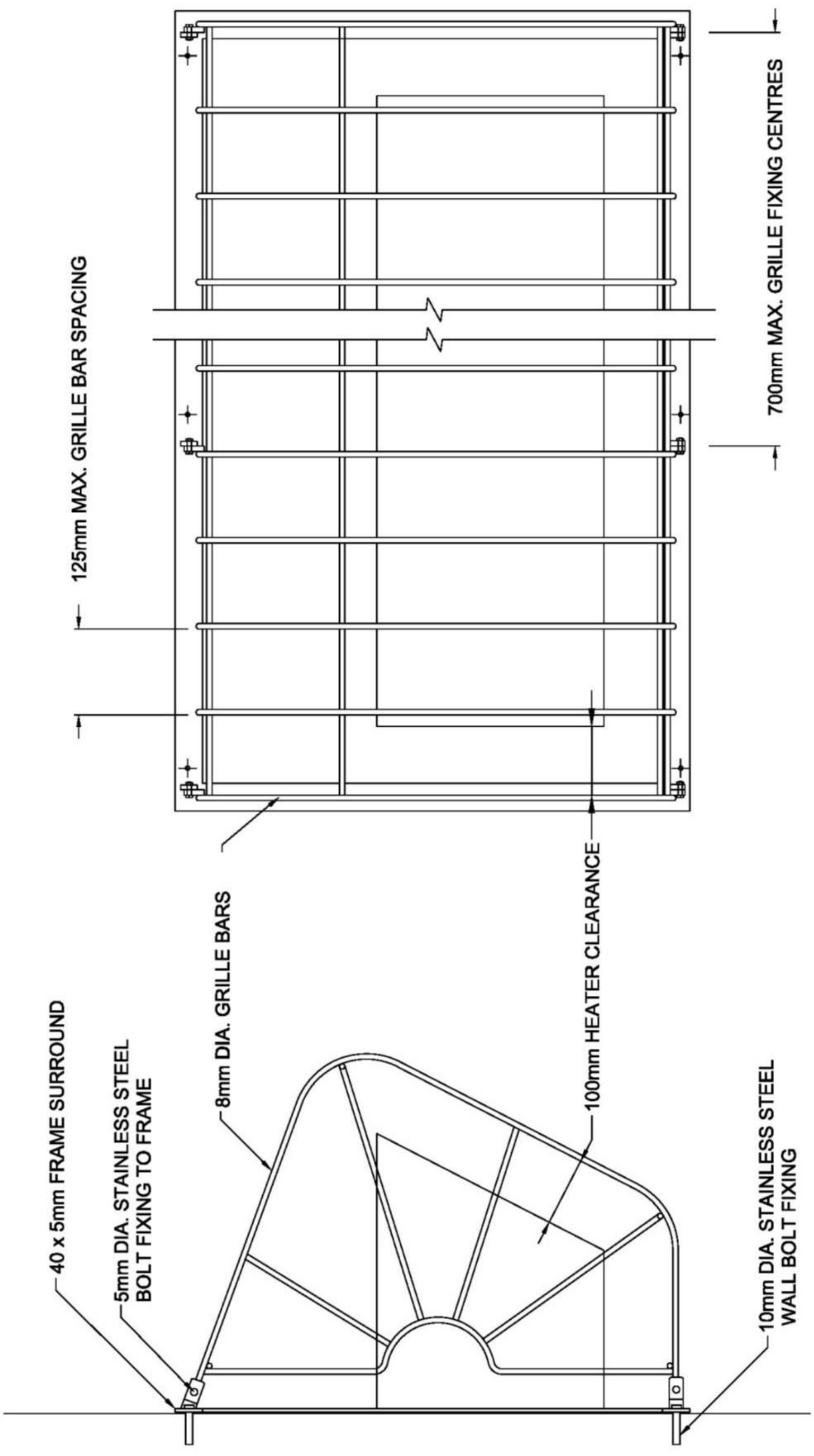


Figure 03: Grille, Wall Hung Radiant Heater - Secondary



0.04 Air Movement

Air Movement through a space is a mandatory requirement to provide fresh air to areas so that they can be occupied by people for a prolonged time. In simple buildings this is achieved by the use of operable windows located on two opposite sides to enable natural cross ventilation.

Where natural cross ventilation cannot be provided other forms of assisted ventilation will be required. The type of ventilation selected is to be determined based on a Whole of Life assessment of the individual situation.

The building regulations and AS 1668 provide direction on air movement and ventilation requirements.

The following sections provide information on the recommended ventilation forms.

Natural Ventilation

- Is required to all classrooms for comfort in summer and to maintain a healthy indoor environment.
- Where cross ventilation may be restricted (ie where rooms are located on each side of a corridor, at least one whole wall of operable windows plus ceiling fans are required, to provide air movement.
- Some windows need to be operable in driving rain and so must be protected with appropriately designed weather hoods, eaves overhang or other method of protection.

Ceiling Void Ventilation

- Provide ventilation so as to remove hot air build-up in large enclosed roof spaces. Roof mounted turbo ventilators are on approved method.

Refer to 04 ENCLOSURE/0421 ROOFING - COMBINED

Louvres

Louvres are good at allowing air in from the windward side of a building, but poor from the leeward side. They should not be used where there is poor cross ventilation.

Louvres are to be used on mechanical intakes and discharges, in plant rooms and are to be operable where they serve a naturally ventilated habitable space.

Louvres are to be weatherproof and be fitted with vermin mesh.

Sanitary Spaces

- Require greater air circulation than that required by building regulations, with sufficient natural ventilation or mechanical ventilation, to disperse odours and /or humidity.
- Cross ventilation is to be used where possible.

Storage Spaces

Are to have permanent air ventilation openings (without compromising security), to prevent concentration of odours.

0.05 Ventilation

Scope

A ventilation strategy must be developed to ensure that sufficient ventilation is provided to all spaces to meet the requirements of the BCA/NCC and associated standards.

Each room and space must be categorised as required by the BCA into the associated groups, including:

- Habitable spaces, where people will occupy for a time longer than 20 minutes, including all teaching spaces, libraries, offices and toilets.
- Storage spaces.

The need for ventilation equipment must be minimised by employing passive sustainable design principles (e.g. good natural ventilation, rotary ventilators etc).

Where active ventilation systems are required, they must be designed from a Whole of Life" (WOL) perspective to provide:

- Value for Money.
- Fits for purpose.
- Long term reliability.
- Minimal maintenance requirements.
- Low maintenance costs.

Specifically, ventilation equipment must:

- Enable healthy learning environments with indoor air quality (IAQ) that supports learning and teaching (i.e. IAQ that is fit for purpose for schools).

- Support sustainable design principles including reducing energy consumption.
- Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed.

The ventilation systems may include any or all of the following:

- Natural ventilation.
- Mechanical ventilation.
- Mechanical exhaust and fume extraction.
    - Dust extraction from machine.
    - Duplicating printing room ventilation.
    - Fume cupboards and exhaust cabinets.
    - Chemical store ventilation.
    - Ceramic kiln ventilation.
    - Hot metal exhaust ventilation.
    - Darkroom ventilation.
    - Welding area ventilation.
    - Toilet and change room ventilation.
    - Kitchens (materials learning unit).
    - Light commercial kitchens.

The installations must comply with the requirements of the BCA/NCC and related standards.

Documentation

As part of the design process the following documentation will be required for all jobs:

- Cooling system strategy including Whole of Life analysis.
- Concept plans.
- Construction drawings.
- Trade-based Specification.
- Work-as-executed drawings.

Provide construction and work-as-executed drawings in industry recognised DWG CAD file format as well as PDF format.

All drawing sets shall include:

- Site plan (1:500 or 1:1000).
- Layouts (1:100).

- Plant rooms, details and sections (1:50; 1:20).
- Power and control schematics (NTS).

Equipment schedules (NTS) Drawings shall be drafted in CAD file formats approved by DoE.

Design approach

Ensure effective co-ordination between disciplines. Organise the information from all sources to meet a set programme.

At sketch plan stage:

- Locate and estimate the size of the plant rooms in consultation with the Architect.
- Design appropriate ventilation system.
- Co-ordinate with other disciplines for provision of water supply, tundish for drain, power supply, structural openings etc, associated with the ventilation system.
- Prepare life cycle cost analysis as required. Assets requiring life cycle costing would include exhaust systems, supply air systems.
- Prepare estimates as required.
- Ensure that compliance is met with AS1668 Parts 1&2. This is particularly the case with ventilation rates, distances between intakes and exhaust points, also distances to boundaries, adjacent buildings and trafficable areas.

Equipment Life-Cycle Cost Calculations

For new schools and when replacing or updating major ventilation system components, a simple life-cycle cost should be calculated. This should be based on the Life Cycle Cost considerations following over a period of time, e.g. 20 years and/ or the life of the asset.

As part of the Whole of Life analysis, the life cycle costs must consider the following:

- Capital cost of the asset.
- Capital cost of any supporting/ enclosing structure (plant rooms/ platforms) and/ or servicing equipment (e.g. access ladders etc).
- Multi-service integration and interface - provision (and costs) of any supporting services (e.g. power etc.).
- Reticulation of ductwork, piping and of cables, if applicable.
- Provision for expansion of plant and equipment (if a likely possibility).
- Resource (power etc.) consumption costs. Based on; 1 year, 5 years, 10 years and / or 20 years. Resource consumption costs should be based on likely rates, envisaged usage requirements (seasonal and hours of operation).

- Maintenance required and cost of this maintenance for the realistic life span of the asset.
- Frequency, nature and costs of capital upgrades needed over the life of the asset to maintain fit for purpose.
- Cost of disposing of the asset or its components.

The following should also be considered:

- Future improvements and updates. Flexibility and change.
- Value for Money from any chosen material, equipment or product.
- Life span of the asset.
- Accessibility for servicing.

Design Conditions

- Noise criteria: NR 45

Refer to 00 PLANNING AND DESIGN/0001C DESIGN CHECKLIST - ACOUSTICS

Selection of ventilation system

- To suit the areas served.
- To achieve indoor air quality complying with Codes and Ordinances.
- Ensure that design complies with AS1668.2 and NCC(BCA).
- A low maintenance ventilation system is recommended.

Natural ventilation

- Provide by way of building openings allowing cross ventilation, and induced by thermal currents created via high level vents.
- Fully analyse local site conditions to allow for the impact of winds upon openings that may affect the operation of a facility (particularly canteens).
- Consider the impact of opening windows on internal noise levels.
- Ensure that all permanent openings (eg louvres) have a vermin mesh.

0.06 Ducted dust extraction

A ducted dust extraction system is required in materials handling learning areas within secondary schools. This system transports the fine air-borne wood particles from the work face via ducting to a dust extraction unit, where they are separated from the air and collected.

Consideration should be taken of noise at the boundary.

References

The areas and machines to be treated are stipulated in the EFSG SECONDARY SCHOOLS.

Dust Extraction Space

Provide a separate Dust Extraction space adjacent to Materials Workshops if required.

Minimum clear internal dimensions are 1800 mm (depth) x 3600 mm (wide) x 3500 mm (height).

Construct enclosure to provide noise isolation, protection from vandalism and weather protection.

Door opening to be central to the enclosure. Door opening to be minimum 1800 mm and height to be as high as the machine, minimum door height 2040mm.

Noise

To improve the noise attenuation of the surrounds to the dust extraction unit:

- All joints gaps and duct penetrations etc are to be acoustically sealed with silicon sealer.
- Door, jambs & heads, bottom and overlapping door stiles are to be fitted with acoustic seals.

Air Relief

"Cleaned air" to be discharged to atmosphere.

Door-Access and Security

Lock to be PW "E" keyed.

Access and Floor Levels

External access to the Dust Extraction space is preferred with no change in floor level at point of access, for maintenance purpose.

Minimum acceptable floor finish: broom swept concrete graded to door

Ceiling Levels

Avoid excessive difference in ceiling levels between Dust Extraction space and Materials Workshop in order to minimise bends, and so reduce pressure drop.

Machines for Dust Extraction - New School

Machines are nominated and supplied by the school. Liaise with DoE Project Director for the type and number.

A single dust extraction point can be used for air from a Disc Sander and Bandsaw, as generally both units will not be used at the same time.

Provide for a future (air shared) extraction point in the Machine Zone in each Materials Workshop Type 2 and Materials Workshop Type 3 if required.

Ductwork

Use circular high pressure fully welded pre-fabricated metal ductwork and fittings. Ductwork must be demountable by the use of quick couplings suitable for sawdust extraction. To reduce air pressure, drop, co-ordinate the grouping of machines to provide a balanced layout to assist duct design and to eliminate unnecessary long ductwork. Ensure that there is a least 400mm clearance between rear-side of lathes and adjacent partition or wall. Confirm the type and model of each wood machine in order to ensure the correct hood design.

Run ductwork clear of ceiling by 50-100 mm. Avoid ducts running directly in front of ceiling lights. If surface mounted or recessed lights are present, provide sufficient clearance to enable diffuser and fluorescent tube removal.

The aim of the layout is to achieve a balanced, equal resistance design, and minimise the static resistance whilst achieving acceptable internal noise levels.

Verify that ceiling or wall structures do not conflict with duct penetrations and duct runs (it is essential to avoid sudden changes in direction of ducts for materials handling). Check head height clearances from ductwork if structural beams force ductwork to be lowered.

Air Relief

Provide air relief from adjoining spaces. Minimise noise transfer through air relief paths to other parts of the school.

Heating

Where heating is necessary, use only ducted warm air heating or low surface temperature heaters.

Instruction Labels and Signage

Provide labels and signage to instruct the user in the operation and general maintenance of the system. Specify the appropriate labels from the Standard Instruction Label Sheet for inclusion in the project.

Controls

Provide remote “stop-start” controls in each of the spaces served by the unit.

0.07 Duplicating / printing room ventilations

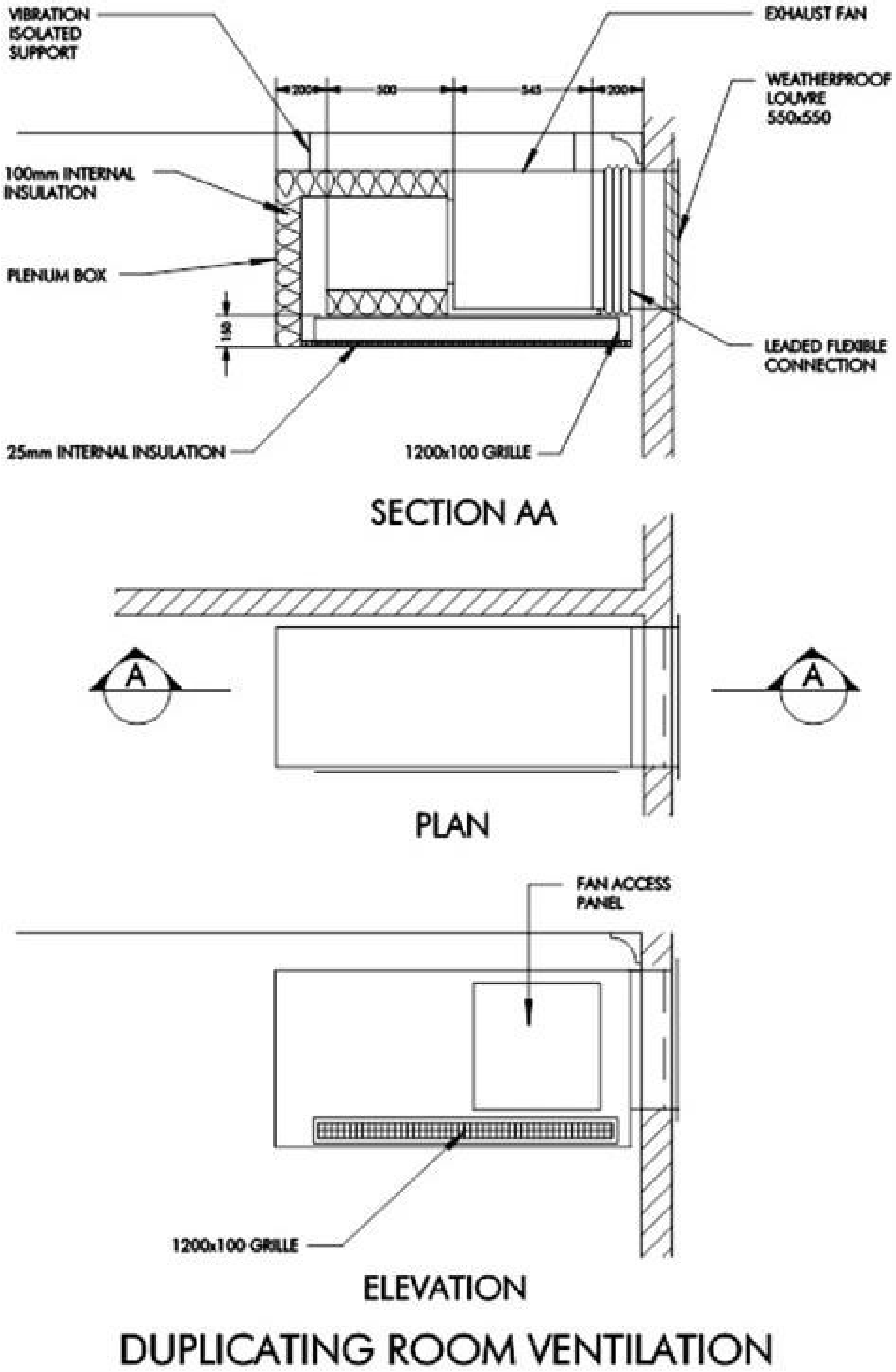
Modern dry photocopiers are designed for low emissions, provided they are properly maintained (including replacement of the ozone filter). The ventilation system is to be designed to serve the whole room and is not intended to provide localised exhaust at equipment.

Provide ventilation systems to meet the following performance requirements in new photocopier and printing rooms:

- Discharge air from the ventilation unit to the outside of the building via vermin proofed louvre.
- Draw Make-up air from inside the building through wall or door grilles.
- Inlet and exhaust grilles require security bars to preserve the physical security of the duplicating room.
- Locate the inlet/s and exhaust to achieve good airflow across the room in plan and elevation to pick up all machine emissions.
- Minimise noise emission from the ventilation equipment to the environment. Refer to section 11.04.
- Ensure the airflow doesn’t draw equipment emissions across operator’s face.
- Note that the room door in many schools may be left open in normal daily operation. Allow for this when locating the exhaust fan so that cross ventilation is achieved with make-up air drawn through the door opening.
- Install and treat the exhaust fan to achieve the internal noise level requirements in section 11.06.

- Provide controls for the operation of the exhaust system. This should be a variable speed controller located adjacent to the room lighting switch with minimum and maximum settings corresponding to the limits below. This switch is to be labelled with function and an instruction when it is to be used. Required speed range: minimum of 6 air changes per hour and maximum of 15 air changes per hour.
- Controls should also include a time clock restricting operation to normal school hours.
- When installing a new system in an existing building, remove any existing ventilation system and replace glazing or wall where there is an existing window mounted exhaust fan. Make good any damaged surfaces.
- Ventilation of old photo copiers will require a system to be designed in accordance with the equipment manufacturer’s instructions.

Figure 04: Duplicating Room Ventilation



0.08 Fume cupboard – single sided or double sided

Provide separate system for each fume cupboard. The ventilation system to strictly comply with AS2243.8 (Safety in Laboratories Part 8: Fume cupboards). Fume cupboards are to be located clear of openings and corners as required in the standard.

Exhaust Fans

UPVC Construction. The following types of fans, may be used:

- SISW centrifugal exhaust fan.
- This is recommended by the Australian Standard AS 2243 part 8.
- Bifurcated axial flow fan. This is the Departmental preferred option and is suitable for horizontal or vertical installation.
- Bifurcated in-line centrifugal. This is generally quieter and suitable for vertical installation only. Recommended only in circumstances preventing the use of other two options.

The Mechanical Engineer is to advise on the type of installation to be used. All exhaust fans are to be installed outside and supported from the building. Provide safe access for service of all fans as required for compliance with WH&S

Fans are to run continuously whilst class is in use and fan speed is to vary to provide exhaust volume control depending on sash height of fume cupboard

System to maintain a constant air velocity at the fume cupboard opening

Ductwork

Use equal friction method for duct sizing with 1 Pa/m maximum pressure drop or 5 m/s maximum air velocity.

Ductwork design to comply with AS 4254.

Materials: UPVC or Special Grade Stainless Steel.

Ductwork is to run outside the building well clear of any air inlets. Ductwork should follow the most direct route from the cabinet/cupboard to a point of discharge keeping bends to a minimum.

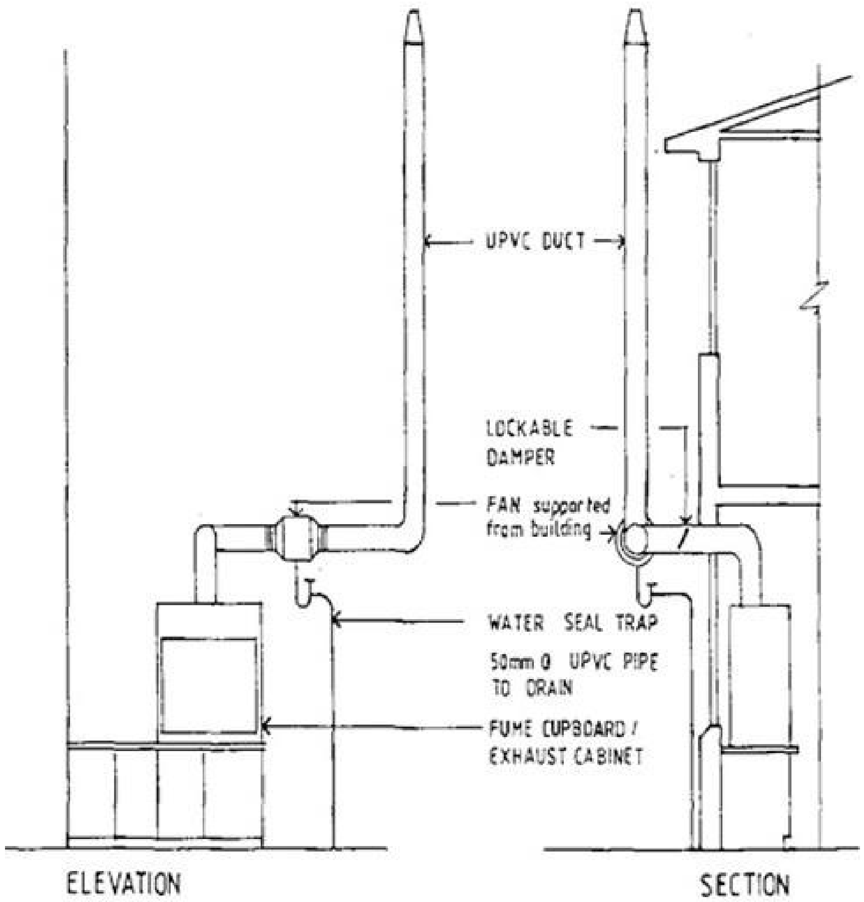
The discharge position and arrangement are to comply with AS 2243 part 8.

Minimise horizontal duct runs and if unavoidable, slope duct towards a drainage point.

Drainage

Connect a permanently plumbed-in drain of 50 mm UPVC pipe to the lowest point of the fan casing to permit disposal of condensate. To prevent recirculation of fumes, the drain is to incorporate a water seal or P-Trap.

Figure 05: Fume Cupboard and Exhaust Cabinet



0.09 Chemical store ventilation

Introduction

Provide mechanical exhaust system with high- and low-level exhaust points to all chemical stores, with a minimum of 15 air changes per hour flow rate.

Air Discharge

Discharge air according to the requirements of BCA. The discharge outlet is to be fitted with bird wire mesh.

Fresh Air Intake

Provide make up air to all chemical stores, (to replace exhausted air) through openings in an external wall, fitted with weatherproof louvres. All grilles and louvres are to be fitted with vandal proof bars and be fitted with vermin mesh.

For security and fire rating reasons do not use windows/doors or door grilles for air intake.

Control

The Chemical stores ventilation systems are to run continuously.

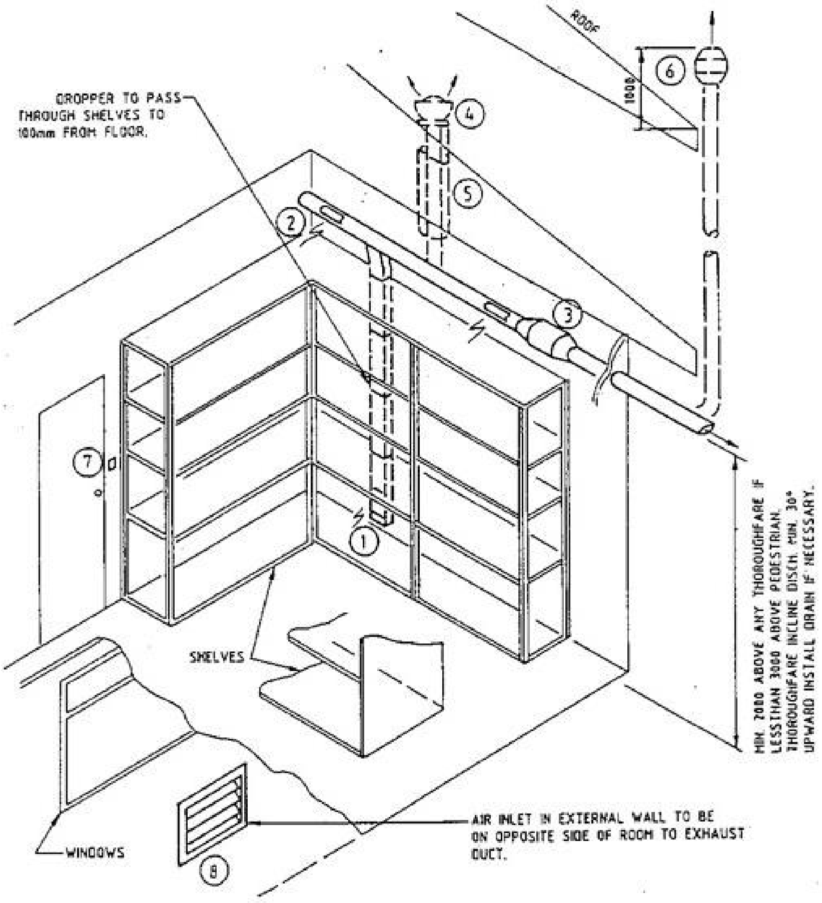
Ductwork

Use equal friction method for duct sizing with 1 Pa/m maximum pressure drop or 5 m/s maximum air velocity.

Ductwork design to comply with AS4254.

Ductwork to be bracketed against or close to wall and allowance to be made for a 150 x 150 mm dropper. Provision to be made for dropper to penetrate shelving to 100 mm from floor for low level exhaust intake.

Figure 06: Chemical Store Ventilation System



Low Level Exhaust
High Level Exhaust
In-Line Centrifugal Fan
Alternative Roof Mounted Vertical Discharge Exhaust Fan
2 Hour Fire Rated Enclosure for Duct to Roof Mounted Fan
Alternative Vertical Discharge Cowl
Control Switch
Air Inlet Louvre in External Wall.

0.10 Ceramic kiln ventilation

Where open mesh walls are provided in accordance with EFSG, mechanical ventilation is not required.

A mechanical exhaust system must be used in the following situations:

- Kiln spaces without a mesh/ louvre external wall.
- Kiln spaces with a low ceiling.
- Kiln spaces with a ceiling which can trap hot air; or
- Kiln spaces where the exhaust area is a passage, food area or similar.

Install a separate stainless-steel hood and stainless-steel fan above each kiln. Stainless steel sheet metal ductwork must be used for kiln exhaust system.

Refer to the ASHRAE Handbook for guidance on the face velocity at the hood.

The general arrangement is described below.

Exhaust Fans

Exhaust fans may be vertical discharge mixed flow roof extract types or duct mounted axial flow type. Axial flow type fans are to be installed above the roof and fitted with a weatherproof vertical discharge cowl. Ensure fans or other equipment are located in positions where safe roof access has been provided for maintenance.

Air Discharge

Discharge air according to the requirements of BCA.

Discharge to be vertical above roof and well clear of any adjacent building to avoid corrosion by the fumes extracted from the exhaust fan. The discharge outlets are to be fitted with stainless steel bird wire mesh.

Controls

For each kiln exhaust fan provide an on-off switch with red indicating light and labelled “gas fired/electric/No.1 kiln exhaust fans”, as applicable.

0.11 Hot metal exhaust ventilation

Provide galvanised steel exhaust hood over all hot metal workstations to remove the fumes and hot air.

Where hot metal and welding share the same area provide separate ventilation for each service.

The exhaust system is to be designed to ensure the Noise Rating level NR45 is not exceeded for the area where the exhaust hood is located.

Exhaust Fan

Use in-line duct-mounted exhaust fan, or a roof-mounted exhaust fan providing that all necessary safety precautions are implemented and safe access is provided for maintenance.

The fan is to be sized to ensure a uniform air velocity of 0.6m/s across the face of the hood.

Air Discharge

Discharge is to be vertical above roof and well clear of any building openings in accordance with the BCA/NCC.

Exhaust ducts that pass-through floors and rooms above are to comply with the fire-rating protection requirements in the BCA/NCC.

Fresh Air Intake

Provide for makeup air to enter the workshop, to replace the exhaust air. A weatherproof and vermin-proof grille suitably sized and fitted to an external wall/window is required.

Controls

Provide a fan on-off control with a 0 to 4-hour run-on timer, located near the workstation.

0.12 Darkroom ventilation

Introduction

Where dark rooms are included, a ventilation system will be required to provide safe and satisfactory working environment as required by AS. The system is to:

- Provide adequate fresh air.
- Remove noxious airborne substances.
- Maintain adequate comfort conditions.
- Provide general dilution ventilation.

Fresh Air Supply

Adequate filtered fresh air supply is essential in controlling both temperature and fume exhaust.

Supply air is to be from a source external to the building in accordance with the BCA/NCC.

Exhaust Air

Ensure that the dark room has a general exhaust system giving the rate specified in AS1668.2 but no less than a minimum of 15 air changes per hour as well as local exhaust to cover fume emissions.

Discharge the exhaust system vertically to the outside of the building in accordance with the BCA/NCC.

Use in-line duct-mounted exhaust fan, or a roof-mounted exhaust fan providing that all necessary safety precautions are implemented and safe access is provided for maintenance.

Ducts that pass-through floors and rooms above require fire-rating protection in accordance with the BCA/NCC.

Local exhaust should be at the source of fume emissions. Use side draft plenum type with horizontal exhaust slots 150 mm above the source. The slots are to have an air velocity of 10-12 m/sec at the face and 0.6 m/sec at 450 mm from face of slot.

Ductwork

Use equal friction method for duct sizing with 1 Pa/m maximum pressure drop or 5 m/s maximum air velocity.

Ductwork design to comply with AS 4254.

Both Air Supply and Exhaust systems shall be designed in accordance with noise levels noted in 00 PLANNING AND DESIGN/0001C DESIGN CHECKLIST - ACOUSTICS

Light Transmission

Ensure that external light does not enter the dark room. All penetrations or openings into the dark room are to be sealed or designed so that light penetration is not possible. All fittings are to be light-proof.

Heating

Provide temperature control to avoid unwanted chemical reactions, by heating the supply air system. Control the supply air temperature by a room thermostat.

Controls

Controls are required as follows:

- Provide 0-3hr adjustable run-on timer.
- Tempered supply air system – ON/OFF with thermostatic controlled heating.
- Exhaust air system – to be interlocked with supply air system.

The controls shall be located within the room. Location to be decided by the Architect.

0.13 Welding area ventilation

Provide mechanical exhaust points adjacent to each welding workstation.

Where welding and hot metal share the same area provide separate ventilation for each service.

Exhaust Point

- Provide extraction at the source of the fumes generated in the welding process by the use of an exhaust plenum.
- The plenums shall be of the side draft type with high and low exhaust points designed to remove the welding fumes away from the operator's breathing zone.
- Minimum exhaust capacity of 250 L/s per plenum.

Air Discharge

- Discharge fumes vertically to the outside of the building in accordance with the BCA/NCC.
- An in-line duct-mounted exhaust fan is to be provided, or a roof mounted exhaust fan would be satisfactory provided the necessary safety precautions are implemented and safe access is provided for maintenance.
- Ducts that pass-through floors and rooms above require fire-rating protection in accordance with the BCA/NCC.

Fresh Air Intake

- Include Provision for makeup air to enter the workshop to replace the exhaust air in accordance with the BCA/NCC.
- Use weatherproof and vermin-proof grille suitably sized and fitted to openings in external wall for make-up air intake.
- The use of windows/doors for air intake is not recommended.
- For large systems consisting of a number of exhaust points, a ducted filtered supply air system with heating is required.

Ductwork

- Use equal friction method for duct sizing with 1 Pa/m maximum pressure drop or 7 m/s maximum air velocity.
- Ductwork design to comply with AS4254.

- The exhaust system including ductwork is to be designed to provide a satisfactory operating system with maximum noise levels in accordance with noise levels noted in 00 PLANNING AND DESIGN/0001C DESIGN CHECKLIST - ACOUSTICS.

Control

The fan on-off control is to be located near the workstation, subject to the approval of the Design Architect.

0.14 Wind powered roof ventilators

School buildings can use wind powered roof ventilators with dampers to provide effective summer ventilation. Design to suit local ambient climatic conditions to ensure correct sizes, locations and numbers are provided for each particular application. Refer to manufacturer's specification's for assistance in system sizing according to various wind velocities.

Co-ordinate the locations of ventilators with the ceiling fans to achieve effective air movement.

Fan assisted ventilators should also be considered on days of low wind

Provide a wall mounted switch to open /close the damper.

0.15 Communication room

- Provide an exhaust ventilation system complete with exhaust fan, ductwork and fittings. Provide clean make-up air from outside the building.
- The exact heat output of the equipment along with the maximum working temperature should be confirmed by manufacturer as a guide of how to size the ventilation. Should the calculation indicate ventilation alone will not sufficiently control the air temperature to allow effective operation of the equipment due to make up air being at an unacceptable temperature, then air conditioning should be provided to this room.
- The system is to be thermostatically controlled to activate once the room temperature reaches the maximum working temperature of the equipment and is to run continuously until the room temperature falls to an acceptable level. Provide a manual override switch to the system.
- Avoid a rate of temperature change that exceeds the permissible limit of 1oC per 10-minute period.

- The room should preferably be windowless to avoid entry of sunlight and the associated solar heat gain.

0.16 Toilet and change room ventilation

- Provide mechanical ventilation to all Disabled Toilets.
- Apply mechanical ventilation where natural ventilation is not appropriate.
- Comply with BCA and Australian Standard AS1668 parts 1 & 2.
- Operate the system by time control equipment (time switches or run-on timers as appropriate).
- Provide door undercuts or door grilles for the makeup air.

0.17 Laundry

- Provide ducted exhaust ventilation in accordance with the BCA.
- The designer is to ensure minimum 15 air changes per hour.
- Equipment within the laundry may require additional mechanical services including the installation of flues, exhaust ducts etc. These are to be provided to the manufacturer's recommendations.

Make-up air for the mechanical exhaust system is to be provided by under cutting doors or by providing a door grille except where acoustic level requirements prevent this occurring.

0.18 Mechanical assisted cross ventilation

- In multi storey buildings where natural cross ventilation is not possible, mechanically assisted ventilation must be provided to learning spaces as nominated in the EFSG.
- The ventilation system is to be sized to provide at least 7 air changes per hour. The system is to be thermostatically controlled to activate when room temperature exceeds 28O C and is to run continuously until the room temperature drops below 27O C.
- Additionally, the system is not to be activated unless the outdoor temperature is lower than the indoor temperature and is to be immediately de-activated as soon as the outdoor temperature exceeds indoor air temperature.
- Provide programmable seven-day time clock and 0-2 hrs adjustable after-hour timer to control each mechanically assisted exhaust ventilation system.

0.19 Cupboards enclosing gas services

Where there is a risk of gas build up in a cupboard enclosing a gas service, (e.g. under a gas cook top and especially with LP gas), ensure the cupboard is adequately vented by way of solid metal grilles/vents in at least one side at the top and bottom.

Ensure ventilation rate and design is in accordance with the gas code AS5601 and ventilation AS1668.2.

Where bottled gas is used, the enclosure is to comply with relevant codes and standards.

0.20 Damper Operation Switch

Switches are to be on white faceplate with black lettering.

Figure 07: Typical Switch Layout for Damper Operation for Roof Ventilators

TYPICAL SWITCH LAYOUT FOR DAMPER
OPERATION FOR ROOF VENTILATORS

Specification

01 General

As per current NATSPEC.

02 Product

As per current NATSPEC.

03 Execution

As per current NATSPEC.

04 Selections

As per current NATSPEC.