# QUANTUM CLIMATE CHANGER
# AIR HANDLING UNIT
# GUIDE SPECIFICATION

## 1.0 GENERAL CONSTRUCTION

The contractor shall furnish central station air handling units as shown and scheduled on the plans, the unit shall be furnished in strict accordance with this specification.

The casing shall have an enclosed box section framework with a modular size system based on standardised panels.

The unit framework shall be manufactured from 2mm thick extruded aluminium profiles, joined together by 3D injection moulded Nylon corner pieces secured in place by galvanised locking cleats. The framework shall be “cold bridge free” and both the framework and casing panels shall incorporate a thermal break.

The casing strength of the assembled Air Handling Unit shall be designed to meet BS EN 1886, Class 2A.

The casing air leakage of the assembled Air Handling Unit shall be designed to meet BS EN 1886, Class B.

Casing panels shall be double wall 25mm thick (50mm where increased thermal and acoustic performance is required or specified) sandwich type with injected CFC free polyurethane foam insulation forming a rigid non-vibrating construction.

The casing panel shall be attached to the frame through a self-locking mechanism represented by a wedge and frame, this shall exert pressure evenly onto the panel and the sealing gasket attached to the frame.

The foam insulation shall not absorb moisture and must be rot-resistant, and shall have a density of > 40 $Kg/m^3$ and a heat transfer coefficient value of < 0.02 W/mK.

The overall casing panel shall have a U value of < 0.92 $W/m^2$ K for 25-mm panels and < 0.46 $W/m^2$ K for 50-mm panels.

Casing panels shall be tested and rated in accordance with BS 476, part 7: Class 1 & Class 0 (Building Regulations paragraph A12 (b) Fire Safety).

The weighted Sound Reduction Index (Rw) of the casing panels shall not be < 28dB, when tested in accordance with ISO 140/3 and BS5821 part1.

The panels shall be flush mounted, and there shall be no sharp edges or corners on the unit which might cause accident / injury. Sealing shall be achieved by means of non-hydroscopic seal compressed between the panel and the aluminium frame channels to prevent cold tracking and air leakage between the panels and the frame.

Removal of the access panels must not affect the structural integrity of the unit.

There shall be no exposed gaps between fixed panels and between fixed panels and unit framework.

The outer panel wall shall be galvanised steel sheet, chemically treated, pre coated with primer and HP200 Plastisol coating (minimum 200 microns thickness). The Plastisol coating shall be ultra violet resistant, water-resistant and shall not be affected by detergent cleaning.

The inner wall shall be galvanised steel sheet, both inner and outer panel walls sheet thickness shall not be < 0.5 mm for 25-mm panels and not < 0.9 mm for 50mm panels

Access panels shall have double wall construction, gasketing around the full perimeter of the access doors frame shall be used to prevent air leakage. The panels shall be held in place by rapid access clips, latches and Allen key arrangements for easy removal, the fixing of each panel to the unit framework shall be from the inside of the unit, hinged doors shall be provided as an option.

Floor panels shall have double wall construction to allow maintenance personnel access without damage to the insulation the panels shall be self supporting and capable of bearing a load of up to 250 Kg/m² without any visible signs of deformation.

Each component section of the Air Handling Unit shall have matching cross-sectional dimensions of the same construction showing a neat exterior along the length of the unit and a clean interior appearance to ensure even air flow through each plant item.

All sections of the Air Handling Unit shall be constructed to conform to the pressure characteristics of the system under all operating conditions to prevent drumming, distortion and vibration upto 2000 Pa.

The complete unit shall be mounted on a fabricated galvanised sheet base frame for ease of shipment and handling. The minimum height of the base shall be 160mm and designed to ensure air circulation and avoid entrapment of moisture below the unit.

Units may be shipped fully assembled or in sections in accordance with the shipping or job site requirements or restrictions, units shall have break points as required for ease of unit handling and transportation.

Prior to dispatch the complete unit or each section of unit shall be shrunk wrapped using polythene sheets to provide protection during transportation, storage and installation.

**2.0 EMPTY SECTION**

Empty / access sections shall be provided by the Air Handling Unit manufacturer as required in the schedule.

**3.0 FAN SECTION**

Fans shall be of DWDI, belt driven centrifugal type, forward curved or backward curved blades as required to suit the pressure and operating characteristics specified and for stable non surging operation.

The blades of the forward curved impellers shall be made of galvanised steel and the backward curved impellers shall be made of welded heavy gauge steel, treated and painted after manufacturing.

Fan performance shall be measured and rated according to AMCA 210-85 and AMCA 300-85

Fan impellers shall be dynamically balanced to an accuracy of G 6.3 according to ISO 1940 – 1973

Fan shall have steel shafts with keyways at both ends and shall be designed for a critical speed which is 20% higher the maximum catalogued fan speed.

Fans shall be equipped with permanently lubricated single row deep groove ball self aligning bearings, bearing life 40,000 hrs ($L_{10}$)

The complete fan / motor assembly shall be mounted on a common base frame entirely isolated from the unit by rubber in shear or 1" open spring type anti vibration isolators, the fan discharge shall also be isolated from the casing by use of a flexible connection.

As an option belt guards shall be provided with a painted metal sheet belt guard that totally encloses the drive, The guard shall be rigidly attached to the fan base support structure.

**4.0 MOTOR and DRIVES**

Motors shall be high efficiency totally enclosed fan cooled type, foot mounted, dual voltage, IP55 , class F insulation and class B temperature rise.

Motors shall comply with BS 4999 Part 141, BS 4999 Part 105 EN 60034 Parts 5,6 and 7

Motors shall be suitable for operation at ambient temperatures of up to 45°C.

Motors shall be mounted inside the fan section and shall provide adequate drive belt adjusted by means of "tixit" slide rails.

Motors shall be capable of staring under all service conditions and shall be continuously rated with a minimum of 20% power margin over the driven load requirements.

The motors shall be of high torque staring characteristic appropriate to starting the load of the fan and shall be suitable for inverter drive control.

Fan drives shall be of a Wedge belt pattern conforming to the requirements of BS 3790. Belts shall be matched and be of an anti-static type and rated for 200% capacity.

Drives shall be constant speed, fixed pitch sheaves, selected at 1.4 service factor (24 hr running).

An option to provide variable pitched drives upto 20 kW motor power with suitable adjustment within 10% of specified rpm.

**5.0 INLET DAMPERS AND MIXING BOX SECTION**

The mixing box shall be provided by the air handling unit manufacturer with the casing construction as the unit.

The mixing boxes shall have a side access panel to allow entry for inspection of the dampers and other associated controls equipment.

Dampers shall be provided to modulate the volume of outside / return air, and shall be opposed blade type fitted into casing of galvanised sheet steel.

The dampers shall have self-lubricating nylon shaft bushes and shall be complete with all necessary linkages for motorised operation.

The maximum face velocity through the dampers shall not exceed (6.0m/s) to minimise pressure drop and generate noise across the damper.

All dampers shall have an “open-closed” indication sign.

Low leak dampers / Volume control dampers shall be provided with synthetic seals on the blade tips and spring loaded stainless steel side-edge seals, to ensure an air leakage rate of not > 1% @ 250Pa negative pressure.

**6.0 FILTER SECTION**

Pre-filter cells shall be 50 mm thick disposable panel type and shall be constructed from coarse fibre glass or pleated non woven synthetic element, in a moisture resistant card frame, flame proof card or metal frames shall be provided as an option.

The folded die cut frame shall be bonded together, forming a double wall around the entire filter.

The pre-filters shall be in accordance with Eurovent 4/5 Grade G3 or G4 having an average efficiency of 25-35%, grade supplied as specified in the schedule.

Main filter cells shall be of the high efficiency dry disposable bag type with the media being constructed from ultra fine fibreglass or non-woven synthetic fibres, formed into pockets and then attached to a rigid 22-mm thick Galvanised steel header. Flameproof media shall be provided as an option.

The main filters shall be in accordance with Eurovent 4/5 Grade G4 to G9, grade supplied as specified in the schedule.

The pre and main filters shall be installed in a Galvanised steel slide channel, the arrangement designed to minimise air bypass and allow for filter access and replacement from the access side of the Air Handling Unit.

“Mid-life” resistance as specified shall be allowed in the calculation of total fan static pressure.

Vertical manometer or dial pressure gauge shall be provided over each filter bank to give a visual indication of filter clean and dirty status, the Air Handling Unit manufacturer shall fit pressure drop indicators.

Differential pressure switches for remote warning of filter condition shall be provided as part of the unit mounted controls option.

**7.0 LPHW COIL SECTION**

Coils shall be mounted in the unit casing on non-corrosive slide rails to allow for easy removal when required, coils shall be designed to utilise the full available unit cross section area.

Coil face velocities shall not exceed what is specified on the coil schedule.

The number of fins provided should be the minimum needed to meet the performance requirements to minimise the pressure drop across the coil.

The coil casing shall be manufactured from 2mm Galvanised steel with drain holes in the bottom channels to insure condensate drainage.

Coil tubes shall be copper and mechanically expanded into aluminium plate fins, no soldering or tinning shall be used in the bonding process.

The fin block shall be manufactured from 16 mm o/d solid drawn seamless copper tube with a wall thickness of not < 0.5 mm, the return bends shall be copper and brazed to the tube ends.

Fins shall have a activated air pattern to maximise heat transfer and shall be Aluminium and having a thickness of not < 0.19 mm, the Manufacturer shall provide an option for Copper fins.

The coil headers shall be manufactured from copper tube in accordance with BS 2871 whose diameter shall will vary according to coils size and water flow rates, the coil header shall be fitted with BSPT male connection in accordance with BS 1400.

Where coil connections protrude through the casing the openings shall be suitably sealed with grommets or gaskets.

Coil connections shall be fitted with plugged drain and vent tappings to facilitate draining and venting.

Coils shall be air pressure tested to a minimum pressure of 21 bar by immersing the completed coil into a tank of water. Heating coil performance shall be independently certified by an independent testing authority. Coil connections shall be capped be means of a plastic cap prior to unit shipment.

**8.0 CW COIL SECTION**

Coils shall be mounted in the unit casing on non-corrosive slide rails to allow for easy removal when required, coils shall be designed to utilise the full available unit cross section area.

Coil face velocities shall not exceed what is specified on the coil schedule.

The number of fins provided should be the minimum needed to meet the performance requirements to minimise the pressure drop across the coil.

The coil casing shall be manufactured from 2mm Galvanised steel with drain holes in the bottom channels to insure condensate drainage.

Coil tubes shall be copper and mechanically expanded into aluminium plate fins, no soldering or tinning shall be used in the bonding process.

The fin block shall be manufactured from 16 mm o/d solid drawn seamless copper tube with a wall thickness of not < 0.5 mm, the return bends shall be copper and brazed to the tube ends.

Fins shall have a activated air pattern to maximise heat transfer and shall be Aluminium and having a thickness of not < 0.19 mm, the Manufacturer shall provide an option for Copper fins.

The coil headers shall be manufactured from copper tube in accordance with BS 2871 whose diameter shall will vary according to coils size and water flow rates, the coil header shall be fitted with BSPT male connection in accordance with BS 1400.

Where coil connections protrude through the casing the openings shall be suitably sealed with grommets or gaskets.

Coil connections shall be fitted with plugged drain and vent tappings to facilitate draining and venting.

An Insulated Galvanised steel drain pan will be incorporated inside of all cooling coil sections and will extend underneath the headers and beyond the fin block to ensure adequate collection of condensate, a stainless steel drain pan will be provided as an option.

The drain pan shall have a 3 way sloped construction with a bottom outlet connection to eliminate stagnation of condensate, the pan shall be in compliance with HS(G) 70.

On stacked coils intermediate drain pans will be fitted by the coil manufacturer to provide drainage of condensate on the elevated coil block

Coils shall be air pressure tested to a minimum pressure of 21 bar by immersing the completed coil into a tank of water. Heating coil performance shall be independently certified by an independent testing authority. Coil connections shall be capped be means of a plastic cap prior to unit shipment.

The air pressure drop over cooling coils and eliminators were fitted shall be based on a fully wetted coil, not a dry coil.

**9.0 ELECTRIC HEATER SECTION**

The heaters shall be cartridge type, mounted on slide rails suitable for easy removal. The heaters shall be suitable for either single or multi step control.

The sheathed stainless steel elements shall be capable of running at “black heat” with an element surface temperature of < 400°C.

All heaters shall be fitted with capillary type thermal cut-out devices, having an adjustable range of 0°C – 300°C and rated at 16 amps, the thermal cut-out shall be able to be reset manually or will automatically reset when the temperature drops by 30°C.

Heaters shall be selected to suit the minimum air volume of the system if a variable air volume (VAV) system is employed.

**10.0 SILENCER SECTION**

Arranged within the Air Handling Unit casing the splitters shall be located upstream or downstream of fan module to ensure effective sound reduction.

The acoustic material utilised for the infill shall be non-hydroscopic, inert, vermin and rot-proof and shall have a class I spread of flame as measured by BS 5432, Part 6

Each splitter shall have a bull nose and bellmouth entry to minimise pressure drop and self-noise regeneration.

**11.0 CROSS FLOW PLATE HEAT EXCHANGER SECTION**

The plate heat exchanger shall be manufactured by Greenbox or equal and approved.

The heat exchanger matrix shall consist of several specially thermoformed plates, connected together via aerodynamic folded leading edges, which are permanently bonded and sealed.

The complete heat exchanger matrix shall be mounted and sealed into a heavy duty PVC casework, comprising extruded PVC box section framework and thermoformed PVC end trays stiffened with ‘L’ section PVC extrusion.

The heat exchanger manufacture shall provide a 5 year anti-corrosion warranty.

A side or middle bypass suited to the exchanger package shall be built into the casing and shall be complete with opposed blade dampers fitted within the frame and fastened directly on the casing and be complete with all necessary linkages for motorised operation.

The cross flow plate heat exchanger section shall be complete with Galvanised sloping drain pans.

An option for a corrosion-protected exchanger and stainless steel drain pans shall be provided where units are designed to operate in conditions of Chlorine or Saline laden air, such as swimming pools and coastal locations.

**12.0 HUMIDIFIER SECTION**

Humidifiers shall be of the self-contained, electronically controlled, self-generative type.

The Air handling unit manufacturer shall mount the humidifier onto the outside of the humidifier section.

The steam shall be generated in a polypropylene cylinder of the disposable type for ease of maintenance.

Stainless steel steam lances shall be sized in accordance with humidifier manufactures recommendations and installed within the humidifier section by the Air Handling Unit manufacture, condensate pipework and separators shall also be provided if required.

The humidifier shall have a microprocessor-based control able to detect abnormal operation and respond to it by corrective action, the internal control circuit shall operate at 24 VAC

The humidifier shall shut-down and provide local indication in the event of: a)high current b)blocked drain pump and c)fault on feed water supply.

When connected to a mains water supply and appropriate humidity controller, the humidifier shall be totally automatic in operation. The boiled water condition shall be automatically and continuously monitored to ensure operation with minimum energy wastage.

The humidifier section shall be complete with Galvanised sloping drain pans, an option for a stainless steel drain pan shall be provided.

Where the Air Handling Unit is located externally the AHU manufacturer shall provide a weatherproof enclosure to house the humidifier. The enclosure shall be manufactured from the same casing construction as the Air Handling Unit and shall be sized to allow maintenance of the humidifier, in accordance with the humidifier manufacturers IOM.

## 13.0 UNIT MOUNTED CONTROLS

FACTORY-MOUNTED CONTROLS

Factory mounted DDC control system shall be engineered, mounted, wired and tested by the Air Handling Unit manufacturer to reduce installed costs, save time and improve reliability.

Each control system shall be fully functional in a standalone mode or be tied into a building automation system.

*Direct Digital Controller*
A dedicated programmable controller with the appropriate point capabilities shall be unit mounted on each air-handling unit, an LCD screen and keypad shall be provided to facilitate local monitoring, trouble shooting and changing of set points.

*Factory-Mounted Control Options*

- Airflow Monitoring station (TRAQ™ damper)

A factory mounted damper/airflow-monitoring station in the fresh air damper opening of each mixing box as specified.

The airflow monitoring output shall be a 2-10 VDC signal representing velocity and shall have a total accuracy of +/- 5 percent of actual flow down to 15 percent of nominal flow between –40°C and + 70°C.

- Damper Actuators

Actuators shall be mounted with the return air damper operating in reverse action to the fresh air damper.

- Supply Air Temperature Sensor

NTC type thermistor sensor shall be mounted in the fan discharge.

- Averaging Temperature Sensor

An NTC type averaging thermistor type) shall be serpentined with the sensor fitted across the unit.

- Frost Protection Switch

An auto rest low limit switch shall be installed as an option. The capillary shall be serpentined with clips across the unit.

- Airflow Switches

A differential pressure switch piped to the discharge and suction sides of the fan shall indicate fan status.

- Differential pressure switch

A pressure switch piped to both sides of the filters shall indicate filter status.

- Customer Interface Relays

6 off Single Pole Change Over & 2 off Double Pole Change Over relays shall be provided as required for each binary output of the controller.

FIELD-MOUNTED CONTROL OPTIONS

- Control Valves

Control valves shall be provided by air handling unit manufacturer and field piped by the piping contractor. Power and signal wiring shall be by a simple quick connect.

- Space Temperature Sensors

Thermister type sensors shall be provided as required for field wiring.

- Outside Air Sensors

Thermister type sensors shall be provided as required for field wiring.

*VARIABLE FREQUENCY DRIVE / DISCONNECTS*

A combination VFD / Disconnect package shall be factory mounted and wired by the Air Handling Unit manufacturer, the package shall include:

*A - Variable Frequency Drive*

- Pulse width modulated drive w/IGBT transistors
- LCD display & keypad
- English language, values, parameters, self test, faults and diagnostics
- Power, pending fault and fault LED indicator lights
- Form C Fault contacts
- 4-20 mA or 0-10V speed input signal

*B - Auto restart after momentary power loss*

*C - Critical frequency avoidance*

*D - Power wiring in PVC flexible conduit directly from VFD to motor*

The factory mounted control system shall include for wiring to the controls start/stop relay, and analog speed signal wiring to VFD to be wired.

All Factory mounted controls shall be covered by the Air Handling Unit manufacturers standard warranty.