CBC

CHILLED BEAM CASSETTE

Int. Pat. App. WO 2005/015090

Specification, Application & Installation Manual

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Contents

Part Numbers

STANDARD COMPONENTS	
PART NUMBER	**DESCRIPTION**
97400001	Chilled beam (inc gravity drain connector)
97400002	Fascia - (metal)

FACTORY OPTIONS	
PART NUMBER	**DESCRIPTION**
97400822	Filter (to suit metal fascia)
97400000	Plastic fascia
97400814	Filter (to suit plastic fascia)
97400817	LPHW coil, High Temperature (80/70°C nominal)
97400821	LPHW coil, Medium Temperature (50/40°C nominal)
97400811	Electrics box (req'd if lift pump, light or valve is fitted)
97400812	*Lift pump (0.5m lift)
97400815	*Metal fascia with integral light fitting
97400820	*Metal fascia with integral light fitting & battery backup
97400819	Blanking cap kit (to allow for side blanking)
97200354	Valve drip tray
97400816	*CW valve, two port on/off
97400818	*LPHW valve, two port on/off
On Request	∅100mm air Damper Kit
On Request	450mm x ½" Flexible Hose Kit

* Any combination of these items requires the electrics box (part number 97400811) to be fitted.

The Quartz CBC Chilled Beam Cassette

Developed in conjunction with the Building Research Establishment at Garston, the Quartz CBC Chilled Beam Cassette is a novel product that combines the many benefits offered by active chilled beam technology with the cost and space saving advantages of cassette technology.

Active Chilled Beams

Once the concept of cooling by chilled beam had been proven and accepted using passive chilled beams, development focused on increasing the beam capacity. By introducing the required fresh air through nozzles adjacent to the cooling coil, room air could be induced through the coil. This induced flow substantially increased the beam's capacity. Such devices became known as "Active Chilled Beams."

Active chilled beams provide many benefits to the end user over traditional methods of cooling and heating. Key benefits are;

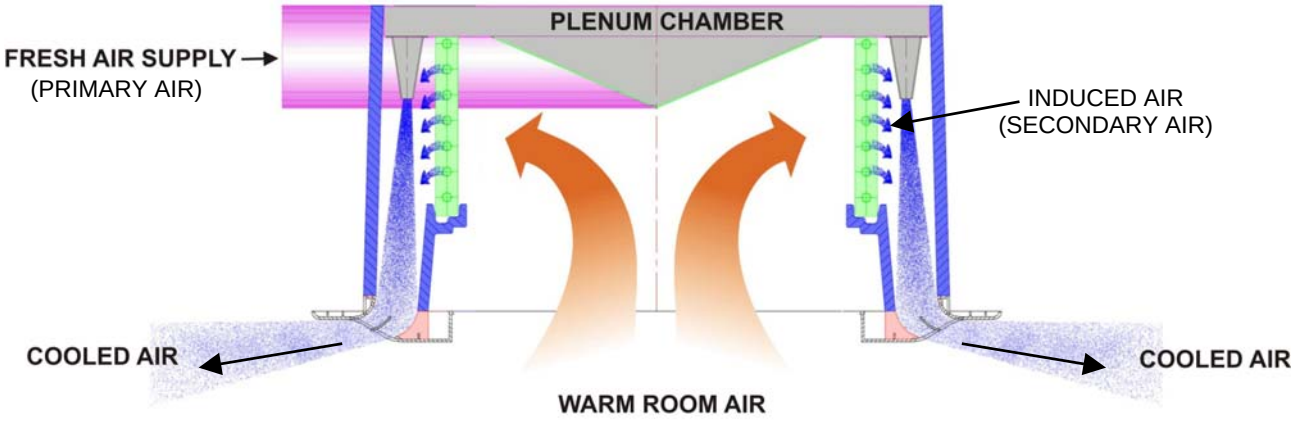
1) When cooling, the use of relatively high water temperatures results in a high-energy efficiency rating (EER) for the chiller supplying the circuit, as well as providing substantial opportunities for free cooling in Northern European climates. Analysis of the whole life cost of a chilled beam system shows it to be only 2/3 the cost of an equivalent fancoil system and 1/2 the cost of a VAV system.
2) Due to the fact that there are no moving parts, maintenance and service requirements are substantially reduced.
3) Chilled beams are virtually silent in operation.
4) Chilled beams provide a better air distribution in the occupied space, with less draughts.

Specific Benefits of CBC Product

In addition to the general benefits described above, the CBC cassette offers further features: -

1) The CBC is one of the few active chilled beams with the facility for condensate collection and removal. This enables water temperatures (and hence cooling effect) to be maintained when the room conditions are such that condensate would be generated. Other chilled beams must stay "dry" and do so by increasing the water temperature, with a resultant drop in cooling duty.
2) The unique construction of the CBC enables easy and complete removal of the chassis, by one person, from within the occupied space, without disturbing the ceiling grid. Removal exposes both sides of the cooling coil and the condensate tray for disinfection, a process that is essential in the health care sector.
3) By utilising standard suspended ceilings for mounting, the CBC can easily be moved within the grid to accommodate changes of use of office space.

Description of Operation



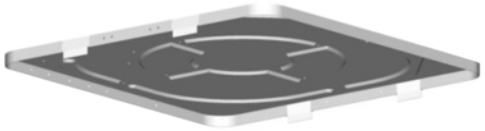
The Quartz Chilled Beam Cassette operates on the induction principle.

The building fresh air supply is treated (filtered, then heated or cooled) in an external air-handling unit. This treated fresh air is introduced to the room via the chilled beam cassette, being discharged within the unit through specially designed nozzles located around the periphery between the coil and the chassis. The flow of air from these nozzles causes a reduction in pressure, thereby inducing a flow of air from the unit centre across the heat exchange coil(s). This air is replaced by warm air from the room that rises by convection and enters the cassette via the central grille.

The main coil is supplied with cooling water and the optional LPHW coil (if fitted) with heating water. The induced air is thus conditioned and mixed with the fresh air supply before discharging to the space via the four-way blow fascia.

Standard Components

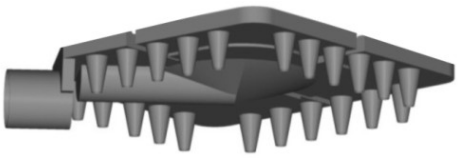
The standard Quartz Chilled Beam Cassette consists of two components, a chassis (part number 97400001) and a metal fascia (part number 97400002).
The condensate gravity drain connector is supplied loose as standard with each unit.



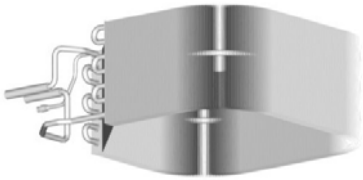
Top panel

Options

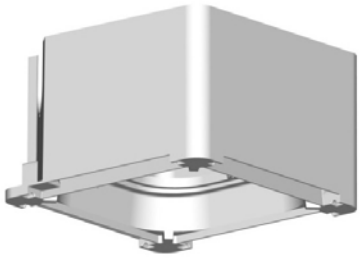
- A filter which, when fitted into the fascia, will remove dust from the return air prior to passing through the coil.
- Two versions of LPHW coil are available that have been designed to minimise stratification when using the CBC for heating. The coil type selected is dependant upon the water temperature available for heating (supply either 50°C or 80°C).
- An electrics box that **must** be fitted if the lift pump, light fitting or valve options are being used.
- A lift pump that can achieve a lift of 0.5m. The pump controls provide a high level alarm as standard.
- A high efficiency light fitting, incorporated into the metal fascia. Using this option enables the lighting and cooling grids to be combined in the ceiling layout. There is also a version with battery back up that can be used in areas requiring emergency lighting.
- A blanking cap kit. The caps are fitted over the nozzles to reduce or eliminate airflow from one side of the unit.
- A valve drain tray kit. This tray screws onto the pipe panel and sits below the control valves. Any condensate that forms on the valve body can thus be removed.
- A low cost plastic fascia with discharge air deflectors fixed at 35° for optimum performance. In addition, a filter for this fascia is also available.
- Two port, 15mm control valves for chilled water and LPHW circuits. The valves are fitted with 240V on/off actuators as standard.
- Air damper kits for ∅100mm ducting. The standard kit has a manually adjustable damper.
- Flexible hose kit that consists of two 450mm x ½" flexible hoses with Speedfix connectors as standard.



Fresh air plenum



Coil



Chassis

Metal fascia

Metal fascia with light

Construction

- **Top Panel:** The press-formed top panel to which all the main components are attached, is manufactured from galvanised mild steel sheet.
- **Fresh Air Plenum:** Moulded in medium density polyethylene. It has flame retardancy properties that comply with the requirements of Class O.
- **Heat Exchange Coils:** Manufactured from copper tubes and collar spaced aluminium fins. By expansion of the copper tube, the fins are mechanically bonded to the tubes, thereby ensuring maximum contact and optimum heat transfer.
- **Main Chassis:** Moulding in medium density polyurethane foam that is flame retardant to UL94-V0. The material is a poor conductor of heat thereby eliminating the requirement for additional insulation. The lightweight nature of the construction reduces the labour requirement for installation and for cleaning.

- **Metal Fascia (Standard):** The fascia is made from an assembly of extruded aluminium profiles, whilst the grille is produced from perforated, galvanised, mild steel sheet. All fascia components are painted gloss white to RAL 9010.

Plastic fascia

Performance Data

Total Cooling Capacity Q_{tc} (Watts)

Chilled Water		Fresh air	Room air	Total Cooling Capacity Q_{tc} (W)							
Supply	Differential			Primary Air Volume Flow (l/s)							
				15 l/s		20 l/s		25 l/s		30 l/s	
(°C)	(°C)	(°C)	(°C)	Qtc (W)	Flow (l/s)	Qtc (W)	Flow (l/s)	Qtc (W)	Flow (l/s)	Qtc (W)	Flow (l/s)
12	2	12	22	504	0.038	670	0.051	835	0.063	997	0.075
		14	24	662*	0.057	875*	0.075	1086*	0.093	1292*	0.111
		16	26	839*	0.077	1092*	0.102	1213*	0.124	1497*	0.148
	3	12	22	470	0.023	618	0.030	766	0.036	913	0.044
		14	24	624*	0.035	824*	0.046	1014*	0.057	1180*	0.066
		16	26	792*	0.049	1033*	0.063	1178*	0.077	1354*	0.092
	4	12	22	450	0.016	595	0.021	736	0.026	871	0.031
		14	24	573*	0.023	762*	0.031	942*	0.038	1127*	0.045
		16	26	741*	0.033	981*	0.044	1104*	0.054	1263*	0.065
14	2	12	22	416	0.027	557	0.037	684	0.045	818	0.054
		14	24	492*	0.037	665*	0.050	825*	0.062	987*	0.074
		16	26	663*	0.056	881*	0.076	1085*	0.093	1173*	0.112
	3	12	22	408	0.018	526	0.022	658	0.028	773	0.033
		14	24	467	0.022	618	0.030	755	0.036	913	0.043
		16	26	625*	0.035	828*	0.046	1016*	0.057	1104*	0.068
	4	12	22	403	0.013	506	0.016	615	0.019	745	0.023
		14	24	450	0.016	595	0.021	728	0.025	879	0.031
		16	26	577*	0.023	764*	0.031	947*	0.038	1065*	0.045
16	2	12	22	353	0.020	463	0.026	573	0.032	683	0.038
		14	24	419	0.027	545	0.036	677	0.044	819	0.053
		16	26	496*	0.037	655*	0.049	810*	0.061	977*	0.072
	3	12	22	339	0.012	432	0.015	532	0.018	631	0.022
		14	24	391	0.017	530	0.021	648	0.027	783	0.033
		16	26	470	0.022	622	0.030	756	0.036	913	0.043
	4	12	22	316	0.008	404	0.010	501	0.012	604	0.014
		14	24	382	0.012	505	0.016	617	0.019	736	0.022
		16	26	450	0.016	585	0.021	728	0.025	867	0.029

* Denotes duty points where condensate may form on the coil

Heating Capacity Q_{th} (Watts)

LPHW		Fresh air	Room air	Heating Capacity Q_{th} (W)							
Supply	Return			Primary Air Volume Flow (l/s)							
				15 l/s		20 l/s		25 l/s		30 l/s	
(°C)	(°C)	(°C)	(°C)	Qth (W)	Flow (l/s)	Qth (W)	Flow (l/s)	Qth (W)	Flow (l/s)	Qth (W)	Flow (l/s)
80	70	20	20	610	0.016	726	0.017	832	0.020	937	0.022
			22	556	0.013	665	0.016	761	0.018	859	0.030
		22	22	584	0.013	693	0.016	796	0.018	892	0.030
50	45	20	20	523	0.025	634	0.030	736	0.035	838	0.040
			22	449	0.021	548	0.026	635	0.030	709	0.034
		22	22	482	0.021	585	0.026	671	0.030	766	0.034
50	40	20	20	404	0.010	512	0.012	608	0.015	696	0.017
			22	331	0.008	417	0.010	493	0.012	556	0.013
		22	22	365	0.008	458	0.010	534	0.012	622	0.013

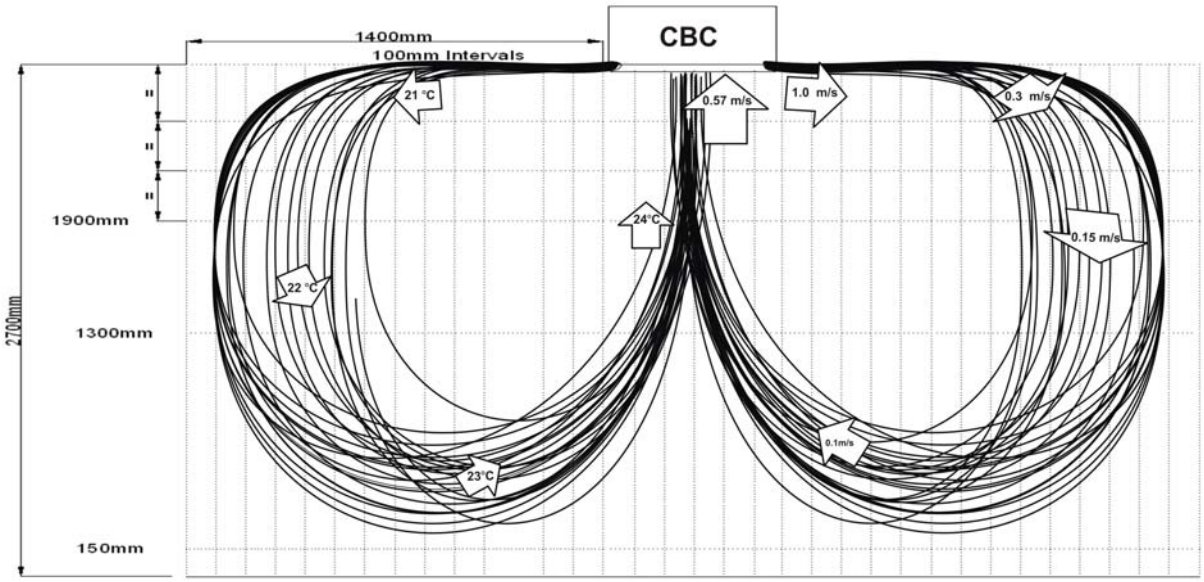
Air volume flow

	l/s	m³/h	l/s	m³/h	l/s	m³/h	l/s	m³/h
Primary (Fresh) Air	15	54	20	72	25	90	30	108
Secondary (Room)	28	100	37	134	46	167	56	200
Total Supply Air	43	154	57	206	71	257	86	308

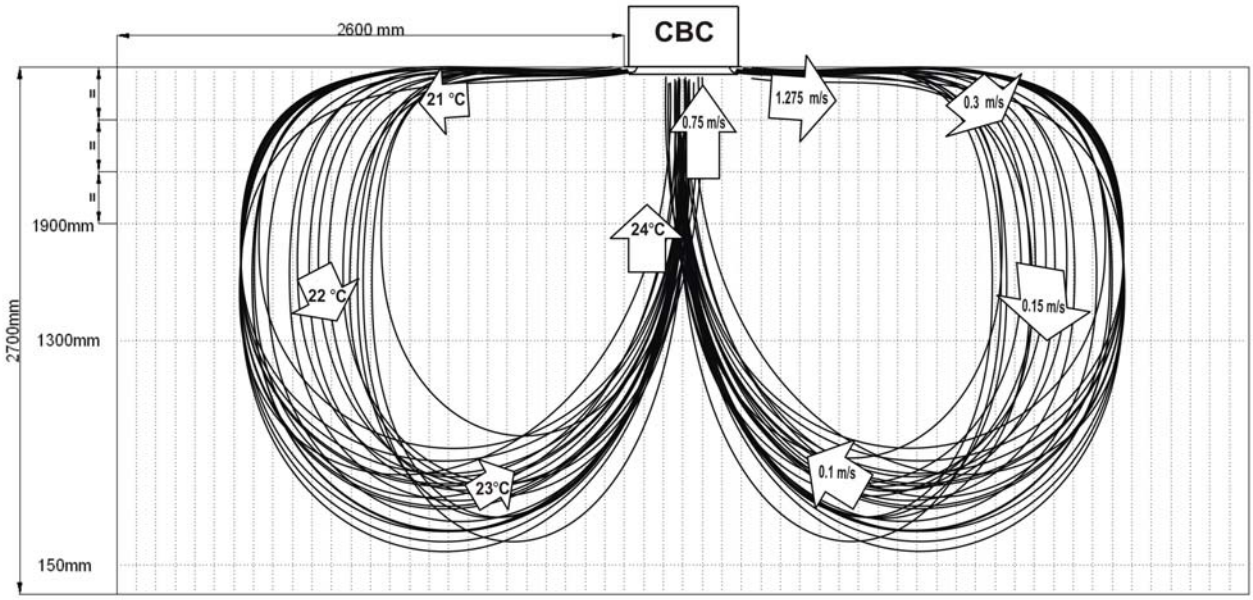
Air/Temperature Distribution

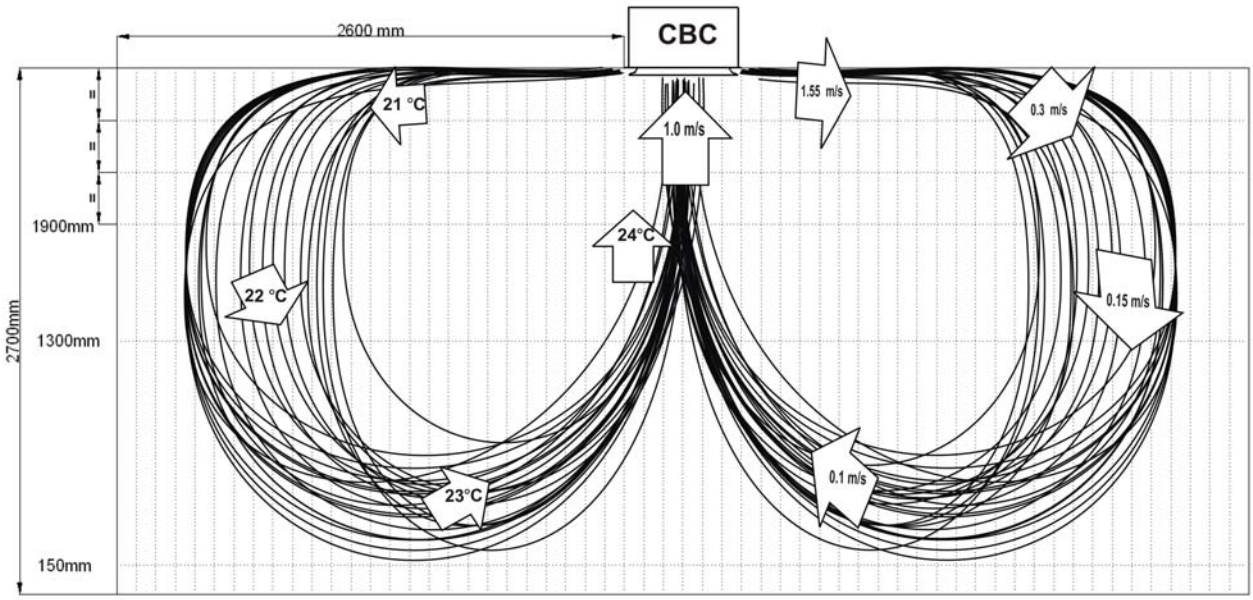
Conditions: Room air 24°C, Primary air 14°C, Chilled water 14°C Flow, 16°C return

Airflow volume flow 15 l/s



Airflow volume flow 20 l/s





Airflow volume flow 25 l/s

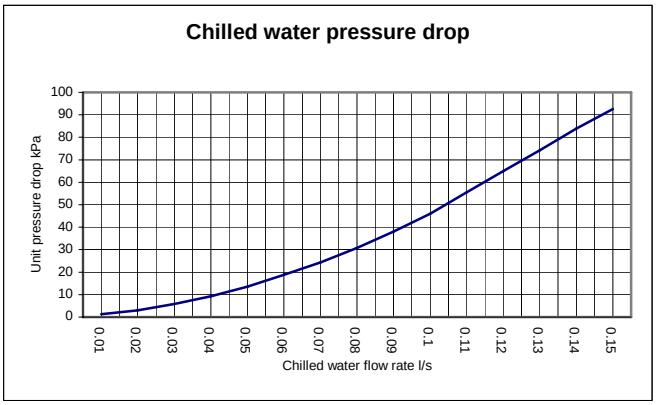
Sound Levels

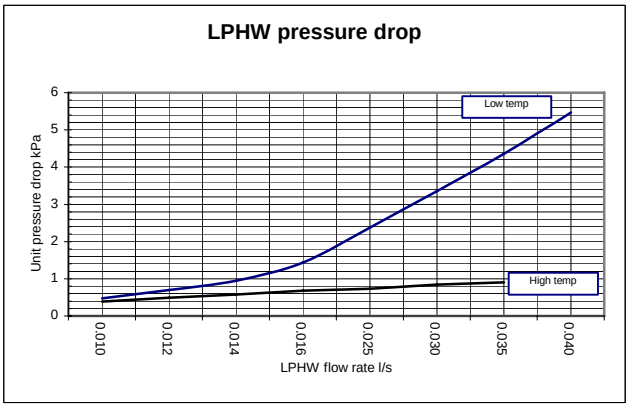
The maximum sound pressure level (measured 1m down and 1m away from the centre of the unit, in a room of 32m³ volume and with a reverberation time of 0.5 seconds) is 32dB(A) (NR27) with a primary air volume of 30l/s. At lower primary air volumes, the sound Pressure level is in the order of 28dB(A) (NR23-25).
For further details contact TEV Applications Department.

Weights

Item	Packed Weight (kg)	Unpacked Weight (kg)	Coil Water Volume (litres)	Operating Weight (kg)
CBC	16	15	0.5	15.5
Metal Fascia	7	5		5

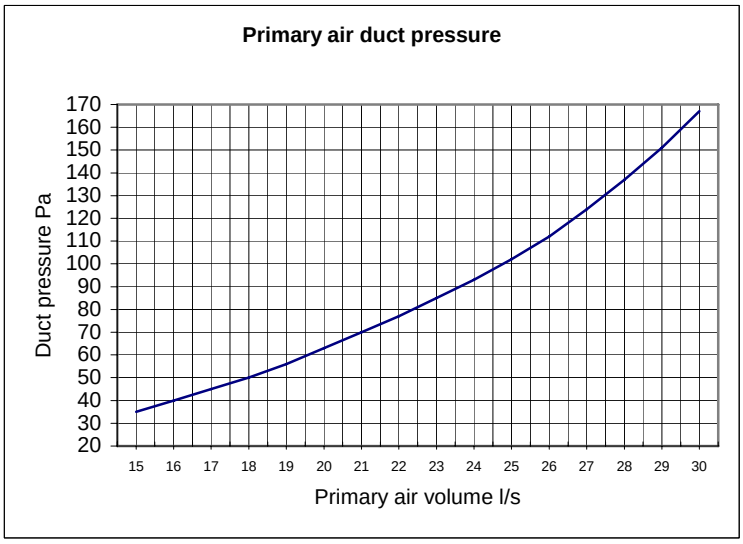
Pressure Drops





supply temperature

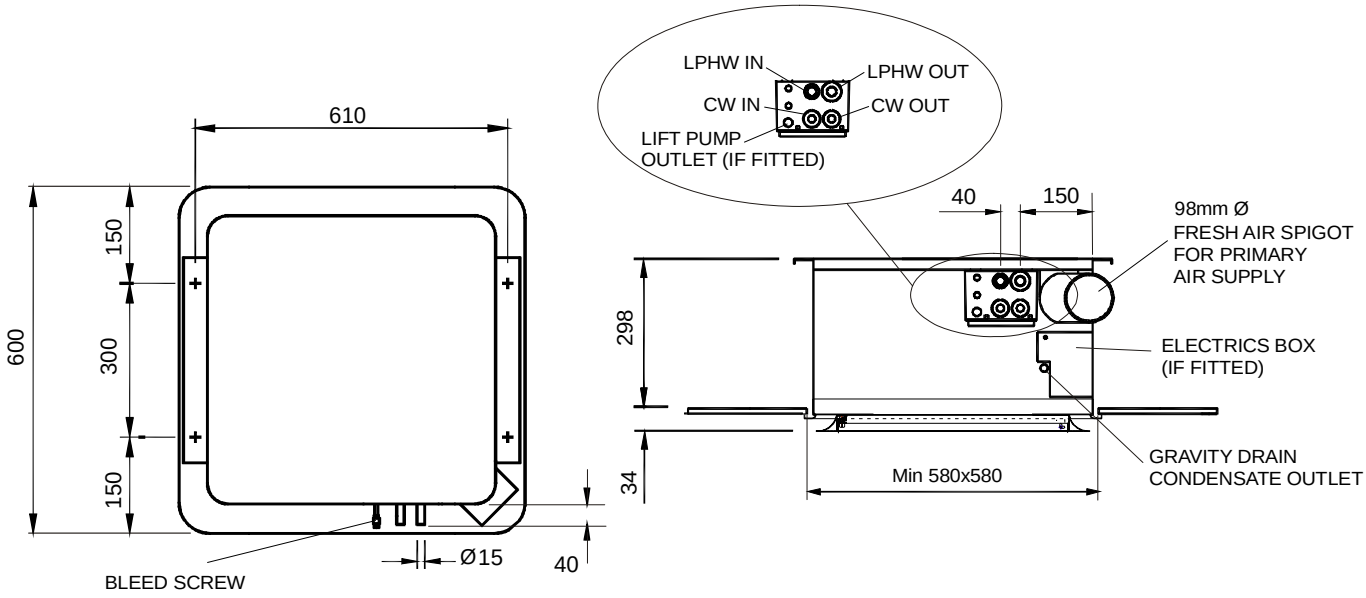
supply temperature



Low temp – LPHW of 50°C
High temp – LPHW of 80°C

Dimensions

Dimensions in mm



Application Guidelines

Selection of Units

Active chilled beams may be selected and applied in a similar manner to fancoils. It is important to ensure that, at any given condition, sufficient units are chosen to meet the cooling load. With fresh air supply rates of 12 l/s per person and one person per $5m^2$, the CBC will cater for loadings of 70-90 W/m^2. Typically, a single CBC will be required for every $10m^2$ in this arrangement.
Lower loadings will obviously require fewer units and, in such instances, provision for extra fresh air supply may have to be made.
Higher loadings that require more than one unit per $10m^2$ can be catered for, but care must be taken that airflows from adjacent units do not impinge on each other and "dump" (refer to airflow diagrams). Blanking caps are available to reduce or eliminate the airflow from one side of the unit.

If the unit is to be installed close to a wall (typically nearer than 1.5m), the discharge from the side nearest to the wall should be blanked off.

Note that the noise data provided is for a single unit and that most applications will require multiple units in the zone. A correction for the effect of adjacent units must be made.

Controls & Valves

The output of the CBC may be controlled in two ways. The main method of control is by variation of the water flow to the cooling coil; however, it is also possible to adjust the capacity by variation of the primary air supply.

Where an area has continuous occupation during working hours, the CBC can be controlled by variation of the water flow. This can be either simple on/off valves or more sophisticated modulation of the flow with respect to distance from set point. Each CBC can be fitted with a valve and controlled individually. However, in larger zones that have multiple CBC units, a single valve can control a group of units. This is the most cost effective means of performing group control, although it can also be achieved using relay boxes switching multiple individual valves.

In areas with intermittent occupancy (meeting rooms, for instance), control of both water and primary air will be required. When fully occupied, the control method will be by variation of the water flow as described above. When the occupancy level drops or disappears, the reduction in load will cause the valve to close. The primary air however, being supplied at a low temperature, will continue to cool the room. The controller must recognise this and close off the primary air supply to prevent over cooling the room. Sophisticated systems will further detect the increase in duct static pressure and, by means of speed controllers on the AHU motor, reduce the overall fresh air supply.

Energy Efficiency & Free Cooling

Active chilled beams are an exceptionally energy efficient method of providing comfort cooling to an occupied space. There are several reasons for this.

The CBC unit operates using the energy of the fresh air supply that must be provided to the building. No other energy input is required. The energy used by the fan in a traditional fancoil is thus saved and, although this appears to be small, on large projects with long hours of operation, it becomes substantial. It must be borne in mind that the energy use over the entire life of the unit must be considered and this is why whole life costing analysis of chilled beam projects is so important.

The higher water temperatures that are used (initially to prevent the coil generating condensate) provide the opportunity to operate the chiller at very high EER's. This benefit can be lost if the design of the system is compromised by using the chiller to temper the fresh air with 6/12°C water. Ideally, tempering of the fresh air would be performed using a DX coil with an inverter controlled condensing unit, whilst the chiller is dedicated to supplying the chilled beam circuit with high temperature (14°C) water.

If 14°C water is used, a substantial opportunity to generate this by free cooling exists in Northern European climates. Either a dry cooler can be incorporated in the water circuit or a dedicated free cooling chiller utilised for the chilled beam circuit. The latter option will have specialised controls built in to the chiller to maximise the free cooling, thereby obviating the requirement for a specialist bespoke control package.

Installation

General

1. CBC units must only be installed and maintained by qualified persons, in accordance with all national and local regulations relating to plumbing and electrical installation.

2. The data plate only gives information for the CBC unit.

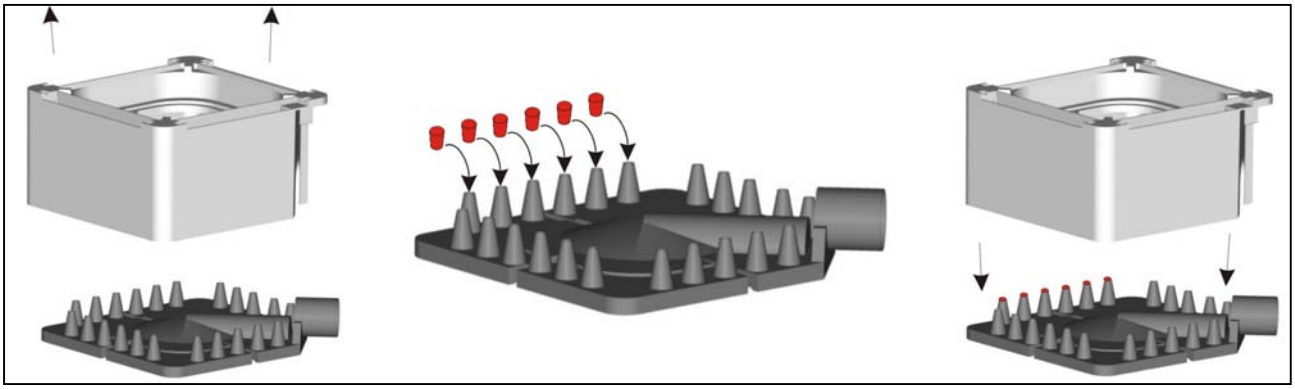
3. TEV Ltd recommend that personnel working on this equipment be skilled and fully conversant with the appropriate air conditioning and electrical practices and have sound knowledge of current industrial safe working practices.

CONTENTS	
PARTS DESCRIPTION	**QUANTITY**
Installation instruction and Declaration of Conformity	1
Fascia assembly (inc 4 x screw / washer)	1
Template	1
Hanging bracket	2
Washer	8
Screw	4
Drain Connector (inc 'O' ring)	1

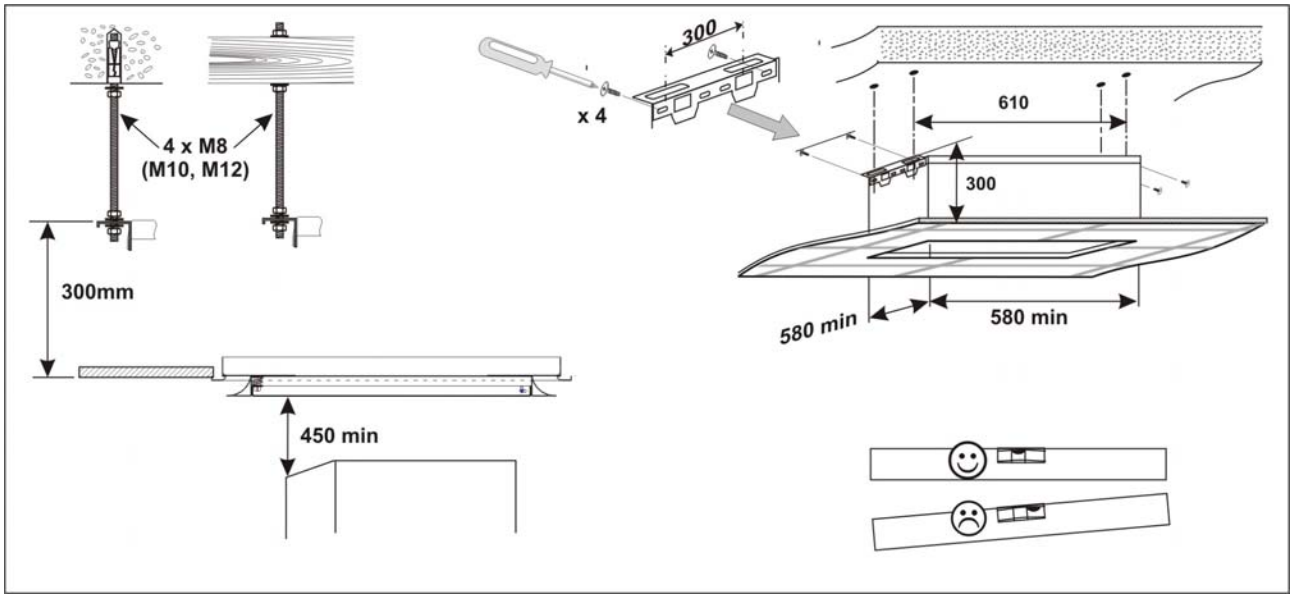
NOTE: The unit can be installed with the chassis in position or removed prior to installation for easier access.

Blanking Caps

(These can be fitted to any of the 4 sides of the plenum chamber to reduce or eliminate airflow from one side of the unit)

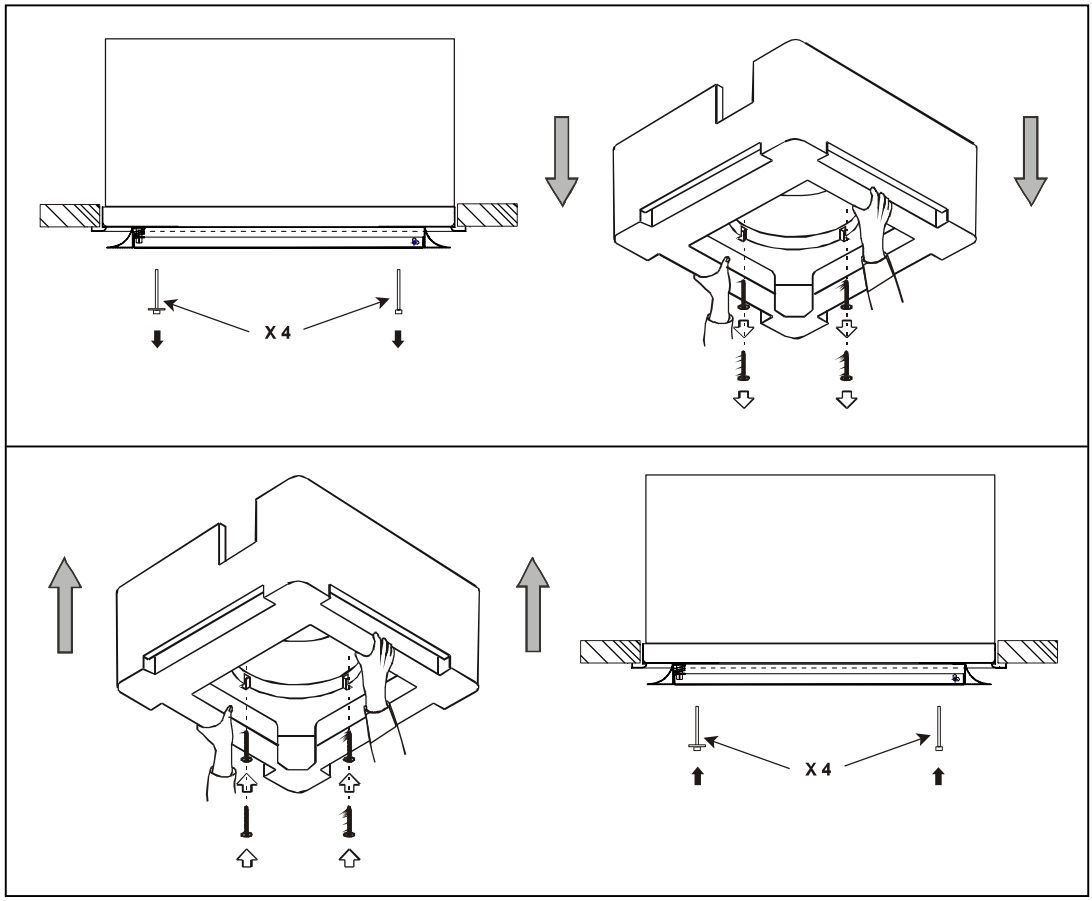


Mounting



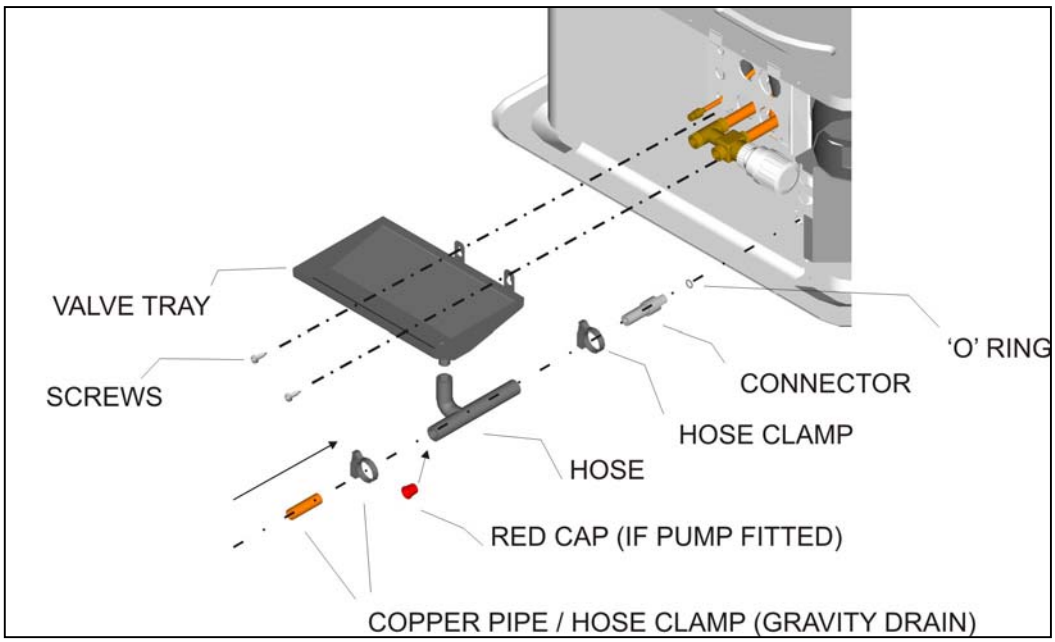
Fascia And Chassis

(optional removal and refitting)



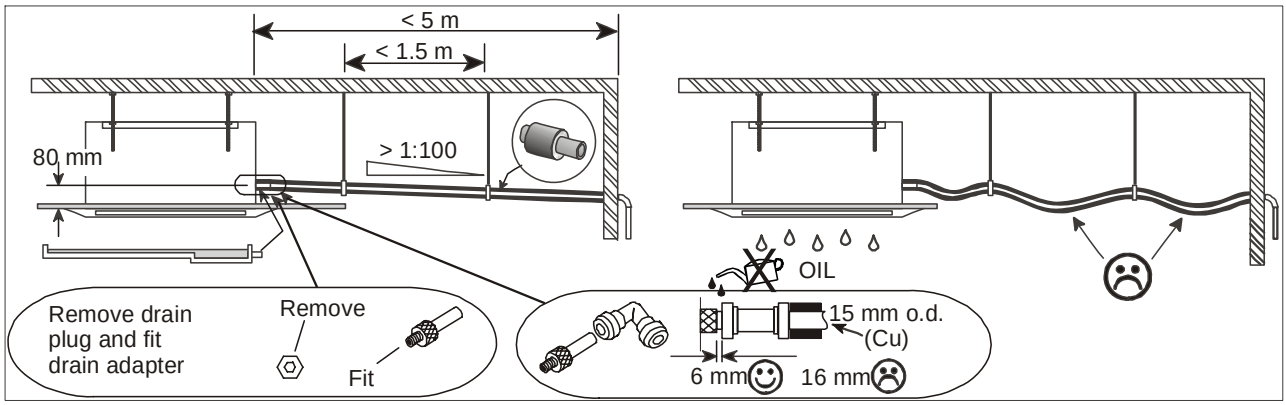
Valve Tray

(option when a valve is fitted)

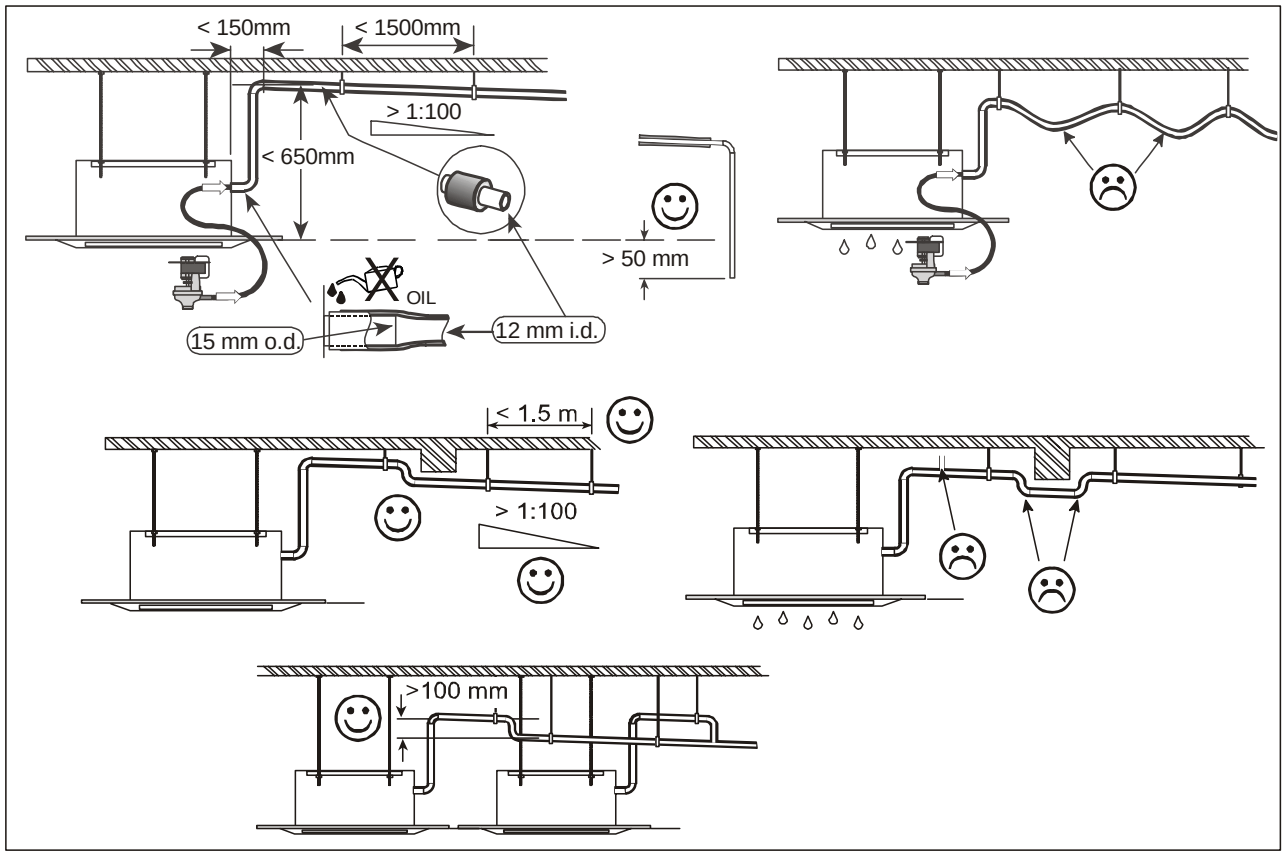


Condensate Drain
(If fitted)

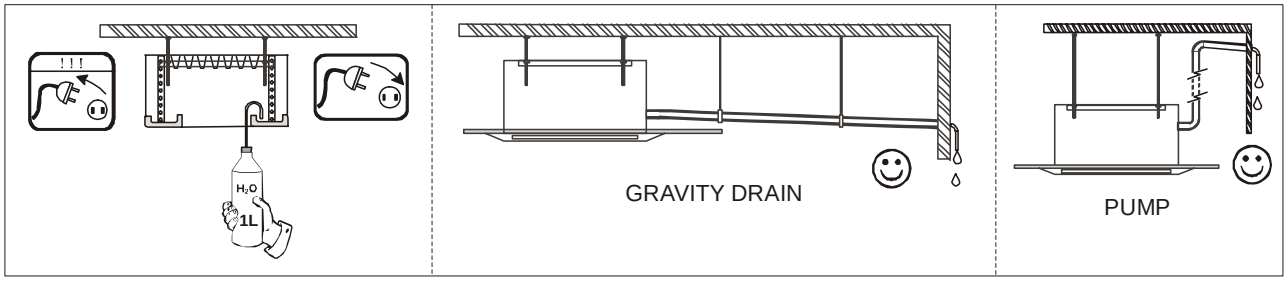
GRAVITY DRAIN



0.5m LIFT PUMP

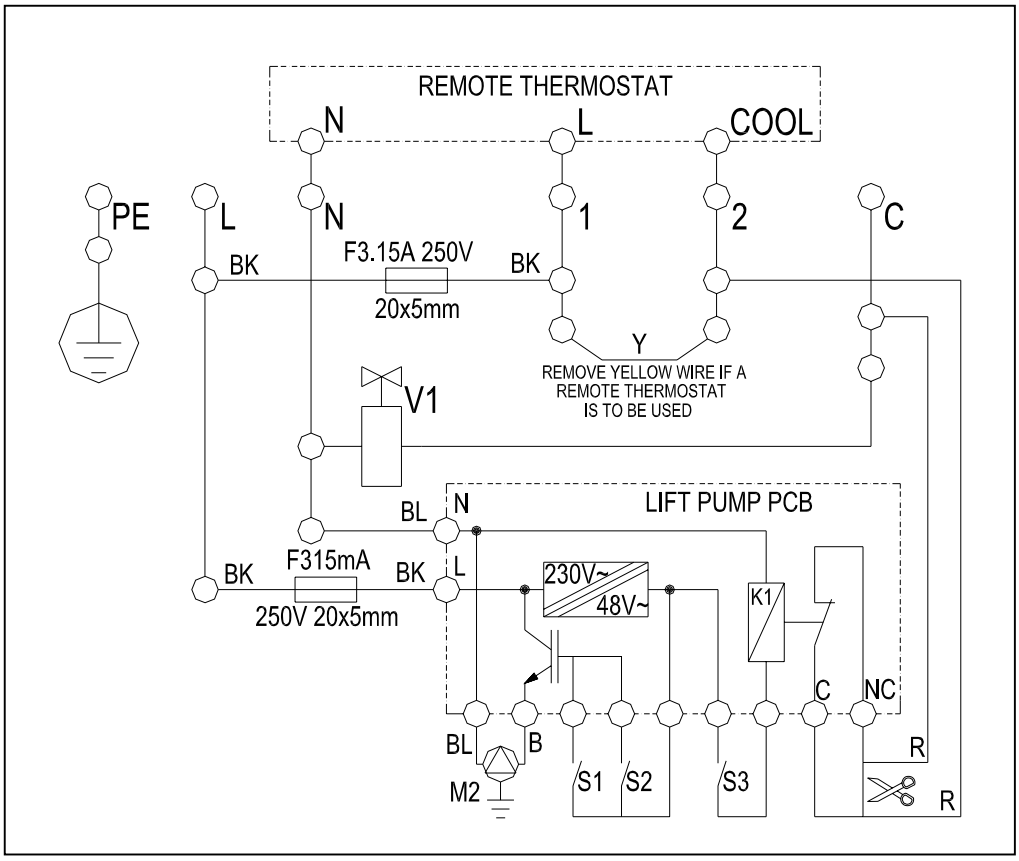


TESTING



Wiring Diagram

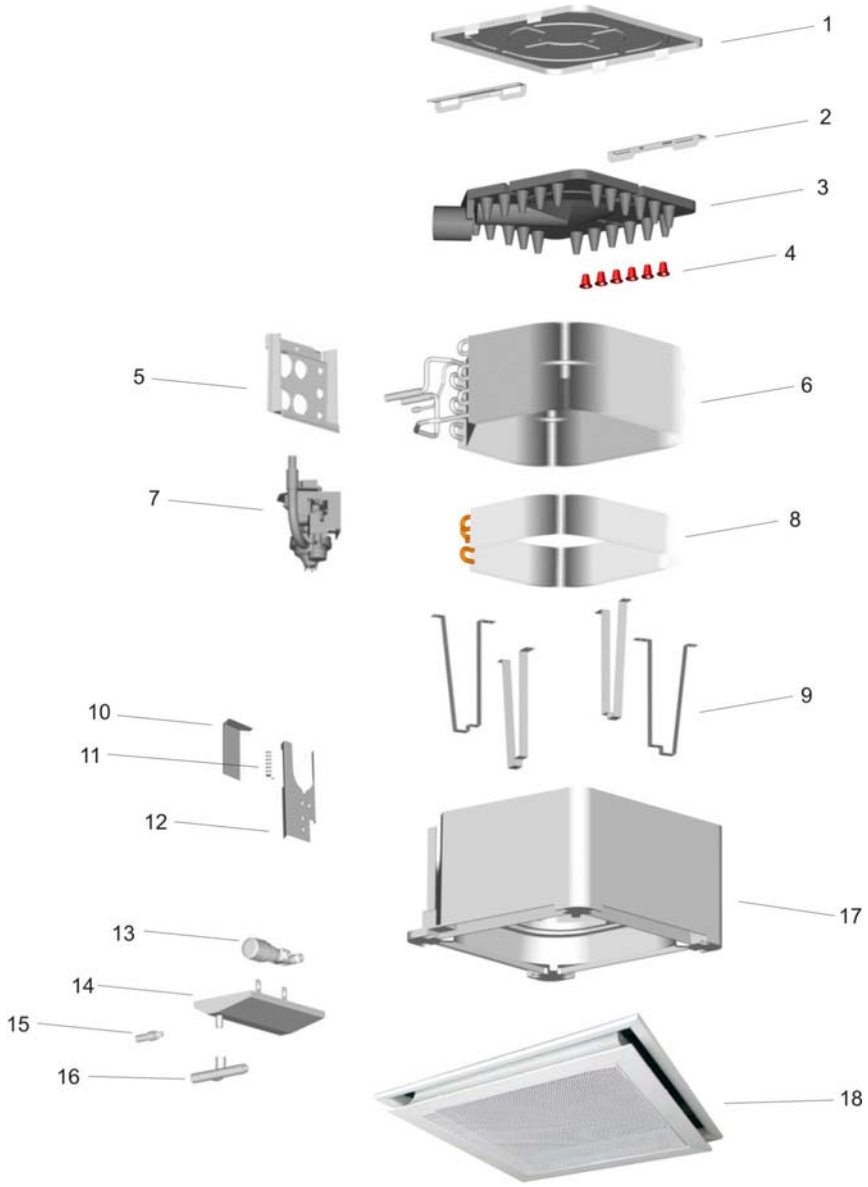
Electrics Box & Lift Pump (if fitted)



Check List

		Checked
1	Is the unit square and level with the ceiling?	
2	Is the pipework correctly supported throughout its length?	
3	Are the chilled water pipes insulated right up to the unit?	
4	Have all pipework joints been carefully checked for leaks?	
5	Is the condensate drain correctly sized, connected, supported and insulated?	
6	Has the effectiveness of condensate removal system been tested and there are no leaks?	
7	Is the air distribution as required?	
8	Is the fresh air ductwork connected?	

CBC Component Identification



1	Top panel	**10**	Electrics box cover (option)
2	Hanging brackets (2 off)	**11**	Terminal block (option)
3	Fresh air plenum	**12**	Electric box (option)
4	Blanking caps (option)	**13**	2 port valve (option)
5	Pipe panel	**14**	Valve tray (option)
6	Cooling coil heat exchanger	**15**	Gravity drain adaptor
7	Lift pump (option)	**16**	Hose (supplied with valve tray)
8	LPHW coil (option)	**17**	Chassis
9	Coil bracket (4 off)	**18**	Metal Fascia