Dantherm®

# Operation & Maintenance Manual for Dehumidifier Type AF

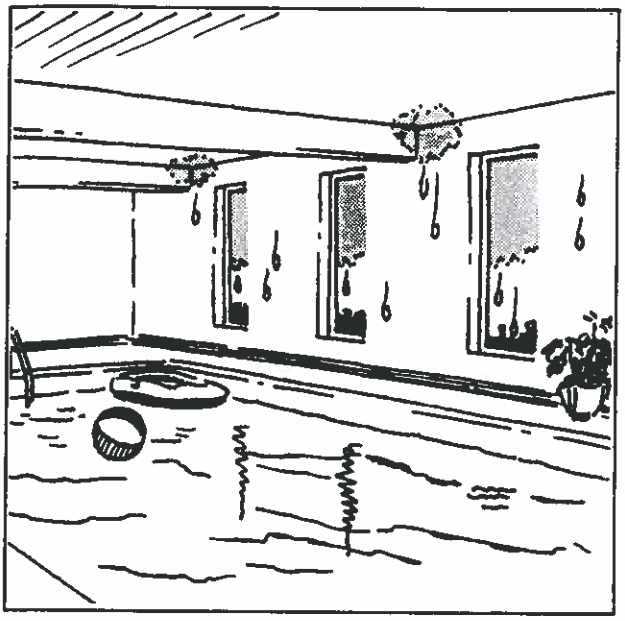

# Dehumidification In Swimming Pools

## OPERATION & MAINTENANCE MANUAL AF

CONTENTS

# 1. INTRODUCTION

In a swimming pool large quantities of water evaporate off the pool surface, from wet surrounds and from the occupants. If this evaporation is not removed the relative humidity will rise and condensation start to form on windows and other cold surfaces.



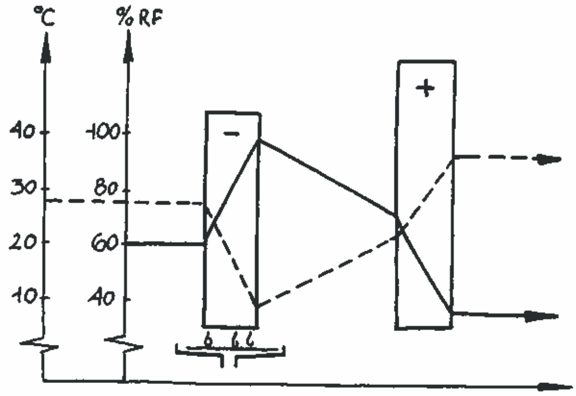
The maximum relative humidity acceptable is governed by the building construction, insulation values, glazing etc. For most modern buildings a room condition of 26-30$^{o}$C and 55-65% RH is acceptable.

The air movement through the pool hall is of particular importance. The air distribution system should be designed in such a way that the exposed (colder) surfaces have a direct flow of warm, dry air across them.

The method for removing moisture was previously by ventilation. However, as energy costs rose, this became too costly and today the method generally used is by dehumidification.

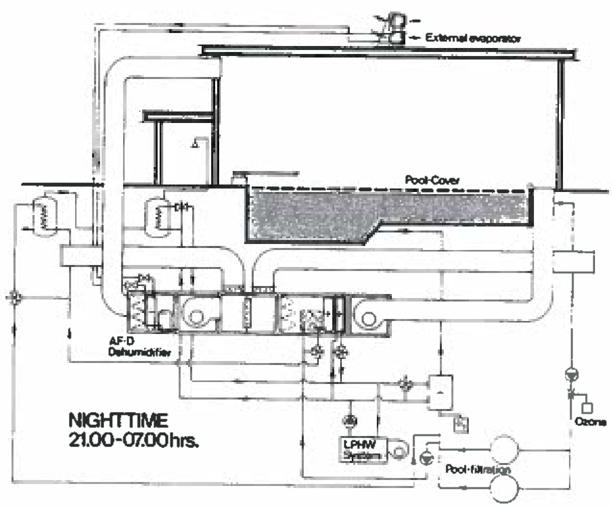
## 1.01. DEHUMIDIFICATION PRINCIPLE

A heat pump dehumidifier works by cooling down the air extracted from the pool hall. When the temperature is below the dew-point moisture is condensed out and drained away. This process takes place on the evaporator (cold) coil of the heat pump. The air then passes across the condenser (hot) coil where the compressor energy, together with the latent heat extracted in the dehumidification process, is released to the air. The result is that the now dry warm air is returned to the pool hall, able to pick up moisture, after which the process is repeated.



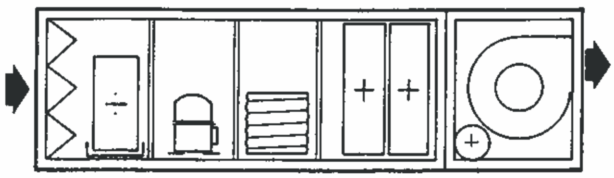

Normally the air will leave the dehumidifier unit at a temperature some 4-6$^{o}$C higher than the entering temperature. This surplus heat is used in part or in total to cover the fabric loss from the building.

There will be times, particularly in the summer, when more surplus heat is generated than can be used for the fabric loss. In order not to overheat the pool hall this heat is transferred to the pool water via a water cooled condenser built into the unit. The amount of energy added to the pool water can be quite high, but because of the volume of water in the pool the actual temperature rise of the pool water will not normally be more than 0.5-1.0$^{o}$C per 24 hour period.

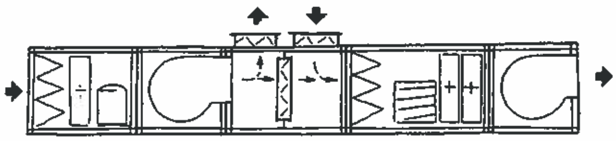


## 1.02. EQUIPMENT

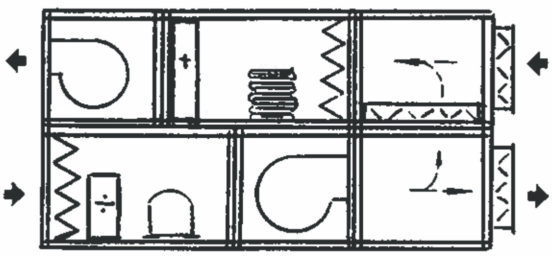
The type of equipment manufactured by Dantherm operates on the principle described above. There are two main variants normally used:



Draw-through unit with one fan section.



6-box unit with two fan sections and mixing section, either in-line or stacked.



The first type is generally used for smaller pools, domestic and small commercial hotel pools, whereas the second type will normally be installed in public pools.

In both types an amount of fresh air is introduced to the building. The simpler system is normally restricted to some 20% of the total circulated air volume being fresh air, whereas the more complex system will permit from 0% to 100% fresh air being used.

The fresh air will ensure that the air quality in the pool hall remains acceptable and will also add a certain amount of dehumidification capacity to the overall system, because the fresh air will almost always be drier than the air in the pool hall.

## 1.03. CONTROLS

The type of controls supplied with the equipment can vary quite considerably. In section 2 of this manual are descriptions of the more commonly used systems. If the controls supplied do not match any of the ones described the installer should provide additional information to the operator of the pool.

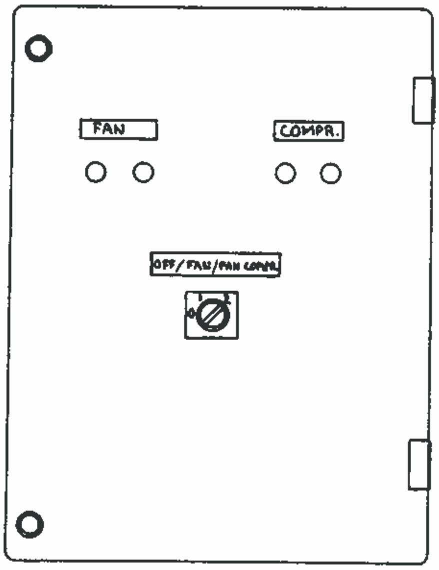
## 2. OPERATING INSTRUCTIONS

Dantherm supply two different types of control system, which will be described in this section. The first deals only with the operation of the refrigeration system and the fans, whereas the eternal controls (thermostat, humidistat, time switch etc.) are supplied by the installer. For this panel additional information must be obtained from the installer.

The second panel is comprehensive and contains all the controls functions required for the operation of the plant.

### 2.1. BASIC PANEL

With the unit will be supplied a wiring diagram and the following explanation of the controls should be read in conjunction with the wiring diagram.




#### 2.1.1. Function Switch

On the front of the panel is the function control switch, with three positions.

| | |
|---|---|
| OFF: | Plant inoperative. |
| FAN: | Fan running, compressor(s) off. |
| FAN/COMPR.: | Fan and compr.(s) running. |

If the fan motors supplied are for two-speed operation the switch will have an additional position marked FAN 1/2 speed. In this position the compressor(s) will not operate.

For plant with both a return and supply fan section both of these are operated by the same function switch, although there is a built-in time delay between start of the two fans.

#### 2.1.2. Control Lights

When the fans are running the green light on the front of the panel will be on and similarly for the compressor(s). Next to each green light is a red fault light, which will come on if the thermal overloads protecting the fans and the compressor(s) have tripped.

The overloads are fitted inside the panel. Open the panel door with the key provided.

**WARNING: ISOLATE FROM THE MAINS BEFORE OPENING PANEL.**

To reset the overloads press the red button situated in the lower right hand corner of the contactor. Reset the function switch to OFF position, reconnect the mains supply and switch the plant on again. If the overload trips out again investigate by checking motor and compressor amperage to ensure that it is not a failure of these components or that one of the phases is shorting out. If there is no obvious fault change the thermal overload.

#### 2.1.3. Controls Sequence

In order to operate the plant the function switch must be in the FAN/COMPR. position.

The fans will now run, providing the frost thermostat (if fitted by others) has not switched off the plant, and the time switch (if fitted) is in the ON position. In addition the service switch mounted on the plant itself next to the terminal access panel below the HP/LP gauges must be in the ON position.

The compressors will now start, providing the humidistat (by others) is calling for dehumidification. In units with more than one compressor these will start in sequence, at random intervals.

When the room humidity falls below the set point the compressor(s) switch off, whereas the fans continue to run.

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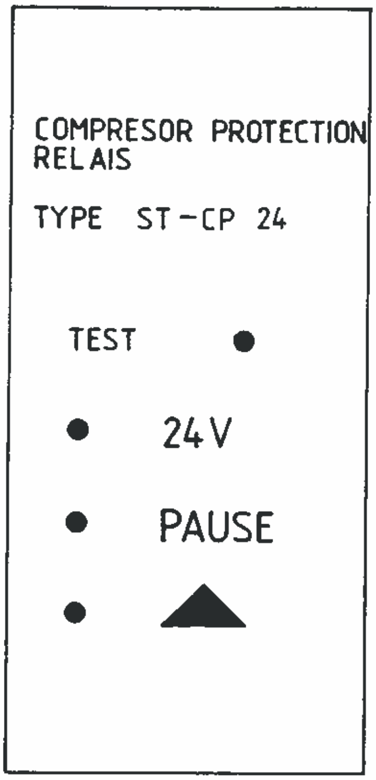
### 2.1.4. Compressor Protection Relay

The random start sequence described above is effected by the compressor protection relay. This relay has got two further functions:




1. Start Limiter. This prevents a compressor from starting within 6-10 minutes from the last start. The maximum number of starts is therefore approx. 10 per hour. This will protect the compressor against excessive wear. The front panel of the compressor relay contains a test button, which will over-ride the start limiter. This button should obviously not be mis-used.

2. Locking relay. If the thermal overload or the pressure stat switches off the compressor the FAULT light will come on. Before re-start of the compressor check the cause of the fault.

   To re-start, momentarily switch off the system on the function switch. This will reset the compressor protection relay.

### 2.1.5. External Controls

The panel described above will only deal with the operation of fans and compressors. Normally the following additional controls will be provided by the installer.

#### 2.1.5.1. Thermostat

The thermostat generally, has two functions, 1) to control the re-heat battery via a 3-port valve and 2) to switch on the pump for the water cooled condenser and/or control the associated 3-port valve (see below).

#### 2.1.5.2. Water cooled condenser controls

When a water cooled condenser is fitted to the plant a pump and/or a 3-port valve to control the output from the condenser must be provided. The water cooled condenser is designed to take pool water directly and is therefore normally supplied with pool water from a continuously running pump, with a 3-port valve controlling the flow to the condenser. If the main pool water pump is capable of overcoming the pressure drop over the condenser the additional pump can be omitted.

#### 2.1.5.3. Time Switch

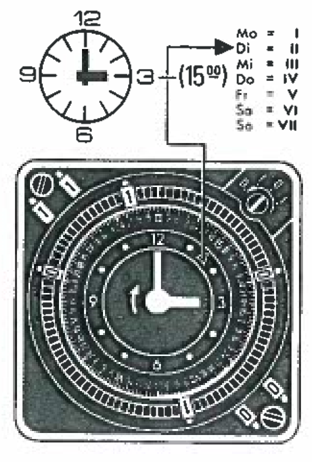
If a time switch is fitted it will normally have one or more of the following functions:

1. To switch off plant completely during the unoccupied period. This is usually only possible if a pool cover is fitted <u>and used.</u>

2. To switch off the fresh air intake during the unoccupied period, by closing the fresh air damper.

3. To switch two-speed motors to half speed during the unoccupied period.

If the time switch is supplied by Dantherm it will be ready fitted in the control panel.



The type supplied will have the facility to set the time of operation on a daily basis by positioning RED and GREEN pins in the appropriate slots. An over-ride control to operate the plant before the desired time or switch off before the normal shut down time is fitted to the clock.

The clock has a reserve of approximately 150 hours should the power supply fail.

The 7 days model has 168 tappet holes to give a minimum switching period of 3 hours, and is normally supplied with 9 pairs of tappets.

To set the operating times, select the day required on the outer edge of the dial from one of the Roman numerals (i.e. Monday - I), and position a GREEN tappet at the required ON time, a RED tappet at the required OFF time by inserting the tappet pin in one of the holes provided.

Continue this operation for every day the plant is required to run, omitting tappets from the days no operation of the plant is needed.

When all the tappets are in position, set the clock by turning the knob at the centre of the hands on the clock face in the direction of the arrows, until the current day reaches the white triangle opposite the top right hand corner.

Continue, turning the knob slowly until the hands show the correct time of day in relation to the 24 hour mode on the outer edge of the dial.

Ensure the correct time is not passed, as the hand cannot be turned back without damaging the clock mechanism. If it should inadvertently be set past the correct time, then the hands must travel the full seven day cycle to return to the current day.

The over-ride knob is positioned at the top right hand corner of the unit and has a white line across its face

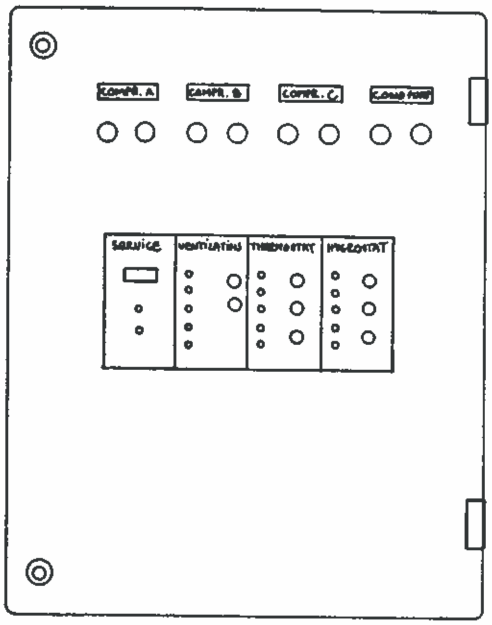
It can be used to advance the clock's operation in front of the next ON tappet, but the system will still switch off when the next OFF tappet is activated. Conversely, it can be used to switch the system off before the next OFF tappet is reached and revert to normal operation when the next tappet is activated.

On days when the plant is normally out of use due to no tappets being in position on the dial, the system can be switched on by using the advance knob and turned off after the required period in the same way without affecting the normal clock settings.

The latter method also allows the system to be activated for testing or servicing should the clock be in a OFF position at the time work is to be carried out on the plant.

## 2.2. COMPREHENSIVE CONTROLS PACKAGE

With the unit will be supplied a wiring diagram and a detailed description of the controls elements included. Please refer to this as a supplement to the brief description given below.




The controls system will include some or all of the following elements.

### 2.2.1. Service Module

The service module contains an electronic time switch, auxiliary relay for frost protection and a service switch for activating the remainder of the control circuitry.

The green light on the panel will be on when there is power to the control circuit and the fans can start. If the frost protection function is activated the green light goes off, the FAULT light comes on and the fans stop. If an LPHW coil is used for frost protection the associated control valve will open fully and fresh air intake dampers close.

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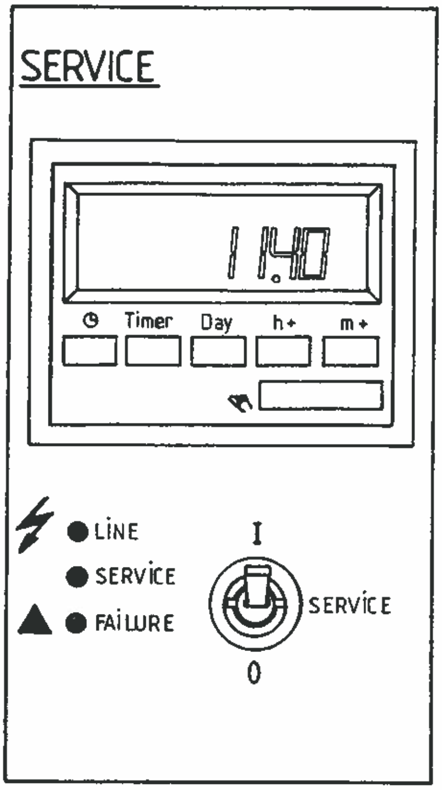



When the service switch is put in the off position the fans will stop immediately. This should therefore only be used during maintenance, NOT for normal start/stop, particularly if electric re-heat battery is fitted.

The service switch is wired in series with the corresponding switch on the plant itself.

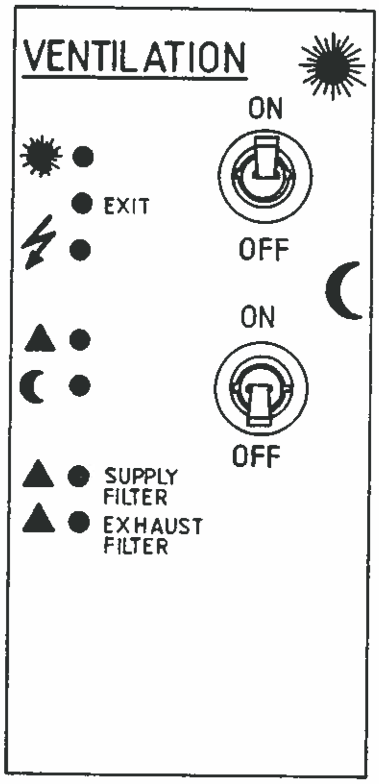
2.2.2. **Ventilation Module**

The ventilation module contains two toggle-switches on which DAY and NIGHT operation can be independently selected. The switches are marked ON-OFF for single speed motors and 1/2 - 0 - 1/1 for two-speed motor.

The two lights marked DAY and NIGHT indicate if the plant is currently in DAY or NIGHT mode.

When the switch is set to ON (or 1/2 or 1/1 for the two-speed version) the exhaust fan will start and after approximately 10 seconds the supply fan will start. Power is also now supplied to the other controls modules.

When the switch is set of OFF (or 0 for two-speed) or when the time switch switches to a toggle switch in OFF positions, power to the other modules is cut off, but the fans will continue to run for approximately 100 seconds, in order to dissipate heat from the heating coils. While the fans are running the light with the flash symbol is ON.




2.2.2.1. **External Control**

The module contains facility to over-ride the setting of the toggle switch with an external controller.

The highest fan speed selected either externally or by the toggle switch determines the fan speed. When the fans are under external control the light marked EXT. is ON.

2.2.2.2. **Overloads**

If a fan motor overload trips out the power to all modules is turned off, the fans stop and the red warning light (triangle) comes ON.

2.2.2.3. **Filter Guard**

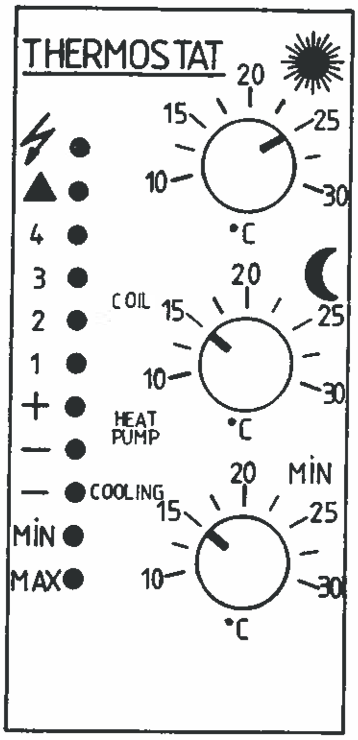
The two yellow indicator lights will be ON if a filter guard is wired to the panel and the filter resistance is higher than the set value. The filter guards are passive only and do not form part of the controls system.

2.2.3. **Thermostat Module**

The front of the thermostat modules contains three dials and eleven control lights.

2.2.3.1. **Temperature Setting**

The required room temperature DAY and NIGHT, is set on the two top dials, whereas the minimum leaving air temperature is set on the bottom dial, marked "MIN".




### 2.2.3.2. Min./Max. Limiter

The bottom control light marked MAX. will be ON if the leaving air temperature is over 50°C and the Max. thermostat will take control and gradually switch off the re-heat until this is fully off at 65°C.

Above the MAX. light is the MIN. light which will be ON if the leaving air temperature is lower than the set value. In this case the MIN. thermostat takes over from the room thermostat.

### 2.2.3.3. Room Thermostat

The seven lights above the MIN. light belong to the room thermostat and indicate how much of the re-heat capacity is being used. The two bottom lights (marked HEAT PUMP and COOLING) are not used for dehumidifier units.

If the room temperature rises above the set point the fresh air proportion will be increased by opening the fresh air damper. In this case the hygrostat setting (see below) will be over-ridden.

The warning lights marked with a triangle will come on if the electric heater battery has tripped out on the OT stat. If so the stat must be manually re-set to re-activate the heater.

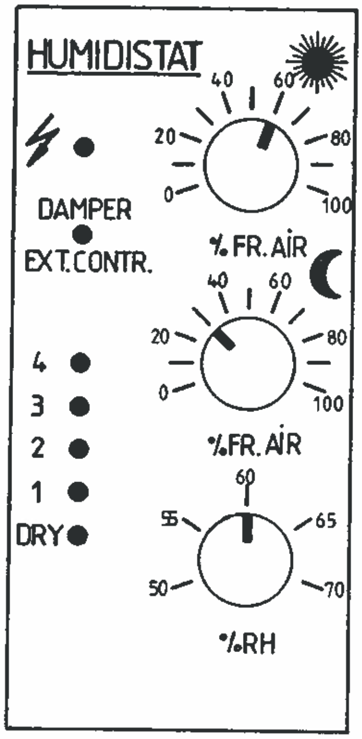
The power ON light marked with a flash will be lit when there is power to the thermostat module. This will not happen until the fans are running.

### 2.2.3. Hygrostat Module

The hygrostat module is designed to maintain the set humidity level by switching on fans, compressor and fresh air in sequence.

The module consists of a five-step hygrostat and sensor, calibrated so that a signal 2 - 10V corresponds to 0 - 100% RH, with relay ports to the five steps, DRY 1-2-3-4.

The set point can be chosen between 50 and 70% RH, and the proportional band between 2 and 10% RH.




Built into the module is a damper control function used on conjunction with a mixing section. The mixing section is controlled by the hygrostat by opening the damper for more fresh air between step 3 and 4. Alternatively the mixing section can be forced to more fresh air by a thermostat over-ride if the room temperature rises.

There are separate settings for DAY and NIGHT.

### 2.2.4. Compressor Protection Relay.

The function of the compressor protection relay is discussed in section 2.1.4.

### 2.2.5. Additional Controls

Three port pumps and valves are not normally supplied by Dantherm, but the control of these components is included in the control panel. For a description of the function see 2.1.5.1. and 2.1.5.2. above.

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## CONTENTS



## 3. MAINTENANCE

SAFETY: ISOLATE FROM MAIN ELECTRICAL SUPPLY BEFORE COMMENCING ANY MAINTENANCE WORK ON THE EQUIPMENT.

### 3.01. SERVICE PANELS

All service covers have a quick release locking arrangement of either a threaded knob or a twin lock that requires the centre chrome knob to be undone to release the tension and the black plastic knob turned $90^{\circ}$ to release the retaining lever.

All other side panels are retained by self tapping screws with a plastic spacer on the inside of the cover to prevent over tightening.

### 3.02. FANS

#### 3.02.1. Description of Fans

The fans used are always of the centrifugal type and they are driven by electric motors through a V-belt drive. The r.p.m. rating of standard fans is 700 to 1500 or 2200 r.p.m., whereas special fans, with backward curved blades, can go up to 3000 r.p.m. The fans are mounted on two transverse rails resting on vibration dampers fixed to the frame profile construction of the unit.

The drive between the fan and the motor is made with a V-belt, profile SPA or SPB (13 x 10 mm or 16 x 13 mm). On systems up to 7.5 kW the motor pulley is adjustable and the fan pulley is fixed.

One or two belts are used, depending upon motor size.

#### 3.02.2 General Maintenance

Check and clean the fan unit at least once every 12 months.

Remove the cover panels of the fan unit as described above for service covers.

Remove dust or other deposits from the fan blades with a vacuum cleaner.

Check the fan bearing for slackness or noise. Defective bearings must be replaced, as described under replacement of parts.

Check the fan pulley for secureness on drive shaft.

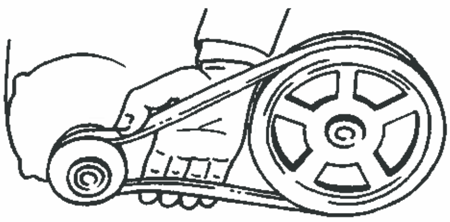
## 3.03. BELTS

### 3.03.1 Fan Belt Tension

Check the belt drive for correct tension. Incorrect tension of the belt drive from the motor will produce "slap", and vibration through the fan and motor and will shorten the life of the bearings on both components.

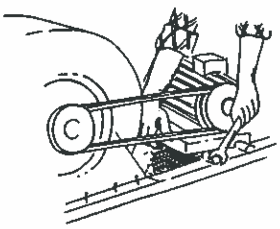
It will also resonate through the cabinets frame, giving annoyance to users.

Check the tension by depressing between the fingers to find a maximum deflection of 15 mm on motors over 4 kW and 10/12 mm on motors under 4 kW.



### 3.03.2 Fan Belt Adjustment

The adjustment of the fan belt tension is obtained by raising the motor bed plate at the edge nearest the fan.



Slacken off fully the retaining bolts on the side nearest the fan and release the tightness of the two bolts furthest away from the fan.

Lift the bed plate until the belts are fully tensioned, and retain the tension until the two bolts nearest the fan are re-tightened

Check the belts again by depressing between the fingers for the correct deflection and if obtained, tighten the other two bolts at the rear edge of the bed plate.

### 3.03.3 Belt Drive Wear

Check drive belts for wear or damage.

If there are signs of cracking, abrasion, or twisting new belts must be fitted.

On twin pulley drives check that when correctly tensioned, both belts are equal in deflection. If there is a difference in deflection then both belts must be replaced.

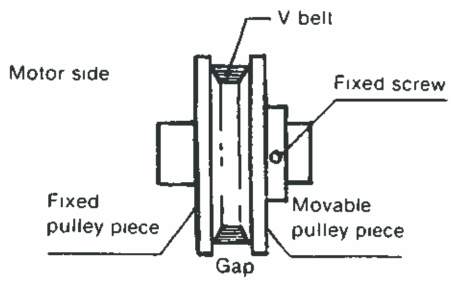
Replacement of drive belts can be carried out using the method described for belt adjustment Section 4.02.2.

## 3.04. ADJUSTABLE PULLEYS

### 3.04.1 Description of Pulleys

To allow final on-site adjustment of air volumes, each motor of 7.5 kW or smaller are fitted with adjustable pulleys, that once set to the required air volume should not be changed.

The construction of the pulleys are as shown below, and on single pulleys only one of the outer flanges can be rotated on the centre spigot, while on twin pulleys both outer flanges rotate on the centre spigot with a fixed centre flange.




Each rotating flange is secured to the centre spigot by a metric hexagon headed grub screw that sits in the groove on the spigot.

Depending on the pulley diameter either two or three grooves are cut into the spigot allowing the pulley to be moved either half a rotation, or a one third rotation.

### 3.04.2 General Check

Check motor drive pulleys for tightness on the shaft and that split flanges are secured to the centre spigot.

On shaft sizes below 22 mm one retaining grub screw is used, whilst on shaft sizes over 22 mm two grub screws are used. These screws lock down on the keyways.

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If on commissioning the plant the pulley needs adjustment, special attention must be made on twin pulleys, that both flanges are rotated the same number of times by moving the grub screw through the same number of locking grooves for each flange to avoid unequal tension of the belt drives.

### 3.04.3 Fitting New Pulleys

The instructions for fitting new pulleys can be found in Section 4. concerning Replacement of Equipment

## 3.05. MOTORS

### 3.05.1 General Check

Check that motors are firmly secured to bed plate and foot mounts are not cracked.

### 3.05.2 Lubrication

From the factory the motor is fitted with an acid free, high quality lubricating grease with a life time of about 10,000 working hours or maximum 3 years. After this period the bearings should be completely cleaned of old grease and half filled with new. Should too much grease be applied there is a risk of the bearings being damaged because of over-heating.

### 3.05.3 Bearings

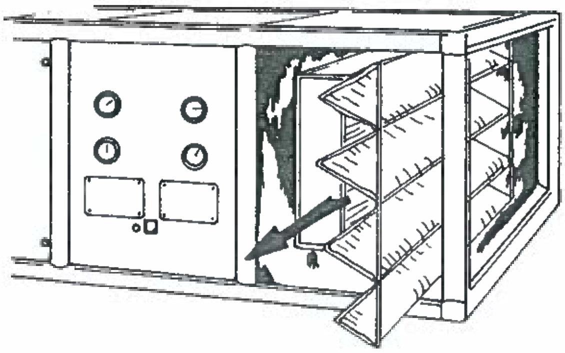
Check the bearings for noise and wear, and replace if required.

Check the electrical connections in the terminal box for tightness and no arcing on the terminal posts.

## 3.06 BAG FILTERS

Standard draw-through units have one filter fitted, whereas 6-box units can have an additional filter, fitted in the condenser section.

In both cases the filters are flat filters type G85 fitted across a Z frame to give low velocity and better filtration.



Filters can be withdrawn sideways by undoing the four retaining screws of the cover panel. Depending on the size of unit there will be from one to five separate filter sections.

The filter is secured by a U-shaped strip top and bottom. Take this off to free the filter material. Cleaning can be done by shaking, vacuuming or by washing in warm detergent if greasy.

If the filters are very dirty or damaged they should be replaced.

**NOTE: DIRTY FILTERS CAUSE ADDITIONAL FAN POWER TO BE USED AND REDUCED AIR VOLUME WITH RESULTANT PLANT FAILURE.**

## 3.07. COILS

### 3.07.1 LPHW and Steam Coils

Remove dust from fin spaces.

Check no leaks present on tubes and headers.

Check no leaks on pipe connections.

Check motorised valves for correct operation.

### 3.07.2 Electric Heating Coils

Check and tighten all wire connections for power to the heating coils. Check that no internal wires are burnt or damaged. Check the thermostats for correct setting.

Clean off any deposits of dust from the heating elements and fin section by blowing with compressed air or by brushing.

## 3.08. CONDENSE SYSTEM

### 3.08.1 Condense Drain

Check the trap and drain pipe for obstructions and free running of water.

Check that the condense tray is clean and free of sediment.

Check all components for leaks.

### 3.08.2 Eliminator Plates

Clean off plates of any deposits and check for secureness in mounting frame.

## 3.09. DAMPERS

### 3.09.1 General Check

Check the damper blades for free movement and the actuating gears for damage.

Grease all moving parts and gear teeth with a silicone based grease.

3.09.2 Damper Motor Drives

Check the motor actuator for full movement of blades and all electrical connections for tightness.

## 3.10. REFRIGERATION SYSTEM

**THE REFRIGERATION CHECK-UP MUST BE CARRIED OUT BY A QUALIFIED REFRIGERATION ENGINEER.**

3.10.1 Pressure Check

Check and note HP and LP pressures in bar and compare with earlier values from commissioning sheets.

**NOTE: Values can vary slightly due to changes in air temperature. Drastic changes in pressure, however, can be due to dirt and other blockage of coils (on the air side), icing up, insufficient Freon cooling medium or reduced air flow**

3.10.2 Refrigeration Circuit

The cooling circuit in the heat pump is from the factory filled with a precise amount of cooling medium - Freon 22 - and thereafter hermetically sealed.

Cooling medium is not consumed during normal operation.

In rare cases small leakage can occur due to vibrations, which unfortunately cannot be traced at the factory testing. Such leakage can occur at a soldering flare or connection, with the result that the Freon will escape due to the high pressure in the system.

Check therefore the sight glass (item 9 on the fridge circuit and drawing).

**NOTE: During start up small bubbles and turbulence in Freon can occur but after a few minutes this will disappear and the sight glass will be full and the fluid constant flowing.**

Check the level in receiver (item 7) sight glass - level to be middle of the glass. This check can be carried out through the sight glass on the front panel, using a torch.

If Freon shortage is observed, or the heat pump malfunctioning call a refrigeration service engineer.

In the event of a leakage this must be located and repaired immediately.

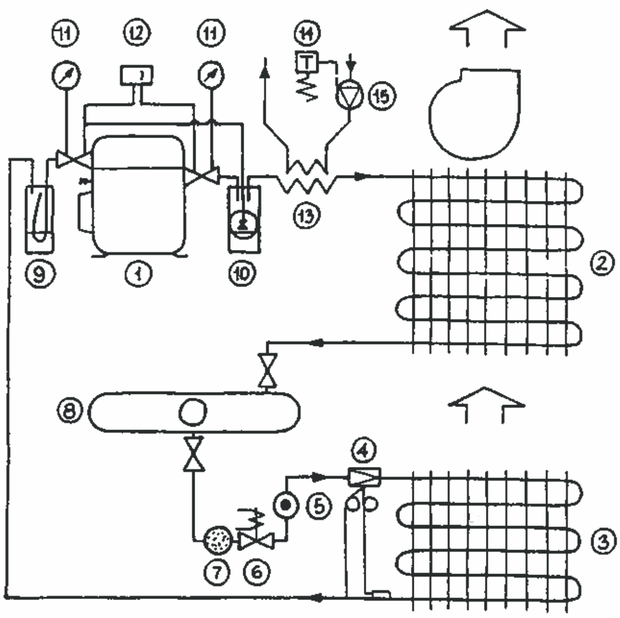
The refrigerant must be evacuated and re-filled with the quantity stipulated on the compressor label.

3.10.3 Compressor

The compressor and other cooling components require no special maintenance. The evaporator and condenser coils must be checked and cleaned for dust and other particles. Cleaning must be carried out very carefully with a vacuum cleaner or compressed air so that the fins are not damaged.

Service access to the coils is through the front panel.

3.10.4 Schematic Refrigerant Circuit




1. Compressor.
2. Condenser.
3. Evaporator.
4. Expansion valve.
5. Sight Glass.
6. Solenoid Valve.
7. Line Drier.
8. Receiver.
9. Suction Accumulator.
10. Oil Separator.
11. Manometers LP/HP.
12. Pressure Stat.
13. Water cooled condensers (optional).
14. Return air thermostat*
15. Pump. *
    * not supplied by Dantherm.

3

## 3.11. ELECTRICAL COMPONENTS

### 3.11.1 Connections

Check all electrical connections in the terminal compartments and the service switch section.

### 3.11.2 Ancillary Components

Check all ancillary components for correct operation and soundness of wiring.

### 3.11.3 Filter Warning

Check clogged filter warning device for electrical soundness and operation.

## 3.12. SERVICE SCHEDULE

The service intervals will depend largely on the actual operating conditions particularly with regards to cleaning. In the absence of other indications the chart below provides a guide line.

The actual running time and elapsed time are alternatives. Service should be carried out at the running time shown or the elapsed time shown, whatever occurs first.

| Component | Running Hours | | | Elapsed Time | | |
|---|---|---|---|---|---|---|
| Description | 1000 | 2500 | 10000 | Monthly | 6-monthly | Annually |
| 3.02.2 | | x | | | x | |
| 3.03.1 | x | | | x | | |
| 3.03.2 | x | | | x | | |
| 3.03.3 | x | | | x | | |
| 3.04.2 | | | x | | | x |
| 3.05.1 | | | x | | | x |
| 3.05.2 | | | x | | | x |
| 3.05.3 | | | x | | | x |
| 3.06 | x | | | x | | |
| 3.07.1 | | | x | | | x |
| 3.07.2 | | | x | | | x |
| 3.08.1 | x | | | x | | |
| 3.08.2 | | | | x | | x |
| 3.09.1 | | | | x | | x |
| 3.09.2 | | x | | | x | |
| 3.10.1 | x | | | x | | |
| 3.10.2 | x | | | x | | |
| 3.10.3 | | x | | | x | |
| 3.11.1 | | | | x | | x |
| 3.11.3 | | x | | | | x |

## 4. REPLACEMENT OF COMPONENTS

SAFETY
ISOLATE FROM THE MAIN ELECTRICAL SUPPLY BEFORE COMMENCING THE REPLACEMENT OF ANY COMPONENTS PARTS.

GENERAL
BEFORE COMMENCING WORK ON REPLACEMENT PARTS, READ THE INSTRUCTIONS AND THE TECHNICAL INFORMATION CAREFULLY, TO OBTAIN A GOOD UNDERSTANDING OF THE ITEM BEING REPLACED AND TO ENSURE THE COMPONENT FUNCTIONS EFFICIENTLY ON COMPLETION OF THE WORK.

### 4.01 FANS

#### 4.01.1 Description

The fans used are of the centrifugal type with belt drive from the motor. Either forward curved blades or backward curved blades will be fitted and will be designed to run at a specific R.P.M. for any one installation.

It is important that any new fan fitted be recommissioned, and by using a tachometer or revolution counter, the original R.P.M. be checked against that shown in Section 6.

The fan is mounted on two galvanised plates whose bases will be secured to the motor frame support rails. The fan outlet will be connected with a flexible connection to the cabinet wall.

The drive shaft will protrude equal distances either side of the fan scroll to allow the pulley to be fitted on the required access side of the unit.

#### 4.01.2 Replacement

1. Release the tension from the drive belt by slackening off fully the two retaining bolts on the motor bed plate nearest to the fan and releasing the tightness of the two bolts furthest from the fan. Remove the belt when free enough to do so.

2. Remove the fixed pulley from the fan shaft with pullers only. Remember to undo the hexagonal grub screw(s) first.

3. Remove the self tapping screws supporting the fan scroll to the galvanised bracket on both sides of the fan.

4. Remove the retaining bolts securing the galvanised bracket to the support rail on the side nearest to the access area.

   * This may not be necessary on smaller fans, see the next item for removal instructions.

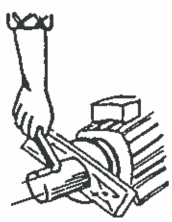
5. Pull and lift the fan scroll, so that its outlet is released from the flexible rubber mount on the cabinet wall, ensuring that the rubber is not damaged in doing so.

   Turn the curved end of the fan towards the access area and withdraw from cabinet.

   * When special motors are fitted of a larger frame size than standard, it may be necessary to remove these also to allow clearance for the fan scroll. (See section 4.04.2).

6. Fit the new fan in reverse order of removal, ensuring that the rubber in the flexible connection is fitted correctly, and all securing screws are replaced tightly.

7. Refit the fan pulley by tapping onto the fan shaft with a wooden block. Do not use a hammer so that metal hits metal.



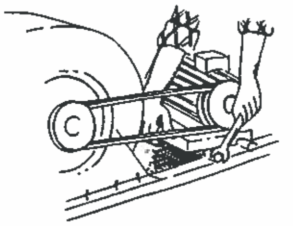
8. Line up the fan pulley with the motor pulley, using a straight edged board, and tighten the hexagon grub screw on the pulley down onto the keyway of the shaft.

   * If twin pulleys are fitted, line up from the centre flange on both pulleys and not the outer edges of the flanges.

9. Refit drive belt if not damaged and re-tension by lifting the motor bed plate.

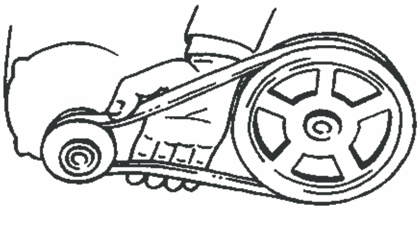
4

4



Retain the tension until the two bolts nearest the fan are fully tensioned.

Check the belt for correct tension by depressing between the fingers to find a maximum deflection of 15 mm on motors over 4 kW, and 10/12 mm on motors under 4 kW.



If the tension is correct, tighten the two bolts furthest away from the fan.

10. Run fan to ensure no vibration is present and that it is running at the correct R.P.M.

    Check belts are running straight and are not "slapping".

11. Replace access covers securely and leave plant running.

4.02. BELTS

4.02.1 General

Single belt or twin belt drives are used depending on the power required, with a belt profile of S.P.A. (13 x 10 mm) or S.P.B. (16 x 13 mm), depending on the duty imposed.

The belt lengths are not standard to any one particular type of equipment due to the numerous combinations of air volumes. Motor sizes and on site measurement should be taken, or reference made to the commissioning record in Section 6.

Belts should be replaced when wear is apparent, twisting has taken place, or cracks are showing on the inside of the belt.

<u>When new belts have been fitted, re-tensioning will be required after 30 days use due to a normal stretching of the belt.</u>

4.02.2 Replacement

Release the belt tension by lowering the motor bed plate.

Slacken off fully the retaining bolts on the side nearest the fan and release tightness of the two bolts furthest away from the fan.

Fit the new belt, or belts, and adjust the belt tension by raising the motor bed plate.

Lift the bed plate until the belts are fully tensioned, and retain the tension until the two bolts nearest the fan are re-tightened (see Section 3.03.1).

Check the tension by depressing between the fingers to find a maximum deflection of 15 mm on motors over 4 kW and 10/12 mm on motors under 4 kW.

On twin pulley drives, check that when correctly tensioned, both belts are equal in deflection.

* If not see Section 4.03.4 on pulley adjustment.

When the correction tension is obtained, tighten the other two bolts at the rear edge of the bed plate.

Run fan to check belts are running smoothly.

<u>When new belts have been fitted, re-adjustment of the belt tension will be required after 30 days, due to belt stretch.</u>

4.03. PULLEYS

Two type of pulley are used in the equipment and both can be either single drive, or twin drive.

4.03.1 Fan Pulleys

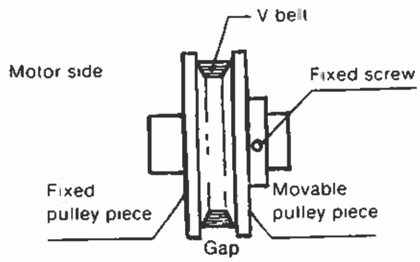
These are the fixed type, being manufactured from cast iron or pressed steel, suitable for single or twin belt drive in profiles SPA or SPB.

They are secured to the drive shaft with a hexagon headed grub screw.

4.03.2 Motor Pulleys

On motors below 7.5 kW special adjustable pulleys are fitted, either single or twin drive.

The construction of the pulleys are as shown below and on single pulleys only one of the outer flanges can be rotated on the centre spigot, while on twin pulleys, both outer flanges rotate on the centre flange.




Each rotating flange is secured to the centre spigot by a metric hexagon grub screw, that sits in a groove on the spigot.

Depending on the pulley diameter either two or three grooves are cut into the spigot allowing the pulley to be moved either half a rotation, or a one third rotation.

The standard motor pulleys are of the following dimensions:

| Adjustable Range mm | Shaft size mm.dia | Single Drive | Twin Drive |
|---|---|---|---|
| 62/86 | 11 | x | - |
| 62/86 | 14 | x | - |
| 62/86 | 19 | x | - |
| 70/102 | 28 | x | x |
| 102/136 | 19 | x | x |
| 102/136 | 24 | x | x |
| 102/136 | 28 | - | x |
| 102/136 | 38 | - | x |
| 102/136 | 42 | - | x |

### 4.03.3 Replacement

Before removing the existing pulley, note the gap dimension so that the new pulley can be set to an approximately comparable diameter when fitted.

a. Remove the drive belts as described in Section 4.02.2.

b. Release the metric hexagon headed grub screw fitted in the centre boss that retains the pulley to the drive shaft.

   * On twin pulleys the grub screws will be between the pulley gaps in line with the key. The outer flange will require unscrewing several turns to gain access to the steel hexagon screw.

c. Remove the pulley with a puller, ensuring the motor shaft does not receive damage by uneven removal.

d. Clean the inside of the new pulley with fine emery cloth and lightly grease.

e. Position the new pulley evenly on to the shaft, ensuring the key is flat in the keyway.

   * On large pulleys, the hexagon grub screw must be at the rear of the pulley and not towards the front on the pulley if only one retaining screw is fitted.

f. Drive the pulley on to the shaft by using a block of wood between the pulleys and a mallet (do not let metal hit metal), until the pulley is in line with the fan pulley.

   * On large twin pulleys the motor shaft will not extend to the outer edge of the pulley, but providing the locking screw is at the rear of the pulley sufficient retention to the shaft will be obtained.

g. Make final alignment to the fan pulley by using a straight edge. On twin pulleys use the centre flange on both pulleys for alignment.

   When the alignment is complete, securely lock the pulley to the motor shaft with the hexagon grub screw.

   On shaft sizes below 22 mm, one retaining grub screw is used, whilst on shaft sizes over 22 mm two grub screws are used. These screws lock down on the keyways.

h. Secure the adjustable flanges to the boss by ensuring the hexagon grub screws are tightened into the grooves cut into the boss.

i. Refit the belt and tension as described in Section 3.03.

j. Run the fan to full speed and check with a revolution counter that the fan is set to the correct R.P.M. as shown in the Technical Data Section 6.0.

   If the fan speed is not correct, reset the motor pulley diameter as described in 4.03.4.

4

4

4.03.4 **Adjustment of Motor Pulleys**

a. Release the tension on the drive belts by swivelling the motor base plate.

b. Slacken off the grub screw on the outer flange to free the flange from the locking groove cut in the centre boss.

c. Rotate to the flange to decrease the gap or increase as required.

* Decreasing the gap will increase the fan speed, and widening the gap will lower the fan speed.

On completion, tighten the grub screws, ensuring that it is in line with the groove cut in the centre boss, and that the screw is not cutting into the fins thread on the boss.

**Special Note**

**On twin pulleys it is important that both outer flanges are rotated the same number of turns when adjusting.**

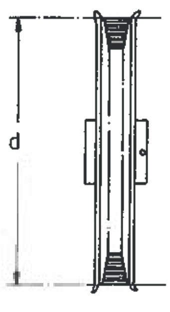
**Either two or three grooves will be cut in the centre boss to accommodate the grub screw, and these can be used as a guide when a half, or a third turn only, is required on the flange.**

4.03.5 **Fan Speed Calculations**

a. From the following chart find the motor's R.P.M.

| Motor | R.P.M. | | |
|---|---|---|---|
| kW | 3 phase | Single Phase | Two-speed 3 Ph. |
| 0.55 | 1380 | 1380 | 1400 |
| 0.75 | 1380 | 1450 | 1400 |
| 1.1 | 1410 | 1430 | 1410 |
| 1.5 | 1400 | 1430 | 1420 |
| 2.2 | 1425 | 1430 | - |
| 3. | 1430 | 1420 | 1420 |
| 3.7 | - | - | 1420 |
| 4.0 | 1430 | - | 1440 |
| 7.5 | 1435 | - | 1440 |
| 11.0 | 1440 | - | 1440 |

and from the Technical Data Section 5 find the required fan R.P.M.




b. The speed ratio is:

$$\frac{\text{Motor R.P.M.}}{\text{Fan R.P.M.}} = \text{Ratio}$$

$$\text{Ratio} = \frac{\text{fan pulley dia.}}{\text{Motor pulley dia.}}$$

c. If motor pulley size is known then

Fan pulley diameter
= Ratio x motor pulley dia.

If fan pulley size is known, then

$$\text{Motor pulley dia.} = \frac{\text{Fan pulley dia.}}{\text{Ratio}}$$

The motor pulley adjustment size can be increased by taking the distance across the two outer edges of the belt and deducting 5.6 mm for SPA belts and 7 mm for SPB belts.

The fan pulley diameter is usually stamped on the side of the pulley. If not it can be found as indicated above for the motor pulley.

## 4.04. Motors

4.04.1 **General**

Two types of motor are available for the operation of the plant:

Standard: 420 V 3 phase single speed.

Special : 420 V 3 phase 4/8 pole tap-wound. Two speed.

All are on construction in compliance to IEC 34-1/5/6 (DIN).

Details of motors fitted to the appropriate unit can be found in Section 6. or on the motor plate.

4.04.2 **Replacement**

a. Release the belt tension, remove belts and adjustable drive pulley.

See section 4.02.2 and 4.03.3 for description of this operation.

b. Disconnect electrical connections inside motor terminal box, noting the arrangement of links if fitted.

c. Remove the two bolts nearest the fan on the motor bed plate to allow the bed plate to be raised to its highest point.

d. Remove the four nuts and bolts securing the motor and lift the motor clear of the unit.

e. Fit the new motor and secure with the four bolts, ensuring that the motor shaft is parallel with the fan shaft before fully tightening the bolts.

f. Replace the two bolts in the motor bed plate but do not fully tighten at this stage.

g. Refit motor pulley as described in Section 5.03.3 e/f/g/h.

h. Reconnect electric's to terminals on motor, ensuring that the links are positioned as the old motor (see also Section 4.04.3 (a).

i. Run motor to determine if the pulley rotation is correct in relation to the arrow stamped on the fan scroll.

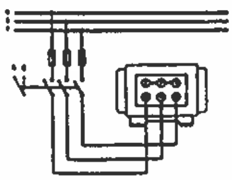
 * Change any two phases on the terminals to change the rotation of 3 phase motors.

j. Fit belt drive and tension as described in Section 4.03.2 and 4.03.3.

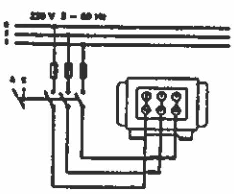
4.04.3 **Electrical Connections**

a. Three phase single speed motors have six terminal points, with a link arrangement for connections as shown below.

<u>Star Coupling Europe and U.K.</u>



Operated from a single contactor on 420 V 3 phase for direct on line start.

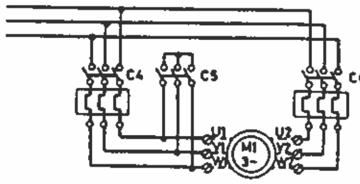


Operated from a single contactor on 220 V 3 phase for direct on line start.

TO CHANGE THE ROTATIONAL DIRECTION, CHANGE ANY TWO PHASE CONNECTIONS.

b. For larger motors of 3 phase single speed, a Star/Delta Start can reduce the initial current surge, and three contactors with interlocking devices fitted can be wired as the drawing below, with the terminal links removed completely.

STAR/DELTA START




c. **Two-speed Motors**

Two speed motors, when supplied by Dantherm are of standard DIN construction, with tapped windings, 4/8 pole.

Connection to the contactors is as shown in the previous drawing for Star/Delta Start, that in this instance gives a low speed start if wired as the diagrams shown in Section 6.
All bridging links are removed from the terminals on this arrangement.

4.05 **FILTERS**

See section 3.06 Removing Filters.

Filters can be ordered in sizes cut to the the individual units, or in rolls for cutting to size on site.

The following sizes and number of filters apply:

| | Size | No. Req'd |
|---|---|---|
| AF-A | 1000 x 640 | 1 |
| AF-B | 1140 x 540 | 2 |
| AF-C/CS | 1140 x 420 | 4 |
| AF-D/DS | 1370 x 500 | 4 |
| AF-E/ES | 1900 x 450 | 5 |

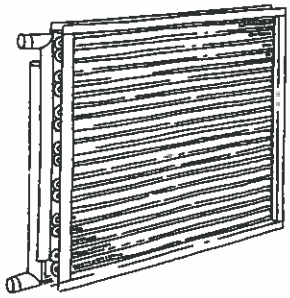
4.06. **HEATING COILS**

4.06.1 **General - Internally Mounted**

Coils are an integral part of the cabinet's construction, and a small amount of general engineering work is required to remove and replace them.

As the life of the coil is normally many years, the normal access area may not be adequate for the coils removal, and an on site survey should be carried out before commencing work to assess the best method of removing the coil from the cabinet in relation to any obstruction near the unit.

4



4

### 4.06.2 LPHW Coils - Internal

a. Isolate from water supply pipes, and drain off coil contents into a receptacle.

b. Disconnect all pipework to give clearance to coil.

c. Remove access panels on both sides of the coil compartment.

d. The coil is mounted on formed metal sections, secured to the cabinet frame, with the flange of the coil pop riveted to the sections.

Using a metric drill, remove all the retaining rivets until the coil is completely free of the mounts.

e. Remove the coil from the cabinet, noting the flow and return pipe positions.

f. Position the new coil into the cabinet, ensuring the pipe connections have their flow arrows positioned as the one removed.

* If no arrows are present on the new coil, always mount the coil so that the return pipe is nearest the airflow onto the coil, and the flow pipe is down stream of the airflow.

g. Line up the flange of the coil with the mounting plates and drill through one of the holes near the top corner position. Retain the coil temporarily through this hole with a small nut and bolt.

h. Lift the coil at its free end until it is completely square and evenly positioned on the plates. Drill through another existing hole on the top, and rivet into position.

i. Continue drilling through all the existing holes, and riveting at the same time, until every existing hole has been drilled and riveted.

j. Using a sealing gun, make every joint air tight, and fill any gaps between the cabinet and coil with sealant also.

(DOW CORNING, CLEAR SILICONE 875 IS SUITABLE FOR SEALING ALL JOINTS).

k. Replace the side panel with the pipe entry holes in.

l. Reconnect all pipework and test system for leaks.

m. Replace all side panels.

n. Run and test system.

### 4.06.3 LPHW Coils - External

As these coils are mounted on the flange of the unit's duct outlet and the ductwork flange, no special instructions for their removal and replacement are required.

An on site inspection will make the operation self explanatory.

### 4.06.4 Steam Coils

These are nearly always mounted externally to the unit due to space restrictions on accommodating the headers. Their removal and replacement will be self explanatory on inspection.

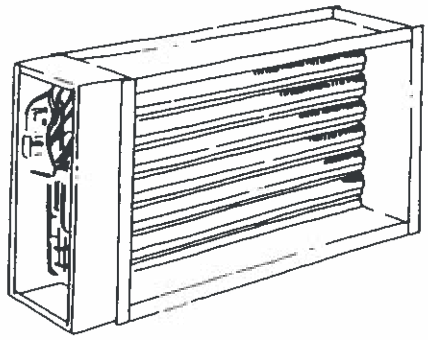
* If they should be mounted internally the procedure for LPHW coils (4.06.2) can be followed.

### 4.06.5 Electric Coil Construction

a. Four separate elements are fitted to the coil with fins situated in the air flow. The output of the elements have ratio of 1-2-4-4 in relation to the full kW output of the particular coil.

sketch

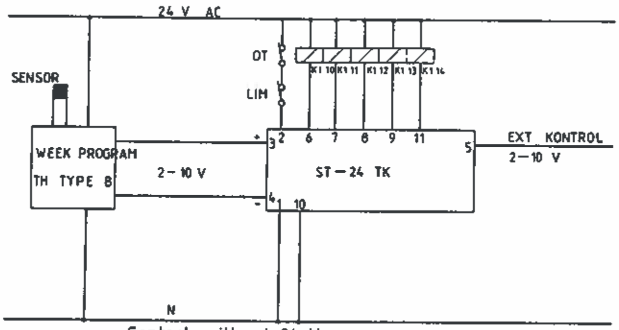
b. Supply connection to each of the four elements in the coil has to go through its own contactor. In this way the four elements can be controlled in any combination, dependent upon the type of control system used.



c. The heat output from the coil is normally controlled by a step-controller, either lineary or binary.

The lineary controller will switch on the coil steps in sequence, connecting the smallest step first.

The binary controller will switch on in accordance with demand, in steps of one fifteenth of the total coil output at a time, the end in this case being split in steps ratio 1:2:4:8:.



Control with st-24 tk.

The temperature sensor will provide a signal to the actual thermostat, which will provide a 2-10 V signal to either the lineary or binary controller, which converts the signal to activiate the relevant contacts.

### Control Circuit

d. The different separate groups of electric heating coil are internally led to a counter sunk terminal row where supply cables and control current cables can be connected.

e. The necessary safety thermostats are built into the terminal box to protect the heating coil. A control thermostat (LIM), the temperature setting of which is adjustable, switches off the heat at abnormally high temperatures and switches it on again automatically when the temperature has dropped.

f. An overheat thermostat (OT) is an extra safety and switches off at an air temperature of 100°C. OT does not reset automatically when the temperature has dropped but has to be manually operated via a reset-button on the terminal box.

To ensure that the accumulated heat in the electric coil is dissipated when the coil and fan is switched off, the fan will automatically continue running to 100 sec., after the coil has been on. This minimises the risk of the OT thermostat cutting out and the manual reset required.

## 4.06.7 Replacing Electric Coils

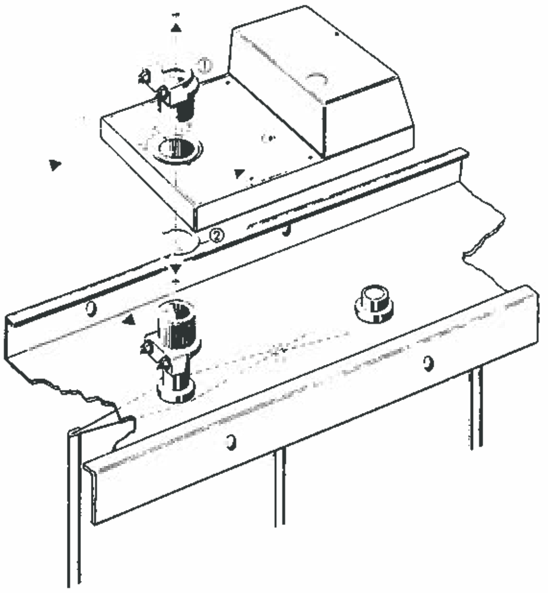
a. These units will be mounted and secured to the cabinets in a similar way to water coils and the same procedure can be followed (see 4.06.2) with the exception of water pipe connections.

b. Electrical connections to the coil are 3 phase, and it is advisable; for a qualified electrician to disconnect and reconnect all cables.

## 4.07 DAMPER ACTUATORS

a. Factory fitted actuators are of Belimo manufacture, mounted as shown, direct to Dantherm dampers.

**Installation with short damper shaft**



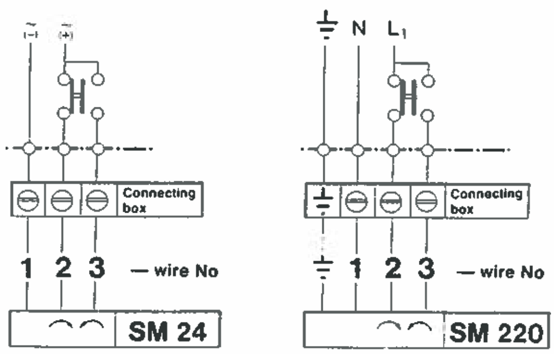
Dampers can be supplied without actuators, and on site fitting of actuators, with linkage, may be carried out by the installer who will supply all technical data.

b. The normal function of Belimo actuators are to either Open fully/Close fully, or they can be fully modulating.

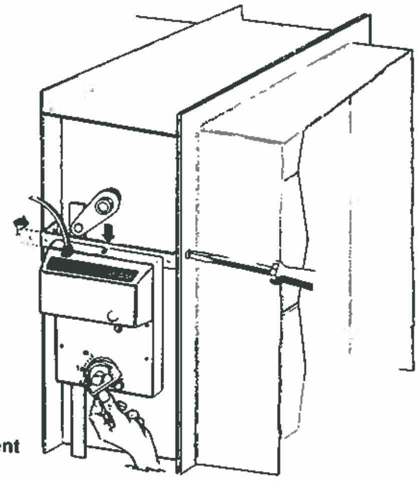
The internal connections of the units are as shown below for 24 V and 240 V.

**Wiring diagram**

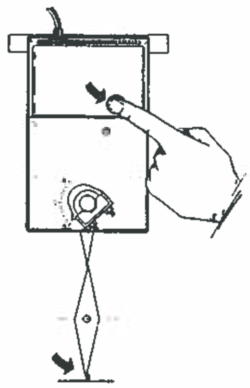
Power supply 24 V ~ (=) Power supply 240 V ~




c. The rotating motion of the reversible motor is transmitted onto the drive segment through a reduction gear. The motor is simply clipped onto the damper shaft (10 - 18 mm) and secured by a "U" - bolt attached to the drive segment. The universal mounting bracket supplied with the motor will prevent swerving of the motor. The damper motor is not provided with and does not require any limiter switches, but is protected against overloading. The angle of rotation is mechanically limited to 95°. When reaching the damper or motor end position, the motor stops automatically.



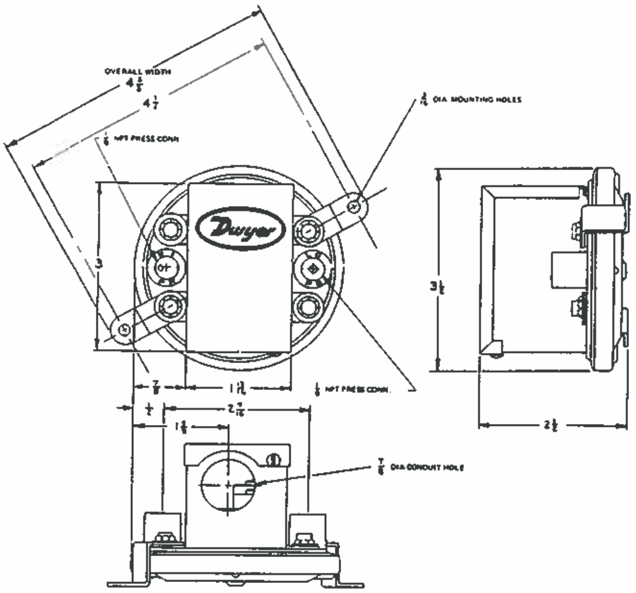
**Adjustment**



The gears can be manually disengaged by simply pressing down the spring loaded button on the motor cover. Whilst this button is pressed down, the damper blades can be adjusted by hand. The position of the motor is indicated by means of a scale reading 1 - 10. One or two auxiliary switches can be added to the motor which are adjustable to provide indicating signals for end positions, or to provide control signals depending on specific damper positions as required.

## 4.08. FILTER WARNING

4.08.1 a. When required, this unit can be installed at the time of manufacture, but retro-fitting can be carried out by a service engineer.

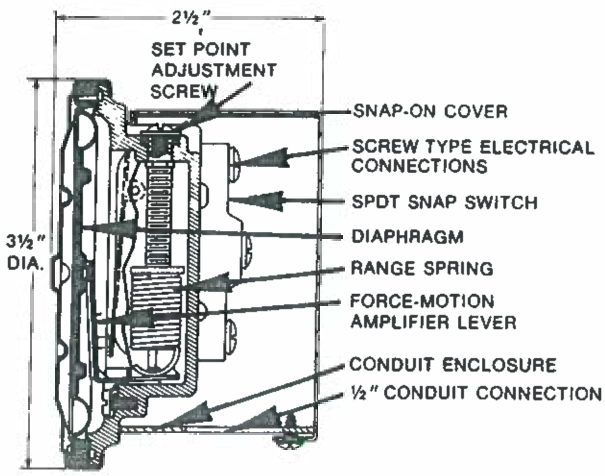


b. The unit is installed inside the cabinet and two plastic 6.3 mm O.D. tubes are led to a fixed position either side of the filter.

Connect the highest pressure air (before the filter) to the connection marked HI-PR and the lowest pressure air (after the filter) to the connection marked LO-PR.

c. Electrical connections are marked Common/Normally Open/Normally Closed.

Connect the supply to Common and the return signal to Normally Open.




### 4.08.2 Adjustment

To change the set point, proceed as follows:

Remove the snap-on cover from the conduit enclosure by loosening its retaining screw and pulling firmly on its bottom end. Turn the slotted adjustment screw at the top of range spring housing clockwise to raise the set point pressure and counter-clockwise to lower the set point.

The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly.

NOTE that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in a upright position.

### 4.08.3 Replacement

Replacement can be carried out with reference to the above paragraphs, ensuring that the name plate DWYER is in an upright position.

The unit is mounted with two securing screws.

## 4.09. REFRIGERATION SYSTEM

### 4.09.1 Refrigerant Circuit

The heat pump is designed as a traditional refrigeration system, charged with Freon (R22) and is not provided with defrost controls. In the event of the ON/OFF temperature falling below 22°C the compressor(s) will switch off.

ALL REPAIRS AND MAINTENANCE OF THE HEAT PUMP SYSTEM MUST BE CARRIED OUT BY A QUALIFIED REFRIGERATION ENGINEER. UNDER NO CIRCUMSTANCES SHOULD SUCH WORK BE ATTEMPTED BY UN-QUALIFIED PERSONNEL.

The following is a description of some of the possible component failures, their causes and general hints on rectification. The qualified refrigeration engineer will not require a more detailed explanation of the rectification procedures.

### 4.09.2 Compressor

The compressor life is largely dependent on the operation conditions. Running at a constantly high condensing pressure increases wear. Frequent stop and start (hunting) can cause the motor windings to burn, and lack of lubricant can cause bearings to seize and valves to burn.

If the windings have burnt, lacquer from the windings together with acid containing products can be carried into the refrigerant. If a replacement compressor is fitted the refrigerant must therefore be evacuated from the system and the circuit cleaned out using f.ex. R 11. A test for acid in the lubricant will establish if this step is necessary.

Defect motor winding can be identified by measuring the resistance over the windings and a burnt valve will cause cooling output to drop.

After replacing the compressor the heat pump circuit must be carefully evacuated and the system charged with the correct quantity and type of Freon.

### 4.09.3 Automatic Controls

If insufficient refrigerant reaches the evaporator, which can be identified by abnormally low pressure or by surface temperature measurement on flow and return pipes, the cause can be a defective thermostatic valve sensor or a nozzle blocked. To rectify , empty the system, replace the top part of the valve, evacuate and re-charge the system with Freon.

The function of the liquid line drier is to absorb any moisture in the circuit and to arrest any dirt in the system. If blocked, replace the filter. Any leakage in, or opening of, the hermetic system (other than very brief ones) should always be followed by a replacement of the filter.

Defective manometers can be replaced without evacuating the system, by turning off the compressor isolating valves (fully anti-clockwise). The high/low pressure stat. can be replaced, without emptying the whole circuit by turning off at both compressor isolating valves (fully clockwise). After replacement of the stat. only the compressor has to be evacuated through the Schrader valve on the compressor body. No extra Freon charge is necessary.

A Schrader service valve for high pressure (HP) and one for low pressure (LP) are placed just behind the inspection cover panel and can be used for emptying, evacuating and charging.

### 4.09.4 Leakages

Leakages on solderings and flare connections are from experience the most common cause of operational diff-iculties. They can develop because of vibration, mech-anical damage or by frequent temperature change.

A leakage is often associated with an escape of lubricant, which helps in location of the leakage.

Any leakage, indicated by lack of Freon, should be located immediately and rectified rather than filling on more refrigerant. If it is necessary to repair the leakage by soldering, the refrigerant must be emptied, evacuated and re-charged.

In rare cases leakages can occur in the evaporator and condenser coils, which cannot be soldered. In this case the entire coil must be replaced, following a similar procedure to that given in section 4.06.2. for heating coils.

## 4.10. CONTROL PANELS

Most components fitted within the panels are standard and are easily available from most electrical suppliers. Replace-ment of parts are self explanatory, on inspection by a qualified electrician.

Other none standard components such as printed heat pump circuit boards, printed control light and board transformer, can be obtained from Dantherm, and their replacement will also be self explanatory on inspection.

Normal electrical fault finding and repair procedures can be carried out on the control panels, if reference is made to the appropriate wiring diagrams.

## 4.12. INSULATION

Two types of panel insulation are used, depending on requirements.

a. Fibreglass, with a special coated surface to contain the material.

To replace, disengage the metal clips on the protruding pins by placing two small screw drivers under the plate until they touch the pins. Turn the screw drives 90° and lift the plates clear of the pins.

Cut the new insulation to size with a sharp blade, using the old insulation as a template.

Position the new insulation material on the panel with the protective coating facing outwards, and line up precisely with the panels profile.

Press firmly at each point one of the pins in position, until it protrudes outside the insulation. Push on the retaining plate until it lies level with the insulation. Do not force in to the insulation so that the protective coating becomes depressed. Continue this operation until all the pins have their retaining plates in position.

b. Rubber Insulation. This is retained to the panel with a rubber adhesive, evenly spread on the panel.

To remove damaged material, peel away by hand as much as possible and remove the remainder with a scraper until the panel is free and clean.

Cut the new material to shape, and position on panels. Trim away any rubber that is required until the insulation is a neat fit.

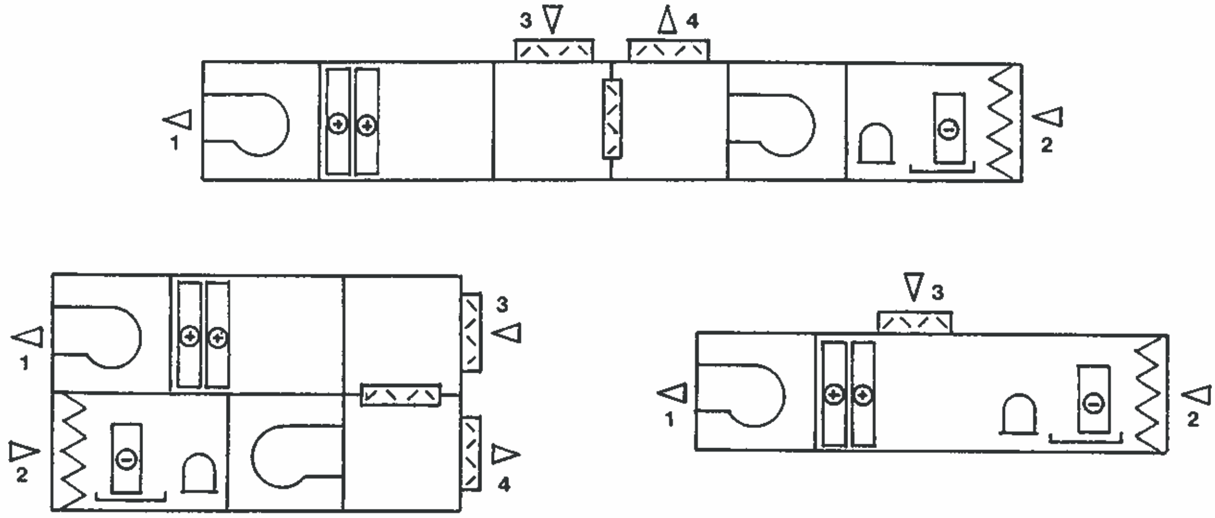
Remove the panel, coat the metal surface with adhesive and reposition the insulation carefully, starting at one straight edge and lowering down evenly, ensuring that all air bubbles are removed at the same time.

## 5. OVERALL STANDARD TECHNICAL DATA

| Dehumidifier type AF | | A | B | C | CS | D | DS | E | ES |
|---|---|---|---|---|---|---|---|---|---|
| Standard air volume | $m^3/h$ | 3000 | 6000 | 9000 | 10000 | 12000 | 14000 | 18000 | 22000 |
| Standard internal pressure available | Pa | 250 | 250 | 300 | 300 | 300 | 300 | 300 | 300 |
| Standard fan motor, single speed | kW | 1.5 | 3.0 | 4.0 | 5.5 | 5.5 | 7.5 | 7.5 | 11.0 |
| Standard fan motor. two-speed | kW | 1.3/0.32 | 2.5/0.6 | 3.6/0.75 | 4.8/1.1 | 4.8/1.1 | 6.5/1.5 | 6.5/1.5 | 9.0/1.9 |
| Fan motor absorbed power | kW | 1.1 | 2.2 | 3.0 | 4.2 | 4.7 | 6.1 | 5.4 | 8.1 |
| Single speed fan motor FLC | Amp | 3.4 | 6.1 | 8.0 | 11.3 | 14.3 | 14.4 | 14.4 | 20.7 |
| Two-speed fan motor FLC | Amp | 2.8/1.1 | 5.4/2.0 | 7.1/2.5 | 9.0/3.0 | 9.6/3.0 | 12.5/3.9 | 12.5/3.9 | 18.0/5.3 |
| Fan standard RPM | | 1800 | 1320 | 1220 | 1380 | 1090 | 1200 | 840 | 950 |
| Compressor grouping | No x kW | 1x4.0 | 1x6.4 | 1x8.0 | 1x10.0 | 2x8.0 | 2x10.0 | 2x8.0 | 3x10.0 |
| Compressor absorbed power at 27°C/60% RH | kW | 3.15 | 4.8 | 6.25 | 7.9 | 13.5 | 15.8 | 18.8 | 23.7 |
| Compressor FLC | Amp | 6.9 | 11.0 | 13.7 | 16.5 | 27.4 | 33.0 | 41.1 | 49.8 |
| Refrigerant R22 quantity | No x kg | 1x6 | 1x7 | 1x8 | 1x9 | 2x8 | 2x9 | 3x8 | 3x9 |
| Water cooled condenser flow rate | litres/h | 580 | 750 | 1100 | 1250 | 2200 | 2500 | 3300 | 3750 |
| Hydraulic pressure drop | Bar | 0.07 | 0.10 | 0.13 | 0.09 | 0.13 | 0.09 | 0.13 | 0.09 |
| Single row coil flow rate | litres/h | 930 | 1800 | 2300 | 3200 | 4000 | 4700 | 7000 | 8200 |
| Single row coil hydraulic pressure drop | Bar | 0.05 | 0.10 | 0.09 | 0.13 | 0.13 | 0.18 | 0.20 | 0.27 |
| Two row coil flow rate | litres/h | 1700 | 3100 | 4600 | 5500 | 6800 | 8100 | 12000 | 14300 |
| Two row coil hydraulic pressure drop | Bar | 0.11 | 0.07 | 0.07 | 0.09 | 0.09 | 0.13 | 0.14 | 0.21 |
| Three row coil flow rate | Litres/h | 2200 | 4300 | 5900 | 7300 | 8800 | 10700 | 15500 | 18900 |
| Three row coil hydraulic pressure drop | Bar | 0.09 | 0.19 | 0.05 | 0.07 | 0.07 | 0.10 | 0.11 | 0.16 |

## 6. COMMISSIONING REPORT FOR DANTHERM TYPE AF -

| Site | Date |
|---|---|




| | Test point | Test 1 | 2 | 3 | 4 | 5 | Final | Devi-ation |
|---|---|---|---|---|---|---|---|---|
| Return air volume | 2 | | | | | | | |
| Supply air volume | 1 | | | | | | | |
| Fresh air volume | 3 | | | | | | | |
| Exhaust air volume | 4 | | | | | | | |
| Ext. resistance, return | 2 + 4 | | | | | | | |
| Ext. resistance, supply | 1 + 3 | | | | | | | |
| Ext. resistance, total | 1 + 2 | | | | | | | |
| Return fan motor FLC | N/A | | | | | | | |
| Supply fan motor FLC | N/A | | | | | | | |
| Return fan RPM | N/A | | | | | | | |
| Supply fan RPM | N/A | | | | | | | |
| Compressor A FLC | N/A | | | | | | | |
| Compressor B FLC | N/A | | | | | | | |
| Compressor C FLC | N/A | | | | | | | |
| Evap. temp. compr. A | N/A | | | | | | | |
| Evap. temp. compr. B | N/A | | | | | | | |
| Evap. temp. compr. C | N/A | | | | | | | |
| Cond. temp. compr. A | N/A | | | | | | | |
| Cond. temp. compr. B | N/A | | | | | | | |
| Cond. temp. compr. C | N/A | | | | | | | |
| Return air temp. | 2 | | | | | | | |
| Return air humidity | 2 | | | | | | | |

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