## 05 – Roofing, Roof Fabric & Roof Safety

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Introduction

05.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

05.02 Notwithstanding any Consultant’s particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

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Specific Design Requirements

05.03 Roofs should not be used as plant areas. Where roof mounted equipment is required, install:

- on a structurally sound steel platform to be designed with a limited amount of roof penetrations; or
- on a structurally sound waterproofed concrete slab formed as the whole or part of the roof structure.

05.04 Consultants are to consider every roof penetration which could present a potential roof leakage point.

05.05 Polycarbonate is not to be used as a roof sheet material.
05.06 Fibreglass is not to be used as a roof sheet material.

05.07 The Consultant shall consider Safety in Design principles for roof construction, roof access and roof maintenance.

05.08 Internal box gutters are not acceptable, stringent design standards are applicable to gutters located on the inside edge of external wall parapets.

05.09 No downpipes are to be incorporated in structural building elements such as columns.

05.10 Roof, gutter and stormwater water noise must be considered and mitigated where issues are anticipated.

05.11 Overflows are to be provided to all roofs and gutters as a safeguard against flooding. Overflows are to discharge clear of building lines and pedestrian paths or bridges.

05.12 As a minimum roofs and roof drainage systems are to be designed for a 1:100 year return rainfall intensity. Specific projects may be assessed as a higher risk.

Roof Penetrations Generally

05.13 When a roof penetration is required only a complete composite proprietary roof flashing system is to be specified for sealing pipes and penetrations. The system is to include all internal and external gaskets and boots.

05.14 Each proprietary roof flashing kit installed is to have a 20 year warranty.

05.15 For single pipes and penetrations only specify products suited to that purpose.

05.16 For roof penetrations where a set of condensing pipes can be grouped and passed through the roof fabric specify only Deks Top Hat Roof Kit or equal equivalent.

Roof Sheeting and Flashing Specifications

05.17 For all roof sheeting and flashing the following specifications apply:

- roof sheets shall be a minimum of .48 BMT (base metal thickness). Specify the heaviest gauge available in the product range;
- roof sheets should be 700 series Stramit or Bluescope with proprietary purpose made accessories including concealed fixing brackets. (Roof sheets with no screws, helps eliminate roof leaks.);
- use only the manufacturers standard colour range;
- flashings and gutters to be .60TCT (Total coated thickness);
- all fixings should be class 3 or 4;
- do not use aluminium rivets, unless it is an existing aluminium roof. Use only blind steel rivets;
- syphonic drainage shall not be used in areas where there is any chance of leaf litter. (This covers most ANU buildings and environments.);
- due to the large amount of traffic on our roofs, battens or C-sections supporting the roof sheeting shall not exceed 800 mm at the top end and bottom of the roof sheets. the intermediate supports shall not exceed 1000 mm;
- ensure that roof sheets are protected when welding or cutting;
- use a cold cut saw blade or tin snips when cutting out sheet metal;
- on completion of roof work, all metal fillings, pop rivets, screws, pieces of metal and any other excess materials to be removed. Ensure roof is left neat and tidy; and
- roof sheets under no circumstances should have a fall of less than 5 degree. A greater degree is better.

05.018 Due to the amount of equipment placed on ANU roofs, it is essential to follow these guidelines. Roofs should not become plant rooms as increases in roof penetrations will increase the potential for roof leaks.

Apron Flashings

![Diagram of Apron Flashings]

- Roof sheet must be turned up before placing flashing over roof sheets
- Drip edge
- 3deg fall
- 300mm minimum cover
- Roof sheet must extend under the flashing a minimum of 250mm
Apron Flashings to be installed with a dry tray

Note - This can be a full section or over lapped as shown

Correct
Drip edge

3 deg slope in capping

Incorrect

No dry tray

Note: This can be a full section or over lapped as shown

Drip edge

3 deg slope in capping

Correct

Dry Tray

Note: This can be a full section or over lapped as shown
Back Trays

Correct method of installing a back tray

a/ End view

Suitable support for back tray timber or high density polystyrene.

Note: Tray must have a support unless the width of the tray is under 75mm

b/ Side view

2 runs of silicon

150mm lap with the high side lapped over the low side

c/ End Finish

Lower end of back tray

Ends of bent down to suit the profile of the roof sheet.
**Requirements for Box Gutters**

05.019 The sizes indicated below are minimum sizes. Larger sizes may be required and are to be calculated to accommodate a 1:100 year return rainfall intensity.

On buildings that require box gutters the internal section of the gutter is to be 75 mm above the external side of the box gutter.

The box gutter is to be made in one piece extending over the external wall or fascia.

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**Rain head preferred concept from a box gutter.**

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**Note:**
- Box gutters with rain head outlets can be used on buildings that have roof and gutter upgrades.
- The removal of water from the box gutter is of prime importance. Do not reduce the flow from the gutter to the rain head.
Valley Box Gutters

a/ Conventional vee shape valley gutters
Only to be used on roofs over 22deg pitch

b/ Valley box gutters to be used on all roofs under 22deg pitch
Size of the valley box gutter depends on roof area, rain fall and the amount of leaf litter.

Box valley gutter to be cut into the back of the box gutter or external gutter

Size of the valley box gutter depends on roof area, rain fall and the amount of leaf litter.
Refer to AS:3500
Roof sheet not to extend into the box section any more than 60mm to allow for easy cleaning
Vent Pipes

**05.020** Only one proprietary roof flashing kit shall be used for each single pipe/ conduit that penetrates the roof. Fluted flexible electrical conduit will not be accepted. Only smooth surfaces shall be flashed in this way.

Walkway Supports

a) If walkways are specified in aluminium, they are to be 22 mm in thickness or greater.

b) Wherever a walkway joins, a support must be placed as close as possible either side of the join. Supports are to be placed no more than 250 mm apart.
Support of Equipment on Roofs

Note: When there are multiples of equipment a platform should be used

Never place the supports in the tray of the roof sheet, this restricts the flow of water and traps leaf matter

a/

Place a rubber seal between the two metal surfaces

b/

Some examples of the correct support on roof sheets

Ensure there is structural support within the building frame work to carry the load intended

c/

d/
Roof Penetrations

Exception to dry tray rule

a/ Seal flange to tray so that it is water tight

b/ Install back tray

c/ Install Dektite

This would only be suitable for pipes or tubing up to 100mm.
**Cross section of a roof penetration**

*d/

Seal

--- 80mm down minimum 70mm exposed ---

80mm down minimum 70mm exposed

--- Roof sheet support ---

--- Extra support if over 300mm ---

--- Roof sheet support ---

--- Water flow ---

--- 150 turn up ---

--- For larger roof penetrations ---

*e/

**Overflushing**

--- 150 mm turn up ---

--- Dry Tray ---

Support top and bottom of roof sheet and sides if over 300mm

Turn down front of back tray to suit profile roof sheet.
End Capping/Barge Capping

a/

Top end of sheet must be turned up

300mm minimum cover

Drip edge

A minimum of 250mm of cover over the roof sheet.

b/

Ends of capping must be turned down

300mm minimum cover

End sheet overlaps side sheet

Dry tray

c/

Ends of capping must be turned down

Ridge Capping

a/

Top end of sheet must be turned up

300mm minimum cover each side
Roof Drainage from Gutters

a/ Syphonic systems for roof drainage should not be used where there is any chance of leaf litter.

b/ Recommended down pipe size to be 150mm with grated drain at ground level

c/ Residential buildings such as individual dwellings, 50mm round or 100mmx75mm to be the minimum size and a grated drain still required

d/ Internal downpipes may only be used as per details below.
**Mechanical Plant on Roofs**

05.022 Where possible, the best location for such plant is not on the roof, as this increases the probability of roof leaks. If such plant is to be placed on the roof, it should be placed on waterproofed concrete roofing slab sections designed to bear the structural live loading of such equipment.

05.023 If mechanical services equipment has to be located on metal deck roofs that have no designated concrete slabs to accommodate the plant, well designed structural steel platforms with galvanised finish shall be provided to accommodate and distribute the weight of mechanical services equipment such as chillers, boilers, air handling units, fan coil units, fans, fume scrubbers, cooling towers, process cooling units, storage tanks, pumps, air cooled condensing units, refrigeration condensing units and switchboards.

05.024 In the specific situation where multiple air cooled condensing units are to be installed, these should be placed on a platform as indicated. This general principle shall be used to accommodate all items of mechanical services equipment.

Spread the weight over the ribs of the sheet so as not to restrict water flow.

Incorrect | Correct
---|---
Rubber boots to roof flashing kits should be pulled up correctly and not placed in the middle of the tray (pan) of the roof sheet.

Incorrect | Correct
Have pipe and conduits enter as close to the condenser as possible and install metal protective cover

Single pipe or conduit is the only time a proprietary roof flashing kit is to be used without a protective cover
Protection from potential damage caused by birds must be provided

Must have a metal protective cover, or encased in a PVC or metal pipe and elbow

Correct installation using a proprietary roof flashing kit

Correct installation of an over flashing

Installation of penetrations and flashing should not result in restricted water flow from the roof desk/surface
ANU Height Safety Specifications

Safety Lines and Components
- All wire ropes and components exposed to the elements must be stainless steel.
- All systems must be able to withstand fall arrest loads.
- All systems must have end supports connections capable of withstanding a minimum of 40 kN.
- All systems must be fitted with permanently connected shock absorbers. If calculations are provided to show that the loads are low enough to not require shock absorber this may be allowed.
- All systems must be designed to protect personnel from reaching the ground if a fall occurs.
- All systems where possible should be capable of two person operation, where lines are very short a single person capability will be accepted, providing this is clearly indicated on system data plates.

Safety Anchors
- All anchors and components exposed to the elements must be stainless steel.
- All anchors must be of a load reducing style.
- All retro style pins must be attached to the roof structure. A single piece stainless steel adaptor plate may be used, providing they are fitted with a stnp seal where the structural rivets penetrate the roof sheetong, anchor load capability must be maintained to Australian Standards.
- At least two transition anchors or transition line anchors shall be lotted to allow safe access from ladder brackets to roof. (Accepted in existing installations only) But all new Installations require a stainless steel transition line to be used to gain access to the roof. Approximate length of line is to be 2.0 m.

Ladder Brackets
- All access ladder brackets must be stainless steel.
- Provision shall be provided to allow the ladder to be tried off to the bracket

Permanently Connected Ladders
- New/refurbished buildings must have internal access to the roof.
- Shall be manufactured from aluminium or galvanized steel.

Roof Seals
- Use stainless steel plates when placing anchor points in trays on roof decking as a roof seal.

Personal Protection Equipment (PPE)
- Extra PPE is not required unless specially required for the system.
Roof Safety Layout and Roof Safe Area

05.025 Examples of roof safety layout and roof safe area.
Correct Installation of Safety Systems

05.027 Included below are pictures and diagrams illustrating ANU requirements. The aim is to have continuity throughout the ANU. Facilities and Services are responsible for the maintenance of ANU roofs while reducing the amount of ongoing maintenance required.

- Contractors are to comply with all Australian Standards, authorities and State Government Regulations/Requirements as well as ANU installation practices.
- Seek technical advice from the Principal’s Representative (the Principal or the Principal’s Project Manager) before installing an anchor point into the pan. This must only be carried out when there is no other option.
Location of Harness Anchor Points

Figure 1
Indicates preferred method of no fixing in the tray.
This applies to anchor points as well as static points.
Figure 2
Indicates static line which is the ANU preferred method for safety systems.

Figure 3
If fixing into the structure under the roof sheet, where possible go through the rib of the sheet as indicated.

Figure 4
If fixing into the structure under the roof sheet, where possible go through the rib of the sheet as indicated.

Figure 5
Fixing into the pan must be carried out using a stainless steel plate as indicated.
Note: Do not use a proprietary roof flashing kit designed for pipework.

Figure 6
Do not place fixing plate too high on the roof as indicated.
Roof safety systems certification

05.028 All roof safety systems must be certified on an annual basis in accordance with the relevant State or Territories requirements.

Preferred method of roof entry with ladder access
Fixed Ladder Installations

- Adhere to applicable Australian Standards.
- Step-through styles extend to 1000 mm above upper roof level.
- Only have ladder at 90 degrees if no other option.
- Stepping plate to be 900 x 600 mm.

Signage Requirements

- Signage must be provide by contractor for certifying contractor’s safety system.
- If there are skylights there must be signage to indicate location.
- The ANU has its own signage which will be provided for the contractor as shown in below.