Spot 60

A/W/X/C

Close Control
Air Conditioning
System

Engineering Data Manual

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This Engineering Data Manual has been prepared to provide technical information and guidance when designing and planning a close control airconditioning system. Development is continuous and the manufacturer reserves the right to change specifications without notice.
The distribution of this manual is strictly limited to consulting engineers and architects only.

1 – SPOT 60

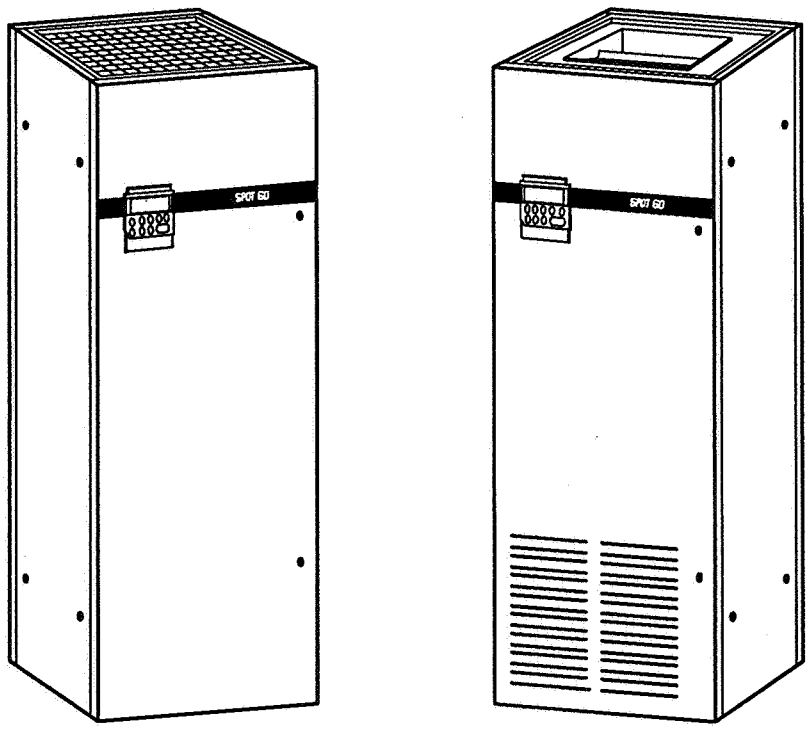
SPOT 60 air conditioners are **compact** and **autonomous** units for conditioning and circulating process air in modern computer rooms and similar environments where comfort air conditioners are inadequate. Specially developed for this purpose, SPOT 60 conditioners offer a guarantee of continuous **reliable** service to the user and the correct environment for maximum reliability of the process served.
Flexibility is a main characteristic of the SPOT 60, as well with regard to the **costumer requirements** (the generous dimensioned direct driven radial fan, equipped with different motors provide exactly the requested air flow and available head pressure), as also for its **easy installation** and **simple positioning** on site.

The baseframe dimensions of the Spot 60 allow the positioning of the unit on the raised floor by simply cutting a floor tile.

Four different systems available:

UNDER/OVER 10 A	**aircooled**	**with external aircooled condenser**
UNDER/OVER 10 W	**watercooled**	**with built–in watercooled condenser**
UNDER/OVER 10 X	**split version**	**with external compressor–condenser**
UNDER/OVER 10 C	**chilled water**	**with chilled water coil**

Fig. 1 – The Shape

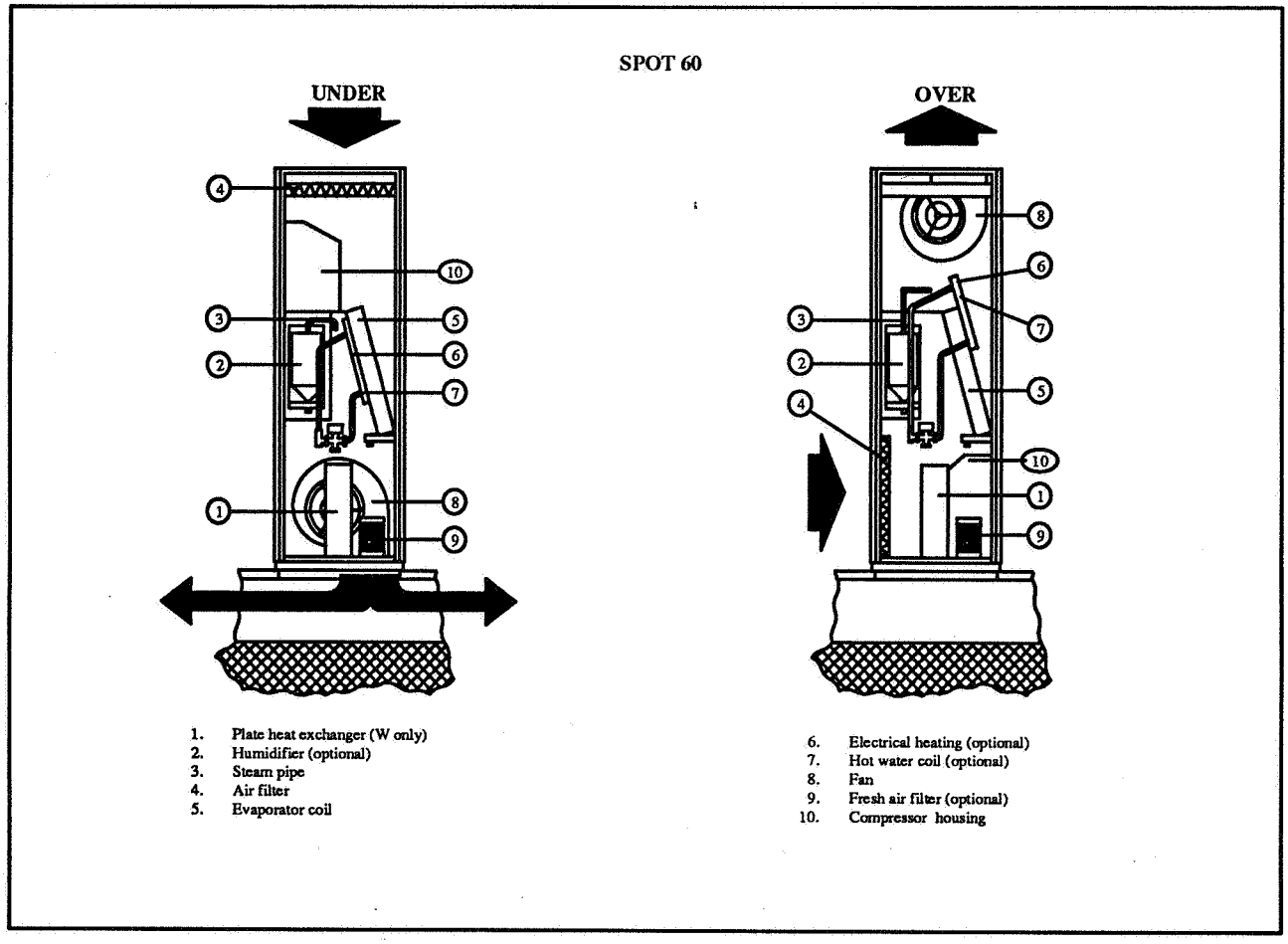


Electronic equipment produces only sensible heat. SPOT 60 is carefully designed and dimensioned to produce only sensible cooling. No energy for undesired latent cooling. With SPOT 60, 100 % of the generated cooling capacity is available to deal with the environment load. SPOT 60 is also fitted with a direct driven fan, thus avoiding the energy losses typical of belt driven assemblies.

2 – Operating Principles

2.1 – AIR CIRCUIT – MAIN FEATURES (all models)

Fig. 2 – Air Circuit



The SPOT 60 conditioner cabinet forms an airtight plenum and contains all the components required for complete air treatment. The air is drawn in through the top air intake and directed downwards in the UNDER models, and from the front air intake directed upwards in OVER models. The air is initially filtered and then passes through the different stages of air treatment, before finally being discharged by the unit fan.

2.1.1 – Fan (8)

The units are equipped with double inlet centrifugal fans with weels and housing in deep galvanized steel plate. They are provided with forwarderly bladed weels and built in electrical motors, directly keyed on the motor shaft. The impellers are statically and dynamically balanced with lifetime lubricated bearings for quiet, vibration free operation.
Single phase, 6–poles, 3–speed motors: the highest speed is selected as standard, a lower speed is used during dehumidification operation. The fans are completely mounted on antivibrated supports with rubber gaskets to minimize the structure vibration and the noise generation; a special antivibration gasket is installed on the air discharge: the result is an exceptional quietness of operation. A special low flow sensor is standard installed to monitorize the ventilation fault.
The generously dimensioned direct driven radial fan can be equipped with different motors to fulfill exactly the costumer requirements (e.g. air flow, available head pressure and noise level). See options D–FAN and LOW–FAN, 5.2/5.3.

2.1.2 – Prefilter (optional)

The prefilter is an initial coarse stage of filtration to extend the life of filters. The prefilters are metallic and easy to clean.

2.1.3 – Main Filters (4)

DATAFILTER: SPOT 60 is fitted with long life high efficiency pleated filters to remove any pollutant particle up to EUROVENT Standard EU3 filtration.

SUPERDATA FILTER (OPTIONAL): When very high efficiency filtration is required, bag filters can be housed inside the SPOT 60 without requiring any special add–on hood. These filters are designed to meet Eurovent Standard EU5 filtration. For other filter classes please contact your official Hiross dealer.

2.1.4 –Electrical Panel

The general electrical panel is located behind the frontdoor of the SPOT 60. Access to the electrical panel is possible only by opening the frontdoor of the unit. This panel contains all the principle components necessary for operation of the unit. The auxiliary circuits operate at low voltage (24V) for maximum safety, while a protective shield prevents accidental contact with high voltage parts. The power circuit supplies the fan, the compressor, the electric heating elements, the humidifier and the transformer for the auxiliary circuits; all these devices are individually protected against short circuit.

2.1.5 – Cabinet and frame

The SPOT 60 frame consists of a robust base section constructed from welded 2 mm sheet steel, supporting the weight bearing struts and cross members to give maximum support with low self weight. Contur panels, lined with 20 mm thick thermal and acoustic, dust and fibre free, non–flammable insulation, are fitted on all sides of the unit using 1/4 turn fasteners.
Frame and panels are primed and high temperature baked painted in a standard colour RAL 7032 to match with the computer and to give an overall appearance in harmony with the computer equipment, even when installed in a free standing location away from walls and partitions. Special double–skinned cover panels are available as an option.

2.2 – REFRIGERANT CIRCUIT (U/O 10 A, W, X)

Fig. 3 – Principal diagram of refrigeration circuit
Aircooled Type (A)
Split Version (X)

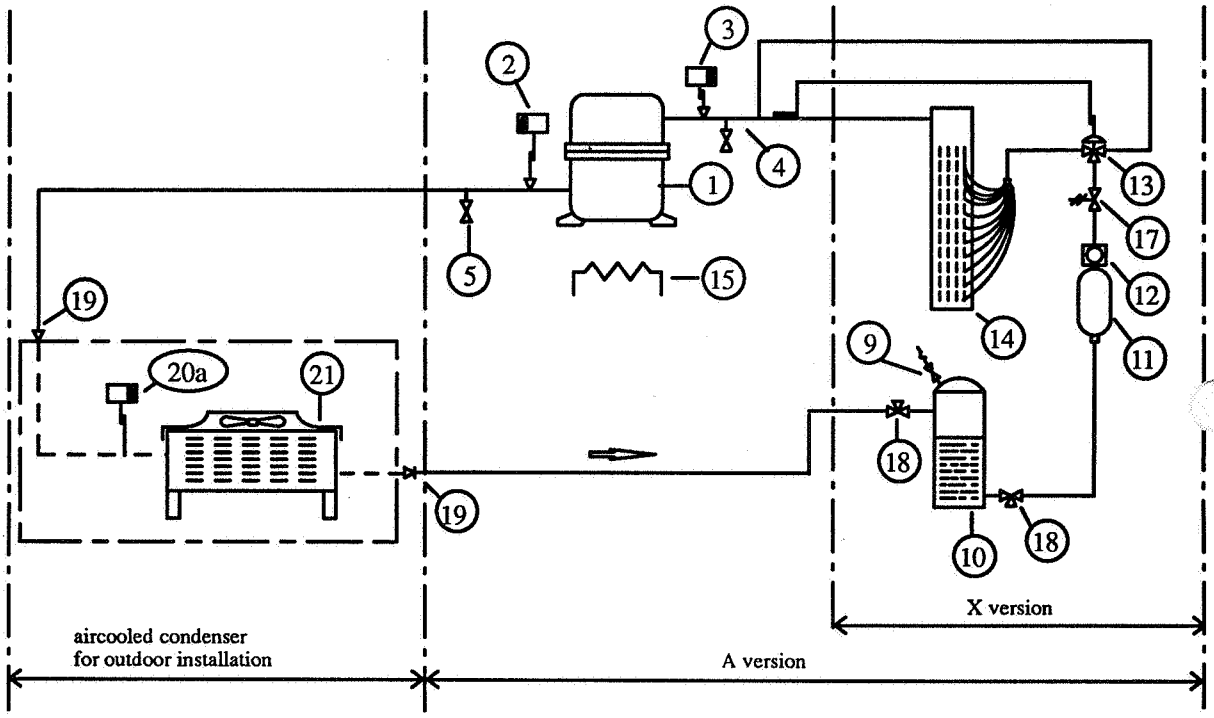
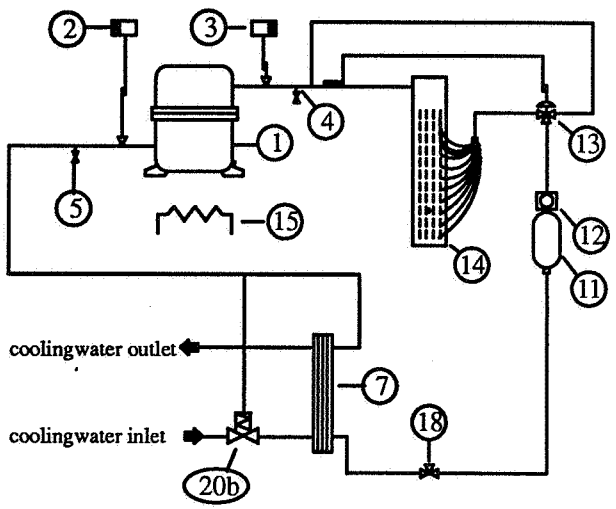


Fig. 4 – Principal diagram of the refrigeration circuit
Watercooled Type (W)



1	Compressor
2	High pressure switch
3	Low pressure switch
4	Suction schrader connection
5	Discharge schrader connection
7	Condenser water/glycol cooled
9	Pressure safety valve
10	Liquid reciever
11	Filterdryer
12	Sight glass
13	Thermostatic expansion valve
14	Evaporator
15	Crankcase heater
17	Liquid line solenoid valve
18	Liquid line valve
19	Non return valve
20a	Condenser fan – pressure switch
20b	Water – head pressure control valve (W only)
21	Aircooled condenser

Superheated refrigerant gas is pumped at high pressure from the compressor (1) to the condenser (7,21).
This condenser can be aircooled (A,X) or watercooled (W). In the first case an axial flow fan, operated by a pressure switch (20a) in the high pressure circuit, drives cooling air over a coil condensing the refrigeration gas. In the second case the condenser is cooled by water, then controlled by a valve (20 b).
In both cases the liquid refrigerant passes through a filter dryer (11), a sight glass (12) and a thermostatic expansion valve (13), where the refrigerant expands before entering the evaporator (14). Here the refrigerant absorbs heat from the recirculating air before return to the compressor (1) to start a new cycle.

2.2.1 – Compressor (only for models A,W) (1)

The compressor is of the fully hermetic type without seals, belts and lubrication points. All internal moving parts are mounted on vibration dampers and the compressor itself is fitted on antivibration mountings at ground level to ensure vibration and noise free operation. The compressor is equipped with a crankcase heater. The suction gas passes over the motor before entering the cylinders, i.e. the motor is refrigerant cooled.
The compressor is equipped with a low and a high pressure switch to protect it from high condensing temperature and low evaporating temperature. The low pressure switch has an automatic reset. To avoid compressor short cycling at high discharge pressures, the high pressure switch has a manual reset.
The inclusion of a high pressure switch in compliance with TÜV standards is optional.

2.2.2 –Evaporator (14)

The evaporator is designed as a finned tube heatexchanger with copper tubes and aluminium fins. The refrigerant evaporating inside the tubes draws heat from the air, which flows over the extended heat exchange surfaces.

2.2.3 –Liquid Receiver (10) (only A)

The refrigerant circuit is provided with a liquid receiver. This receiver is fitted with a Rotalock valve on the outlet and is equipped with a pressure relief valve to meet all pressure vessel regulations. As an option, delivery in compliance with different approvals, such as TÜV, ISPESL, etc., is possible.

2.2.4 –Condenser (7,21)

The condenser of models U/O 10W is designed as plate heatexchanger. This unit can be provided with an automatic water regulating valve for an open cooling water circuit, or without for closed cooling circuits with glycol coolers.
For the aircooled units external aircooled condensers are necessary. For further details see chapter 7.0 – Aircooled Condensers and Radcoolers and the relevant manual. Radcoolers can be installed in connection with the models U/O 10 W.

2.2.5 – Filter Dryer (11)

A filter–dryer is installed on the liquid line of the circuit to ensure a clean and moisture free system for maximum efficiency and a long and safe working life.

2.2.6 – Sight Glass (12)

A sight glass with moisture indicator is installed in the liquid line of the circuit to allow a visual check of the refrigerant charge and moisture content.

2.2.7 – Expansion Valve (13)

The externally equalized thermostatic expansion valve controls the refrigerant flow to the evaporator and provides a constant value of vapour superheat.

2.2.8 – Solenoid Valve (17), (only for Models A, X)

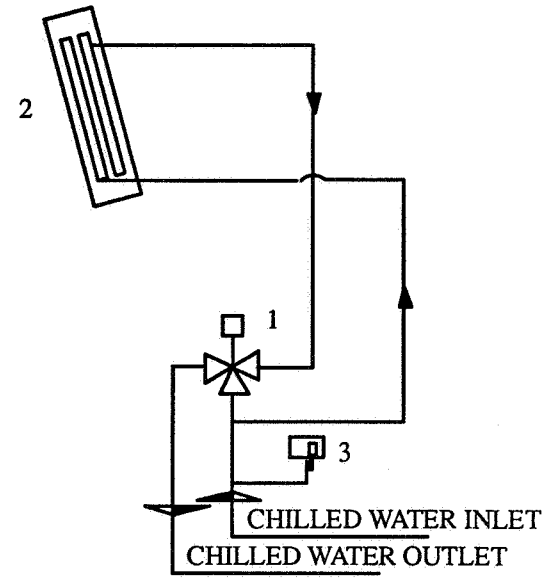
The solenoid valve stops the refrigerant flow, when the compressor is not in operation.
Thus preventing liquid refrigerant entering the evaporator and, from there, the compressor.

2.2.9 – Safety Valve (9), (only A, for X–version on request)

The liquid refrigerant receiver is equipped with a pressure relief valve to meet all pressure vessel regulations. As an option, delivery of values in compliance with differant approvals, such as TÜV, ISPESL, a.s.o. is possible.
After the opening of the safety valve in case of to high pressures, we suggest to replace it. As a matter of fact it is very easy, that dirty particles contained in the refrigerant circuit maintain some microopening in the teflon seal from where the refrigerant will flow slowly into the environmental atmosphere.

2.3 – CHILLED WATER CIRCUIT (units U/10 C)

Fig.5 – Chilled Water Circuit Diagram



N	DESCRIPTION
1	Chilled water 3–way valve
2	Chilled water coil
3	Chilled water alarm thermostat (optional)

2.3.1 – 3–Way Valve (1)

The chilled water control–valve is actuator operated. The valve body is bronce, the stem and seats are made of stainless steel. The valve does not require any end switches to be adjusted.
A maintenance free 3–point actuator in a synthetic housing is mounted on the valve by a cap nut.
It also includes a slot for manual control using a 5mm allen key and a valve position indicator.
NEVER PERFORM MANUAL OPERATION USING A SCREW DRIVER
The terminal board is within the housing. An opening is available for the passage of connecting wires into the housing.
The modulating control is achieved with the control device using the valve running time.
Technical specifications – Control voltage: 24V a.c. +/– 20%
– Frequency: 50...60Hz

CONSTRUCTION
The valve body is bronze, the valve seat is worked directly into the body, the stem and closure are stainless steel. The valve stem seal is a double o–ring complete with "scrapers" to avoid dirt coming into contact with the o–rings.

2.3.2 – Cooling Coil (3)

The cooling coil is designed as finned tube heat exchanger with copper tubes and aluminium fins. The chilled water draws heat from the air, which flows over the extended heat exchange surfaces.

2.4 – Control System

SPOT 60 is delivered with a microprocessor control, developed by HIROSS: **HIROMATIC.**
This high–tech computer, in addition to precise control reaction provides new features in a large display, which shows temperature, humidity, system status, date and time. In case of alarm, HIROMATIC displays the corresponding alarm text with related service hints.
A great variety of alarm sensors can be connected to the SPOT 60 control and any resultant alarm signal is displayed on the HIROMATIC display panel. The most common alarm sensors include:
High/low temperature and humidity, heater overheating, fan failure, high/low pressure failure (A, W and X–units), clogged filters and liquistat (water detection). Other specific alarm requirements can be easily accomodated.
Up to 20 of those alarms are memorized in a data–file, which can be recalled at any time.
Some other features as working–hour–counters, humidifier control (no separate module necessary), two alarm stages ("WARNING" for service and "ALARM" for failures), etc. are included in the HIROMATIC. An optional HIROMATIC version features high resolution graphic display showing temperature and humidity curves with the data for the previous 24 hours. The graphic version gives the opportunity to memorize up to 60 alarms. HIROMATIC is fitted with one Volt–free contact to give remote signals for failure.
For further information see HIROMATIC–Operating manual.

3 – MAIN OPTIONALS (Accessories and Main Features)

Technical data of optionals are included in the technical data sheets.

3.1 – MAIN OPTIONALS INSTALLED ON BOARD

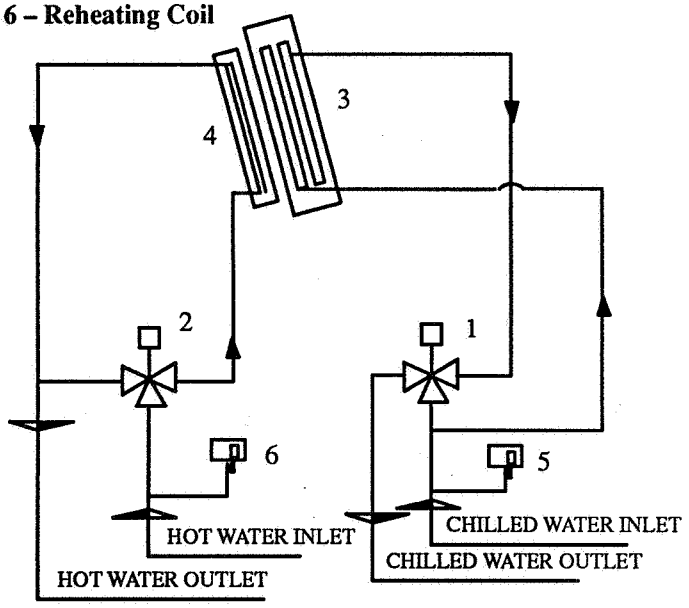
3.1.1 – Electric reheat

SPOT 60 features an electric reheat coil with ample capacity to maintain the correct dry bulb temperature when the system calls for dehumidification.
The elements are of high capacity aluminium tube design with a low watt density. Ionization effects are eliminated due to the low surface temperature of the elements.

3.1.2 – Hot water reheat

A hot water reheat coil made from copper tubes with aluminium fins is available as an alternative, or in addition to the electric heating elements. It is designed also to operate with low temperature hot water, typical of heat recovery systems (heat pumps, condenser water, etc.).
The system and its controls are factory mounted and include a 3–way control valve and connecting pipes.
The air pressure drop through the coils is low enough that the influence on the air flow rate through the unit is negligible.

Fig. 6 – Reheating Coil



N	DESCRIPTION
1	Chilled water 3–way valve
2	Hot water 3–way valve
3	Chilled water coil
4	Reheating coil
5	Chilled water alarm Thermostat (optional)
6	Hot water thermostat (optional)

3.1.3 – Hot gas reheat (only for models A,W)

(optional and only used during dehumidification)
The hot refrigerant, which exits the compressor, flows through the hot gas coil thus heating the air passing over it.

3.1.4 – Humidifier (2)

The correct relative humidity in the computer room is maintained with an electronically controlled electrode/boiler steam humidifier, with a disposable plastic tank. This humidifier produces clean and particle–free steam and its operation which includes an automatic flushing cycle, is particularly safe and service–free.
The Humidifier can use virtually any type of hard or soft water, provided it is not distilled water. Further information is given by the separate HUMIDAIR–Operating manual.

3.2 – MAIN OPTIONALS SUPPLIED AS SEPARATED KITS

3.2.1 – Electronic environmental alarm package (E.E.A.P.)

The E.E.A.P. is a package of two temperature and two relative humidity sensing elements.
Electrically connected to the HIROMATIC, E.E.A.P. will make the following visual and audible alarms operative:

– high room temperature
– low room temperature
– high room humidity
– low room humidity

The sensing elements can be individually programmed between 0–50°C (40–50°F) and 10–99 % R.H.

3.2.2 – Clogged filter alarm

A differential pressure switch can be fitted to operate a visual and audible alarm when the air pressure drop through the filters reaches the maximum acceptable value before the filters have to be changed.

3.2.3 – Liquistat

The LIQUISTAT senses the presence of water or any other conductive liquid and operates an alarm in the HIROMATIC. There are no moving parts and it is not affected by dirt or vibration.

3.2.4 – Smokestat

A smokestat can be fitted to shut down the air conditioning system upon sensing the presence of smoke in the return air.

3.2.5 – Firestat

In certain areas, fire regulations require a firestat to be fitted to shut down the air conditioning system in the event of an abnormaly high return air temperature.

3.2.6 – Fresh air

A fresh air supply between 20 and 30 m^3/h (12 to 18 cfm) is required for each person occupying the computer room to ensure sufficient oxygen, remove odours and to maintain a slight positive pressure within the room to prevent ingress of dust from surrounding areas. The fresh air supply can be introduced and filtered within the SPOT 60 with a fresh air intake in the lower compartment of the unit, connected to the external ambient by a flexible duct.

3.2.7 – Application frame

A base frame, 75 mm high, is available and can be fitted in the space left free by removing a 600 mm x 600 mm raised floor panel. This allows easy installation without the need for cutting any raised floor panels (see Fig. 5).

3.2.8 – Extension hood (all models Under)

The SPOT 60 can be supplied with an extension hood on the top for connection to a ventilated ceiling when air return via the ceiling void is specified. If an ultra–silent installation is required, the extension hood can also be fitted internally with noise attenuation baffles (see Fig. 7).

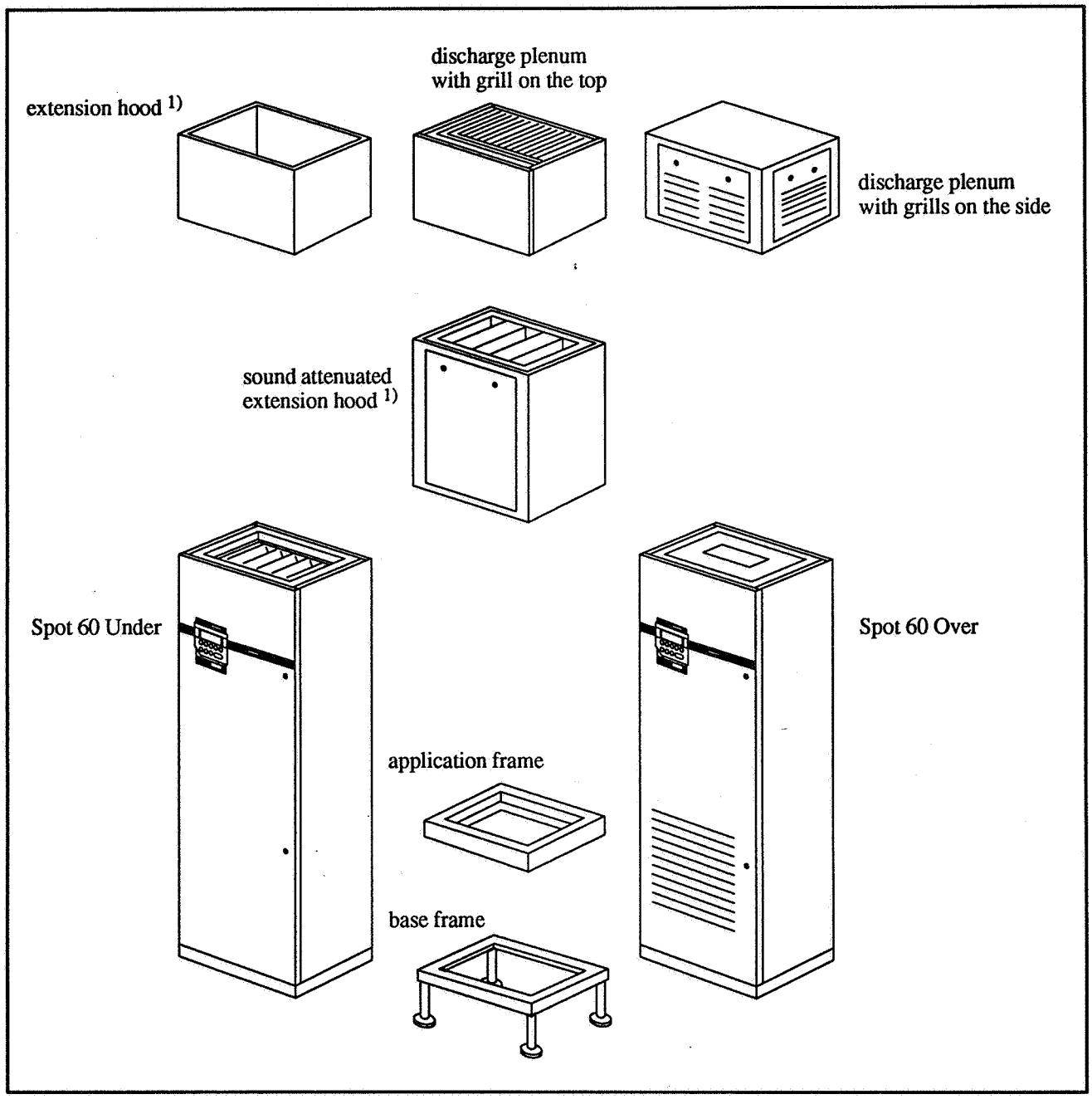
3.2.9 – Discharge plenum (all models Over)

SPOT 60 can be supplied with alternative discharge plenums, which distribute the air in different configurations (front, ceiling etc.)

3.2.10 – Sound attenuators (all models Under)

SPOT 60 can be supplied with "sound attenuators", which permit to obtain a noise reduction of appx. 4 dB(A).
The silencers can be held in an extension hood (see 3.2.8), or built–in inside the conditioner, in the space generally reserved for the air bag filters (in this case of course the installation of bag filters is not possible).

Fig. 7 – Optional extension hoods and base frames



No floor cutting or base frame is required. Spot 60 can be relocated simply by removing a floor tile and inserting an application frame, which fits exactly in the 600x600 mm space.
The extension hood can also be used as base and be mounted with flaps or airfilters.

ad. 1) Plenum as well as extension hoods can be used also as base moduls.

4 – PERFORMANCE TABLES

4.1 – COOLING CAPACITY SPOT 60 A,W MODELS

Tab. 1

Model		U10A	O10A	U10W	O10W	U10W	O10W
		aircooled		glycolcooled		watercooled	
Cooling capacity data *) at air flow rate 4000 m³/h							
Room conditions 22°C – 50% R.H.							
Total capacity	kW	10.4	10.1	10.3	10.1	10.8	10.6
Sensible capacity	kW	9.9	9.7	9.6	9.7	9.9	9.7
Water flow rate	m³/h	–	–	1.4	1.4	0.9	0.9
Pressure drop condenser	kPa	–	–	25.0	25.0	11.0	11.0
Pressure drop water regulating valve	kPa	–	–	–	–	69.0	69.0
Room conditions 23°C – 50% R.H.							
Total capacity	kW	10.6	10.4	10.8	10.6	11.3	11.1
Sensible capacity	kW	10.0	9.8	10.1	9.9	10.3	10.1
Water flow rate	m³/h	–	–	1.5	1.5	0.9	0.9
Pressure drop condenser	kPa	–	–	28.0	28.0	11.0	11.0
Pressure drop water regulating valve	k pa	–	–	–	–	69.0	69.0
Room conditions 24°C – 50% R.H.							
Total capacity	kW	10.9	10.7	11.4	11.2	11.6	11.4
Sensible capacity	kW	10.1	10.0	10.4	10.2	10.4	10.2
Water flow rate	m³/h	–	–	1.6	1.6	1.0	1.0
Pressure drop condenser	kPa	–	–	32.0	32.0	13.3	13.3
Pressure drop water regulating valve	kPa	–	–	–	–	83.2	83.2
Room conditions 25°C – 50% R.H..							
Total capacity	kW	11.2	11.0	11.7	11.5	11.9	11.7
Sensible capacity	kW	10.4	10.2	10.6	10.4	10.7	10.5
Water flow rate	m³/h	–	–	1.6	1.6	1.0	1.0
Pressure drop condenser	kPa	–	–	32.0	32.0	13.3	13.3
Pressure drop water regulating valve	kPa	–	–	–	–	83.2	83.2
Room conditions 26°C – 50% R.H.							
Total capacity	kW	11.4	11.2	11.9	11.7	12.2	12.0
Sensible capacity	kW	10.5	10.3	10.8	10.6	10.9	10.7
Water flow rate	m³/h	–	–	1.6	1.6	1.0	1.0
Pressure drop condenser	kPa	–	–	32.0	32.0	13.3	13.3
Pressure drop water regulating valve	kPa	–	–	–	–	83.2	83.2
Room conditions 27°C – 50% R.H.							
Total capacity	kW	11.7	11.5	12.2	12.0	12.5	12.3
Sensible capacity	kW	10.6	10.4	11.0	10.8	11.2	11.0
Water flow rate	m³/h	–	–	.1.7	1.7	1.1	1.1
Pressure drop condenser	kPa	–	–	35.0	35.0	15.8	15.8
Pressure drop water regulating valve	kPa	–	–	–	–	99.1	99.1

*) reference conditions:
aircooled version, at outdoor temperature 32 °C
glycolcooled version, at outdoor temperature 32 °C and 30 % glycol content
watercooled version, at water inlet temperature 10 °C, condensing temperature 45 °C

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

4.2 – COOLING CAPACITY SPOT 60 X MODELS

Tab. 2

Model		U10X	O10X	U10X	O10X	U10X	O10X
Cooling capacity data *) at air flow rate 4000 m³/h							
Evaporating temperature	°C		4		6		8
Room conditions 22°C – 50% R.H.							
Total capacity	kW	13.1	12.9	11.0	10.8	9.5	9.3
Sensible capacity	kW	12.0	11.8	9.9	9.7	9.5	9.3
Room conditions 23°C – 50% R.H.							
Total capacity	kW	13.8	13.6	11.6	11.4	10.0	9.8
Sensible capacity	kW	12.5	12.3	10.5	10.3	10.0	9.8
Room conditions 24°C – 50% R.H.							
Total capacity	kW	14.5	14.3	12.1	11.9	10.6	10.4
Sensible capacity	kW	13.1	12.9	11.0	10.8	10.6	10.4
Room conditions 25°C – 50% R.H..							
Total capacity	kW	15.2	15.0	12.7	12.5	11.2	11.0
Sensible capacity	kW	13.7	13.5	11.6	11.4	11.2	11.0
Room conditions 26°C – 50% R.H.							
Total capacity	kW	15.9	15.7	13.2	13.0	11.9	11.7
Sensible capacity	kW	14.3	14.2	12.1	11.9	11.9	11.7
Room conditions 27°C – 50% R.H.							
Total capacity	kW	16.6	16.4	13.8	13.6	12.6	12.4
Sensible capacity	kW	15.1	14.9	12.7	12.5	12.6	12.4

*) at 50 °C condensing temperature and 6 K suction overheat

Note: For low noise applications with a reduced air flow, above cooling capacity data cannot be used.
A new selection based on the requested reference conditions has to be required.

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

4.3 – COOLING CAPACITY SPOT 60 C

Cooling capacity SPOT 60 C – Over/Under models

Tab. 3

Model		O/U 10 C						
Cooling capacity data at air flow rate 4000 m³/h								
Water inlet/outlet temp.	°C	6/10	6/12	7/12	8/13	10/15	11/16	12/17
Room conditions 22°C – 50% R.H.								
Total capacity	kW	12.71	10.88	10.75	9.73	7.70	6.64	5.56
Sensible capacity	kW	11.37	10.14	10.05	9.37	7.70	6.64	5.56
Water flow rate	l/h	2750	1570	1860	1680	1330	1150	960
Pressure drop (incl. valve)	kPa	20	7	10	8	5	3	2
Air outlet temp.	°C	13.6	14.5	14.5	15.0	16.3	17.1	17.9
Air outlet R.H.	%	80.9	78.0	77.8	76.3	71.5	68.0	64.6
Room conditions 23°C – 50% R.H.								
Total capacity	kW	13.73	11.89	11.77	10.74	8.70	7.69	6.63
Sensible capacity	kW	12.03	10.80	10.72	10.03	8.70	7.69	6.63
Water flow rate	l/h	2970	1710	2040	1860	1510	1330	1150
Pressure drop (incl. valve)	kPa	23	8	11	10	6	5	3
Air outlet temp.	°C	14.0	15.0	15.0	15.5	16.5	17.3	18.1
Air outlet R.H.	%	82.5	79.5	79.3	77.7	74.8	71.3	67.8
Room conditions 24°C – 50% R.H.								
Total capacity	kW	14.74	12.90	12.78	11.75	9.70	8.69	7.68
Sensible capacity	kW	12.68	11.45	11.37	10.69	9.35	8.69	7.68
Water flow rate	l/h	3190	1860	2210	2030	1680	1500	1330
Pressure drop (incl. valve)	kPa	27	10	13	11	8	6	5
Air outlet temp.	°C	14.5	15.4	15.5	16.0	17.0	17.5	18.3
Air outlet R.H.	%	84.0	80.9	80.8	79.1	76.1	74.6	71.1
Room conditions 25°C – 50% R.H..								
Total capacity	kW	15.76	13.91	13.79	12.76	10.71	9.69	8.67
Sensible capacity	kW	13.31	12.08	12.01	11.34	10.00	9.69	8.67
Water flow rate	l/h	3410	2010	2390	2210	1850	1680	1500
Pressure drop (incl. valve)	kPa	30	11	15	13	10	8	6
Air outlet temp.	°C	15.0	16.0	16.0	16.5	17.5	18.0	18.5
Air outlet R.H.	%	85.6	82.9	82.3	80.6	77.5	76.0	74.4
Room conditions 26°C – 50% R.H.								
Total capacity	kW	16.78	14.92	14.81	13.78	11.72	10.69	9.67
Sensible capacity	kW	13.94	12.71	12.64	11.97	10.65	9.99	9.67
Water flow rate	l/h	3620	2150	2560	2380	2030	1850	1670
Pressure drop (incl. valve)	kPa	34	13	18	15	11	10	8
Air outlet temp.	°C	15.5	16.5	16.5	17.0	18.0	18.5	19.0
Air outlet R.H.	%	87.3	84.0	83.8	82.1	78.9	77.4	75.9
Room conditions 27°C – 50% R.H.								
Total capacity	kW	17.79	15.93	15.82	14.79	12.73	11.70	10.68
Sensible capacity	kW	14.55	13.33	13.26	12.59	11.28	10.63	10.68
Water flow rate	l/h	3840	2300	2740	2560	2200	2020	1850
Pressure drop (incl. valve)	kPa	38	15	20	18	13	11	10
Air outlet temp.	°C	16.1	17.0	17.0	17.5	18.5	19.0	19.5
Air outlet R.H.	%	88.9	85.6	85.4	83.6	80.3	78.8	77.3

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

Cooling capacity SPOT 60 C – Over/Under

Tab. 4

Model		O/U 10 C						
Cooling capacity data at air flow rate 3500 m³/h								
Water inlet/outlet temp.	°C	6/10	6/12	7/12	8/13	10/15	11/16	12/17
Room conditions 22°C – 50% R.H.								
Total capacity	kW	11.64	9.99	9.87	8.93	7.07	6.13	5.13
Sensible capacity	kW	10.44	9.33	9.25	8.62	7.07	6.13	5.13
Water flow rate	l/h	2520	1440	1710	1550	1230	1060	890
Pressure drop (incl. valve)	kPa	17	6	8	7	5	3	2
Air outlet temp.	°C	13.2	14.2	14.2	14.8	16.1	16.8	17.7
Air outlet R.H.	%	82.6	79.6	79.3	77.7	72.5	68.9	65.3
Room conditions 23°C – 50% R.H.								
Total capacity	kW	12.57	10.91	10.79	9.85	7.99	7.06	6.12
Sensible capacity	kW	11.04	9.93	9.85	9.23	7.99	7.06	6.12
Water flow rate	l/h	2720	1570	1870	1710	1380	1220	1060
Pressure drop (incl. valve)	kPa	20	7	10	8	5	3	3
Air outlet temp.	°C	13.7	14.6	14.7	15.2	16.3	17.0	17.8
Air outlet R.H.	%	84.2	81.1	80.9	79.2	76.0	72.3	68.7
Room conditions 24°C – 50% R.H.								
Total capacity	kW	13.50	11.83	11.71	10.77	8.90	7.97	7.05
Sensible capacity	kW	11.63	10.52	10.45	9.83	8.61	7.97	7.05
Water flow rate	l/h	2920	1710	2030	1860	1540	1380	1220
Pressure drop (incl. valve)	kPa	23	8	11	10	7	5	3
Air outlet temp.	°C	14.2	15.1	15.2	15.7	16.7	17.3	18.0
Air outlet R.H.	%	85.8	82.6	82.4	80.7	77.5	75.8	72.1
Room conditions 25°C – 50% R.H..								
Total capacity	kW	14.42	12.75	12.64	11.70	9.82	8.89	7.96
Sensible capacity	kW	12.21	11.11	11.03	10.42	9.20	8.60	7.96
Water flow rate	l/h	3120	1840	2190	2020	1700	1540	1380
Pressure drop (incl. valve)	kPa	26	10	13	11	8	7	5
Air outlet temp.	°C	14.7	15.6	15.7	16.2	17.2	17.7	18.2
Air outlet R.H.	%	87.5	84.2	84	82.2	78.9	77.4	75.6
Room conditions 26°C – 50% R.H.								
Total capacity	kW	15.35	13.67	13.56	12.62	10.74	9.81	8.87
Sensible capacity	kW	12.78	11.68	11.61	11.00	9.79	9.19	8.60
Water flow rate	l/h	3320	1970	2350	2180	1860	1700	1540
Pressure drop (incl. valve)	kPa	29	11	15	13	10	8	7
Air outlet temp.	°C	15.2	16.1	16.2	16.7	17.7	18.2	18.7
Air outlet R.H.	%	89.3	85.8	85.6	83.8	80.4	78.8	77.3
Room conditions 27°C – 50% R.H.								
Total capacity	kW	16.27	14.59	14.49	13.55	11.67	10.73	9.79
Sensible capacity	kW	13.34	12.24	12.17	11.57	10.36	9.77	9.18
Water flow rate	l/h	3520	2100	2510	2340	2020	1860	1700
Pressure drop (incl. valve)	kPa	33	12	17	15	11	10	8
Air outlet temp.	°C	15.7	16.6	16.6	17.2	18.2	18.7	19.2
Air outlet R.H.	%	91.0	87.5	87.3	85.4	81.9	80.3	78.7

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

4.4 – COOLING CAPACITY SPOT 60 LOW NOISE VERSIONS

Cooling capacity SPOT 60 C – Under at air flow rate 2500 m^3/h

Tab. 5

Model		U 10 C						
Cooling capacity data at air flow rate 2500 m^3/h								
Water inlet/outlet temp.	**°C**	**6/10**	**6/12**	**7/12**	**8/13**	**10/15**	**11/16**	**12/17**
Room conditions 22°C – 50% R.H.								
Total capacity	kW	9.14	7.89	7.77	7.53	5.60	4.88	4.10
Sensible capacity	kW	8.42	7.58	7.51	7.35	5.60	4.88	4.10
Water flow rate	l/h	1980	1140	1350	1490	970	850	710
Pressure drop (incl. valve)	kPa	11	3	5	8	2	2	1
Air outlet temp.	°C	12.2	13.2	13.3	13.5	15.5	16.3	17.2
Air outlet R.H.	%	89.1	85.7	85.4	84.7	75.1	71.2	67.2
Room conditions 23°C – 50% R.H.								
Total capacity	kW	9.86	8.60	8.49	7.76	6.31	5.59	4.87
Sensible capacity	kW	8.89	8.06	7.98	7.50	6.31	5.59	4.87
Water flow rate	l/h	2130	1240	1470	1340	1090	970	850
Pressure drop (incl. valve)	kPa	13	5	6	5	3	2	2
Air outlet temp.	°C	12.6	13.6	13.7	14.3	15.6	16.5	17.3
Air outlet R.H.	%	90.9	87.4	87.1	85.2	79.0	74.9	71.0
Room conditions 24°C – 50% R.H.								
Total capacity	kW	10.58	9.32	9.21	8.48	7.02	6.29	5.57
Sensible capacity	kW	9.35	8.52	8.45	7.97	7.02	6.29	5.57
Water flow rate	l/h	2290	1350	1600	1470	1220	1090	970
Pressure drop (incl. valve)	kPa	15	5	7	6	3	3	2
Air outlet temp.	°C	13.1	14.0	14.1	14.7	15.8	16.6	17.5
Air outlet R.H.	%	92.8	89.2	88.9	87.0	83.2	78.8	74.7
Room conditions 25°C – 50% R.H..								
Total capacity	kW	11.3	10.03	9.93	9.20	7.74	7.01	6.28
Sensible capacity	kW	9.8	8.98	8.91	8.43	7.49	7.01	6.28
Water flow rate	l/h	2440	1450	1720	1590	1340	1210	1090
Pressure drop (incl. valve)	kPa	16	6	8	7	5	3	3
Air outlet temp.	°C	13.5	14.5	14.6	15.1	16.2	16.8	17.6
Air outlet R.H.	%	94.8	91.1	90.8	88.7	84.9	82.9	78.5
Room conditions 26°C – 50% R.H.								
Total capacity	kW	12.01	10.75	10.65	9.91	8.45	7.72	7.00
Sensible capacity	kW	10.15	9.42	9.36	8.89	7.95	7.49	7.00
Water flow rate	l/h	2600	1550	1840	1720	1460	1340	1210
Pressure drop (incl. valve)	kPa	18	7	10	8	6	5	3
Air outlet temp.	°C	14.1	14.9	15.0	15.6	16.7	17.2	17.8
Air outlet R.H.	%	95.6	92.9	92.6	90.6	86.6	84.8	82.6
Room conditions 27°C – 50% R.H.								
Total capacity	kW	12.72	11.47	11.36	10.63	9.17	8.44	7.71
Sensible capacity	kW	10.48	9.86	9.80	9.33	8.40	7.94	7.49
Water flow rate	l/h	2750	1650	1970	1840	1590	1460	1340
Pressure drop (incl. valve)	kPa	20	8	11	10	7	6	5
Air outlet temp.	°C	14.7	15.4	15.5	16.0	17.1	17.6	18.2
Air outlet R.H.	%	96.4	94.9	94.6	92.4	88.4	86.5	84.7

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

Cooling capacity SPOT 60 C – Under at air flow rate 2000 m^3/h

Tab. 6

Model		U 10 C						
Cooling capacity data at air flow rate 2000 m^3/h								
Water inlet/outlet temp.	**°C**	**6/10**	**6/12**	**7/12**	**8/13**	**10/15**	**11/16**	**12/17**
Room conditions 22°C – 50% R.H.								
Total capacity	kW	7.86	6.96	6.80	6.19	4.98	4.38	3.79
Sensible capacity	kW	7.29	6.72	6.62	6.19	4.98	4.38	3.79
Water flow rate	l/h	1700	1010	1180	1070	860	760	660
Pressure drop (incl. valve)	kPa	23	8	11	10	6	4	4
Air outlet temp.	°C	11.2	12.0	12.2	12.8	14.6	15.5	16.4
Air outlet R.H.	%	95.4	92.6	92.0	89.5	79.6	75.2	71.1
Room conditions 23°C – 50% R.H.								
Total capacity	kW	8.45	7.55	7.39	6.79	5.57	4.97	4.37
Sensible capacity	kW	7.60	7.11	7.01	6.61	5.57	4.97	4.37
Water flow rate	l/h	1830	1090	1280	1180	970	860	760
Pressure drop (incl. valve)	kPa	26	10	13	11	8	6	4
Air outlet temp.	°C	11.7	12.4	12.5	13.1	14.7	15.6	16.5
Air outlet R.H.	%	96.2	94.6	94.0	91.8	84.1	79.4	74.9
Room conditions 24°C – 50% R.H.								
Total capacity	kW	9.04	8.14	7.99	7.38	6.17	5.56	4.96
Sensible capacity	kW	7.89	7.44	7.35	7.00	6.17	5.56	4.96
Water flow rate	l/h	1950	1180	1380	1280	1070	960	860
Pressure drop (incl. valve)	kPa	29	11	15	13	10	7	6
Air outlet temp.	°C	12.2	12.9	13.0	13.5	14.8	15.7	16.6
Air outlet R.H.	%	96.9	95.7	95.4	93.8	88.8	83.8	5.55
Room conditions 25°C – 50% R.H..								
Total capacity	kW	9.62	8.74	8.58	7.97	6.76	6.15	5.55
Sensible capacity	kW	8.17	7.73	7.65	7.35	6.60	6.15	5.55
Water flow rate	l/h	2080	1260	1490	1380	1170	1070	960
Pressure drop (incl. valve)	kPa	33	13	18	15	11	10	7
Air outlet temp.	°C	12.8	13.4	13.5	14.0	15.1	15.8	16.7
Air outlet R.H.	%	97.7	96.4	96.3	95.3	91.4	88.5	83.5
Room conditions 26°C – 50% R.H.								
Total capacity	kW	10.21	9.33	9.17	8.56	7.35	6.75	6.14
Sensible capacity	kW	8.42	8.01	7.93	7.64	6.98	6.60	6.14
Water flow rate	l/h	2210	1350	1590	1480	1270	1170	1070
Pressure drop (incl. valve)	kPa	37	14	20	17	13	11	10
Air outlet temp.	°C	13.4	14.0	14.1	14.5	15.5	16.1	16.7
Air outlet R.H.	%	98.1	97.2	96.9	96.2	93.4	91.3	88.1
Room conditions 27°C – 50% R.H.								
Total capacity	kW	10.79	9.92	9.76	9.15	7.94	7.34	6.73
Sensible capacity	kW	8.67	8.27	8.20	7.92	7.34	6.98	6.60
Water flow rate	l/h	2330	17	1680	1580	1380	1270	1170
Pressure drop (incl. valve)	kPa	41	1430	22	20	15	13	11
Air outlet temp.	°C	14.0	14.5	14.7	15.1	15.9	16.5	17.0
Air outlet R.H.	%	98.7	97.8	97.7	96.9	95.2	93.2	91.1

Note: Cooling capacities do not consider the heat removed from fan motors that must be added to the system heat load.

5 – TECHNICAL DATA

5.1 – TECHNICAL DATA SPOT 60

Tab. 7

		U10A	O10A	U10W	O10W	U10X	O10X	U10C	O10C
		aircooled		water/glycolcooled		f. ext. compressor		chilled water	
FAN 6 poles, direct driven									
Airflow	m^3/h	4000	4000	4000	4000	4000	4000	4000	4000
Discharge head pressure	Pa	20	50	20	50	20	50	20	50
Number/motor power	–/kW	1/0.500	1/0.736	1/0.500	1/0.736	1/0.500	1/0.736	1/0.500	1/0.736
COMPRESSOR									
Number		1	1	1	1	–	–	–	–
Type		hermetic	hermetic	hermetic	hermetic	–	–	–	–
Refrigerant		R22	R22	R22	R22	–	–	–	–
EVAPORATOR / CHILLED WATER COIL									
Face area	m^2	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Tubes/fins		CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL
FPI		12	12	12	12	12	12	12	12
No. of rows		4	4	4	4	4	4	4	4
Face velocity	m/s	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09
Number/Configuration		1/inclined	1/inclined	1/inclined	1/inclined	1/inclined	1/inclined	1/inclined	1/inclined
HOT GAS REHEAT COIL (optional)									
Room conditions 24°C / 50% RH; 45°C condensing temp.									
Face area	m^2	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Tubes/Fins		CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL	CU/AL
FPI		12	12	12	12	12	12	12	12
No. of rows		1	1	1	1	1	1	1	1
Heating capacity	kW	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
ELECTRIC REHEAT (optional)									
Type		AL–finned	AL–finned	AL–finned	AL–finned	AL–finned	AL–finned	AL–finned	AL–finne
No. of elements		3	3	3	3	3	3	3	3
No. of stages		3	3	3	3	3	3	3	3
Total capacity	kW	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
HOT WATER REHEAT COIL (optional) **Waterinlet 80°C and return air 24°C / 50% RH**									
Hot water temperature 80°C / 65 C. room cond. 24°C / 50% RH									
Face area	m^2	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Fins/Tubes		AL/CU	AL/CU	AL/CU	AL/CU	AL/CU	AL/CU	AL/CU	AL/CU
FPI		12	12	12	12	12	12	12	12
No. of rows		1	1	1	1	1	1	1	1
No. of coils		1	1	1	1	1	1	1	1
Capacity	kW	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Hot water flow	l/s	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Total pressure drop	kPa	5	5	5	5	5	5	5	5
Valve type		on/off	on/off	on/off	on/off	on/off	on/off	on/off	on/off
Valve body		3–way	3–way	3–way	3–way	3–way	3–way	3–way	3–way
Valve dimension	inches	3/4 "	3/4 "	3/4 "	3/4 "	3/4 "	3/4 "	3/4 "	3/4 "

Model		U10A aircooled	O10A	U10W water/glycolcooled	O10W	U10X f. ext. compressor	O10X	U10C chilled water	O10C
PREFILTER – METALLIC TYPE (optional)									
Number		1	–	1	–	1	–	1	–
Dimensions	mm	610x610 x12.5	–	610x610 x12.5	–	610x610 x12.5	–	610x610 x12.5	–
DATAFILTER									
Number		1	1	1	1	1	1	1	1
Material		pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.
Dimensions	mm	610x610 x95	608x500 x50	610x610 x95	608x500 x50	610x610 x95	608x500 x50	610x610 x95	608x500 x50
Efficiency Eurovent 4/5		EU3	EU3	EU3	EU3	EU3	EU3	EU3	EU3
SUPERDATA FILTER (optional)									
Number		1	–	1	–	1	1	1	1
Material		pleated sin. fib.	–	pleated sin. fib.	–	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.	pleated sin. fib.
Dimensions	mm	610x570 x240	–	610x570 x240	–	610x610 x600	608x500 x195	610x610 x600	608x500 x195
Efficiency Eurovent 4/5		EU5	–	EU5	–	EU5	EU5	EU5	EU5
HUMIDIFIER (optional)									
Capacity				(adjustable up to 5 kg/h)					
Max. power	kW	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
CHILLED WATER CONTROLS 3–way body valve									
Control action		–	–	–	–	–	–	prop.	prop.
KV		–	–	–	–	–	–	10	10
Valve size	in.	–	–	–	–	–	–	1"	1"
WATER REGULATING VALVE – (water cooled version)									
Type		–	–	head pressure actuated		–	–	–	–
Flow		–	–	2–way	2–way	–	–	–	–
Number		–	–	1	1	–	–	–	–
Size	in.	–	–	1/2"	1/2"	–	–	–	–
Max. water operating pressure	bar	–	–	10	10	–	–	–	–
KV	m^3/h	–	–	1.9	1.9	–	–	–	–
CONNECTIONS									
Humidifier feedwater	mm	8	8	8	8	8	8	8	8
	in.	3/4" G	3/4" G	3/4" G	3/4" G	3/4" G	3/4" G	3/4" G	3/4" G
Condensate drain	mm	19	19	19	19	19	19	19	19
Hot water (quick connection)	mm	22	22	22	22	22	22	22	22
Freon line	mm	18	18	–	–	18	18	–	–
Cooling water	in.	–	–	1/2 "G	1/2 "G	–	–	–	–
Chilled water	in.	–	–	–	–	–	–	1" G	1" G
DIMENSIONS AND WEIGHT									
Width	mm	710	710	710	710	710	710	710	710
Depth	mm	660	660	660	660	660	660	660	660
Height	mm	1940	1940	1940	1940	1940	1940	1940	1940
Weight (approx.)	kg	261	271	267	277	218	228	215	225

5.2 – NOISE DATA

Tab. 8/1

Model		U10A/W		O10A/W		U10C/X		O10C/X	
Model		Compressor and Fan (DD12/9–500W high speed)		Compressor and Fan (DD12/9–736W high speed)		Fan (DD12/9–500W high speed)		Fan (DD12/9–736W high speed)	
Airflow	m^3/h	4000		4000		4000		4000	
Level		SPL	PWL	SPL	PWL	SPL	PWL	SPL	PWL
Position	m	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge into a duct	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge into a duct
Reference		freefield	—	freefield	—	freefield	—	freefield	—
Tolerance	dB	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2
Frequency octave band (Hz)									
31.5	dB	50.5	73.5	51.0	75.0	49.0	73.0	50.0	74.0
63	dB	49.5	75.0	52.5	76.5	48.5	74.5	51.5	75.5
125	dB	47.5	76.0	54.0	77.5	46.5	75.5	53.0	76.5
250	dB	48.0	76.5	55.0	78.0	47.5	76.0	54.0	77.0
500	dB	47.0	77.0	53.0	78.5	46.0	76.5	52.0	77.5
1000	dB	44.5	73.0	50.5	74.5	44.0	72.5	49.5	73.5
2000	dB	40.5	70.0	46.0	71.5	39.5	69.5	45.0	70.5
4000	dB	36.0	67.5	42.0	69.0	35.0	67.0	41.0	68.0
8000	dB	30.0	62.5	36.5	64.0	28.0	62.0	35.5	63.0
global	dB(A)	50.5	80.5	56.0	82.0	49.5	79.0	55.0	81.0

Note: The installation of sound attenuators inside the unit (if bag filters are not required) or in a silenced extension hood allows a noise reduction of apx. 4 dB(A). (see 2.5.13)

Tab. 8/2

Model		U10C/X		U10C/X		U10C/X		U10C/X		U10C/X	
Model		Fan (DD12/9–500W medium speed)		Fan (DD12/9–500W medium speed)		Fan (DD10/10–245W high speed)		Fan (DD10/10–245W medium speed)		Fan (DD10/10–245W medium speed)	
Airflow	m^3/h	3500		3000		3000		2500		2000	
Level		SPL	PWL	SPL	PWL	SPL	PWL	SPL	PWL	SPL	PWL
Position	m	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge	3m in front 1.5m in height	air discharge
Reference		freefield	—	freefield	—	freefield	—	freefield	—	freefield	—
Tolerance	dB	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2	–0 +2
Frequency octave band (Hz)											
31.5	dB	47.0	72.0	46.0	69.5	43.0	66.5	42.5	65.5	43.5	64.5
63	dB	46.5	73.5	45.0	70.5	42.5	68.0	41.0	67.0	42.0	66.0
125	dB	44.5	74.5	43.5	72.0	42.0	70.0	40.0	69.0	38.0	68.5
250	dB	45.0	75.0	44.0	73.0	41.0	72.0	39.0	71.0	37.0	70.0
500	dB	42.5	75.5	41.5	73.5	39.5	71.0	37.5	70.0	35.5	69.0
1000	dB	42.0	71.5	41.0	71.0	41.5	68.0	34.0	67.0	32.0	66.5
2000	dB	37.5	68.5	37.0	67.0	32.5	65.0	31.0	64.0	28.5	63.0
4000	dB	32.5	66.0	31.5	64.5	27.5	60.0	25.5	58.5	23.5	57.5
8000	dB	25.0	61.0	24.0	62.0	23.0	55.0	19.5	54.0	17.0	53.0
global	dB(A)	47.5	78.0	46.0	76.5	43.5	73.0	41.0	72.0	39.0	71.0

Note: The installation of sound attenuators inside the unit (if bag filters are not required) or in a silenced extension hood allows a noise reduction of apx. 4 dB(A). (see 2.5.13)

5.3 – AVAILABLE STATIC PRESSURE

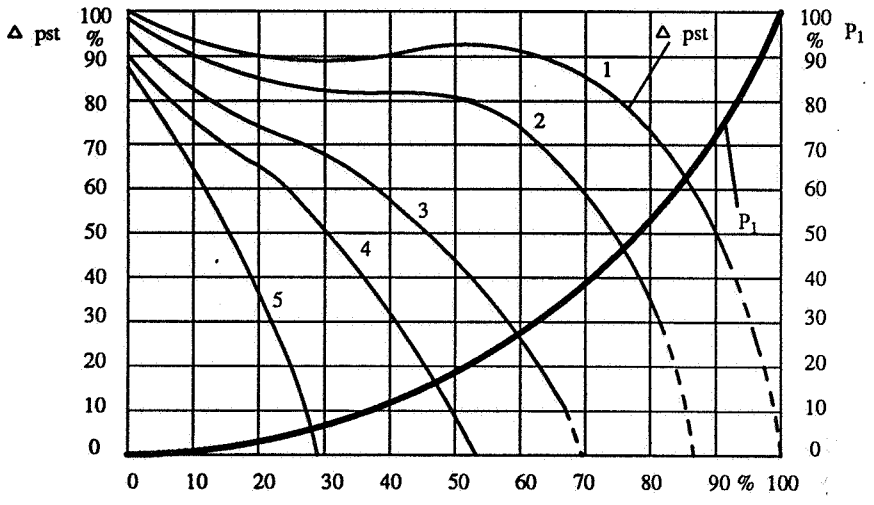
The SPOT 60 is sized for a standard available pressure of 20 Pa at Under version and 50 Pa at over version.
When the air circuit pressure drop is higher, or additional devices are provided in the air stream, the airflow varies as indicated here below.

Tab. 9 Available static pressure O10

O10C/X standard		O10C/X standard		O10C/X DFAN 10	
Fan DD12/9–736W high speed		Fan DD12/9–736W medium speed		Fan DD12/9–1.1kW	
air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa
3000	160	2000	210	3000	190
3200	145	2200	190	3200	170
3400	130	2400	180	3400	150
3600	105	2600	166	3600	117
3800	85	2800	148	3800	90
4000	50	3000	120	4000	70

If higher available static pressure is required, a special 4 pol 1.5 kW fan can be used: optional DFAN 40
The available static pressure can be selected between 180 and 480 Pa by means of an adjustable tongue, housed inside the blower.
The power consumption of course depends on the real performances of the fan, i.e. on the position of the tongue (see diagram 1).

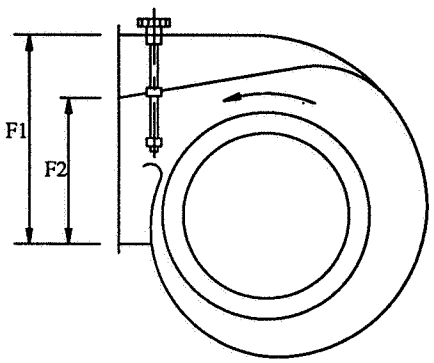
Diagram 1



Δ pst ... raising of pressure

$\dot{V}$ ... airflow

P_1 ... fan motor power consumption



curve no.	F1 : F2
1	1 : 1
2	1 : 0.8
3	1 . 0.6
4	1 : 0.4
5	1 : 0.25

Tab. 10/1 – Available static pressure U10

U10C/X standard		U10C/X standard		U10C/X DFAN10		U10C/X DFAN15	
Fan DD12/9–500W high speed		Fan DD12/9–500W medium speed		Fan DD12/9–736W high speed		Fan DD12/9–1.1kW	
air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa
3000	220	2000	220	3000	210	3000	240
3200	190	2200	230	3200	200	3200	220
3400	160	2400	230	3400	190	3400	200
3600	130	2600	200	3600	170	3600	180
3800	70	2800	80	3800	150	3800	170
4000	20	3000	20	4000	130	4000	150

If higher available static pressure is required, a special 4 pol 1.5 kW fan can be used : optional DFAN40
The available static pressure can be selected between 180 and 480 Pa by means of an adjustable tongue, housed inside the blower.
The power consumption of course depends on the real performances of the fan, i.e. on the position of the tongue (see diagram 1 – page25).

Tab. 10/2 – Available static pressure U10–low noise version

U10C/X LOW FAN		U10C/X LOW FAN	
Fan DD10/10–245W high speed		Fan DD10/10–245W medium speed	
air flow rate m^3/h	available static pressure Pa	air flow rate m^3/h	available static pressure Pa
2400	110	1800	120
2600	90	2000	100
2800	60	2200	50
3000	20	2400	20

5.4 – ADDITIONAL PRESSURE DROPS [1]

Tab. 11

		sound attenuator	Datafilter h=100 (U) h=50 (O)	Superdatafilter EU5 h=240 (U) h=195 (O) [2]	
airflow rate m^3/h		O/U 10	O/U 10	U 10	O 10
2000	Pa	21	8	27	30
2500	Pa	24	11	40	45
3000	Pa	27	15	55	61
3500	Pa	31	16	71	80
4000	Pa	35	25	90	100

Air bag filter [3]					
airflow rate m^3/h		bag 300 mm EU3	bag 500 mm EU5	bag 625 mm EU6	bag 625 mm EU7
2000	Pa	18	20	23	26
2500	Pa	27	30	34	39
3000	Pa	36	42	48	54
3500	Pa	48	55	63	71
4000	Pa	60	70	80	90

Note: 1) Data based on clean filter.
2) Built in only in OVER C and X version.
3) In U10 A/W and all OVER versions air bag filter as well as sound attenuators can only be housed in a base module or in an extension hood.

6 – ELECTRICAL REQUIREMENTS

Tab. 12

Standard voltage supply: 380–415 V/3/50 Hz + N + E. (On request: 220–240 V/3/50 Hz + E).

	Voltage	Frequency	Full load amps. FLA	Locked rotor amps. LRA
Fan 500 W	1 x 220 V	50 Hz	5.0 A	10.0 A
Fan 736 W	1 x 220 V	50 Hz	7.1 A	14.2 A
Fan 1.1 kW	3 x 380 V	50 Hz	4.1 A	16.8 A
Fan 1.5 kW	3 x 380 V	50 Hz	5.7 A	23.4 A
Fan 245 W	1 x 220 V	50 Hz	2.3 A	4.7 A
Compressor 3.25 HP	3 x 380 V	50 Hz	7.2 A	37.0 A
Electric reheat 5.25 kW	3 x 380 V	–	4.3 A	–
Humidifier	3 x 380 V	–	5.0 A	–

7 – AIRCOOLED CONDENSER – GLYCOL COOLER

Condensers and rad coolers are available in standard (ACN/ARN) or silenced (ACL/ARL) version.
They consist of a coil enclosed in an embossed weather proof aluminium hood, suitable either for vertical or horizontal installation.

7.1 MATCHINGLIST

Tab. 13

return air 23 °C – 50% R.H. ext. ambient temp. up to	U10A/O10A – aircooled		U10W/O10W – glycolcooled	
	standard model	silenced model	standard model	silenced model
30 °C	ACN 103	ACL 103	ARN 109	ARL 109
32 °C	ACN 103	ACL 103	ARN 109	ARL 109
35 °C	ACN 103	ACL 105	ARN 109	ARL 118
40 °C	ACN 103	ACL 105	ARN 109	ARL 118
46 °C	ACN 105	ACL 108	ARN 118	ARL 127

7.2 AIRCOOLED CONDENSERS ACN–ACL

Tab. 14

		standard model		silenced model		
		ACN 103	ACN 105	ACL 103	ACL 105	ACL 108
Number of fans		1	1	1	1	2
Voltage	V	1 x 220	1 x 220	1 x 220	1 x 220	1 x 220
Fan motor power	kW	0.48	0.48	0.125	0.125	0.25
Power consumption	A	2.3	2.3	0.61	0.61	1.22
Fan motor protection		IP55	IP55	IP55	IP55	IP55
Sound pressure level at 5m free field conditions	dB(A)	52	52	41.5	41.5	44.5
Length	mm	800	800	800	800	1270
Width	mm	800	800	800	800	1000
Height	mm	938	938	938	938	938
Weight (approx.)	kg	38	46	38	46	62

7.3 GLYCOL COOLERS ARN–ARL

Tab. 15

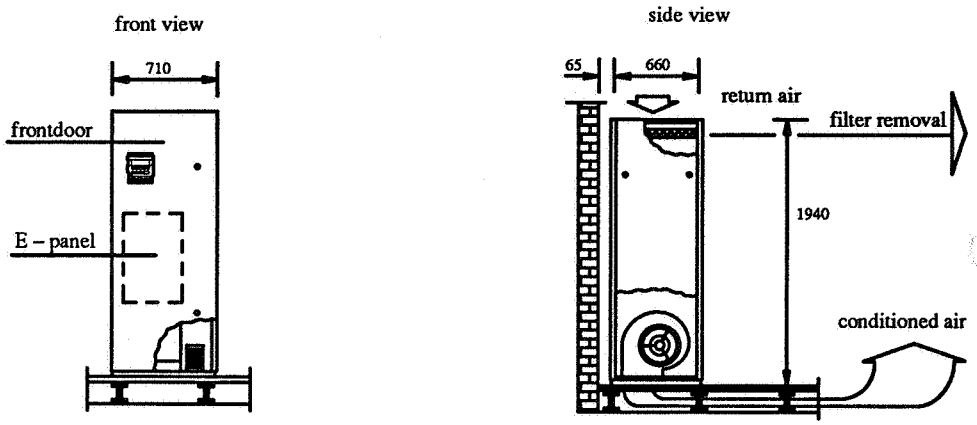
		standard model		silenced model		
		ARN 109	ARN 118	ARL 109	ARL 118	ARL 127
Number of fans		1	2	1	2	3
Voltage	V	1 x 220	1 x 220	1 x 220	1 x 220	1 x 220
Fan motor power	kW	0.48	0.96	0.125	0.25	0.375
Power consumption	A	2.3	4.6	0.61	1.22	1.83
Fan motor protection		IP55	IP55	IP55	IP55	IP55
Sound pressure level at 5m free field conditions	dB(A)	52	55	41.5	44.5	46.5
Pressure drop at 1.4 m^3/h (glycol content 30%)	kPa	3.3	3.7	3.3	3.7	2.2
Liquid content of coil	l	7.5	13.5	7.5	13.5	19.0
Length	mm	880	1270	880	1270	1810
Width	mm	880	1000	880	1000	1000
Height	mm	938	938	938	938	938
Weight (approx.)	kg	42	72	42	72	100

8 – TRANSPORT – DIMENSIONS – POSITIONING

The unit should always remain in vertical position and should not be raised on parts inside the unit.
Before transporting on site it is opportune to check the selected route based on the weights and dimensions given in table 9.
The packing of SPOT 60 units is adapted to the kind of transporting: cardboard and pallet for transport by truck, container or wooden crate for transport by sea.

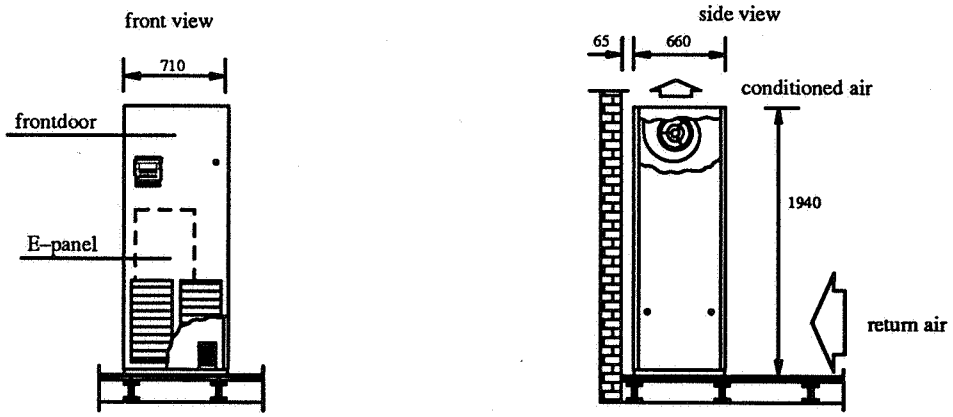
8.1 – DIMENSIONS Spot 60 UNDER

Fig. 8 – Dimensions Spot 60 Under



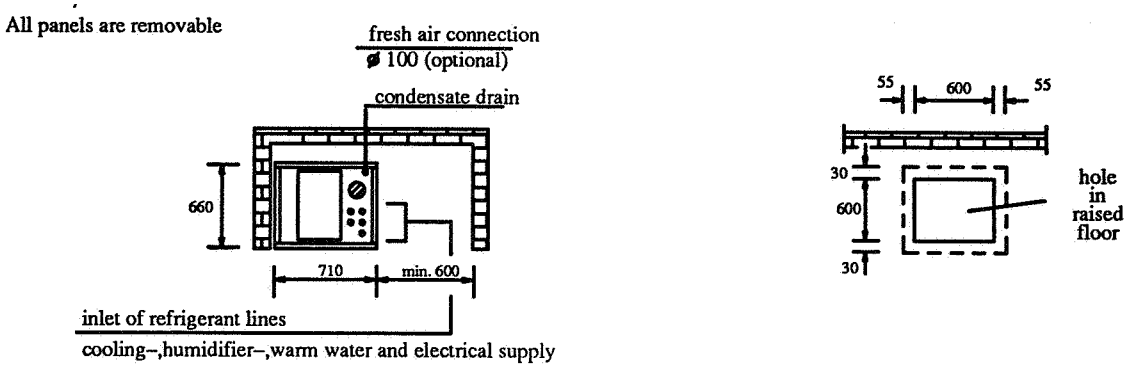
8.2 – DIMENSIONS Spot 60 OVER

Fig. 9 – Dimensions Spot 60 Over



8.3 – POSITIONING ON SITE – SERVICE AREA

Fig. 10 – Positioning on access floor



9 – INSTALLATION GUIDELINES

SPOT 60 occupies the space of just one 600x600 mm raised floor tile. The unit can be relocated simply by removing a floor tile and inserting an application frame, which fits exactly in the 600x600 mm space.
The modular design of SPOT 60 allows a combination of up to three units (any version) to be connected to form a double or triple SPOT 60.
The SPOT 60 can be installed in the computer centre itself or in any closed environment where it is not subject to a corrosive atmosphere.
The unit should be located to ensure good allround air distribution. The unit should not be located in an alcove or at the end of a long narrow room.

The treated air from an Under–unit serves the computer equipment and the ambient in which it operates, delivered via the raised access flooring which serves as an air distribution plenum.
The SPOT 60 Over system is designed to deliver conditioned air directly into a duct or an extension hood.
However, in order to achieve uniform conditions in the ambient, consideration should be given to the air distribution to serve the areas, where heat is generated and where people will work in order to avoid any personal discomfort.

Ceiling and walls of the conditioned area must form a vapour barrier to prevent significant humidity changes through the walls, this considerably increases the humidification costs in winter and introduces greater work load in summer.
The area of window glass should be kept to the minimum possible, and every window should be double glassed, with additional blind protection.
If the rooms adjacent to the computer centre are subject to different thermo–hygrometric conditions, a continuous transfer of humidity may occur from the computer room to the adjacent rooms (and vice–versa).
In order to prevent air loss, considerable care should be taken to ensure correct insulation of the walls of the conditioned space and of the planned passages for electric cables, water pipes, etc.

9.1 – ELECTRICAL REQUIREMENTS

A three–phase and earth power supply of 380 V + N respectively 220 V at 50 Hz is required. Other voltages are available on request. Voltage fluctuations should not exceed +/– 5 % and the electrical services must conform to local electrical regulations. Power wiring sizes must be selected for minimum allowable voltage drops to ensure reliable operation during periods of voltage reduction (see amperage values Tab. 14).

9.2 – REMOTE CONTROL CONNECTIONS

The unit is equipped with numbered terminals for remote ON/OFF operation:
For detailed information see electrical diagram.

9.3 – ALARM CONNECTIONS

Internal and external alarm signals can be connected to terminals.
For detailed information check E–drawing and operating manual of control system.

9.4 – CHILLED WATER CONNECTIONS

Careful attention should be paid on planning the layout of all piping running underneath the computer room access floor to ensure that it offers the least possible resistance to airflow and that no portions of the underfloor area are "starved" of air. For example: pipes which have to be grouped together should be laid side–by–side in the same horizontal plane in the sub–floor and should not be stacked one on top of another, and, as far as possible, all piping should run parallel to the direction of the airflow.
In order to avoid the consequences of sub–floor flooding in the event of a water leak in the room, the installation of "liquistat" moisture detectors in the sub–floor is recommended. It is recommended that manual shut–off valves be installed at the supply and return line of each unit. This will provide for routine service or emergency isolation of the unit. Insulation should be applied to prevent condensation on the chilled water supply and return lines to the unit.

9.5 – COOLING WATER CONNECTIONS (W–models Fig. 14 – Fig. 15)

The supply pressure in the W–models should be between 2 and 10 bar. In all other instances, please consult our technical department.
It is advisable to fit a shut–off valve at the condenser inlet and outlet to allow non–routine maintenance.
The introduction of a 3 piece joint between a shut–off valve and the condenser will make this easier.
The water connections should be fitted with 1" pipes, preferably flexibles.

9.6 – REFRIGERATION CIRCUIT CONNECTIONS (A – X models Fig. 14 – Fig. 15)

The refrigeration circuit has been designed for cooling by air (A models): the room unit must be connected by copper tubing to the external condenser unit. The lenght of the piping should not exceed 25–30 m. In special case please consult our technical department.
While the laying of these pipes is a common operation, it is recommended that the work is done by a refrigeration engineer.
N.B.: We recommend the liquid line to be left uninsulated where it runs under the raised floor carrying the liquid refrigerant towards the air conditioner: this permits a certain degree of subcooling in the refrigerant.

9.7 – HOT WATER CONNECTIONS

Hot water connections should be made with 3/4" pipes, preferable flexible, with shut off valves and quick connectors Ø 22 mm.

9.8 – CONDENSATE DRAIN CONNECTION (FIG.14 – FIG.17)

The SPOT 60 is equipped with a stainless steel tray which collects the condensate during the dehumidification phase.
The condensate drain connection is placed on the right side and is equipped with a synthetic pipe Ø 19 mm and a pipe loop. Before starting up the siphon should be filled with water.

9.9 – HUMIDIFIER – CONNECTIONS (Optional)

The "Humid air" humidifier is designed for use with a clean water supply and must be connected to the main drain to allow any possible condensate or overflow from the humidifier. Although the humidifier is equipped with a filter, the water supply should be free from any impurities bigger than 100 microns. The supply pressure should be between 0.8 and 5 atm.

9.10 – CONNECTION TO A FRESH AIR INTAKE MODULE (Optional)

The fresh air duct (Ø 100 mm), connected to the nearest external air inlet, is fixed to a spigot connection situated at the bottom of the unit (Fig. 8–9–10).
The module is equipped with an easily removable filter.

9.11 – AIR DISTRIBUTION

The SPOT 60 is a constant volume system with downflow or upflow discharge air pattern. To ensure maximum operating efficiency, the air circuit should be as free from restrictions as possible.
The following points should all be checked to obtain the best results.

a) The type of access flooring used should ensure a good air seal between floor tiles, and a system such as Hiross Floor is recommended.

b) The height of the access floor should be not less than 200 mm (8") and the layout of cables, pipes, ducts, etc. underneath it should be carefully planned to provide the minimum of obstruction.

c) The SPOT 60 should not be located in an alcove or at the end of a long narrow room. If several units are installed in one room they should be reasonably well spaced to provide the most effective air distribution.

d) If air return through a suspended ceiling is employed then the free area in the ceiling for the passage of the air must be at least equal to that provided in the floor, and preferably greater to minimize the air pressure loss.
The depth of the ceiling should be at least 300mm (12") and the location of lighting fixtures and other services in the ceiling must ensure a correct distribution of the heat load and airflow between the SPOT 60 units installed in the room.

e) Certain CPUs may require cooling by a specific amount of conditioned air drawn directly from the raised floor by means of holes below the CPU; in this case the CPU manufacturer will specify the air flow rate (q_{calc}, in m#/s) required for the CPU.
Using Fig.11 the hole size required can be calculated.

N.B. 1: Fig.11 is formulated according to the assumption that approx. 20% of the hole is occupied by cables.

f) The air flow which remains (ie. that not used in e) above) must be introduced into the room by air outlets distributed around the room.

- Quantity of air outlets:
  Fig.12 allows the number of air outlets required to be calculated.
- Position of air outlets:
  - at least 1m from desks/chairs;
  - along the walls if possible;
  - close to computers, etc. to avoid hot spots;
  - as far as possible from the air conditioner to avoid recirculating conditioned air.

N.B. 2: The air conditioner's total air flow (Q_{cond}) will vary according to the following (see project data):
- type of filters installed;
- type of fans installed.

Tab.16 – TYPICAL AIR OUTLETS AVAILABLE
(to calculate air flow see Fig.13)

POS. (Fig,13)	CODE	DESCRIPTION
1	910121	walkable grille
2	910101	walkable grille (with regulation)
3	–	Krantz unit (KB 150)
4	–	96 hole perforated panel
5	–	256 hole perforated panel
6	–	steel 576 hole perforated panel
7	–	steel 576 hole perforated panel (with regulation)

WORKED EXAMPLE:

An air conditioner supplies 1.1 m^3/s of air (Q_{cond}) with a head pressure of 25 Pa and an air velocity of 2 m/s.

1) There is a CPU which requires 0.5 m^3/s of air (q_{calc}). It thus requires a 0.3 m^2 hole (Fig.11).
2) Walkable grilles ('1',Fig.11) will be used for the remaining air. For 25 Pa these have a 0.3 m^3/s air flow (q_{outlet}) (Fig.13). Thus according to Fig.15 we require (1.1 – 0.5) ⊠ 0.3 = 2 grilles.

Fig.11 – Calculation of hole below CPU

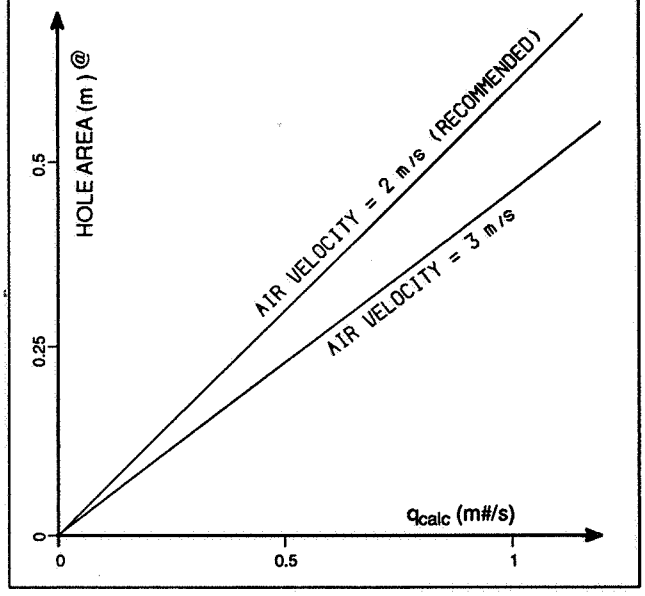


Fig.12 – Calculation of air outlets

NO. OF AIR OUTLETS = $\frac{Q_{cond} - Q_{calc}}{q_{outlet}}$

where:
- Q_{cond} = recirculated air flow of air conditioner (m#/s) – see **N.B. 2.**
- Q_{calc} = total air flow delivered directly to CPUs (m#/s): in effect this is the sum of all the q_{calcs} in 1).
- q_{outlet} = air flow of each air outlet (m#/s) according to the head pressure available: see Tab.18

Fig.13 – Air flow for typical outlets Tab.18

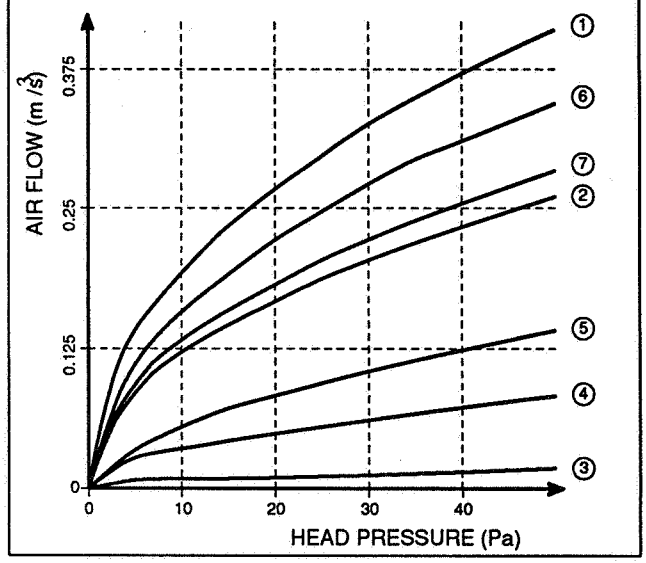
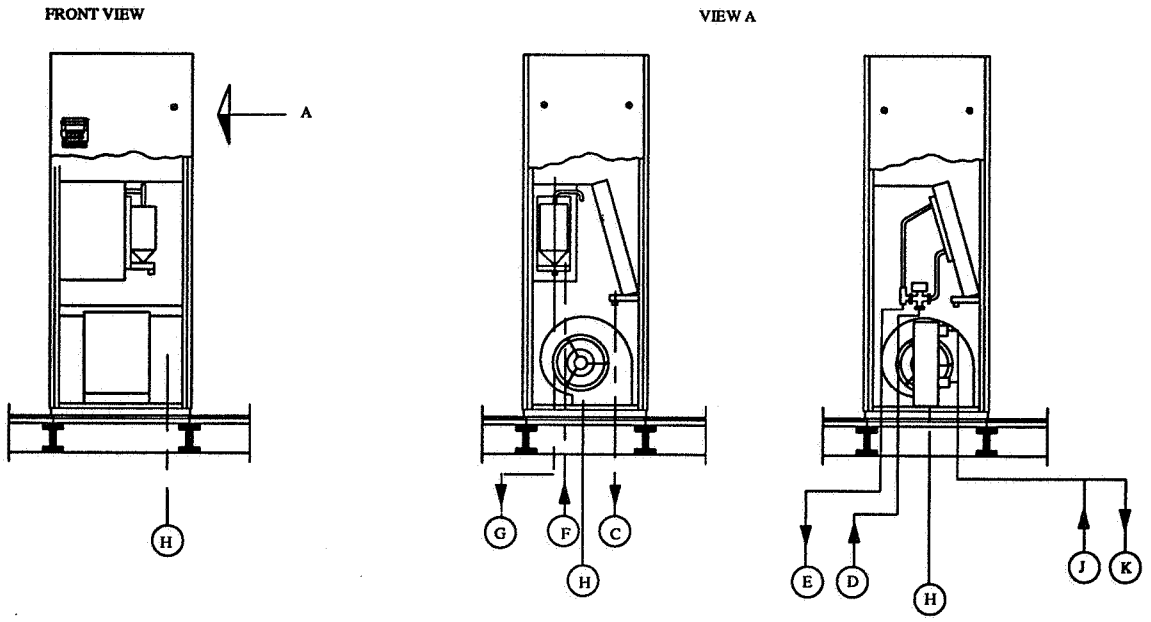
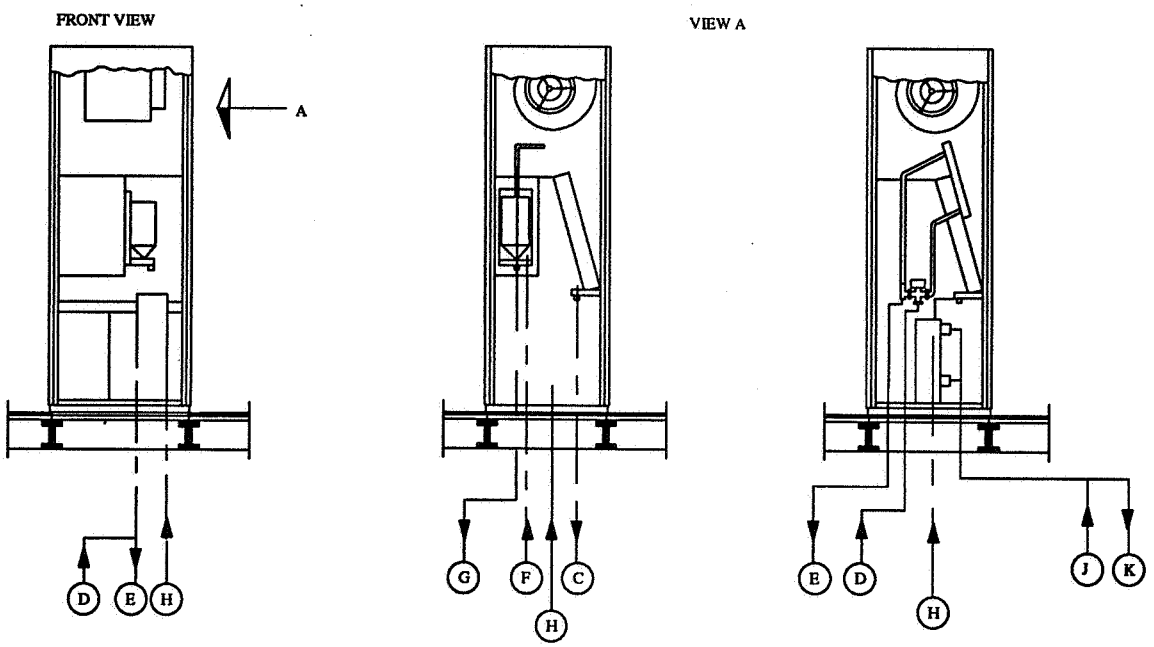


FIG. 14 – WATER AND REFRIGERANT CONNECTIONS SPOT 60 A, W, X UNDER



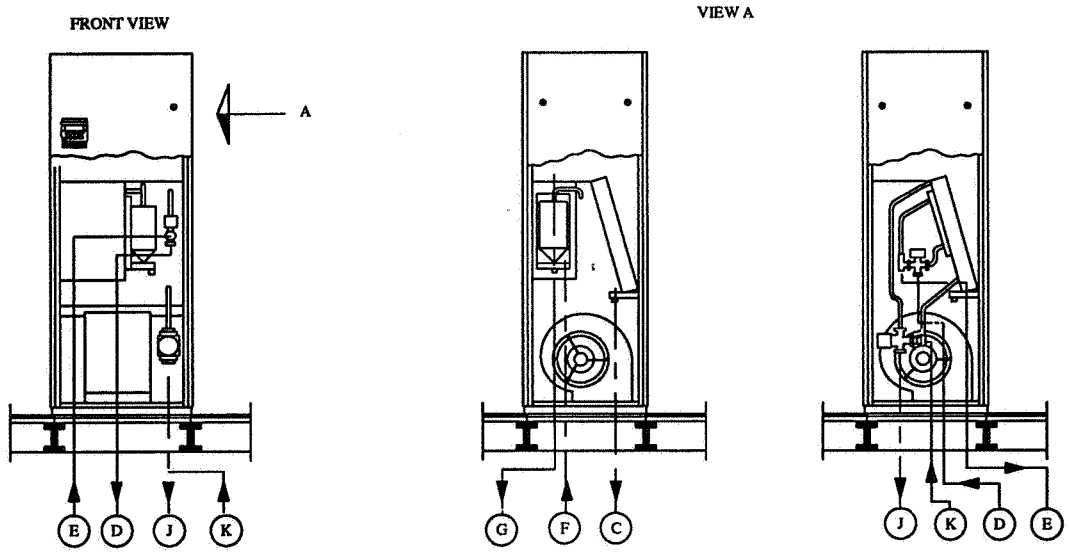
C	CONDENSATE DRAIN	D 19mm MALE	Standard	G	HUMID. DRAIN	3/4"G FEMALE	optional
D	HOT WATER INLET	D 22mm QUICK CONNECTORS	optional	H	REFRI. PIPES	D 18 mm Cu PIPE	A, X
E	HOT WATER OUTLET	D 22mm QUICK CONNECTORS	optional	J	COOLING WATER INLET	1"G FEMALE	W
F	HUMID. SUPPLY WATER	D 8mm FLARE /3/4" G MALE	optional	K	COOLING WATER OUTLET	1"G FEMALE	W

FIG. 15 – WATER AND REFRIGERANT CONNECTIONS SPOT 60 A, W, X OVER



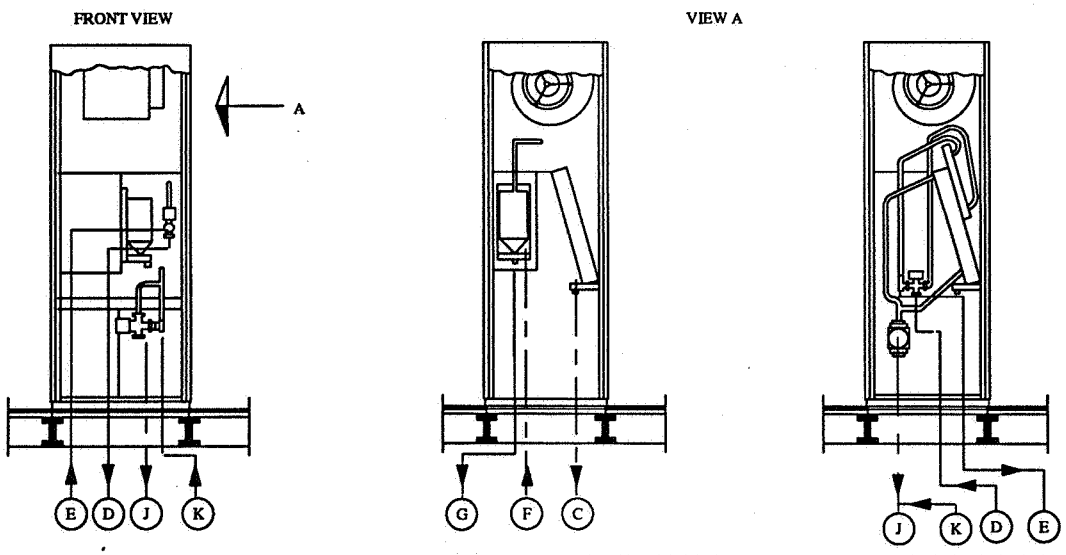
C	CONDENSATE DRAIN	D 19mm MALE	Standard	G	HUMID. DRAIN	3/4"G FEMALE	optional
D	HOT WATER INLET	D 22mm QUICK CONNECTORS	optional	H	REFRI. PIPES	D 18 mm Cu PIPE	A, X
E	HOT WATER OUTLET	D 22mm QUICK CONNECTORS	optional	J	COOLING WATER INLET	1"G FEMALE	W
F	HUMID. SUPPLY WATER	D 8mm FLARE /3/4" G MALE	optional	K	COOLING WATER OUTLET	1"G FEMALE	W

FIG. 16 – WATER CONNECTIONS SPOT 60 C UNDER



C	Condensat drain Ø 19mm male	standard	G	Humid. drain 3/4" female	optional
D	Hot water inlet Ø 22mm quick connectors	optional	J	Chilled water outlet 1" female	standard
E	Hot water outlet Ø 22mm quick connectors	optional	K	Chilled water inlet 1" female	standard
F	Humid. supply Ø 8mm flare / 3/4" male water	optional			

FIG. 17 – WATER CONNECTIONS SPOT 60 C OVER



C	Condensat drain Ø 19mm male	standard	G	Humid. drain 3/4" female	optional
D	Hot water inlet Ø 22mm quick connectors	optional	J	Chilled water outlet 1" female	standard
E	Hot water outlet Ø 22mm quick connectors	optional	K	Chilled water inlet 1" female	standard
F	Humid. supply Ø 8mm flare / 3/4" male water	optional			

10 golden rules

in designing a close control air conditioning system

1

The investment in an average computer centre is approx. $ 10000/m^2. The close control air conditioning for the centre costs approx. $ 150/m^2 but the entire operation of the computer room depends on the air conditioning. A cheap system is false economy.

2

The tighter the control of temperature, humidity and air cleanliness in the room, the lower the failure rate and down time of the EDP hardware. Refer always to the design condition recommended by the computer manufacturer in his installation planning manual and not to the basic specification sheet data.
The latter are the extreme of failure limits.

3

The relative humidity of the conditioned air entering the floor plenum must not exceed 80 %.

4

Fresh air introduced for ventilation should be not more than 30 m^3/h per occupant. Do not rely for calculation on a percentage of the recirculated air volume.

5

Latent heat removal is not required for 60 % of the year. A system with a sensible/total heat ratio near to one will provide the most efficient and low running cost operation. It should however be capable of de-humidification when required.

6

60 % of the maintenance labour costs go in servicing the humidifier. Installing an advanced humidification system can reduce these costs substantially.

7

25 % filtration efficiency based on ASHRAE Standard 52 – 76 is required for recirculated and fresh air to meet
most of the computer manufacturers specifications.

8

An energy efficient system can save as much as 30 % of its costs per year. A running cost evaluation is therefore of paramount importance when choosing the system.

9

Look for a degree of built-in redundancy in the system and when necessary install additional equipment to provide full capacity when part of the total system is down for repair or planned maintenance.

10

Check the local, service and support facilities offered by the manufacturer prior to any decision.

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