

7.1 MECHANICAL SERVICES**7.1.1 GENERAL****7.1.1.1 Aims**Air-conditioning Load Calculations

Calculate the cooling and heating loads using one of the following:

Manual methods: AIRAH DA9, ASHRAE or Carrier.

Electronic methods: ACADS-BSG Camel, Carrier E20 or Trane Trace.

Design

General: Provide systems designed in conformance with the following unless specific items of equipment are identified in the schedules.

Outside design conditions: Use outdoor design conditions listed in AIRAH DA9, Table 1 or Table 1A for the location geographically closest to the site and Comfort Conditions.

Inside design conditions:

Summer: 25°C dry bulb, 50% relative humidity

Winter: 20°C dry bulb.

Zoning: Divide the systems into temperature controlled zones to suit the proposed uses of the facility and heat loss/gain conditions.

Fresh air: Supply fresh air to spaces with airconditioning systems via the air handling systems as applicable.

Windows, walls, floors and roofs: Refer to drawings for construction and insulation.

Lighting load: Refer to drawings for lighting layout and details.

Supply air: To each airconditioned space $\geq 4.5 \text{ L/s/m}^2$ at all times the plant is operational.

Ambient noise emitted: Lower than the level that can be heard within a habitable room in any neighbouring premises, regardless of whether any door or window to that room is open.

Fire separation: Refer to drawings.

Heating: Use reverse cycle plant to provide heating.

Duct design: Size ductwork as follows:

Rigid sheet metal duct: $\leq 6 \text{ m/s}$ and $\leq 1.2 \text{ Pa/m}$.

Flexible duct: $\leq 4.0 \text{ m/s}$.

7.1.1.2 SubmissionsGeneral

Before starting work, submit the following for approval from the Engineer:

Outside design conditions, corresponding geographic location and source of data.

Calculated total and sensible cooling capacities and heating capacity.

Name of calculation method used.

Makes and model numbers of proposed equipment.

Any assumptions on which the calculations are based.

Details of any departures from this specification.

Details of fire provisions.

A drawing of the proposed duct, pipe and equipment layout. Show proposed zoning and methods of heating.

7.1.1.3 Inspection

Notice

Give sufficient notice so that inspection may be made of the equipment in place before connection and commissioning.

7.1.2 PRODUCTS

Refer to **Non-ducted** and **Ducted Air Conditioning System Schedules** for details.

7.1.2.1 Airconditioning Equipment

Standards

Ducted airconditioners: To appropriate international standards from country of origin.

Non-ducted airconditioners: To appropriate international standards from country of origin.

Equipment

Performance: Provide equipment as follows:

Is made by a manufacturer with a demonstrated ability to provide spare parts and service promptly to the site.

Will operate within the specified range of outdoor design conditions under the calculated loads without excessive head pressure or icing.

Reverse cycle units: Provide an effective outdoor coil defrost facility that prevents room temperature dropping more than 3°C during defrost.

Cabinet: Aluminium, powder coated steel or moulded ABS plastic with metallic-coated steel or stainless steel fasteners. Insulate and vapour seal cabinet and drain trays to prevent external condensation under all operating conditions.

Drain trays: Aluminium, stainless steel or plastic to collect all moisture inside indoor and outdoor units.

Filters: Washable panel type.

Coils: Copper tube with aluminium plate fins.

Controls

Provide the following functions:

Temperature control for each zone located to accurately sense zone temperature.

Fan speed selection for multi and variable speed fans.

7.1.2.2 Electric Duct Heaters

General

Standard: To appropriate international standards from country of origin.

Elements: Sheathed in steel or nickel alloy.

Frames: Assemble elements in a galvanized steel frame with terminal connections contained in an enclosed terminal box.

Heating section: Install to allow access to the terminal box and removal of the assembly without disturbing other components.

Refer to **Power Accessories Schedule**.

7.1.2.3 Grilles and Diffusers

Refer to **Air Grills Schedule** for details.

General

Size and locate diffusers to provide even air distribution and temperatures without draughts.

Ceiling diffusers: Provide at least one per airconditioned room and at least one per 12 m².

Construction:

Variable volume diffusers: Powder coated pressed steel.

All others: Powder coated aluminium.

Dampers: Provide a damper to each diffuser and grille. If connected by flexible duct, locate the damper at the duct spigot unless a damper in this position is inaccessible.

Supply Diffusers and Grilles

Louvre ceiling diffusers: Multi-bladed, removable core 4-way blow configuration, fitted with a matt black blanking plate for 1, 2, or 3-way blow, as appropriate. If the outlet neck is smaller than the outlet necessary to suit the louvre face size, provide a matt black reducer neck.

Side wall registers: Double deflection type with horizontal front louvre blades and vertical rear blades at 19 mm maximum centres, capable of field adjustment of air throw over the range □ 45°. Support blades > 600 mm long at mid point on a notched support bar.

Return or Exhaust Grilles – Indoor

Ceiling and wall louvre type: Half chevron louvres at 25 mm maximum centres.

Egg crate type (ceiling use only): Elements at 90° to each other, and at 15 mm maximum centres.

Door grilles: Full chevron, 50% minimum free area. Frame to suit door thickness.

External Intake and Discharge Louvres

General: Refer to *Windows* worksection.

7.1.2.4 Fans

Refer to **Power Accessories Schedule** for details.

General

Guards: Provide galvanized steel or bronze mesh guards.

Steel components: Corrosion protect by zinc plating or better.

Motors in air stream: Direct mount to impellers. Provide terminal boxes external to fan casings and wired to fan motors.

Motor minimum degree of protection: IP55.

Bearings: Provide sealed for life or grease packed bearings.

Balancing: Dynamically balance impellers.

Connections: Provide flexible duct connections at fan.

Centrifugal and Mixed-Flow In-Line Fans

Casings: Rectangular or circular manufactured from metallic-coated steel sheet, fibreglass or plastic with spigot or flanges for duct mounting.

Impellers: Backward or forward curved blades, constructed from metallic-coated steel, aluminium or polypropylene. Provide fans with non-overloading power characteristics.

Propeller Fans

Mounting: Mount on contoured diaphragm plate.

Impellers: Aluminium or UV stabilised ABS or polypropylene.

Window or Wall Mounted Fans

Propeller type: Complete with isolating mountings, discharge cowls or louvres, birdmesh guards and backdraft shutters.

Roof Mounted Fans

Type: Centrifugal, mixed flow or propeller. Comply with the respective clauses above.

Housing: House fans in compact bases fitted with weathering skirts and manufactured from zinc-coated steel or UV stabilised plastic or composite.

Finish:

Metallic-coated steel: UV stabilised powder coat to match roof colour.

Other materials: Manufacturer's standard colour.

Vertical discharge fans: Provide weatherproof galvanized steel, plastic or aluminium backdraft dampers where the weather may enter when units are stopped.

Birdmesh: Where backdraft dampers are not fitted, provide birdmesh guards.

7.1.3 EXECUTION

7.1.3.1 Ductwork

Rigid Duct

Material: Metallic-coated sheet steel.

Flexible Duct

Material: Alumidised fabric clamped on formed metal helix with insulation blanket wrapped around duct and covered with an outer vapour barrier.

Installation: Install flexible duct as straight as possible with minimum number of bends. Maximise bend radius. Check for and rectify any crushed flexible duct.

Support: Limit sag to < 40 mm/m.

Duct Insulation

Insulate ducts to reduce heat gain and prevent condensation. Provide continuous vapour barrier around ducts carrying conditioned air. Insulate flexible connections on ducts carrying air below ambient temperature.

Cleaning

Clean interior of ductwork progressively during installation.

7.1.3.2 Refrigeration Pipework

General

Conform to equipment manufacturer's recommendations for the refrigerant used.

Deemed to comply: Split system manufacturer's standard pre-charged piping kit.

Pipe Insulation

Insulate all refrigerant and drain piping that may sweat with chemically blown closed cell nitrile rubber in tubular form to ASTM C534. Apply to manufacturer's recommendations. Protect insulation from sunlight and mechanical damage.

Insulation thickness: 13 mm for pipes < DN 20, 19 mm otherwise.

Condensate Drains

Provide trapped \geq DN 20 condensate drains from each indoor coil and safety tray. Provide drains from each reverse cycle outdoor coil unless casing freely drains to a roof or other location where condensate will not cause damage or pond.

7.1.3.3 Unit Installation

General

Supply all components and install to manufacturer's recommendations.

Outdoor equipment: Provide clearance around units for condenser air flow and maintenance access. Ensure discharge air does not short-circuit to condenser intake.

Equipment at ground level: Mount on 100 mm high concrete plinth or equivalent impervious material.

Duct connections: Provide internal or external flexible duct connections at indoor unit.

Vibration Isolation

Suspended units: Provide \geq 4 metal spring or rubber-in-shear isolation mountings with \geq 25 mm static deflection and 98% isolation efficiency.

Floor mounted units: Provide neoprene waffle pads. Bolt in place.

Safety Trays

If leaks or condensation from equipment could cause nuisance or damage to the building or its contents, provide a galvanized steel safety tray under the equipment.

7.1.3.4 Completion

Commissioning

Commission the systems to manufacturer's recommendations. Check ductwork for leaks. Test all safety controls by simulating fault.

Air quantities: Balance systems to accord with design air quantities.

Tolerance on air quantities: +10%, -0%.

Check list: Submit signed commissioning check list on completion.

Cleaning

Clean filters, outdoor coils, grilles and diffusers on completion.

Operating and Maintenance Instructions

Provide written operating and maintenance instructions containing:

- Contractor's contact details for service calls.

- Manufacturer's maintenance and operation literature.

- Manufacturer's warranty certificates if the manufacturer's warranty period is greater than the defects liability period.

- Description of day to day operation.

- Schedule of recommended maintenance.

Record drawing: Provide a drawing of the system as installed.

7.1.3.5 Maintenance

General

Provide corrective maintenance on the installation.

Maintenance period: 6 months from the date of commissioning of the systems or the duration of the Defects Liability Period if greater than 6 months.

Warranty: Warrant the installation for the whole of the maintenance period.

Corrective maintenance: Attend site and undertake corrective maintenance within 24 hours of receipt of verbal or written advice.

Maintenance reports: Provide a signed maintenance report setting out the work done and any measured values after each visit.