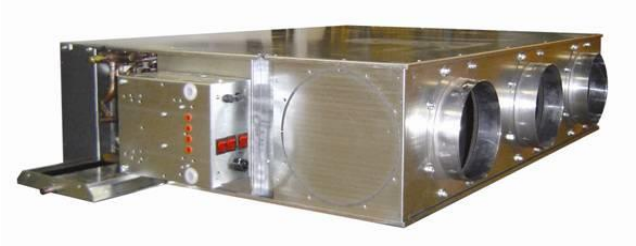
MARSTAIR
REFRIGERATION AND SPECIALIST AIR CONDITIONING



TECHNICAL MANUAL
for DIRECT EXPANSION DUCTED
DXD/CO2 EVAPORATORS.

This manual provides technical and installation information for **DXD/CO2 EVAPORATORS**:

INDOOR UNIT 566 series **direct expansion ducted DXD**

INDEX

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GENERAL

1. TEV Ltd recommend that personnel working on this equipment be skilled and fully conversant with the appropriate Air Conditioning, Refrigeration and Electrical practices and have sound knowledge of current Industrial Safe Working practices.

2. These units are supplied with a holding charge of oxygen free nitrogen.

3. Do not open the valves until the system is fully installed.

4. These units contain love electrical components, moving parts and refrigerant under pressure.

5. Always site out of reach of children and protect from vandalism.

6. The data plate only gives information for the indoor unit.

7. Evaporator tested to 90 bar pressure.

8. Max operating pressure 60 bar.

9. Appropriate safety devices must be fitted to ensure maximum operating pressure is not exceeded.

DXD DIRECT EXPANSION DUCTED EVAPORATORS

The **DXD/CO2** range comprises 566 series ducted indoor units:

PART NUMBERS

566 Series DXD/DXDH INDOOR UNITS

Model	DXD50	DXD60	DXD90	DXD130	DXD150	DXD165
CO2 Cooling only	56600039	56600040	56600041	56600042	56600043	56600060
CO2 Cooling and LPHW Heating	56600044	56600045	56600046	56600047	56600048	56600061

FEATURES/ACCESSORIES
INDOOR UNITS

Integral Discharge Plenum	STD
Long Life Washable Filter (to G2)	STD
5m Condensate Pump	*
Electric Heating	*
LPHW Coil	*
Fresh Air Spigot	**
Return Air Plenum	*
Additional 200mm or 250mm Diameter Spigots	**
Programmable Timer	**
Return Air Sensor	**

Key * = Factory Fitted Option, STD = + Standard, ** = Site Fitted

TECHNICAL INFORMATION

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	50	5	75	1.3	1.0	-	-	-	-	-	-	-	-
		10	75	3.1	2.0	2.2	1.5	1.5	1.0	-	-	-	-
		15	75	5.2	3.0	4.4	2.6	2.8	2.0	2.9	1.5	-	-
		20	50	5.7	3.9	5.0	3.5	4.4	2.9	3.4	2.5	2.8	2.1
		23	50	6.9	4.4	6.1	3.9	5.7	3.5	5.0	3.0	4.2	2.6
Medium	50	5	75	1.3	1.0	-	-	-	-	-	-	-	-
		10	75	3.2	2.1	2.3	1.6	1.5	1.1	-	-	-	-
		15	75	5.5	3.2	4.7	2.7	2.9	2.2	3.0	1.6	-	-
		20	50	6.0	4.1	5.2	3.7	4.6	3.0	3.6	2.6	2.9	2.2
		23	50	7.2	4.6	6.5	4.2	6.0	3.7	5.2	3.1	4.4	2.8
High	50	5	75	1.4	1.1					-	-	-	-
		10	75	3.4	2.2	2.4	1.7	1.6	1.1	-	-	-	-
		15	75	5.8	3.3	4.9	2.9	3.1	2.3	3.2	1.7	-	-
		20	50	6.3	4.3	5.5	3.9	4.8	3.2	3.8	2.7	3.1	2.3
		23	50	7.6	4.8	6.8	4.4	6.3	3.8	5.5	3.3	4.6	2.9

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	60	5	75	1.4	1.2	-	-	-	-	-	-	-	-
		10	75	3.5	2.5	2.5	1.9	1.7	1.3	-	-	-	-
		15	75	5.9	3.8	5.0	3.2	3.2	2.6	3.3	1.9	-	-
		20	50	6.5	4.8	5.6	4.4	5.0	3.6	3.9	3.1	3.2	2.6
		23	50	7.8	5.5	7.0	4.9	6.5	4.3	5.6	3.7	4.8	3.3
Medium	60	5	75	1.5	1.3	-	-	-	-	-	-	-	-
		10	75	3.7	2.7	2.6	2.1	1.8	1.4	-	-	-	-
		15	75	6.3	4.0	5.4	3.5	3.4	2.7	3.5	2.0	-	-
		20	50	7.0	5.2	6.1	4.7	5.3	3.9	4.1	3.3	3.4	2.8
		23	50	8.4	5.9	7.5	5.3	6.9	4.7	6.1	4.0	5.1	3.5
High	60	5	75	1.6	1.4	-	-	-	-	-	-	-	-
		10	75	4.0	2.8	2.8	2.2	1.9	1.4	-	-	-	-
		15	75	6.7	4.2	5.7	3.6	3.6	2.9	3.7	2.2	-	-
		20	50	7.4	5.4	6.4	4.9	5.6	4.1	4.4	3.5	3.6	2.9
		23	50	8.8	6.1	7.9	5.5	7.3	4.9	6.4	4.2	5.4	3.7

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	90	5	75	2.4	2.0	-	-	-	-	-	-	-	-
		10	75	5.7	4.0	4.0	3.1	2.7	2.1	-	-	-	-
		15	75	9.7	6.1	8.2	5.2	5.2	4.1	5.4	3.1	-	-
		20	50	10.6	7.8	9.3	7.0	8.1	5.8	6.3	5.0	5.2	4.2
		23	50	12.8	8.8	11.4	7.9	10.6	7.0	9.3	6.0	7.9	5.3
Medium	90	5	75	2.6	2.2	-	-	-	-	-	-	-	-
		10	75	6.3	4.5	4.5	3.4	3.0	2.3	-	-	-	-
		15	75	10.7	6.7	9.1	5.7	5.7	4.6	6.0	3.4	-	-
		20	50	11.8	8.6	10.2	7.8	9.0	6.4	7.0	5.5	5.7	4.6
		23	50	14.2	9.7	12.7	8.8	11.7	7.7	10.2	6.6	8.7	5.9
High	90	5	75	2.7	2.3	-	-	-	-	-	-	-	-
		10	75	6.7	4.7	4.7	3.6	3.2	2.4	-	-	-	-
		15	75	11.3	7.1	9.6	6.0	6.0	4.8	6.3	3.6	-	-
		20	50	12.4	9.1	10.8	8.2	9.5	6.8	7.4	5.8	6.1	4.9
		23	50	14.9	10.2	13.4	9.2	12.4	8.1	10.8	7.0	9.2	6.2

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	130	5	75	2.4	2.1	-	-	-	-	-	-	-	-
		10	75	5.9	4.4	4.2	3.3	2.8	2.2	-	-	-	-
		15	75	10.0	6.5	8.5	5.6	5.3	4.4	5.5	3.3	-	-
		20	50	11.0	8.4	9.5	7.6	8.4	6.3	6.5	5.4	5.3	4.5
		23	50	13.2	9.5	11.8	8.5	10.9	7.5	9.5	6.5	8.2	5.7
Medium	130	5	75	2.7	2.4	-	-	-	-	-	-	-	-
		10	75	6.6	4.9	4.7	3.7	3.1	2.5	-	-	-	-
		15	75	11.2	7.3	9.5	6.3	6.0	5.0	6.2	3.7	-	-
		20	50	12.3	9.4	10.7	8.5	9.4	7.0	7.3	6.0	6.0	5.0
		23	50	14.8	10.6	13.2	9.6	12.2	8.4	10.7	7.2	9.2	6.4
High	130	5	75	3.2	2.8	-	-	-	-	-	-	-	-
		10	75	7.7	5.7	5.5	4.4	3.7	2.9	-	-	-	-
		15	75	13.1	8.6	11.1	7.3	7.0	5.8	7.3	4.4	-	-
		20	50	14.4	11.0	12.5	10.0	11.0	8.2	8.5	7.1	7.0	5.9
		23	50	17.3	12.4	15.5	11.2	14.3	9.9	12.5	8.5	10.8	7.5

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	150	5	75	4.2	3.2	-	-	-	-	-	-	-	-
		10	75	8.2	5.5	6.4	4.4	3.9	3.1	-	-	-	-
		15	75	12.8	7.7	11.0	6.7	8.7	5.5	6.7	4.9	-	-
		20	50	14.7	10.1	13.0	9.1	10.7	7.9	8.9	6.9	6.7	5.9
		23	50	17.5	11.3	15.8	10.4	13.5	9.1	11.5	8.1	9.5	7.2
Medium	150	5	75	4.6	3.6	-	-	-	-	-	-	-	-
		10	75	9.0	6.0	7.0	4.9	4.4	3.5	-	-	-	-
		15	75	14.0	8.5	12.2	7.4	9.6	6.1	7.6	5.0	-	-
		20	50	16.2	11.1	14.4	10.1	11.8	8.7	9.8	7.7	7.4	6.5
		23	50	19.2	12.4	17.4	11.4	14.9	10.0	12.2	8.9	10.5	7.9
High	150	5	75	5.3	3.9	-	-	-	-	-	-	-	-
		10	75	10.2	6.6	8.0	5.6	5.1	4.0	-	-	-	-
		15	75	15.9	9.6	13.8	8.4	11.0	7.0	8.7	5.7	-	-
		20	50	18.4	12.7	16.3	11.5	13.7	10.1	11.2	8.8	8.4	7.5
		23	50	21.8	14.1	19.7	13.0	16.9	11.5	14.8	10.4	12.0	9.2

FAN SPEED	MODEL	AIR	HUMIDITY	EVAPORATING TEMPERATURE °C									
		ON	75% RH	-2.5		0		2.5		5		7	
		°C		Total	Sens	Total	Sens	Total	Sens	Total	Sens	Total	Sens
Low	165	5	75	5.3	3.9	-	-	-	-	-	-	-	-
		10	75	10.2	6.6	8.0	5.6	5.1	4.0	-	-	-	-
		15	75	15.9	9.6	13.8	8.4	11.0	7.0	8.7	5.7	-	-
		20	50	18.4	12.7	16.3	11.5	13.7	10.1	11.2	8.8	8.4	7.5
		23	50	21.8	14.1	19.7	13.0	16.9	11.5	14.8	10.4	12.0	9.2
Medium	165	5	75	5.5	4.2	-	-	-	-	-	-	-	-
		10	75	10.6	7.1	8.3	6.0	5.3	4.3	-	-	-	-
		15	75	16.6	10.3	14.4	9.0	11.5	7.5	9.1	6.1	-	-
		20	50	19.2	13.6	17.0	12.3	14.3	10.8	11.7	9.4	8.8	8.0
		23	50	22.8	15.1	20.6	13.9	17.6	12.3	15.4	11.1	12.5	9.9
High	165	5	75	5.7	4.5	-	-	-	-	-	-	-	-
		10	75	11.1	7.5	8.7	6.4	5.5	4.6	-	-	-	-
		15	75	17.3	11.0	15.0	9.6	12.0	8.0	9.5	6.5	-	-
		20	50	20.0	14.5	17.7	13.1	14.9	11.5	12.2	10.1	9.1	8.6
		23	50	23.7	16.1	21.4	14.9	18.4	13.1	16.1	11.9	13.0	10.5

OPTIONAL LPHW HEATING CONDITIONS (20°C AIR ON)

DXD	Speed	60-30	60-40	65-40	50-30
50	Low	1.19	2.00	2.10	1.10
	Medium	1.24	2.07	2.17	1.14
	High	1.31	2.19	2.3	1.21
60	Low	1.67	2.54	3.02	1.48
	Medium	1.75	2.66	3.16	1.55
	High	1.84	2.8	3.33	1.63
90	Low	1.88	3.28	3.94	1.79
	Medium	2.20	3.84	4.60	2.09
	High	2.7	4.7	5.64	2.56
130	Low	2.93	4.58	5.49	2.65
	Medium	3.25	5.08	6.09	2.94
	High	3.7	5.79	6.94	3.35
150	Low	4.21	5.78	6.39	3.67
	Medium	4.50	6.18	6.84	3.92
	High	4.94	6.78	7.50	4.30
165	Low	4.94	6.78	7.5	4.3
	Medium	5.52	7.58	8.38	4.81
	High	5.99	8.22	9.10	5.22

OPTIONAL ELECTRIC HEATING (FACTORY FIT ONLY)

DXD	ELECTRIC HEATER (kW at 240V)	ELECTRIC HEATER (kW at 230V)
50	2.0	1.92
60	2.0	1.92
90	2.0	1.92
130	3.0	2.87
150	4.0	3.84
165	4.0	3.84

AIR VOLUME (based on 30 Pa external resistance)

DXD	SPIGOTS FRONT (Qty)	230V Minimum Speed m^3/s	230V Medium Speed m^3/s	230V Maximum Speed m^3/s
50	2	0.160	0.170	0.180
60	2	0.180	0.194	0.209
90	3	0.310	0.350	0.372
130	3	0.335	0.382	0.462
150	4	0.425	0.477	0.560
165	4	0.560	0.680	0.800

NOTE: DXD 165 requires 5-off spigots on discharge plenum and 5-off spigots on inlet plenum if fitted.

DXD ACOUSTIC DATA

All sound data ascertained at 30Pa. external resistance
SoundPowr Level (SWL) dB ref.10 -12 W

		INLET/ CASING RADIATED						DISCHARGE						N.R. GUIDE
		Hz						Hz						
MODEL	SPD	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	
DXD 50	1	57.3	52.6	48.6	37.8	32.3	25.7	48.8	45.8	34.6	27.2	15.0	8.5	35
	2	57.4	54.3	49.1	38.0	34.3	26.5	49.7	46.8	35.9	27.8	16.9	9.9	37
	3	58.3	55.5	49.4	39.2	34.9	28.1	50.9	47.4	37.2	28.3	18.7	11.3	40
DXD 60	1	57.3	52.6	48.6	38.1	32.5	26.1	48.8	45.8	35.2	27.7	15.8	8.9	35
	2	57.6	54.4	49.9	39.2	34.9	27.2	50.2	47.1	37.1	28.2	17.4	10.0	37
	3	58.8	56.1	50.8	41.0	36.2	29.9	52.1	48.3	38.8	30.0	20.0	12.1	40
DXD 90	1	57.4	52.8	48.8	38.8	33.0	27.0	48.9	45.9	36.0	28.2	17.0	9.2	35
	2	58.1	54.8	51.5	41.9	36.0	29.6	51.4	47.8	40.0	30.8	19.6	10.1	37
	3	59.2	58.1	54.6	44.4	38.7	33.4	54.5	52.0	43.6	34.4	23.7	14.0	40
DXD 130	1	57.7	53.5	49.6	40.2	34.2	28.2	49.0	46.0	36.4	29.1	17.9	9.7	35
	2	58.3	56.2	53.0	43.1	36.9	31.1	51.7	48.1	40.4	31.0	20.0	10.6	37
	3	59.8	58.4	55.1	45.1	39.0	34.2	54.7	52.2	43.9	34.7	23.9	14.6	40
DXD 150	1	58.2	55.3	51.7	42.5	35.3	30.5	49.1	46.2	36.5	29.5	18.5	10.0	35
	2	59.7	58.4	54.7	44.9	37.8	33.3	51.9	48.2	40.8	31.2	20.1	11.0	37
	3	60.0	58.5	55.2	45.6	39.2	35.4	55.0	52.4	44.1	34.9	24.0	14.8	40
DXD 165	1	59.7	59.4	55.7	46.9	39.8	35.3	51.9	48.2	41.8	31.2	20.1	11.0	37
	2	61.7	61.4	58.7	48.9	42.8	38.3	53.9	51.2	41.8	32.2	22.2	13.0	40
	3	64.2	63.9	61.2	51.4	45.3	40.8	56.4	53.7	44.3	34.7	24.7	15.5	43

Qualification of N.R. predictions:
The N.R. guide figures quoted on the output data page are intended to show the levels which may be expected in a typical office environment provided the following apply: Room sizes are based on a cooling load of 120W/m2. Units must be correctly mounted onto a solid structure, using drop rods attached to mounting points provided, in a false ceiling not less than 300mm deep, with standard 'T' bar grid and 10mm fibreboard tiles. Rooms should be carpeted, have not more than 20% glazing, or highly reflective surfaces. In open plan areas units should be mounted not less than 6m apart and return-air grilles should not be mounted directly below, or adjacent to unit inlets. 1m of non noise regenerative flexible duct should be fitted to each outlet spigot sized to maintain required N.R. level. i.e. 1.5m/s at NR25, 2m/s at NR30, 3m/s at NR35 and 4m/s at NR40.

The foregoing should ensure the 'guide' N.R. levels are met when measured at 1.5m from the nearest grille, provided the grille plenums are correctly sized and insulated.

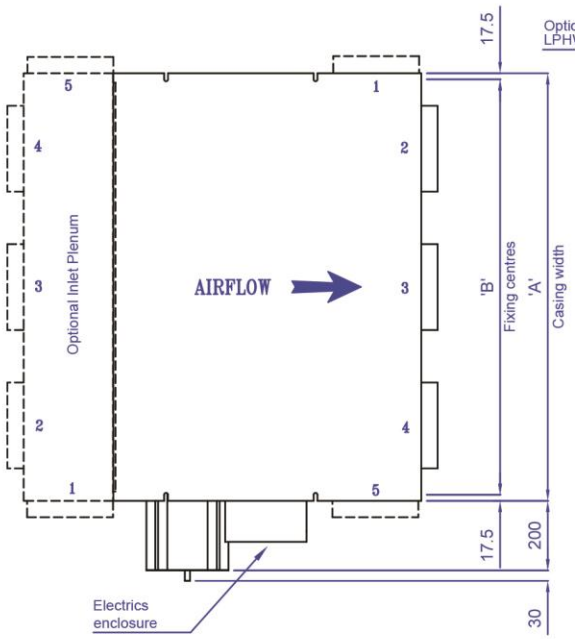
ELECTRICAL LOADS (230 Volts 50Hz 1Ph, in Amps)

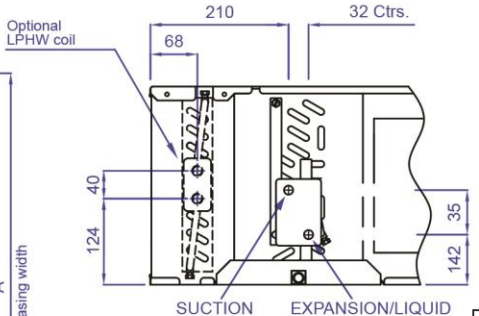
DXD	**50**	**60**	**90**	**130**	**150**	**165**
FAN MOTOR	0.65	0.80	1.38	1.77	2.32	2.8
ELECTRIC HEATER (AIR COND.) OPTION	8.70	8.70	8.70	13.0	17.4	17.4

FUSES

The system and its supply/interconnecting wiring must be protected by fuses, preferably High Rupture Current (HRC) motor rated types (EN60269) or miniature circuit breakers (EN60898) or local codes having similar time lag characteristics, that allow starting of the compressor yet still afford close overcurrent protection under running conditions. The ratings below are for HRC motor rated fuses.

Unit Dimensions
Standard Units

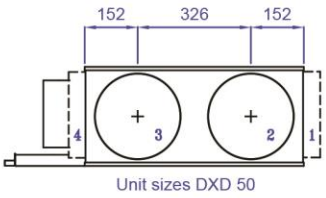




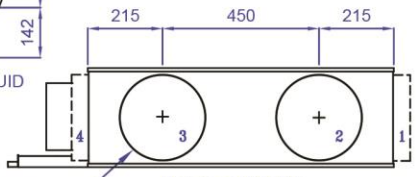
DXD COIL CONNECTION DETAIL

Connections details

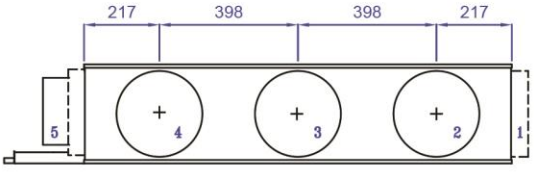
UNIT	SUCT	LIQ
50	3/8"	3/8"
60	3/8"	3/8"
90	12mm	10mm
130	12mm	10mm
150	12mm	10mm
165	12mm	10mm



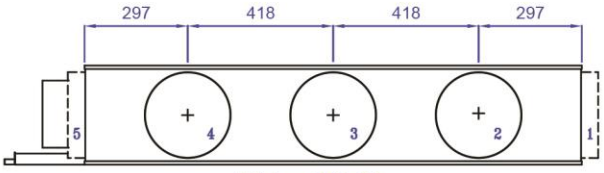
Unit sizes DXD 50



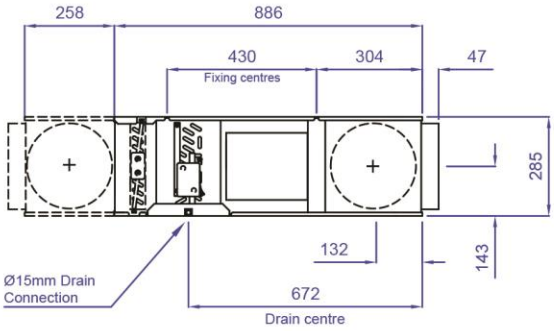
Unit sizes DXD 60

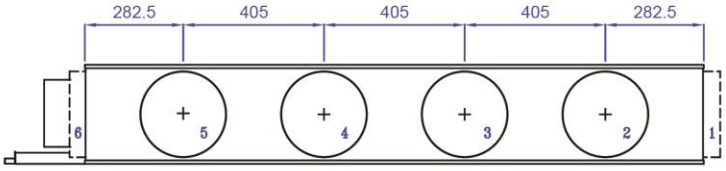


Unit sizes DXD 90



Unit sizes DXD 130





Unit sizes - DXD 150/165

All Handings viewed in direction of airflow
All units supplied as right hand as per illustration above

NB. Max. airflow per 250mm dia. spigot to maintain NR35 = 150 l/s
Max. airflow per 200mm dia. spigot to maintain NR35 = 100 l/s

1. If a front spigot is not to be used then it must be replaced by the corresponding side spigot to allow equal airflow over the coil
2. A maximum of 30pa resistance is allowed (total of inlet and discharge added together)
3. Unit supplied with ALL front spigots fitted
4. DXD 165 requires 5 spigots to be fitted

Dimensional Information

Unit Model	Dim 'A'	Dim 'B'	Spigot Options	Weight (approx Kg)	Minimum number of outlets and return air spigots to be used
DXD 50	630	595	2-3	42	2
DXD 60	880	845	2-3	52	2
DXD 90	1230	1195	2-3-4	69	3
DXD 130	1430	1395	2-3-4	86	3
DXD 150	1780	1745	2-3-4-5	103	4
DXD 165	1780	1745	2-3-4-5	108	4

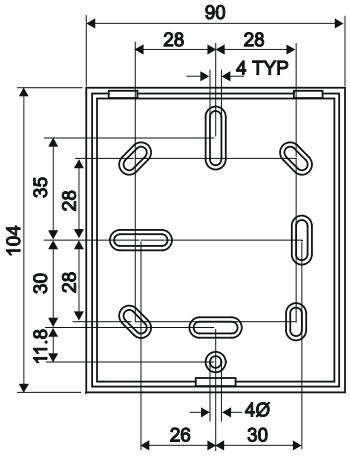
RCC 30 REMOTE CONTROLLER 97200211 - NEW INSTALLATION

The position of the thermostat should account for specific site application:-

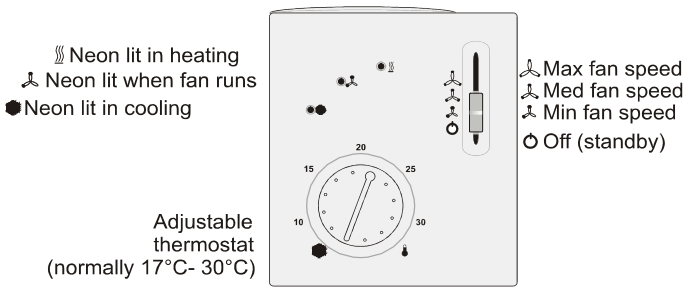
i) Mount on a flat surface within the area conditioned by the unit to which it is connected.
ii) Avoid draughts, heat from radiators, proximity to hot/cold water pipes, direct sunlight.
iii) Avoid corners of the room where air is likely to stagnate.
iv) Avoid direct air discharge from the unit onto the thermostat.
v) Avoid positions where the thermostat may be covered or obscured.
vi) If the room contains pillars, mount on the side of the pillar furthest away from the unit.

Using a flat-bladed screwdriver in the slot at the bottom of the casing, lever off the cover.

Mount the backpanel directly to a wall or onto a plinth, using the fasteners supplied.



VIEW SHOWING MOUNTING HOLE POSITIONS ONLY



The thermostat should be wired with 7 cores of double insulated cable, 0.5mm^2 minimum, preferably in plastic conduit for good appearance. Connections are shown on the table on page 2.

The temperature range is factory set to 17°C - 30°C: it is recommended that this is maintained, but if adjustment is needed (eg. to save energy, a range of 21°C - 25°C might be desired) carefully prise off the rotary dial and reset the stops to suit.

Heating is possible only if the system includes a heat pump outdoor unit, or if electric heaters or a Low Pressure Hot Water coil (CW) has been fitted.

RCC 30 optional return air sensor 97200212 can detect return air temperature at the unit rather than the controller. It should be wired between B1 and M on the RCC 30.

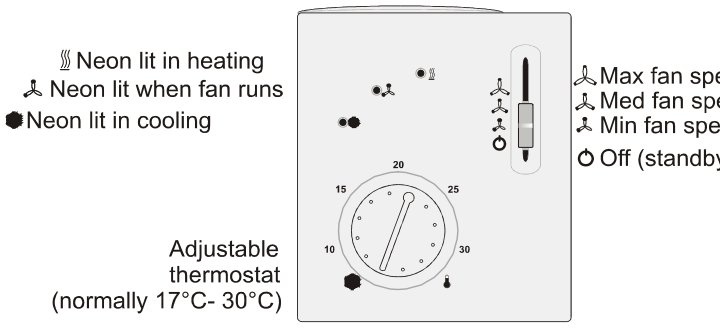
The KLRe 52552 return air sensor is not suitable for use with the RCC 30 thermostat: use 97200212 return air sensor**.**

DIP switches at the bottom rear of the controller are factory set as shown below: these are the recommended settings.

DIP switch	Function	ON position	OFF position
1	Fan control	Fan control is temperature dependent in all operating modes	Fan control in normal operation is temperature independent
2	Operating mode changeover via external switch	Changeover between normal operation and energy saving mode	Changeover between normal operation and standby
3	Action of switch for externally operated mode changeover	Changeover activated when contact of switch is closed	Changeover activated when contact of switch is open
4	Standby	Frost protection disabled	Frost protection enabled
5	Switching differential	1K in heating mode, 0.5K in cooling mode	4K in heating mode, 2K in cooling mode
6	Dead zone in normal operation	2K	5K

= factory settings

OPERATING INSTRUCTION RCC 30 REMOTE CONTROLLER



ON / OFF AND FAN SPEEDS
The slider controls the fan speeds as shown above: in its lowest position the unit is in standby ie. the air conditioner has power supplied to it but does not operate.

TEMPERATURE CONTROL

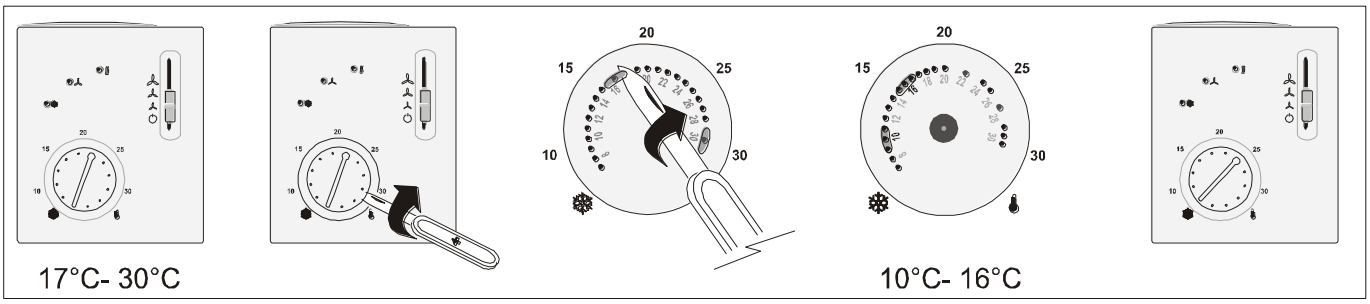
The desired room temperature is set using the rotary switch.

Normally the range is restricted to 17°C - 30°C, although the installer may have set the minimum higher or the maximum lower (eg 20°C - 25°C) to conserve energy.

After resetting the temperature, there may be a short delay (2-3 minutes) before the system operates in its new mode. The air conditioner will then attempt to satisfy the set temperature.

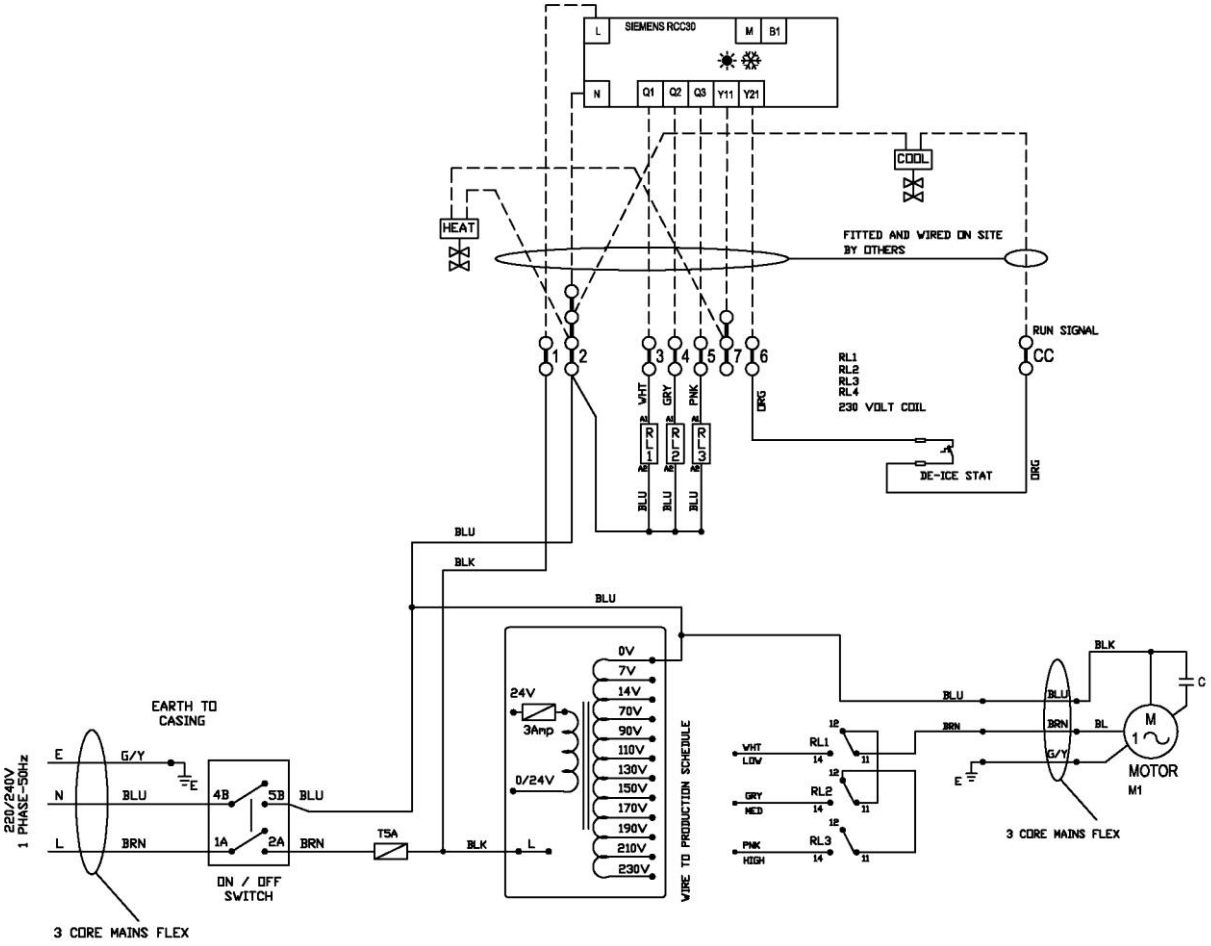
Heating is possible only if the system includes a heat pump outdoor unit or if electric heaters have been fitted (DX systems), or if an LPHW coil is fitted or the unit is supplied from a reverse cycle chiller (CW systems).

<u>For specified low temperature systems :</u> the range is restricted from between 10°C and 16°C.



This adjustment can be made by carefully prising off the rotary dial and re-setting the stops as required.

WIRING DIAGRAM



TROUBLE SHOOTING

Unit will not cool	No mains supply to the control board.
Pump does not run	The fuse on the pcba has failed (315 mA x 20mm) Sensor is disconnected from the control board
Cooling is interrupted	Restriction in pump flow allowing the condensate level to rise and trip the overflow circuit - check for blockage or kink in hoses. Condensate at high level -- tripping overflow circuit Pump filter blocked - remove, clean and replace
Excessive pump noise	Air leak in hoses and/or joints Pumping without water in sump -- control board fault Loose connection between the sensor and the control board Loose fuse, intermittent mains supply to the control board Water syphoning due to lack of an air break in the outlet from the pump

APPLICATION NOTES

1 The pump will work against a 5m head. Flow rate is highest with minimum head.
2 Long drains should not be exposed outdoors, as condensate may freeze and block the drain in winter.
3 Ensure that there are no kinks in any of the drain hoses as this could seriously affect the pump performance.
4 Avoid having the drain outlet more than 200mm below the level of the pump, otherwise syphoning may occur, giving rise to noisy pump operation. Avoid this by fitting an air break eg. by pumping into a larger diameter pipe than that from the pump.
5 Clean the filter at regular intervals.