



ESIE07-06



Service Manual

EWWD-BJYNN

Water-cooled chillers

www.daikineurope.com

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1 Introduction

1.1 About This Manual

Target group ???

Purpose of this manual ???

Five parts This service manual consists of an introduction, five parts and an index:

Part	See page
Part 1–System Outline	1–1
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Introduction overview The introduction contains the following topics:

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1.2 Characteristics

???

1.3 Safety Measures

???

1.4 Installation

???

1.5 **Standard Accessories**

???

1.6 Options (On Request)

???

1.7 Nomenclatures

???

Part 1

System Outline

What is in this part?

This part contains the following chapters:

Chapter	See page
1-General Outline	1-3
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1

1 General Outline

1.1 What Is in This Chapter?

Introduction

This chapter contains the following information:

- Technical specifications
- Electrical specifications
- Fouling factors
- Operation limits
- Outlook drawing

Overview

This chapter contains the following topics:

Topic	See page
1.2–Technical Specifications	1–4
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1.2 Technical Specifications

				EWWD 380BJY NN	EWWD 460BJY NN	EWWD 550BJY NN	EWWD 750BJY NN	EWWD 850BJY NN	EWWD 900BJY NN	EWWD C10BJ YNN	EWWD C11BJY NN
Capacity (Eurovent con- ditions speci- fied in notes)	Cooling	Nominal	kW	369	445	521	734	816	895	976	1050
Capacity steps			%	stepless 25-100	stepless 25-100	stepless 25-100	stepless 12,5-100	stepless 12,5-100	stepless 12,5-100	stepless 12,5-100	stepless 12,5-100
Nominal input (Eurovent con- ditions speci- fied in notes)	Cooling		kW	65	77,9	90	129	142	155	167	180
EER				5,68	5,71	5,79	5,65	5,71	5,77	5,81	5,83
ESEER				6,44	6,47	6,56	7,16	7,23	7,32	7,37	7,40
Dimensions	Unit	Height	mm	2250	2250	2250	2300	2300	2300	2300	2300
		Width	mm	3625	3860	3860	4145	4145	4145	4145	4145
		Depth	mm	1551	1551	1551	1743	1743	1808	1910	1910
Weight	Unit		kg	3089	3370	3603	5546	5636	6007	6448	6698
	Operating weight		kg	3250	3688	3870	5911	6045	6460	6972	7163
Water heat exchanger	Minimum water volume in the system (Formula)			The minimum water content per unit should be calculated with a certain approximation using this simplified formula: Q= 35,83 X (P(kW) / Delta T(°C)) X (1/N); where: Q= mini- mum water content per unit expressed in litres; P= minimum cooling capacity of the unit expressed in kW; Delta T= evaporator entering / leaving water temperature difference, expressed in °C; N= number of compressors. For more accurate determination of quan- tity of water, it is advisable to contact the designer of the plant.							
	Type			Flooded shell and tube							
	Minimum water volume in the system		l	78	107	134	184	210	210	281	302
	Water flow rate	Min	l/min	565	615	776	932	1216	1209	1382	1632
		Nominal	l/min	1058	1276	1494	2104	2339	2566	2798	3010
		Max	l/min	1788	1945	2455	2946	3846	3825	4370	5162
Nominal water pressure drop	Cooling	Heat exchanger	kPa	35	43	37	51	37	45	41	34
Water heat exchanger	Model	Quantity		1	1	1	1	1	1	1	1
	Minimum water volume in the system		l	83	111	133	181	199	243	243	263
	Water flow rate	Min	l/min	665	948	1086	1478	1703	1904	1924	2146
		Nominal	l/min	1244	1499	1752	2474	2746	3010	3277	3526
		Max	l/min	2103	2998	3435	4675	5386	6020	6085	6786
	Nominal water pres- sure drop	Heating	kPa	35	25	26	28	26	25	29	27
Model	Quantity		1	1	1	1	1	1	1	1	
Water heat exchanger heat recovery condenser	Type			Shell and tube							

				EWWD 380BJY NN	EWWD 460BJY NN	EWWD 550BJY NN	EWWD 750BJY NN	EWWD 850BJY NN	EWWD 900BJY NN	EWWD C10BJ YNN	EWWD C11BJY NN
Compressor	Type			Semi-hermetic single screw compressor							
	Refrigerant oil charge		l	30	30	30	60	60	60	60	60
	Model	Quantity		1	1	1	2	2	2	2	2
		Speed	rpm	2950	2950	2950	2950	2950	2950	2950	2950
Sound level	Sound pres- sure	Cooling	dBA	78	79	80	81	81,5	82	82,5	83
Refrigerant cir- cuit	Refrigerant type			R-134a							
	Refrigerant charge		kg	130	165	180	200	215	230	274	290
	No of circuits			1	1	1	1	1	1	1	1
	Refrigerant control			Electronic expansion valve							
Safety devices				High pressure (pressure switch)							
				Low pressure (pressure switch)							
				Compressor thermal							
				High discharge temperature on the compressor							
				Phase monitor							
				Star/delta transition failed							
				Low delta pressure between suction and discharge							
Notes				Nominal cooling capacity and power input are based on: 12/7°C entering/leaving evapo- rator water temperature; 30/35°C entering/leaving condenser water temperature							
				Unit length includes modulating condenser water flow valve							

1.3 Electrical Specifications

			EWWD 380BJY NN	EWWD 460BJY NN	EWWD 550BJY NN	EWWD 750BJY NN	EWWD 850BJY NN	EWWD 900BJY NN	EWWD C10BJ YNN	EWWD C11BJY NN	
Power supply	Name		YN								
	Phase		3	3	3	3	3	3	3	3	
	Frequency	Hz	50	50	50	50	50	50	50	50	
	Voltage	V	400	400	400	400	400	400	400	400	
	Voltage toler- ance	Minimum	%	-10%							
		Maximum	%	+10%							
	Phase tolerance	Minimum	%	-2%							
		Maximum	%	+2%							
Unit	Starting current	A	367	367	367	535	550	561	575	588	
	Nominal running current cool- ing	A	112	129	148	224	244	258	277	295	
	Maximum running current	A	137	178	205	302	331	357	385	410	
	Max unit current for wires siz- ing	A	142	183	210	307	336	362	390	415	
Compressor	Starting method		Star-delta								
Notes			Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.								
			Max unit starting current: absorbed current of compressor n°1 at 75% + starting current of the other compressor.								
			Max unit current for wires sizing: compressor FLA (Full Load Ampere) + fans current.								

Notes

1. Nominal cooling capacity at Eurovent conditions: entering/leaving water evaporator= 12°C/7°C; condensing temperature= 45°C.
2. Nominal power input at Eurovent conditions: see Eurovent 6/C/003 entering/leaving water temperature= 12°C/7°C - condensing temperature= 45°C.
3. Minimum required water volume for standard thermostat settings and at nominal conditions.
4. Piping connections are delivered with victaulic joints and counterpipe for welding.
5. Values between brackets including installation space of delivered filter.

1.4 Fouling Factors

Evaporator fouling factors

Fouling factors m ² °C / kW	Cooling capacity correction factor	Power input correc- tion factor	COP correction fac- tor
0,0176	1,000	1,000	1,000
0,0440	0,978	0,986	0,992
0,0880	0,957	0,974	0,983
0,1320	0,938	0,962	0,975

Condenser fouling factors

Fouling factors m ² °C / kW	Cooling capacity correction factor	Power input correc- tion factor	COP correction fac- tor
0,044	1,000	1,000	1,000
0,088	0,990	1,018	0,973
0,132	0,981	1,036	0,945

Ethylene glycol and low ambient temperature correction factors

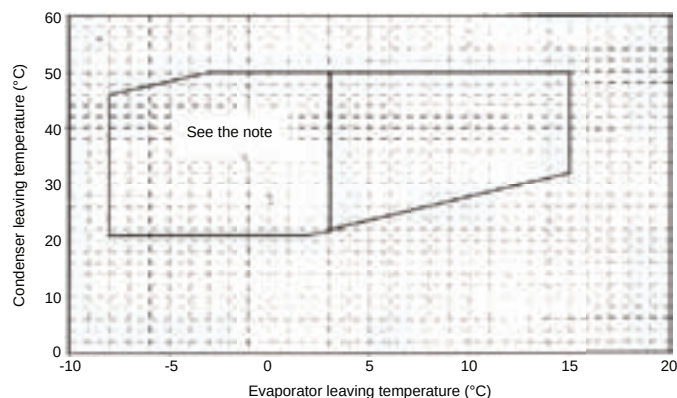
Air ambient temperature °C	-3	-8	-15	-23	-35
% of ethylene glycol by weight	10	20	30	40	50
Cooling capacity correction factor	0,991	0,982	0,972	0,961	0,946
Power input correction factor	0,996	0,992	0,986	0,976	0,966
COP correction factor	0,995	0,990	0,986	0,985	0,979
Flow rate correction factor	1,013	1,040	1,074	1,121	1,178
Water pressure drops correction factor	1,070	1,129	1,181	1,263	1,308

Low temperature operation performance factors

Ethylene glycol/water leaving temperature °C	2	0	-2	-4	-6	-8
Min. % of ethylene glycol	10	20	20	30	30	30
Cooling capacity correction factor	0,842	0,785	0,725	0,670	0,613	0,562
Power input compressors correction factor	0,95	0,94	0,92	0,89	0,87	0,84

1.5 Operation Limits

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Note: The use of glycol is necessary for evaporator leaving water temperature below +3°C.

Explanation

When starting up the unit the customer must guarantee that the unit will always operate within the operation conditions for as well the evaporator as the condenser.

Working out of the operation limits can damage the unit.

It is NOT allowed to change set points at the evaporator or condenser side.

When commissioning the unit, the refrigerant charge is optimised in function of the water temperatures at the evaporator and condenser side.

If customer decides to change the set points, the refrigerant charge needs to be optimised in function of the set point change.

Remark

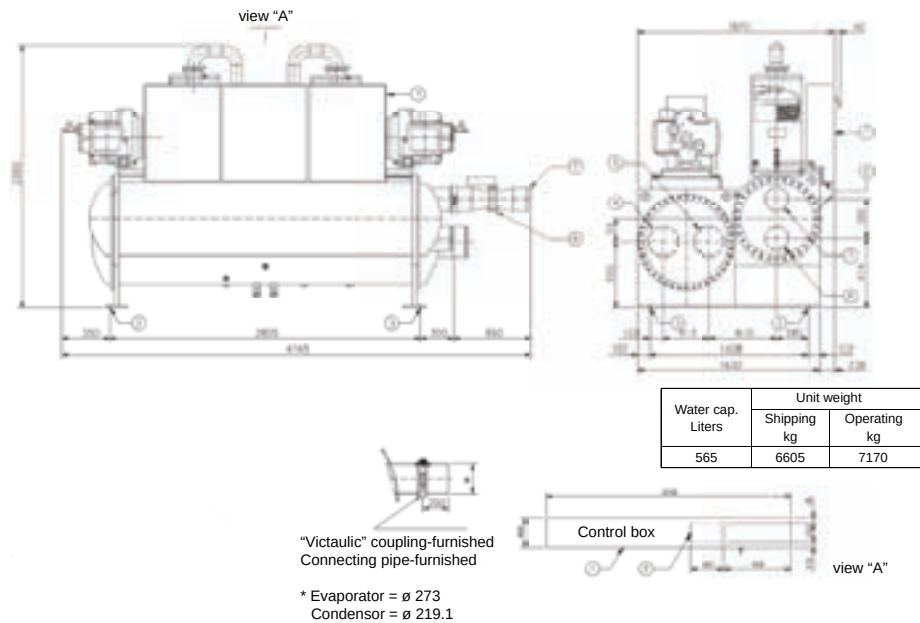
- If there is no optimising of the refrigerant charge when changing the set point Daikin Europe NV cannot be held responsible for possible damage on the unit.
- If the unit is not operating within the operation limits indicated in above picture, Daikin Europe NV cannot be held responsible for possible damage on the unit.

1.6 Outlook Drawing

Example of the outlook drawing for a flooded evaporator.

All outlook drawings can be found on the passdoor.macquay.it

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Legend:

1. Electrical panel
2. Power connections slot 300x150
3. 4 holes $\varnothing 22$ for isolator mounting
4. Evaporator water inlet ($\varnothing 273$ victaulic connection)
5. Evaporator water outlet ($\varnothing 273$ victaulic connection)
6. Condenser water inlet ($\varnothing$ e 219,1 victaulic connection)
7. Condenser water outlet ($\varnothing$ e 219,1 victaulic connection)
8. Condenser water outlet regulator valve

1

2 Piping Layout

2.1 What Is in This Chapter?

Introduction In this chapter a brief explanation will be given of all the refrigerant parts used in this unit.

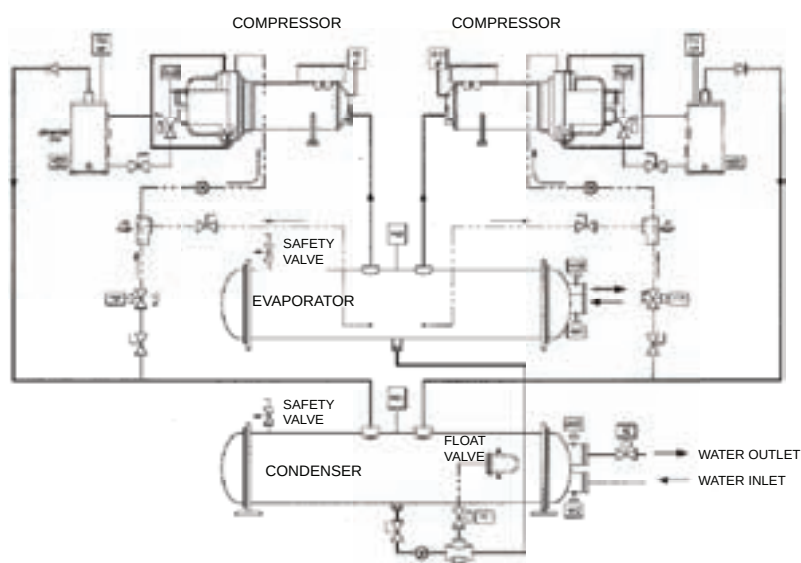
Overview This chapter contains the following topics:

Topic	See page
2.2–Functional Diagram	1–12
2.3–Refrigerant Description	1–13
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2.15–Heaters	1–27

1

2.2 Functional Diagram

Typical refrigerant circuit



F12 - 22 LP	LOW PRESSURE SWITCH
F13 - 23 HP	HIGH PRESSURE SWITCH
OLS1 - 2	OIL LEVEL READOUT
Y1	LIQUID SOLENOID VALVE
Y3 - 4	OIL INJECTION SOLENOID VALVE
Y17 - 27	JET PUMP SOLENOID VALVE
YC	CONDENSING CONTROL VALVE
WH1	HIGH PRESSURE TRANSDUCER (0 - 30 bar)
WL1	LOW PRESSURE TRANSDUCER (-0,5 - 7 bar)
WD1 - 2	DISCHARGE SENSOR
WOC	CONDENSER LEAVING WATER TEMPERATURE SENSOR
WIC	CONDENSER ENTERING WATER TEMPERATURE SENSOR
WOE	EVAPORATOR LEAVING WATER TEMPERATURE SENSOR
WIE	EVAPORATOR ENTERING WATER TEMPERATURE SENSOR

2.3 Refrigerant Description

The low temperature refrigerant gas coming from the evaporator to the compressor cools the electric motor. Later it is compressed and during this phase the refrigerant is mixed up to the oil coming from the separator. The high-pressure oil refrigerant mixture is conveyed inside the oil separator of centrifugal high efficiency type. Oil sediment to the end plate separator due to the pressure difference is again conveyed to the compressor while the refrigerant separated from the oil is delivered to the condenser.

Inside the condenser the liquid refrigerant is equally distributed on all tube bundle surface. Crossing the heat exchanger's tubes, the refrigerant desuperheats starting to condense. Desuperheating and condensing heat is taken off from condensing water consequently increasing the temperature.

Liquid condensed at saturation temperature crosses the subcooling section still yielding heat, which increases the cycle efficiency. The subcooled liquid crosses the rolling gear that by a pressure drop starts an expansion process flashing a part of the refrigerant.

The result is a low pressure and temperature liquid and gas mixture heat sensible that is conveyed to the evaporator.

The liquid-gas refrigerant after being equally distributed along the tube bundle, exchanges the heat with the water to be chilled reducing the temperature until the complete evaporation.

At gas condition the refrigerant leaves the evaporator to be again aspirated by the compressor starting a new cycle.

1

2.4 Evaporator

The evaporator is flooded shell-and-tube with the refrigerant out the tubes and the water inside them. Normally no maintenance and service operation is required. When it is necessary to replace a tube it is easy to remove the old one.

2.5 Condenser

The condenser is shell-and-tube with the refrigerant out the tubes and the water inside them. The condenser tubes are externally finned and expanded on the tube plate. All units have an integrated subcooling in the condenser also equipped with a safety valve. If required it is possible to remove and replace the tubes.

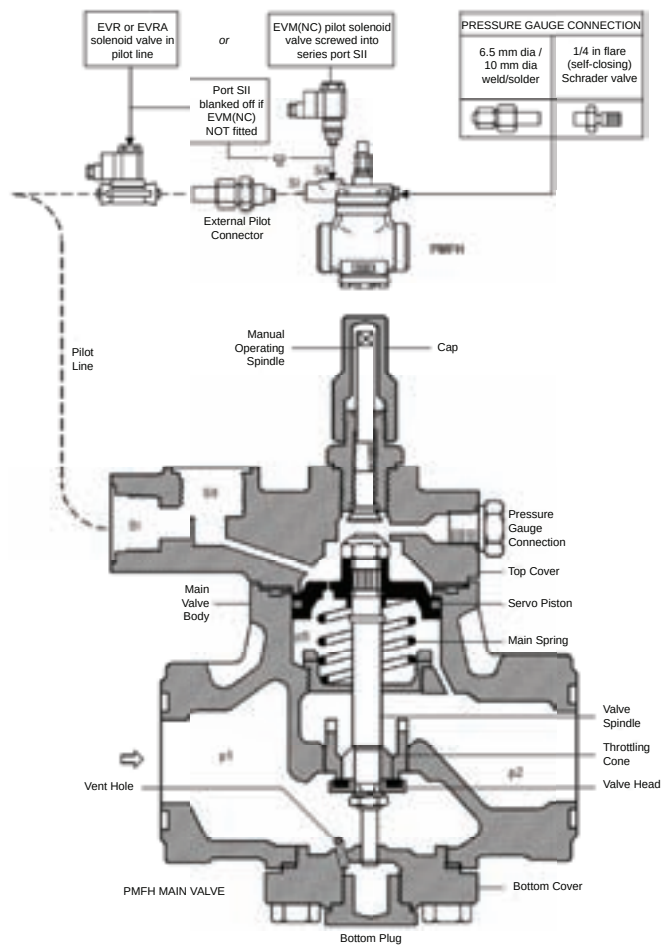
2.6 Liquid Control Valve and Float Valve

The Danfoss SV(H) float valve + PMFH main valve + pilot solenoid valve combination is used to maintain a constant liquid level within a shell and tube condenser on the high pressure of the system. The float valve is attached to the vessel by branch connections at a point corresponding to the desired liquid level.

The float valve functions as a throttle between the high and low pressure sides of the system, passing liquid at reduced pressure through the PMFH main valve as fast as it accumulates in the float chamber, without letting any vapour through. Nearly all the system refrigerant charge is therefore in the evaporator.

How does it operate?

Pressure	Description
P1	Inlet pressure to the PMFH main valve
P2	Pressure acting below the PMFH servo piston (equal to the outlet pressure)
PS	Pressure acting above the PMFH servo piston (equal to the pilot pressure)



The principle of operation is shown in the figure above.

When the liquid within the condenser drops, the SV(H) float valve orifice closed, inlet pressure P1 = pilot pressure PS, the PMFH main valve is closed.

When the liquid level within the vessel rises, the float within the SV(H) float chamber also rises, raising the float arm. The float arm actuates a needle valve.

As the float rises, the needle valve is withdrawn from its seat and opens the float valve orifice, relieving pilot pressure PS through the orifice. Because P1 is now greater than PS, inlet pressure acting on the underside of the servo piston lifts the throttling cone and opens the PMFH main valve to flow.

As the level within the vessel falls, the SV(H) float also falls, closing the needle valve, restricting flow through the pilot line and closing the PMFH main valve. In this way the SV(H) + PMFH combination maintains a constant liquid level within the vessel.

A solenoid valve is fitted in the pilot line to provide a close/permit open function for the PMFH main valve.

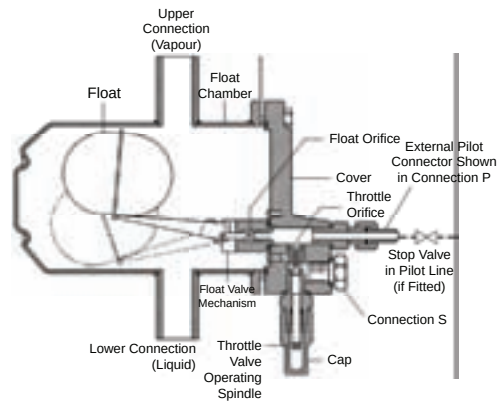
The pilot solenoid operates as follows:

- Energising (opening) the pilot solenoid valve opens the pilot line and permits the SV(H) float valve to modulate flow through the PMFH main valve.
 - De-energising (closing) the solenoid valve closes the pilot line and closes the PMFH main valve.
-

2.7 Refrigerant Level Sensor

The level sensor includes a floating element checking the refrigerant level inside the condenser and controlling the expansion valve indirectly monitoring the refrigerant flow.

A regulating valve, installed on the sensor flange, allows to level stabilizing. This valve is factory set during the test and normally does not require any further adjustment on the field unless on particularly unstable plant where an additional regulation must be operated from qualified personnel only.



Any regulation on the spindle will change the reaction time but not the level inside the condenser.

2.8 Compressor

The compressor is controlled by a special motor, installed on the end of the main driving shaft. It consists of two screwed cast iron element: the main one includes all moving parts as the main rotor and the two satellites, the second element includes the three-phases 2-poles electric motor.

The gas flows through the electric motor, cooling the windings before entering the suction ports. Sensors inside the windings motor constantly monitor the temperature preventing from dangerous overheating. A terminal box including the connectors for thermistors and power lines is located up to the motor casing.

The compressor moving elements executing the compression include 3 rotating parts, there are neither reciprocating nor eccentric motions inside the compressor. Basic elements are the main rotor and two exactly opposed gate rotors tightly meshing each other. A specially shaped synthetic material placed between the main rotor and the satellites executes tightness seal during the compression. The main shaft fixing both the motor and the main rotor is supported by 3 ball bearings. This system is balanced both statically and dynamically before the assembly. Two large closing flanges are also installed on the compressor sides for an easy access to the satellites, rotor, shaft and bearings without influencing the assembly tolerances.

2.9 Compressor Operation

With the single-screw compressor the refrigerant suction, compression and discharge process is operated by a continue flow for each satellite. During this operation the volume is progressively reduced compressing the refrigerant. After the compression, the gas is discharged through the ports properly designed. See the figure below for suction, compression and discharge cycle.

1. and 2. Suction

Main rotor flutes 'a', 'b' and 'c' are in communication at one end with the suction chamber via the bevelled rotor end face, and are sealed at the other end by the teeth of star rotor A. As the main rotor turns, the effective length of the flutes increases with a corresponding increase in the volume open to the suction chamber: Diagram 1 clearly shows this process. As flute 'a' assumes the position of flutes 'b' and 'c' its volume increases, inducing suction vapour to enter the flute.

Upon further rotation of the main rotor, the flutes which have been open to the suction chamber engage with the teeth of the other star rotor. This coincides with each flute being progressively sealed by the main rotor. Once the flute volume is closed off from the suction chamber, the suction stage of the compression cycle is complete.

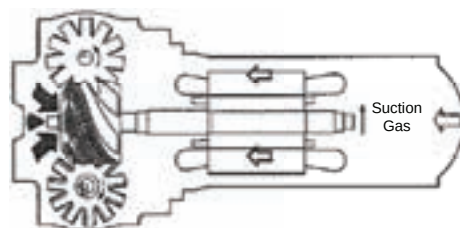
3. Compression

As the main rotor turns, the volume of gas trapped within the flute is reduced as the length of the flute shortens and compression occurs.

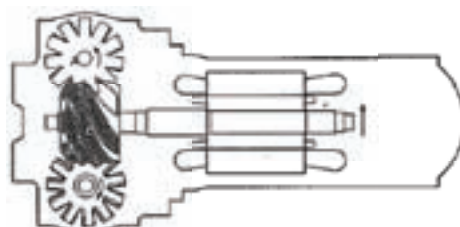
4. Discharge

As the star rotor tooth approaches the end of a flute, the pressure of the trapped vapour reaches a maximum value occurring when the leading edge of the flute begins to overlap the triangular shaped discharge port. Compression immediately ceases as the gas is delivered into the discharge manifold. The star rotor tooth continues to scavenge the flute until the flute volume is reduced to zero. This compression process is repeated for each flute/star tooth in turn. While the compression process described above is occurring in the upper half of the compressor, there is an identical process taking place simultaneously in the lower half using star B, thus each main rotor flute is used twice per rotor revolution (one by one tooth in each star). The compression process may be likened to an assembly of six double-acting cylinders (the main rotor flutes) in which the star rotor teeth move as pistons (always in the same direction).

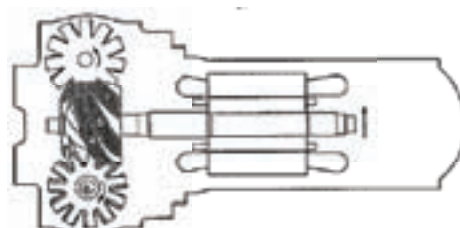
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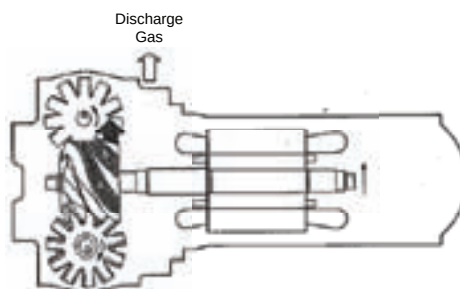
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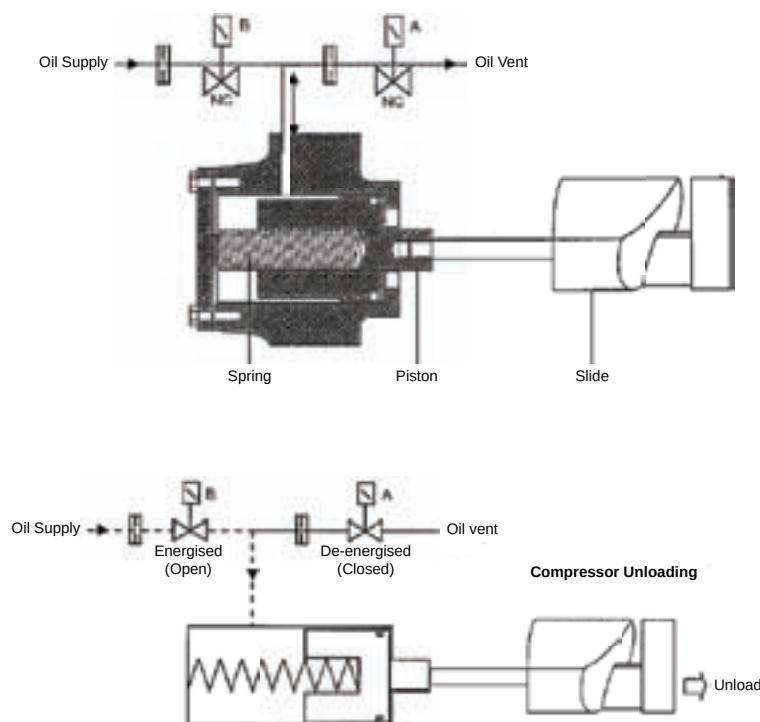
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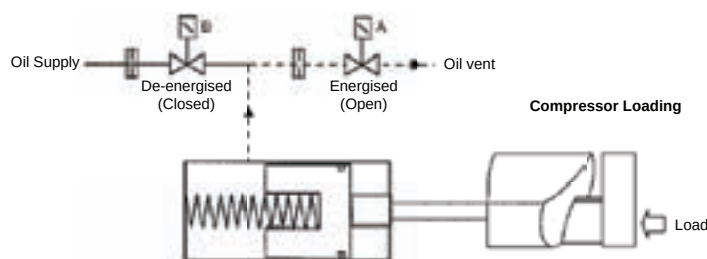
2.10 Capacity Control

Capacity control mechanism

The compressors are provided with infinitely variable capacity control as standard. This system allows unit load to be equal to plant demand. Stepless capacity control is permitted by a pair of sliding valves, fitted in the compressor, one for each half of the symmetrical compression process. Each slide valve is housed in a semicircular slot in the wall of the annular ring which encloses the main rotor. As the slide valve travels axially from the full load position it uncovers a port, which vents part of the gas trapped in the main rotor flute back to suction, before compression can begin. When the flute has passed beyond the port, compression commences with a reduced volume of gas. However, a simple bypass arrangement without any further refinement would produce an undesirable fall in the effective volume ratio which in turn causes under compression and inefficient part load operation. To overcome this problem, the slide valve is shaped so that it delays the opening of the discharge port at the same time as the bypass slot is created.



Oil Pressure + Spring Force > Suction/Discharge Differential Pressure = Slide and Piston Move Towards Unload



Suction/Discharge Differential Pressure > Spring Force = Slide and Piston Move Towards Load

1

CAPACITY CONTROL ACTION	SOLENOID VALVE A	SOLENOID VALVE B
Load compressor Oil is vented from the capacity control cylinder. The action of the suction/discharge differential pressure on the slide/piston assembly overcomes the force of the unloading spring and moves the slide valve towards the maximum load position.	Energised (open)	De-energised (close)
Unload compressor High pressure oil is admitted to the capacity control cylinder. Oil pressure supplements the force of the spring acting on the unload side of the piston. The combined force is sufficient to overcome the action of the suction/discharge differential pressure and move the slide valve towards the minimum load position.	De-energised (close)	Energised (open)
Hold slide valve position The slide valve is hydraulically locked at the desired load position.	De-energised (close)	
¹Start-up		
Compressor Stopped ← 60 Seconds → ← Solenoid Valve B Energised (Open) → Compressor Starts (Loading Inhibited) ← 60 Seconds → ← Solenoid Valve B De-energised (Closed) → Compressor Permitted to Load ← Solenoid Valve B Energised (Open) Until Compressor Required to Load → Start Requested Compressor Starts (Loading Inhibited) Compressor Permitted to Load Time →		

2.11 Oil System Control

Each screw compressor is connected to a tank (oil separator) separating and collecting the oil from discharge gas.

The discharge gas pressure pushes the oil into the compressor where, after passing through a high capacity filter, it is conveyed to the main injection port for compressor seal and lubrication of all moving parts.

During the compression, the oil joins the discharge gas before being conveyed again into the oil separator and re-start the cycle.

The oil flow is granted by the pressure difference created between the condenser and the evaporator. This difference depends on the cooling water and evaporator water temperatures. During the start-up it is vital to establish rapidly the appropriate temperature difference, by checking the right cooling water temperature.

In order to get the right pressure difference, McQuay PFS B units install regulating valve on the condenser outlet. That valve, monitored by an analogical signal released by the microprocessor installed in the electrical panel, is modulated depending on the unit compression ratio. The head of cooling water pump at zero flow rate should not exceed the maximum working pressure of condenser and plant water side.

After the oil filter, a pressure transducer is installed on the compressor always monitoring the oil pressure and forwarding the values to the microprocessor. Oil pressure control prevents the compressor from any possible operating anomalies.

On the oil piping is also installed a flow switch deactivating the compressor in case of oil leak in the cooling system.

Units already include the correct oil charge. Once the system is started, it is not necessary to fill additional oil, unless repairing or when a big quantity of oil has been removed from the system.

Warning

It is dangerous for the unit to execute a wrong maintenance on the lubricating system, including to over charge of oil or to use oil or oil filter different from the original ones. This operation must be performed only by qualified personnel. Please contact your local McQuay Service Centre.

2.12 Lubrication Oils

Besides lubricating the bearing and other moving parts, the oil has the equally important task of granting the seal during the compression, improving the efficiency. Therefore more oil is injected than is required for lubrication alone.

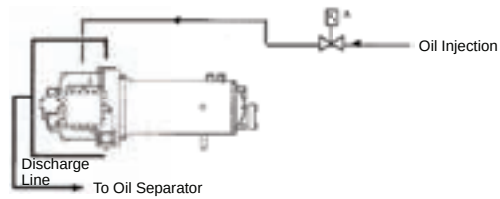
Lubricating oil approved by McQuay is mentioned on the compressor label.

2.13 Liquid Injection

The liquid injection is used to cool down the compressor when the discharge temperature becomes higher than 85°C.

All units produced from August 2009 have this control standard on the unit.

This liquid injection is optional for units manufactured before August 2009.



2.14 Oil Recovery System

Each compressor includes a system to recover the oil accumulated inside the evaporator during the normal operation.

This system consists of a set pump able to collect continuously all the oil from the evaporator preventing from the accumulation due to the low speed refrigerant gas.

The high-pressure discharge gas feeds the jet pump that creates a depression, which allows the suction of the oil refrigerant mixture from the evaporator into the compressor to re-establish the oil level inside the lubrication system.

On the oil recovery piping a sight glass allows to check the oil-gas mixture flow to the compressor. If flow is insufficient or if the unit continuously stops for "Low Oil Level" alarm, verify the correct operation of the corresponding circuit.

Verify:

1. Opening of oil recovery system shutoff valves.
 2. Correct functioning of solenoid valve installed on the Jet Pump feed.
-

2.15 Heaters

The compressor and the oil separator are supplied with resistances for heating the compressor and the oil inside the separator, to prevent the migration and the condensation of the refrigerant during shutdown unit.

The auxiliary circuit should be energised for at least 12 hours prior to start up compressor. The compressor and oil temperatures should be sufficiently high before starting the system lowering at the minimum problems of lubrication and liquid blows. The microprocessor monitors directly the oil temperature and inhibits the compressor starting if the oil temperature is not at least 5°C higher than the evaporating saturation temperature. In that condition the compressor status will be: "Off: Oil Heating". For granting the good operation of the heating resistances, regularly verify their power input.

1

3 Wiring Layouts

3.1 What Is in This Chapter?

Introduction

This chapter gives an example of a wiring diagram.

All wiring diagrams are available on the passdoor.macquay.it

Overview

This chapter contains the following topics:

Topic	See page
3.2–Example Wiring Diagram	1–30

1

3.2 Example Wiring Diagram



Part 2

Functional Description

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Digital Controller	2–3

2

1 Digital Controller

1.1 What Is in This Chapter?

Introduction

This chapter contains information on the menus and the functions used to control the system. Understanding these functions is vital when diagnosing a malfunction that is related to the functional control.

Overview

This chapter contains the following topics:

Topic	See page
1.2–General Description	2–4
1.3–Main Control Features	2–5
1.4–Component Description Digital Control	2–6
1.5–Controller Menus	2–33

1.2 General Description

The Microtech II C Plus control panel contains a microprocessor based controller which provides all monitoring and control functions required for the safe, efficient operation of the Chiller. The operator can monitor all operating conditions by using the panel's built in 4 line by 20 character keypad/display or by using an IBM compatible computer running MicroPlant monitor software release 2.0 and later. In addition to providing all normal operating controls, the MicroTech II CV Plus controller monitors all safety devices on the unit and will take corrective action if the chiller is operating of it's normal design conditions. If a fault condition develops, the controller will shut the system down and activate an alarm output. Important operating conditions at the time an alarm condition occurs are retained in the controller's memory to aid in troubleshooting and fault analysis.

The system is protected by a password scheme which only allows access by authorized personnel. A password must be entered into the panel keypad by the operator before any configuration may be altered.

1.3 Main Control Features

-
- Control of evaporator outlet or condenser outlet or both temperature.
 - Control of leaving water within a $\pm 0,1^{\circ}\text{C}$ (with a steady-state load).
 - Management of sudden load reduction up to 50% with max 3°C controlled temperature obssillation.
 - Read-out of all unit operating main parameters (temperature, pressures, etc.).
 - Automatic control of primary evaporator and condenser pumps.
 - Control up to 4 steps of cooling tower plus bypass valve with proportional signal 0-10 Vdc.
 - Setting of a **double setpoint** with local or remote switch. This function allows to modify the local setpoint between two values previously settled.
 - **Setpoint override** using an external signal (4-20 mA), outside ambient temperature or evaporator return temperature.
 - Adjustable **Max Pull-Down rate** reduces under-shoot during loop pull-down.
 - **Hot Chilled Water Start** feature allows the unit startup without any problem also with high temperature evaporator water.
 - **SoftLoad** feature reduces electrical consumption and peak demand charges during loop pulldown.
 - **Unit Limiting** feature allows to limit electrical consumption based either on current absorption (current limit (SPN)) or on demand capacity (demand limit).
 - Panel mounted 15 key keypad for a rapid interface. Operator can log chiller operating conditions on the backlight display 4 line by 20 character.
 - Four levels of security protection against unauthorized changing.
 - Diagnostic System of compressors constituted by the memorization of the last ten alarms, showing the date, the time and operating conditions at the time the alarm occurred.
 - Weekly and yearly start-stop time schedule.
 - Easy integration into building automation systems via separate 4-20 mA signals for chilled water reset and demand limiting.
 - Communications capabilities for remote monitoring, changing of setpoint, trend logging, alarm and event detection, via a compatible IBM-PC where is installed MICROPLANT 2.0 software.
 - BAS communication capability via Modbus, LonWork, Johnson Metasys.
 - Remote communications capabilities via modem (up to 8 chillers with Gateway Modem).
 - Remote communications capabilities via GSM Modem.
-

1.4 Component Description Digital Control

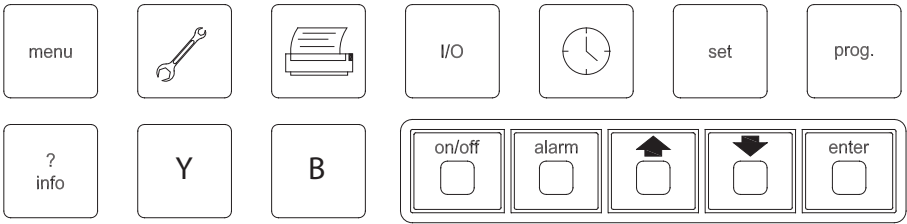
Overview

Topic	See page
1.4.1–Control Panel	2–7
1.4.2–Keypad Keys	2–8
1.4.3–Keypad Keys and Their Functions	2–9
1.4.4–Screen Categories	2–11
1.4.5–Adjusting Contrast of the Display	2–12
1.4.6–Network Addresses	2–13
1.4.7–Layout Microprocessor Board	2–14
1.4.8–Layout Double Circuit	2–15
1.4.9–Explanation Connectors Microprocessor Board	2–16

1.4.1 Control Panel



1.4.2 Keypad Keys

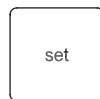


1.4.3 Keypad Keys and Their Functions

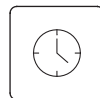


With this button it is possible to set the following parameters:

- Setpoint limits (cooling and/or heating)
- Minimum / maximum set point (cooling and/or heating)
- Regulation parameters
- Startup and shutdown parameters
- Double setpoint
- Soft load
- Hot chiller water temperatures limit
- Water pump timer
- Unit limitation
- Water pump delay timer
- Digital start / stop - digital cool / heat
- Supervisory start / stop and cool / heat
- Auto restart after power failure



It allows to adjust the setpoints within the limits previously set in prog.



Date and time setting.

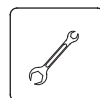


Input/Output and corresponding circuit functions visualization.



(=print)

Print (not available).

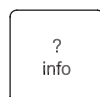


(=maint)

By the Password it is possible to access the maintenance functions.



It allows to visualize the main menu.



It allows the passage from one board to the other (visualizing parameters of corresponding compressors).



It allows the changeover between chiller to heat pump (only if enabled).



It allows the changeover between heat pump to chiller (only if enabled).



Key On/Off unit.



It indicates the presence of possible anomalies and their causes.



(=up)

It allows the passage to the previous display screen.



(=down)

It allows the passage to the next display screen.



It enables the set values.

1.4.4 Screen Categories

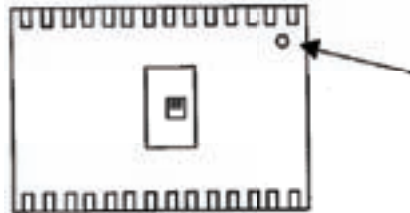
Using the keypad you can access the different menus of the program. In particular there are 9 screen categories, shortly introduced in the following table with the keys to use to access them and with the type of operation they allow.

Category	Description	Keys	Password
Main	Unit operating parameters (view only)		NO
User	User parameter setting		0003
Setting	Setpoint setting		NO
Input/Output	Operating compressors parameters (view only)		NO
Manufacturer	Manufacturer parameters setup	 + 	 →  → 
Maintenance	Maintenance parameter access		 →  → 
Maint auxiliary	Auxiliary maintenance parameter setting	 + 	 →  → 
Alarm	Alarms view		NO
Alarm history	Previous 10 recorded alarms	 + 	NO

Note: The password remains valid for 10 minutes since last access.

1.4.5 Adjusting Contrast of the Display

When you use a remote controller it is possible to adjust the contrast. At the back of the upper left corner of the remote controller you will find a hole where you can adjust the brightness of the remote controller with a small screw driver.

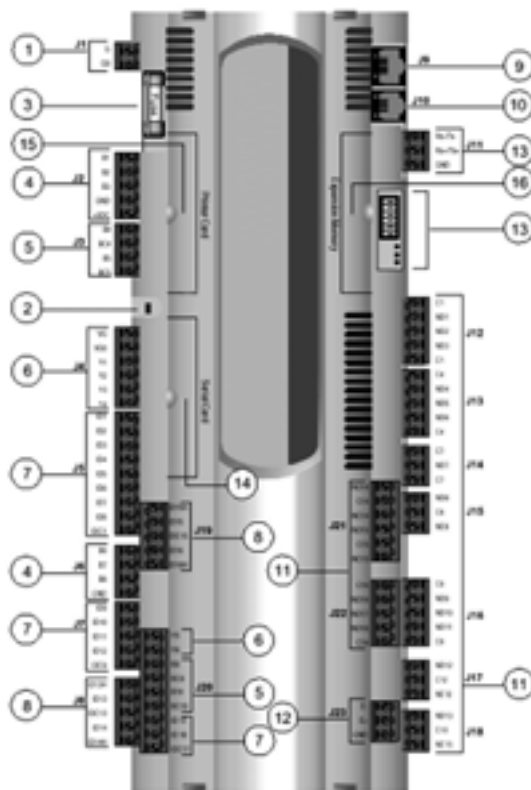


1.4.6 Network Addresses

To get the correct functionality of the net system PLAN, it is necessary to address correctly the microprocessor boards and the terminal. This components have, as previously described, a series of microswitches that must be set up as specified in the following chart.

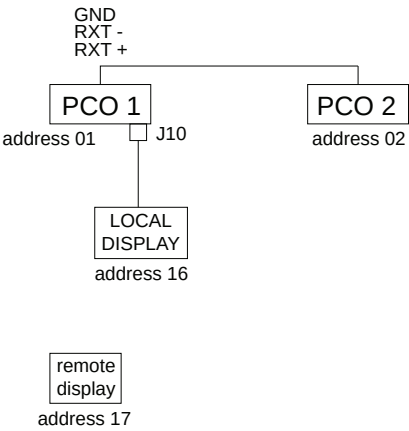
<i>Net component PLAN component</i>	<i>Microswitches Microswitch</i>					
	1	2	3	4	5	6
local DISPLAY	OFF	OFF	OFF	OFF	ON	OFF
remote DISPLAY (if it exists)	ON	OFF	OFF	OFF	ON	OFF
COMP CARD. #1	ON	OFF	OFF	OFF	OFF	OFF
COMP CARD. #2	OFF	ON	OFF	OFF	OFF	OFF

1.4.7 Layout Microprocessor Board



1	Power supply G (+), G0 (-)
2	Status LED
3	Fuse 250 Vac
4	Universal analog inputs (NTC, 0/1 V, 0/10 V, 0/20 mA, 4/20 mA)
5	Passive analog inputs (NTC, PT1000, On- off)
6	Analog outputs 0/10 V
7	24 Vac/Vdc Digital inputs
8	230 Vac or 24 Vac/Vdc Digital inputs
9	Synoptic terminal connection
10	Standard terminal (and program download) connector
11	Digital outputs (relays)
12	Expansion board connection
13	pLAN connection and microswitches
14	Serial card connection
15	Printer card connection
16	Memory expansion connection

1.4.8 Layout Double Circuit



1.4.9 Explanation Connectors Microprocessor Board

Overview

Topic	See page
1.4.9.1–Explanation Connectors Single Circuit Star / Delta	2–17
1.4.9.2–Explanation Connectors Single Circuit Softstarter	2–20
1.4.9.3–Explanation Connectors Double Circuit Star / Delta	2–23
1.4.9.4–Explanation Connectors Double Circuit Softstarter	2–28

1.4.9.1 Explanation Connectors Single Circuit Star / Delta

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL1 WO1 WC1	Low pressure transmitter Oil pressure transmitter Compressor load transmitter Ground terminal Power supply
J3	B4 BC4 B5	WD1 WOC	Discharge sensor Leaving condenser water sensor
J4	VG VGO Y1 Y2 Y3 Y4	 YC 	Power supply Power supply 2 way water valve installed outlet condenser Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q1 F12 K1 OLS1 DP5 KM1/ KM2 QO	Internal protector compressor Low pressure switch Auxiliary contact Oil level switch Discharge terminal protector Compressor contacts Switch local / remote operation Not used Power supply 24 V
J6	B6 B7 B8 GND	 WH1	Set point override 4 – 20 mA Limit operation 4 – 20 mA High pressure transmitter Ground
J7	ID9 ID10 ID11 ID12 IDC9	F112 F116 F117	Reverse phase protector Double set point Flow switch evaporator Flow switch condenser (field supply) Power supply 24 V

J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Terminal connector for display and download software
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1	K1T	Line contactor relay Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y5 Y12 Y13	Power supply 230 V Liquid injection solenoid valve Uploading solenoid valve compressor Unloading solenoid valve compressor
J14	C7 NO7	R11	Power supply 230 V Oil heater
J15	C8 NO8		Power supply 230 V Evaporator water pump field connections (field supply / max 8 amp)
J16	C9 NO9 NO10 NO11	K14	Condenser water pump field connections (field supply / max 8 amp) Tower step 1 field connection Tower step 2 field connection
J17	NO12 C12 NC12		Tower step 3 field connection Power supply 230 V Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used
J20	B9 BC9 B10 BC10	WIE WOE	Evaporator inlet water sensor Evaporator outlet water sensor

J21	NO14 C14 NC14 NO15 C15 NC15		Remote alarm (230 V / max 8 amp) Remote alarm (230 V / max 8 amp) Not used Liquid line solenoid valve Power supply Not used
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1.4.9.2 Explanation Connectors Single Circuit Softstarter

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL1 WO1 WC1	Low pressure transmitter Oil pressure transmitter Compressor load transmitter Ground terminal Power supply
J3	B4 BC4 B5	WD1 WOC	Discharge sensor Leaving Condenser water sensor
J4	VG VGO Y1 Y2 Y3 Y4	YC	Power supply Power supply 2 way water valve installed outlet condenser Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q1 F12 K1 OLS1 DP5 ES1 QO	Internal protector compressor Low pressure switch Auxiliary contact Oil level switch Discharge terminal protector Software module Switch local / remote operation Not used Power supply 24 V
J6	B6 B7 B8 GND	WH1	Set point override 4 – 20 mA Limit operation 4 – 20 mA High pressure transmitter Ground
J7	ID9 ID10 ID11 ID12 IDC9	F112 F116 F117	Reverse phase protector Double set point Flow switch evaporator Flow switch condenser (field supply) Power supply 24 V

J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Terminal connector for display and download software
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1		Line contactor relay Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y5 Y12 Y13	Power supply 230 V Liquid injection solenoid valve Uploading solenoid valve compressor Unloading solenoid valve compressor
J14	C7 NO7	R11	Power supply 230 V Oil heater
J15	C8 NO8		Power supply 230 V Evaporator water pump field connections (field supply / max 8 amp)
J16	C9 NO9 NO10 NO11	K14	Condenser water pump field connections (field supply / max 8 amp) Tower step 1 field connection Tower step 2 field connection
J17	NO12 C12 NC12		Tower step 3 field connection Power supply 230 V Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used
J20	B9 BC9 B10 BC10	WIE WOE	Evaporator inlet water sensor Evaporator outlet water sensor

2

J21	NO14		Remote alarm (230 V / max 8 amp)
	C14		Remote alarm (230 V / max 8 amp)
	NC14		Not used
	NO15		Liquid line solenoid valve
	C15		Power supply
	NC15		Not used

1.4.9.3 Explanation Connectors Double Circuit Star / Delta

Circuit 1

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL1 WO1 WC1	Low pressure transmitter Oil pressure transmitter circuit 1 Compressor load transmitter circuit 1 Ground terminal Power supply
J3	B4 BC4 B5	WD1 WOC	Discharge sensor circuit 1 Leaving condenser water sensor
J4	VG VGO Y1 Y2 Y3 Y4	YC	Power supply Power supply 2 way water valve installed outlet condenser Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q1 F12 K1 OLS1 DP5 KM1 / KM2 QO	Internal protector compressor circuit 1 Low pressure switch circuit 1 Auxiliary contact circuit 1 Oil level switch circuit 1 Discharge terminal protector circuit 1 Compressor contacts Switch local / remote operation Not used Power supply 24 V
J6	B6 B7 B8 GND	WH1	Set point override 4 – 20 mA Limit operation 4 – 20 mA High pressure transmitter Ground
J7	ID9 ID10 ID11 ID12 IDC9	F112 F116 F117	Reverse phase protector Double set point Flow switch evaporator Flow switch condenser (field supply) Power supply 24 V

J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Terminal connector for display and download software
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1		Line contactor relay circuit 1 Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y5 Y12 Y13	Power supply 230 V Liquid injection solenoid valve circuit 1 Uploading solenoid valve compressor circuit 1 Unloading solenoid valve compressor circuit 1
J14	C7 NO7	R11	Power supply 230 V Oil heater circuit 1
J15	C8 NO8		Power supply 230 V Evaporator water pump field connections (field supply / max 8 amp)
J16	C9 NO9 NO10 NO11	K14	Condenser water pump field connections (field supply / max 8 amp) Tower step 1 field connection Tower step 2 field connection
J17	NO12 C12 NC12		Tower step 3 field connection Power supply 230 V Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used
J20	B9 BC9 B10 BC10	WIE WOE	Evaporator inlet water sensor Evaporator outlet water sensor

J21	NO14 C14 NC14 NO15 C15 NC15		Remote alarm (230 V / max 8 amp) Remote alarm (230 V / max 8 amp) Not used Liquid line solenoid valve circuit 1 Power supply Not used
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2

Circuit 2

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL2 WO2 WC2	Not used Oil pressure transmitter circuit 2 Compressor load transmitter circuit 2 Ground terminal Power supply
J3	B4 BC4 B5	WD2 WIC	Discharge sensor circuit 2 Entering water condenser sensor
J4	VG VGO Y1 Y2 Y3 Y4	 YC	Power supply Power supply Not used Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q2 F22 K3 OLS2 DP6 KM3 / KM4	Internal protector compressor circuit 2 Low pressure switch circuit 2 Auxiliary contact circuit 2 Oil level switch circuit 2 Discharge terminal protector circuit 2 Compressor contacts Not used Not used Power supply 24 V
J6	B6 B7 B8 GND		Not used Not used Not used Ground

J7	ID9 ID10 ID11 ID12 IDC9		Not used Not used Not used Not used Power supply 24 V
J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Not used
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1		Line contactor relay circuit 2 Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y6 Y22 Y23	Power supply 230 V Liquid injection solenoid valve circuit 2 Uploading solenoid valve compressor circuit 2 Unloading solenoid valve compressor circuit 2
J14	C7 NO7	R12	Power supply 230 V Oil heater circuit 2
J15	C8 NO8		Power supply 230 V Not used
J16	C9 NO9 NO10 NO11		Not used Not used Not used Not used
J17	NO12 C12 NC12		Not used Not used Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used

J20	B9 BC9 B10 BC10		Not used Not used Not used Not used
J21	NO14 C14 NC14 NO15 C15 NC15		Not used Not used Not used Not used Not used Not used

1.4.9.4 Explanation Connectors Double Circuit Softstarter

Circuit 1

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL1 WO1 WC1	Low pressure transmitter circuit 1 Oil pressure transmitter circuit 1 Compressor load transmitter circuit 1 Ground terminal Power supply
J3	B4 BC4 B5	WD1 WOC	Discharge sensor circuit 1 Leaving condenser water sensor
J4	VG VGO Y1 Y2 Y3 Y4	YC	Power supply Power supply 2 way water valve installed outlet condenser Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q1 F12 K1 OLS1 DP5 ES1 QO	Internal protector compressor circuit 1 Low pressure switch circuit 1 Auxiliary contact circuit 1 Oil level switch circuit 1 Discharge terminal protector circuit 1 Soft start module Switch local / remote operation Not used Power supply 24 V
J6	B6 B7 B8 GND	WH1	Set point override 4 – 20 mA Limit operation 4 – 20 mA High pressure transmitter Ground
J7	ID9 ID10 ID11 ID12 IDC9	F112 F116 F117	Reverse phase protector Double set point Flow switch evaporator Flow switch condenser (field supply) Power supply 24 V

J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Terminal connector for display and download software
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1		Line contactor relay circuit 1 Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y5 Y12 Y13	Power supply 230 V Liquid injection solenoid valve circuit 1 Uploading solenoid valve compressor circuit 1 Unloading solenoid valve compressor circuit 1
J14	C7 NO7	R11	Power supply 230 V Oil heater circuit 1
J15	C8 NO8		Power supply 230 V Evaporator water pump field connections (field supply / max 8 amp)
J16	C9 NO9 NO10 NO11	K14	Condenser water pump field connections (field supply / max 8 amp) Tower step 1 field connection Tower step 2 field connection
J17	NO12 C12 NC12		Tower step 3 field connection Power supply 230 V Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used
J20	B9 BC9 B10 BC10	WIE WOE	Evaporator inlet water sensor Evaporator outlet water sensor

2

J21	NO14 C14 NC14 NO15 C15 NC15		Remote alarm (230 V / max 8 amp) Remote alarm (230 V / max 8 amp) Not used Liquid line solenoid valve circuit 1 Power supply Not used
-----	--	--	--

Circuit 2

Block	Connection	Wiring symbol	Description
J1	G GO		24 V power supply microprocessor board
J2	B1 B2 B3 GND + VDC	WL2 WO2 WC2	Not used Oil pressure transmitter circuit 2 Compressor load transmitter circuit 2 Ground terminal Power supply
J3	B4 BC4 B5	WD2 WIC	Discharge sensor circuit 2 Entering water condenser sensor
J4	VG VGO Y1 Y2 Y3 Y4		Power supply Power supply Not used Not used Not used Not used
J5	ID1 ID2 ID3 ID4 ID5 ID6 ID7 ID8 IDC1	Q2 F22 K3 OLS2 DP6 KM3 / KM4	Internal protector compressor circuit 2 Low pressure switch circuit 2 Auxiliary contact circuit 2 Oil level switch circuit 2 Discharge terminal protector circuit 2 Compressor contacts Not used Not used Power supply 24 V
J6	B6 B7 B8 GND		Not used Not used Not used Ground

J7	ID9 ID10 ID11 ID12 IDC9		Not used Not used Not used Not used Power supply 24 V
J8	ID13H ID13 IDC13 ID14 ID14H		Not used Not used Not used Not used Not used
J9			Synoptic terminal connector
J10			Not used
J11	RX/ TX- RX / TX+ GND		Plan connection
J12	NO1 NO2 NO3 C1		Line contactor relay circuit 2 Not used Not used Power supply
J13	C4 NO4 NO5 NO6	Y6 Y22 Y23	Power supply 230 V Liquid injection solenoid valve circuit 2 Uploading solenoid valve compressor circuit 2 Unloading solenoid valve compressor circuit 2
J14	C7 NO7	R12	Power supply 230 V Oil heater circuit 2
J15	C8 NO8		Power supply 230 V Not used
J16	C9 NO9 NO10 NO11		Not used Not used Not used Not used
J17	NO12 C12 NC12		Not used Not used Not used
J18	NO13 C13 NC13		Not used Not used Not used
J19			Not used

2

J20	B9 BC9 B10 BC10		Not used Not used Not used Not used
J21	NO14 C14 NC14 NO15 C15 NC15		Not used Not used Not used Not used Not used Not used

1.5 Controller Menus

Overview

Topic	See page
1.5.1–Read Out Menu	2–34
1.5.2–Service Menu	2–37
1.5.3–Set Point Menu	2–51
1.5.4–User Menu	2–52
1.5.5–Maintenance Menu	2–56
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1.5.7–Input / Output Menu	2–61

1.5.1 Read Out Menu

Unit status

00/00/00	00:00
Unit Status:	
Cooling Staging	0000
Stp Source: Local	

- Information on the status of the unit
 - White rectangle: Circuit / unit switch OFF
 - Black rectangle: Circuit / unit switch ON
- Capacity: Capacity of the unit
- Set point source: Local / External

Water temperature evaporator

Water Temperatures		
Ent Evap	=	00.0 °C
Lvg Evap	=	00.0 °C

Entering and leaving water of the water-cooled evaporator.

Water temperature condenser

Water Temperatures		
Ent Cond	=	00.0 °C
Lvg Cond	=	00.0 °C

Entering and leaving of the water-cooled condenser.

Operating pressures

Cond	Press	00.0 barg
Evap	Press	00.0 barg
Press.	Ratio	00.0

Low and high pressure value of the unit. For a double circuit there is only one low and high pressure point. Details refer to the piping diagram of the unit. The pressure ratio is used to guarantee a good operation of the unit. Details refer to the chapter functional control of the unit.

Approach values

Cond	Press	00.0 barg
Evap	Press	00.0 barg
Press.	Ratio	00.0

Low and high pressure value of the unit. For a double circuit there is only one low and high pressure point. Details refer to the piping diagram of the unit.

The pressure ratio is used to guarantee a good operation of the unit. Details refer to the chapter functional control of the unit.

Compressor status

Comp.	# 00	
Status:	Please	000 t

For each compressor the status of the compressor is indicated. Following data is available on this screen:

- Off
- Off ready
- Off oil heating
- Off manual
- Manual + capacity step
- Auto + capacity step
- Downloading
- Pump down
- Cycle time
- Starting

Detail compressor

Comp. # 00	
Disch. Temp	00.0 °C
Disch. SH	00.0 °C
Oil Press.	00.0 bar

For each compressor following information is available:

- Discharge temperature
- Discharge superheat (Discharge temperature – Saturated discharge pressure)
- Oil pressure

Remark: Acceptable discharge superheat is between the 8 and 12 K.

Detail compressor

Staging	UP	☐
Staging	Down	☐
Staging	Fixed	☐
Compressor	Off	☐

For each compressor above information is available.

Cooling tower

	Cooling tower
Available steps	0
Active steps	0

Information available if steps selected.

Available steps to control the head pressure.

Cooling tower

	Cooling tower
Valve position	0

Information available if valve selected.

Valve position: Actual position of the valve (range between 25 and 100%).

1.5.2 Service Menu

Introduction

To enter this menu a password is required. We strongly advice you not to give the password to unauthorised persons.

Manufactory password

Insert
manufacturer
password

0000

To enter this menu a password is required.

To enter the menu the unit must be switch OFF to avoid possible damage.

Unit configuration

Unit config.00

CHILLER

- Possible to select type of unit
- Chiller00
 - Heatpump01
 - Pursuit (double set point control)

To select the type of unit, push the “enter” button and select with the arrow key the type of unit.

Number of compressors

Compressors config.

N. of compressors0

The quantity of compressors is factory programmed. This should only be done after replacement of controller or software.

Probes enable

Probes enableU:
B1: N B2: N B3: N B4: N
B5: N B6: N B7: N B8: N
B9: N B10: N

Possibility to enable or disable analogue inputs.

Analogue input	Description
B1	Evaporator pressure transducer
B2	Oil pressure transducer
B3	Capacity sliding valve
B4	Delivery (discharge temperature)
B5	Leaving water condenser
B6	Extern set point signal (4 – 20 mA)
B7	Demand limit (4 – 20 mA)
B8	High pressure transducer
B9	Entering water evaporator
B10	Leaving water evaporator

Low pressure probe configuration

Low pressure probe configuration	
4 mA	00.0 barg
20 mA	00.0 barg

Calibration low pressure transmitter.

Oil pressure probe configuration

Oil pressure probe configuration	
4 mA	00.0 barg
20 mA	00.0 barg

Calibration oil pressure transmitter.

Temperature regulation

Temp. Regulation	
Integral Time	000 s
Derivative Time	000 s
Sampling Time	000 s

Integral time:

Derivative time:

Sampling time:

Proportional-Integral-Derivative: The most common control methodology in process control. It is a continuous feedback loop that keeps the process flowing normally by taking corrective action whenever there is any deviation from the desired setpoint of the process temperature variable. An "error" occurs when an operator manually changes the setpoint or when an event (valve opened, closed, etc.) or a disturbance changes the load, thus causing a change in the process variable.

The PID controller receives signals from sensors and computes corrective action to the actuators from a computation based on the error (proportional), the sum of all previous errors (integral) and the rate of change of the error (derivative).

Number of pulses

Number of pulses to load comp.	000
Number of pulses to unload comp.	000

Load up: Number of pulses required to load up the compressor from minimum capacity to 100%.

Load down: Number of pulses required to unload the compressor from 100% to 0°C.

Compressor timers

Min T between same comp. starts	000 s
Min T between diff. comp. starts	000 s

Minimum time between same compressor: The same compressor is allowed to start up 10 times an hour.

Minimum time between different compressor: There is a minimum time of 120 seconds before the same compressor can restart again.

Compressor timers

Min Time compressor ON	000 s
Min Time compressor OFF	000 s

When a compressor starts, it must run for minimum 120 seconds.

The minimum time the compressor is not allowed to restart.

Minimum load

Min load of last compressor	000 %
Min load of last but one compressor	000 %

This control is only applicable for a unit with 2 compressors.

Minimum load of last compressor: Minimum load of the second compressor.

Minimum load of last but one compressor: Minimum load of the other compressor.

Reload compressor

Last comp. reload at comp. stop	000 %
------------------------------------	-------

When both compressors are at minimum load the compressor with the lowest capacity step will stop and the other compressor will reload to a capacity step equal to the sum of the minimum capacity steps of both compressors. This to avoid big fluctuations of the capacity.

Interstage timer

Interstage time	000 s
Double pulse under	000 %

Interstage timer: If the water temperature is within the regulation band the second compressor will only start of the interstage time. This to avoid over and undershooting of the temperature control.

Double pulse under certain capacity: The double pulses are required to guarantee that the sliding valve is moving to his minimum position.

Unloading

Compressor unloading	
Pulse time	00.0 s
Min pulse period	00 s
Max pulse period	00 s

Pulse time: Time that the unloading solenoid valve is activated.

Minimum pulse period: Minimum time between 2 pulses.

Maximum pulse period: Maximum time between 2 pulses.

Loading

Compressor loading	
Pulse time	00.0 s
Min pulse period	00 s
Max pulse period	00 s

Pulse time: Time that the loading solenoid valve is activated.

Minimum pulse period: Minimum time between 2 pulses.

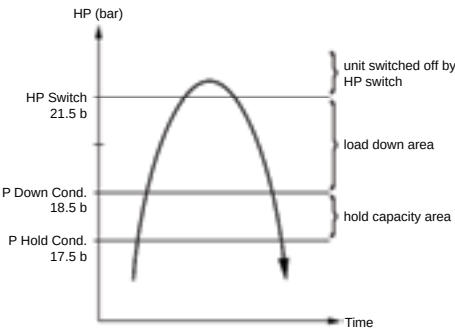
Maximum pulse period: Maximum time between 2 pulses.

Limitations

Cond. P. hold	00.0 bar
Cond. P. down	00.0 bar
Evap. P. hold	00.0 bar
Evap. P. down	00.0 bar

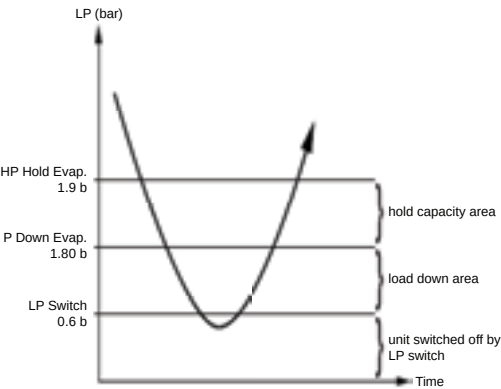
Condenser pressure hold: If the high pressure reaches the hold value, the compressor remains at the same capacity steps.

Condenser pressure down: If the high pressure is above the high pressure hold value, the compressor starts unloading. The moment the high pressure becomes lower than the high pressure hold value, the compressor can upload again.



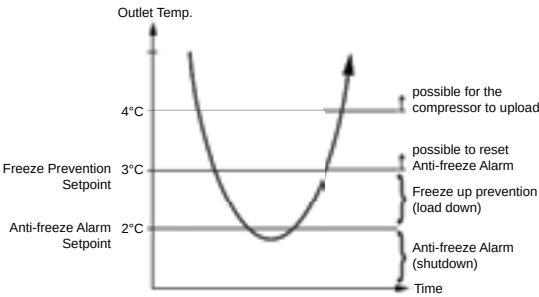
Evaporator pressure hold: If the low pressure reaches the hold value, the compressor remains at the same capacity steps.

Evaporator pressure down: If the low pressure is below the low pressure hold value, the compressor starts unloading. The moment the low pressure becomes higher than the low pressure hold value, the compressor can upload again.



Freeze up prevention

Freeze prevent	
Setpoint	00.0 °C
Diff.	00.0 °C



Set-point: If the leaving water of the evaporator drops below the set point, the compressor starts loading down.

Differential: If the leaving water of the evaporator increases above the set point + the differential, the compressor can reload again if required.

Tower control

Tower control	
Type	: Steps
Input	: Temperature

Type: Steps or Valve.

Input: Temperature / Pressure ratio.

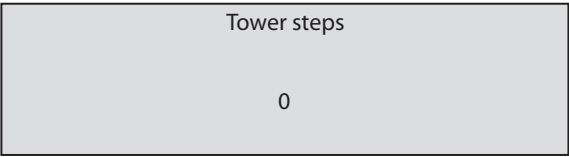
Tower control temperature

Tower control Temperature	
Setpoint	00.0 °C
Differential	00.0 °C

Set point: Set point to start the head pressure control on the cooling tower.

Differential: If the water temperature increases above the set point + the differential, all outputs for the tower control are activated.

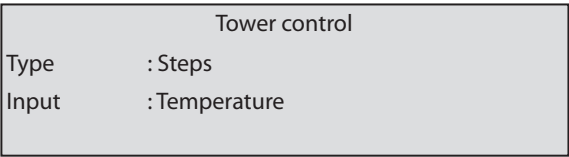
Tower control steps



Quantity of capacity steps for the tower control.

Maximum steps is 3.

Tower control

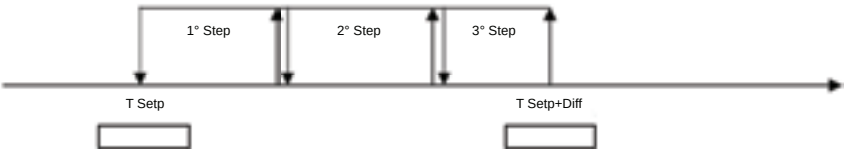


If steps are selected:

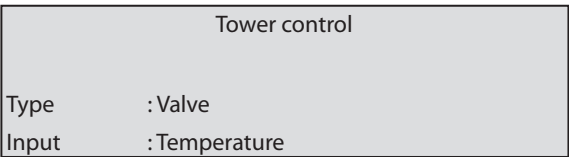
Fan step 1: Set point + (differential / 3)

Fan step 2: Set point + ((differential*2)/3)

Fan step 3: Set point + differential



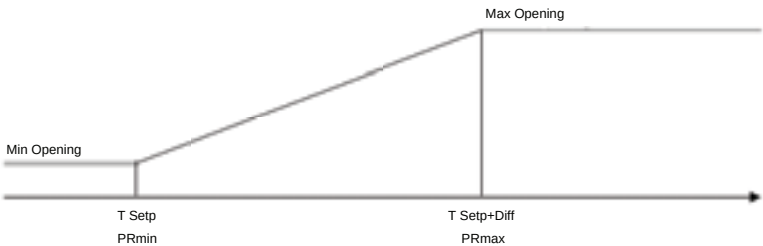
Tower control



If valve is selected:

Opening 25% correspond with a set point of the tower control (refer to the screen "tower control temperature").

Opening 100% with a set point of the (control tower + the differential).



Label

Tower control	
Type	: Steps
Input	: Pressure ratio

Tower control	
Pressure ratio	
Min	0.0
Max	0.0

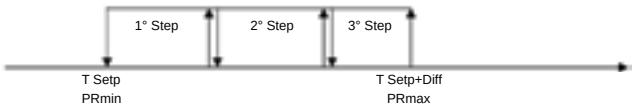
When selecting the input as pressure ratio, the speed of the tower control can be controlled.

When the pressure ratio is at minimum set point there is no tower control.

Fan step 1: Set point + (PR max – PR min)/3

Fan step 2: Set point + ((PR max – PR min *2)/3)

Fan step 3: Set point + PR max



Evaporator control

When the unit is operating in the heating mode (heating mode can be selected with digital input 8).

Evap control	
Type	: Steps
Input	: Temperature

Evap control	
Temperature	
Setpoint	00.0 °C
Differential	00.0 °C

Evap control	
Pressure ratio	
Min	0.0
Max	0.0

Flow switch control

Enable Evaporator	
flow alarm	N
Enable condensator	
flow alarm	N

There is a possibility to enable or disable the flow control on evaporator and or condenser.

We strongly recommend NOT to disable these inputs.

Evaporator flow alarm

Evaporat. flow alarm	
delays	
Startup delay	00 s
Run delay	00 s

When starting up the unit, the control software will check if the flow switch is closed after 20 seconds. If not the unit goes into alarm.

During operation it is allowed that the flow switch remains open for a time less than 5 seconds. If the timer exceeds 5 seconds, the unit goes into alarm.

Condenser flow alarm

Condens. flow alarm	
delays	
Startup delay	00 s
Run delay	00 s

When starting up the unit, the control software will check if the flow switch is closed after 20 seconds. If not the unit goes into alarm.

During operation it is allowed that the flow switch remains open for a time less than 5 seconds. If the timer exceeds 5 seconds, the unit goes into alarm.

Condenser flow alarm

Condenser Flow Alarm	
Valve Threshold	
	000 %

This control is not used.

Evaporator flow alarm

Evap Flow Alarm	
Valve Threshold	
	000 %

This control is not used.

Phase and Oil heating alarm

Enable phase alarm	N
Enable Oil Heating Control	N

From the factory both setting are set to Y.

Phase alarm: Check if the sequence of the phases is correct (details refer to commissioning).

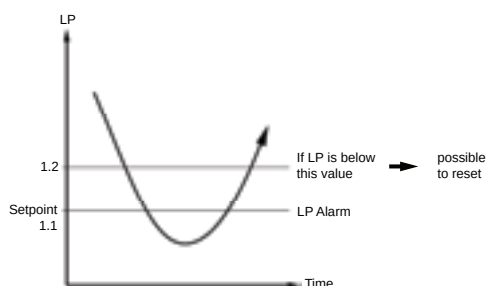
Oil Heating: When the discharge superheat is below 5°C the compressor will not start and "Oil heating" will be displayed on the screen.

Formula to calculate the discharge superheat: [Del temp (PT1000) – Oil pressure (temp)].

Remark: Both values must be set to YES.

Low pressure transducer alarm

Transducer low pressure alarm	
Setpoint	00.0 bar
Diff.	00.0 bar



If the low pressure drops below the set point, the unit goes into low pressure alarm. As soon as the low pressure increase above the (Set point + Differential) it is possible to reset the safety.

Low pressure alarm delay

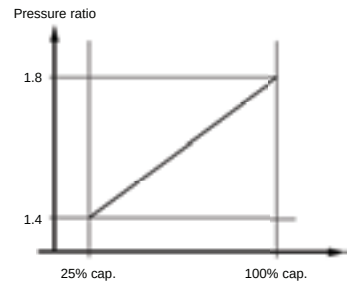
Low pressure alarm delays	
Startup delay	000 s
Run delay	000 s

Start up delay: During start up of the unit the low pressure is bridged for a certain time. During this period there will be no safety if the low pressure drops below the set point.

Run delay: During operation the low pressure can drop below the low pressure set point for a time equal to the run delay. During this time the unit will not go into low pressure failure.

Pressure ratio alarm

Pressure ratio alarm	
Setpoints	
Min Load	0.0
Max Load	0.0



The pressure ratio is related to the load of the unit. This control is incorporated to guarantee an optimum oil circulation in the circuit.

Formula to calculate the pressure ratio:

$$\text{pressure ratio} = \frac{\text{discharge pressure (Abs)}}{\text{suction pressure (Abs)}}$$

Pressure ratio delay alarm

Pressure ratio alarm	
delays	
Startup delay	000 s
Run delay	000 s

Start up delay: During start up of the unit the low pressure ratio alarm is not used for a certain time. During this period there will be no safety if the low pressure ratio alarm drops below the set point.

Run delay: During operation the low pressure ratio alarm can drop below the set point for a time equal to the run delay. During this time the unit will not go into low pressure ratio alarm.

Oil level alarm

Oil level alarm	
delays	
Startup delay	000 s
Run delay	000 s

Start up delay: During start up of the unit the low oil level alarm is not used for a certain time. During this period there will be no safety if the low oil level alarm drops below the set point.

Run delay: During operation the low oil pressure alarm can drop below the set point for a time equal to the run delay. During this time the unit will not go into low oil pressure alarm.

Principal: The Level switch uses light reflecting from a conical glass prism as a means of detecting the absence of a fluid at this level of the glass cone. When no fluid covers the lower half of the cone infra-red light from the module reflects from the mirror-like inner surface of the cone back to a light detector signalling the electronic module to switch. When fluid covers the lower half of the glass cone, the light from the module passes into the fluid. This absence of light detected, by the module which switches into the opposite direction.

2

Oil low pressure alarm delay

Oil low pressure alarm delays	
Startup delay	000 s
Run delay	000 s

Formula to calculate the settings:

Minimum load: (Low pressure X 1,1) + 1

Maximum load: (Low pressure X 1,5) +1

Start up delay: During start up of the unit the oil low pressure alarm is not used for a certain time. During this period there will be no safety if the low oil pressure alarm drops below the set point.

Run delay: During operation the low oil pressure alarm can drop below the set point for a time equal to the run delay. During this time the unit will not go into low oil pressure alarm.

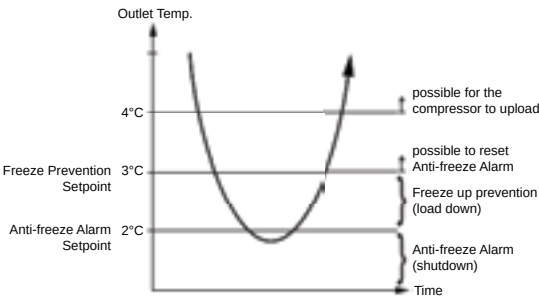
Oil high pressure differential alarm

Oil high pressure diff. alarm	
Setpoint	00.0 bar
Run delay	000 s

If the difference between the high pressure and oil pressure becomes higher than the programmed set point for a time longer than the run delay, the unit goes into failure.

Anti freeze alarm

Antifreeze alarm	
Setpoint	00.0 °C
Diff.	00.0 °C



Set-point: If the leaving water of the evaporator drops below the set point, the unit goes into freeze up failure.

Differential: If the leaving water of the evaporator increases above the set point + the differential, safety can be reset.

Liquid injection

Liquid injection	
Setpoint	000.0 °C
Diff.	00.0 °C

Set point: If the oil temperature become higher than the set point, the liquid line solenoid valve is activated.

Differential: If the discharge temperature become lower than the (set point – differential) the liquid injection is de-activated.

Liquid injection is mainly required when the compressor is running for a long time in partial load. When operating in partial load there is not enough suction gas to cool down the compressor.

Units manufactured from autumn 2009 have this liquid injection standard installed. For units manufactured before the installer should consider if this option is required.

Anti freeze heater

Antifreeze heater	
Setpoint	00.0 °C
Diff.	00.0 °C

This function is not used.

Communication

Communication	
Supervisor	

Supervisor: Building management system. Following protocols can be selected:

1. Lon
2. Modbus

CSM: Not available (only for far east and middle east)

CSC: Chiller sequence control (CSCIII)

2

On communication loss

On comm. loss
Local

This control is only used in the CSC mode.

Local: If there is a communication loss between the different units, the units starts working locally.

Alarm: If there is no communication, all units connected into the network goes into failure.

Communication speed

Supervisor Com. Speed
1200 (RS485/RS422)
Protocol:
Identificat. No.: 000

Supervisor communication speed: Speed between the unit and building management system.

Protocol:???

Identification: Address of the unit in the network.

Default values

Reset all parameters
to default values N

With this function all parameters can be set to the default values, these values do not correspond with the actual values from the official parameter list. Therefore it is important not to use this function.

1.5.3 Set Point Menu

Introduction

???

Set point

Cooling setpoint	00.0 °C
Heating setpoint	00.0 °C

For a cooling only there is only the cooling set point.

For a heat pump there are 2 set points available.

For a pursuit unit there are 2 set points available.

Double set point

Cooling double setpoint	00.0 °C
Heating double setpoint	00.0 °C

When double set point is selected there is a possibility to select the set point with a digital input.

Double set point can be selected in the user menu.

Remark: When using double set point, following actions must be considered:

- When changing the set point in cooling or heating or pursuit, the refrigerant charged must be optimised.
- If there is no optimising of the refrigerant charge when changing the set point Daikin Europe NV cannot be held responsible for possible damage on the unit.

Actual set point

Actual Setpoint	
Cooling	00.0 °C
Heating	00.0 °C

When an external set point is selected (for example 4 – 20 mA) the actual set point will differ from the programmed set point.

Activation of analogue input 6.

1.5.4 User Menu

Introduction

To enter the user menu, a password is required. We strongly advice not to give this password to unauthorized persons.

Set point limits

Cooling temperature setpoint limits	
Low	00.0 °C
High	00.0 °C

For a cooling only unit the installer can select the lowest and highest allowable set point.

For a heat pump and pursuit unit installer can do the same settings for the heating mode.

Cooling set point
override

Cooling Setpoint Override Limits	
Minimum	000.0 °C
Maximum	000.0 °C

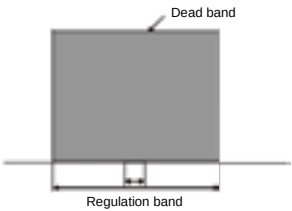
For a cooling only unit the installer can select the lowest and highest allowable set point.

For a heat pump and pursuit unit installer can do the same settings for the heating mode.

This menu can only be used if the analogue B6 is activated. If activated the set point can be changed within the programmed override set point range.

Parameters
thermostat control

Regul. band	00.0 °C
Neutral band	00.0 °C
Max Pull Down Rate	00.0 °C/min



Dead band: When the leaving water is within the regulation band the unit remains at the same capacity.

Regulation band: In the regulation band, the decision to start up a second compressor take place after an interstage time of 210 seconds. This to avoid that the leaving water is dropping to quickly below the set point.

Maximum pull down rate: The software only allows a certain drop in the water temperature per minute. If the water temperature drops too quickly, the unit will remain at the same capacity step.

Start / Shut DT

Startup DT	00.0°C
Shutdn DT	00.0°C



Start up DT: The unit will start if the leaving water is higher than the set point + the start up delta T.

Shut down DT: The unit will switch OFF if the water temperature drops below the set point – the shut down DT.

Double set point

Enable double setpoint	N
------------------------	---

When this double set point is selected to Yes, there is a possibility to use 2 set points.

This can be done using Digital input 10.

If digital input 10 is selected, the set point source in the view menu will change from local to double.

Remark:

- When using double set point, a optimising of the refrigerant is required after every change of the set point.
- If there is no optimising of the refrigerant charge when changing the set point Daikin Europe NV cannot be held responsible for possible damage on the unit.

Enable softload

Enable SoftLoad	N
Maxstage	000 %
MaxTime	000 min
	000

Default soft-load is not programmed.

Max stage: When selected you can program the maximum stage of the unit (not compressor base).

Max Time: Time that the unit will work at the maximum stage.

When the soft-load is activated, the status can be consulted in the I/O menu.

SoftLoad	off
Max Stage	000 %
Rem. Time	000 min
Max Time	000 min

2

High chilled water temperature

En high ChW Temp	N
Temp. Setp.	00.0 °C
Max Stage	000 %

Default High chilled water temperature is selected to NO.

Temperature set point: This temperature can be programmed by the installer.

Maximum stage: Maximum allowable capacity of the unit if the function is programmed.

This control can be used to avoid high pressure problems when the water inside the evaporator is too high.

Delay evaporator pump

Time between evap pump and comp.	000 s
-------------------------------------	-------

When starting up the unit, the flow switch must be closed during the first 30 seconds for 20 seconds.

This 20 seconds is the start up delay, this can be programmed in the manufactory menu.

Unit limiting

Unit limiting
NONE

Current limiting

Current Limit	
Max Curr.	0000 A

Lag timer pump

Delay on switching the main pump off	
	000s

When the unit is switching OFF, the main pump keeps on running for the programmed time.

Remote signals

Digital input remote on/off	N
Digital input remote Summer/Winter	N

There is a possibility to control the unit from a distance.

Remote ON / OFF: To enable this function following actions need to be done:

1. Change the setting from NO to YES
2. Wire up the digital input 7

Remote summer / winter (cool / heat changeover):

1. Change the setting from NO to YES

Wire up the digital input 8.

Supervisory control

Supervisory remote on/off	N
Supervisory remote Summer/Winter	N

This function is only used when BMS is installed.

Autorestart

Autorestart after power failure	N
------------------------------------	---

Default the unit will restart after a power failure.

1.5.5 Maintenance Menu

Introduction

In this menu you can only read values.

Running hours pump

Hour counter	U:
Pump Evap.	000000
Pump cond.	000000

Indication of the total running hours of the condenser and evaporator pumps.

Running hours compressor

Compressor	U:
Hour counter	000000
Number of starts	00000

Indication of the total running hours and compressor starts.

This information is available per compressor.

Cooling PID errors

Cooling PID Errors	
Prop.	00.0 °C
Int.	0000.0 °C x sec
Der.	000.0 °C /min

PID control is used to control the leaving water of the evaporator.

This function is used in the cooling and the heating mode.

Actual value PID

Cool. PID Act.	0000
Proportional	0000
Integral	0000
Derivative	0000

This function is used in the cooling and the heating mode.

Cooling request

Cooling Reg.	
Disable stop	N
Increase stop	N

This function is used in the cooling and the heating mode.

PID request

Global PID request	
Load	N
Unload	N
Standby	N

Indication of Load up / unloading or stand by is requested. This is used for the cooling and heating mode.

1.5.6 Auxiliary Maintenance Menu

Introduction

This menu can be found in the maintenance menu. A password is required to enter this additional menu.

Setting hour counter evaporator

Evap. pump h. count.	
Threshold	000x1000
Reset	N
Adjust	000000

Maintenance menu for the evaporator pump.

Threshold: Installer can program after how many hours there should be maintenance on the pump. When reaching this value, there is an alarm indication "evaporator pump maintenance". Even that there is an alarm indication, the pump keeps on operating.

Reset: Put the counter to 0.

Adjust: Hour counter of the pump.

Setting hour counter condenser

Cond. pump h. count.	
Threshold	000x1000
Reset	N
Adjust	000000

Maintenance menu for the condenser pump.

Threshold: Installer can program after how many hours there should be maintenance on the pump. When reaching this value, there is an alarm indication "evaporator pump maintenance". Even that there is an alarm indication, the pump keeps on operating.

Reset: Put the counter to 0.

Adjust: Hour counter of the pump.

Setting hour counter compressor

Comp. h. count.	U:
Threshold	000x1000
Reset	N
Adjust	000000

Maintenance menu for the compressor.

This menu is available for each compressor.

Threshold: Installer can program after how many hours there should be maintenance on the compressor. When reaching this value, there is an alarm indication "compressor maintenance". Even that there is an alarm indication, the compressor keeps on operating.

Reset: Put the counter to 0.

Adjust: Hour counter of the compressor.

Compressor starts counter

		U:
Comp. Starts		
Reset		N
Adjust		00000

Possible to reset the amount of compressor starts. This can be done for both compressors.

Enable digital input

Enable digital in	U: t
Filter	N
Delay time	0 s

Offset

		U:
Inputs probes offset		
B1:	0.0 B2:	0.0
B3:	---	B4: 0.0

Possible to program an offset on the probes.

Offset regulation can only be done by comparing the value of the sensor with a calibrated sensor.

Offset

		U:
Inputs probes offset		
B5:	0.0 B6:	0.0
B7:	0.0 B8:	0.0

Possible to program an offset on the probes.

Offset regulation can only be done by comparing the value of the sensor with a calibrated sensor.

Offset

		U:
Inputs probes offset		
B9:	0.0 B10:	0.0

Possible to program an offset on the probes.

Offset regulation can only be done by comparing the value of the sensor with a calibrated sensor.

Calibration capacity sensor

Adjustable comp.	
Load sensor	N
Comp. Type	HS_205

Every screw compressor of the Frame 4 series can be equipped with a sensor that detects the position of the capacity control slide. The position data is sent to the controller through a 4-20 mA proportional signal. The controller uses this signal to control the logic of the refrigerated water system and the starting of the compressors.

The minimum and maximum load can be programmed in the maintenance menu.

Standard the load sensor is programmed in the controller.

Slide position

Slide position to consider compressor full load	000%
---	------

The slide position for maximum load can be programmed and should be done during commissioning.

Slide position

Slide position to consider compressor min load	000%
--	------

The slide position for minimum load can be programmed and should be done during commissioning.

1.5.7 Input / Output Menu

Introduction

Using this menu you can read the status of the digital in-and outputs and the analogue.

Software version

CODE: Flooded

V. .000P2 00/00/00

Indication of software version and date the software was produced.

Digital input and output

Digital inputs U:

CCCCCCCCCCCC

Digital outputs

OOOOOOOOOOOCCC

Status of each digital input and output.

For a double circuit installer can change between the 2 compressors using the info button.

Digital inputs compressor 1 and 2.

Digital inputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	On/Off, compressor #1	On/Off, compressor #2
2	Low pressure switch, compressor #1	Low pressure switch, compressor #2
3	High pressure switch, compressor #1	High pressure switch, compressor #2
4	Oil level switch, compressor #1	Oil level switch, compressor #2
5	Overload, compressor #1	Overload, compressor #2
6	Transition, compressor #1	Transition, compressor #2
7	On/Off, remote unit	
8	Cooling/heating switch	
9	Phase monitor	
10	Dual setpoint activation	
11	Flow switch, evaporator	
12	Flow switch, condenser	

Digital outputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	Line contactor, compressor #1	Line contactor, compressor #2
2	Star contactor, compressor #1	Star contactor, compressor #2
3	Delta contactor, compressor #1	Delta contactor, compressor #2
4	Liquid injection, compressor #1	Liquid injection, compressor #2
5	Load solenoid, compressor #1	Load solenoid, compressor #2
6	Unload solenoid, compressor #1	Unload solenoid, compressor #2
7	Oil heater, compressor #1	Oil heater, compressor #2
8	Evaporator pump	
9	Condenser pump	
10	First tower step	
11	Second tower step	
12	Third tower step	
13	Unit in operation	
14	Unit alarm	
15	Liquid solenoid	

Analogue inputs

Analog inputs:		U:
B1:	Evap. Pr.	00.0 bar
B2:	Oil Pr.	00.0 bar
B3:	Slide v.	000 %

Actual operation values of the unit.

Analogue inputs

Analog inputs:		U:
B4:	Del. Temp	00.0 °C
B5:	ENT Cond	000.0 °C
B6:	Ext Setp	00.0 mA

Actual operation values of the unit.

Analogue inputs

Analog inputs:		U:
B7:	D. Limit	00.0 mA
B8:	Cond Pr.	00.0 bar
B9:	Ent Evap	00.0 °C

Actual operation values of the unit.

Analogue inputs

Analog inputs:		
B10:	Lvg Evap	00.0 °C

Actual operation values of the unit.

Analogue outputs

Analog outputs		U:
Y1:		00.0 V
Y2:		00.0 V

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	Valve output, condensation control	
2	Valve output, evaporation control (only HP units from ver. 7.100)	

Soft load indication

SoftLoad	Off
Max Stage	000 %
Rem. Time	000 min
Max Time	000 min

This menu is only visible if the Soft load is activated.

Capacity control compressor

Every McQuay screw compressor frame 4 series, can install a sensor that measures the position of the slide of the compressor. Such position is sent to the MicroTech II controller through a proportional signal 4-20 mA. Due to this signal, the MicroTech II controller manages the control logic of the refrigerated water and the starting of the compressors.

At the minimum signal corresponds the 25% of the produced volume of the compressor while to the maximum signal corresponds the 100%.

The PFS software PCO2 is however able to manage compressors even destitute of the position sensor of the slide; in such a case, position is esteemed based on the impulse number of load and unload sent to the compressors. This allows, in case of breakup of the sensors, to disable easily the input B3 to force the software to work without it.

It is so, possible to find not the sensors or, if this exists, they can be of 2 different types.

1. Sensor with Reset Button:

Such sensor incorporates on the head, near to the electric connection, a reset button protected by a circular hood (see figure below). This button allows to correct the minimum and maximum signal based on the minimal and maximal limits of the compressor.



OLD

2. Sensor without Reset Button:

Such sensor guarantees the direct proportion between signal and position of the capacitive pole without reset possibility (see figure below). The reset of the position of the slide has to be through keypad by software.



NEW

Setup of the transducer of capacity with the reset of position

Under the Service menu (protected by password) of the compressor in examination, when on the display the request "adjustable sensor?" appears, just setup "Y".

Such operation enables the corresponding circuit, to the use of the sensor of capacity with reset button. When done this operation on each compressor, the reset of the sensor has to be made. After started the compressor to be reset, unload it till the minimum load by jumpering the relay of unload (use an ampere meter to identify the load minimum). With the compressor to the minimum load, press the reset button under the cork of the head of the sensor.

Part 3

Troubleshooting

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Alarm	3–3
2–Additional Checks for Troubleshooting	3–39

3

1 Alarm

1.1 What Is in This Chapter?

Introduction

???

Overview

This chapter contains the following topics:

Topic	See page
1.2–Phase Monitoring Alarm	3–5
1.3–Anti Freeze Alarm	3–7
1.4–Low Evaporator Pressure Alarm	3–8
1.5–Evaporator Flow Alarm	3–10
1.6–Condenser Flow Alarm	3–11
1.7–High Discharge Temperature Alarm	3–12
1.8–Transition Fault	3–13
1.9–Low Oil Pressure Alarm	3–14
1.10–Mechanical Low Pressure Alarm	3–15
1.11–High Oil Pressure Differential Alarm	3–16
1.12–Mechanical High Pressure Alarm	3–17
1.13–Oil Level Alarm	3–18
1.14–Compressor Overload	3–19
1.15–Low Pressure Ratio Alarm	3–20
1.16–High Pressure Sensor Alarm	3–21
1.17–Low Pressure Sensor Alarm	3–22
1.18–Oil Pressure Sensor Alarm	3–23
1.19–Load Sensor Fault	3–24
1.20–Discharge Temperature Sensor Fault	3–25
1.21–Condenser Temperature Sensor Fault	3–26
1.22–Set Point Override Input Fault	3–27
1.23–Demand Limit Input Fault	3–28
1.24–Condensation Pressure Sensor Fault	3–29
1.25–Evaporator Inlet Temperature Sensor Fault	3–30
1.26–Evaporator Outlet Temperature Sensor Fault	3–31

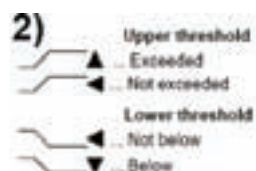
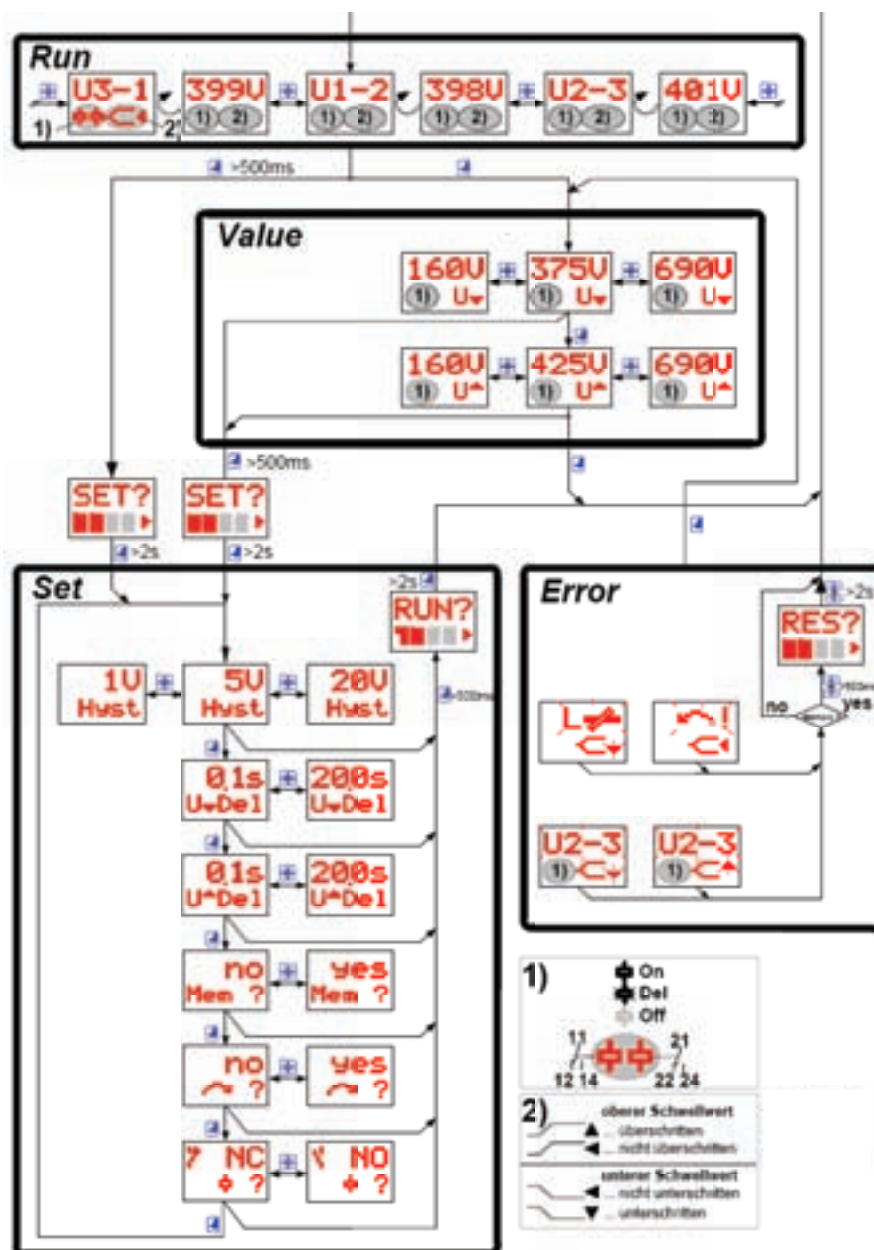
Topic	See page
1.27–Condenser Pump Maintenance	3–32
1.28–Compressor Maintenance	3–33
1.29–Evaporator Pump Maintenance	3–34
1.30–Unit 1 Offline	3–35
1.31–Unit 2 Offline	3–36
1.32–Clock Card Alarm	3–37

1.2 Phase Monitoring Alarm

Symbol	001						
Indication on screen	Phase Monitor Alarm						
Digital input	9						
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>	Safety	Default Value	ON		OFF	
Safety	Default Value						
ON							
OFF							
Reason	1. Incorrect sequence of the phases. 2. Failure of one of the phases. 3. Incorrect power supply.						
Countermeasure	1. Change 2 phases. 2. Reconnect the missing phase. 3. Check the minimum and the maximum power supply.						
Remark	The power supply to the unit must be with $\pm 10\%$ of the supply voltage. The unbalance between the phases must be within the 3%. If for some reasons the power supply is within the range and you still have now and then this failure. There's the possibility to reprogram the phase monitoring device.						

Program procedure

Three dashes (---V) appear in the upper line of the display instead of the current voltage value, if the value falls outside the allowed supply voltage limits.



1.3 Anti Freeze Alarm

Symbol

002

Indication on screen

Lvg Water Freeze Alarm

Digital input

???

Default setting

Safety	Default Value
ON	
OFF	

Reason

- Alarm during operation
 - Water flow in the system too low
 - Incorrect setting of the freeze up setting alarm
 - Antifreeze sensor out of range
- Alarm when unit is not operational
 - If the outlet water temperature drops below the anti freeze setting the water pump starts operating and an anti freeze alarm is activated. If the water temperature increases above the minimum water outlet, the unit will not restart. The installer needs to reset the unit to restart the unit.

Countermeasure

- Alarm during operation
 - Rectify the water flow. The delta T across the evaporator should be between the 3 and 8 K.
 - Program the correct settings of the freeze up alarm.
 - Check the resistance of the water sensor (procedure refer to appendix).
- Alarm when unit is not operational
 - To avoid this type of problem, customer should install a heater-tape or add glycol to the system. When adding glycol the setting of the anti freeze can be decreased.

1.4 Low Evaporator Pressure Alarm

Symbol

003

Indication on screen

Low Evap Pressure Alarm

Analogue input

1

Default setting

Safety	Default Value
ON	
OFF	

Reason

1. Shortage of refrigerant.
2. Liquid valve closed.
3. Incorrect setting of the spindle of the floating valve: If this spindle is almost closed, the unit will go into low pressure.

Spindle



Countermeasure

1. Shortage of refrigerant:

Run the unit at maximum load respecting the design temperature at condenser and evaporator site (these are the values decided during the commissioning of the unit).

- During the stable operation following data must be checked:
 - The discharge superheat must be between the 8 and 12 K.
 - The sub-cooling must be between the 4 and 6 K.
 - The difference between water outlet temperature and evaporating temperature to be in the 0,5 - 2,5°C range.
 - The difference between the condensing temperature and the water outlet condenser must be between 0,2 and 3 K.
 - The evaporator refrigerant level is slightly above the last row of tubes.
 - The condenser refrigerant level must be between the condensing and the sub-cooling diction.
 - Verify that the sight glass on the liquid piping is full of liquid.
- If the measured values are out of range compared to the above mentioned values, an additional trim charging is required.

2. Liquid stop valve closed:
 - Open liquid line solenoid valve.
 3. Incorrect setting of the spindle of the floating valve.
 - ???
-

1.5 Evaporator Flow Alarm

Symbol

005

Indication on screen

Loss Evap Water Flow Alarm

Digital input

11

Default setting

Safety	Default Value
ON	
OFF	

Reason

1. No flow.
2. Not enough flow.
3. Incorrect installation of the flow switch.
4. Incorrect operation of the flow switch.

Countermeasure

1. Check operation of the water pump.
2. Rectify the water flow (delta T across the evaporator should be between the 3 and the 8 K).
3. Always install the flow switch into the horizontal water pipes. If this is not possible, the flow switch can be installed into the vertical pipes, but only in the rising water pipe.
The flow switch should be installed at least 5 times the pipe diameter a way from turbulence producing components such as elbows, valves, flaps etc.
It is advisable to install the flow switches at the outlet of the evaporator.
4. The flow switch must be regulated at 70% of the nominal water flow.

1.6 Condenser Flow Alarm

Symbol

006

Indication on screen

Loss Cond Water Flow Alarm

Digital input

12

Default setting

Safety	Default Value
ON	
OFF	

Reason

1. No flow.
2. Not enough flow.
3. Incorrect installation of the flow switch.
4. Incorrect operation of the flow switch.

Countermeasure

1. Check operation of the water pump.
2. Rectify the water flow (delta T across the evaporator should be between the 3 and the 8 K).
3. Always install the flow switch into the horizontal water pipes. If this is not possible, the flow switch can be installed into the vertical pipes, but only in the rising water pipe.

The flow switch should be installed at least 5 times the pipe diameter a way from turbulence producing components such as elbows, valves, flaps etc.

It is advisable to install the flow switches at the outlet of the evaporator.
4. The flow switch must be regulated at 70% of the nominal water flow.

1.7 High Discharge Temperature Alarm

Symbol	007						
Indication on screen	High Discharge Temp Alarm						
Digital input	???						
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>	Safety	Default Value	ON		OFF	
Safety	Default Value						
ON							
OFF							
Reason	1. Lack of refrigerant. 2. No liquid injection when discharge temperature is higher than 85°C. 3. Incorrect discharge temperature sensor.						
Countermeasure	1. Adjust the refrigerant volume. 2. Check following items: ■ Solenoid valve injection line ■ Injection line clogged 3. Check resistance of discharge sensor (procedure refer to appendix).						

1.8 Transition Fault

Symbol	008
Indication on screen	Failed Trans Start Alarm
Digital input	6
Reason	The starting sequence of the contactors could not be completed.
Countermeasure	Check the wiring between the contactors. When testing the sequence it is better to do a dry run (compressors disconnected).

1.9 Low Oil Pressure Alarm

Symbol	009						
Indication on screen	???						
Digital input	???						
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>	Safety	Default Value	ON		OFF	
Safety	Default Value						
ON							
OFF							
Reason	1. Incorrect operation of the injector. 2. Unit is operating out of the operation range. 3. ???						
Countermeasure	???						

1.10 Mechanical Low Pressure Alarm

Symbol	010							
Indication on screen	Low Mech. Pressure Alarm							
Digital input	2							
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>		Safety	Default Value	ON		OFF	
Safety	Default Value							
ON								
OFF								
Reason	When the low pressure drops below the set point of the mechanical low pressure switch, the unit will generate a low pressure alarm.							
Countermeasure	1. Check the electrical wiring of the low pressure switch. 2. Check the operation of mechanical low pressure switch. 3. Check the setting of the mechanical low pressure switch. 4. Check the subcool and superheat to verify the correct refrigerant charge.							

1.11 High Oil Pressure Differential Alarm

Symbol	011							
Indication on screen	High Oil Press Diff Alarm							
Digital input	???							
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>		Safety	Default Value	ON		OFF	
Safety	Default Value							
ON								
OFF								
Reason	This problem is related to a big pressure drop across the oil filter or incorrect oil pressure sensor or high pressure sensor.							
Countermeasure	1. Check if the oil and high pressure sensor are within the operation range. 2. Clean or replace the oil filter.							
Procedure to clean or replace oil filter	Refer to appendix.							

1.12 Mechanical High Pressure Alarm

Symbol	12						
Indication on screen	High Mech Pressure Alarm						
Digital input	3						
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>	Safety	Default Value	ON		OFF	
Safety	Default Value						
ON							
OFF							
Reason	When the high pressure drops above the set point of the mechanical high pressure switch, the unit will generate a low pressure alarm.						
Countermeasure	1. Check the electrical wiring of the high pressure switch. 2. Check the operation of mechanical high pressure switch. 3. Check the setting of the mechanical high pressure switch. 4. Check the subcool and superheat to verify the correct refrigerant charge. 5. Check if the unit is operation within the operation limits.						

1.13 Oil Level Alarm

Symbol

014

Indication on screen

No Oil Run Alarm

Digital input

4

Default setting

Safety	Default Value
ON	
OFF	

Reason

This alarm is generated if the oil flow is too low.

1. Part damage.
2. Overcharge of refrigerant.
3. Oil is remaining in the evaporator.
4. Clogged injector filter.

Countermeasure

1. Replace the part.
2. Overcharge of refrigerant:

Adjust the refrigerant charge, during the adjustment following parameters must be checked at 100% capacity operation.

- Discharge superheat between 8 and 12 K
- Evaporator approach temperature between 0,5 and 2 K

3. Oil is remaining in the evaporator.

If there is too much oil in the evaporator, there will be a lot of foaming inside the evaporator.

To remove the oil from the evaporator the liquid valve must be closed during operation. During this operation avoid that the low pressure drops below the low pressure set point value. If the low pressure drops too low open the liquid valve a little bit. This procedure should be done for approximately 20 minutes. Check in the mean time if the oil level in the sight glasses of the oil separator increase.

When the oil is returned from the evaporator the foaming inside the evaporator will be disappeared, you will only see a boiling of the refrigerant.

4. Clogged injector filter.

1.14 Compressor Overload

Symbol	016							
Indication on screen	Compressor overload							
Digital input	5							
Default setting	<table><tr><th>Safety</th><th>Default Value</th></tr><tr><td>ON</td><td></td></tr><tr><td>OFF</td><td></td></tr></table>		Safety	Default Value	ON		OFF	
Safety	Default Value							
ON								
OFF								
Reason	The internal clixon of the compressor can be activated due to the following reasons: 1. Shortage of refrigerant. 2. No liquid injection. 3. Incorrect operation of the injector. 4. Water condenser water too high.							
Countermeasure	1. Check the refrigerant charge in the system. (Procedure refers to) 2. Check the solenoid valve for the liquid injection. 3. Check the function of the injector. (Procedure refers to) 4. Decrease water temperature condenser side.							

1.15 Low Pressure Ratio Alarm

Symbol

019

Indication on screen

Low Pressure Ratio Alarm

Digital input

???

Default setting

Safety	Default Value
ON	
OFF	

Reason

- Unit is operating out of the operation limits.

Countermeasure

The pressure ratio is related to the load of the unit. This control is incorporated to guarantee an optimum oil circulation in the circuit.

Formula to calculate the pressure ratio:

$$\text{pressure ratio} = \frac{\text{discharge pressure (Abs)}}{\text{suction pressure (Abs)}}$$

1.16 High Pressure Sensor Alarm

Symbol	023
Reason	1. Wrong or poor electrical connection. 2. Incorrect operation of the high pressure transducer.
Countermeasure	1. Rectify the wiring. 2. Verify the function of the transducer. (Procedure refers to)

1.17 Low Pressure Sensor Alarm

Symbol	030
Reason	1. Wrong or poor electrical connection. 2. Incorrect operation of the low pressure transducer.
Countermeasure	1. Rectify the wiring. 2. Verify the function of the transducer. (Procedure refers to)

1.18 Oil Pressure Sensor Alarm

Symbol	031
Reason	1. Wrong or poor electrical connection. 2. Incorrect operation of the low pressure transducer.
Countermeasure	1. Rectify the wiring. 2. Verify the function of the transducer. (Procedure refers to)

1.19 Load Sensor Fault

Symbol	032
Reason	1. Possible bad electrical connection of the sensor. 2. Incorrect operation of the capacity sensor of the compressor.
Countermeasure	???

1.20 Discharge Temperature Sensor Fault

Symbol	033
Indication on screen	Bad Disch Temp Sensor
Reason	Possible bad electrical connection of the sensor.
Countermeasure	Check the electrical connections of the sensor.

1.21 Condenser Temperature Sensor Fault

Symbol	034
Indication on screen	Bad Cond Lvg Temp Sensor
Reason	Possible bad electrical connection of the sensor.
Countermeasure	Check the electrical connections of the sensor.
Remark	If this fault is generated the unit keeps on running in his minimum capacity step of 35% when programmed in heating mode. In cooling mode the unit does not look to this parameter and runs at the requested capacity step. In the pursuit mode the unit switch OFF.

3

1.22 Set Point Override Input Fault

Symbol	035
Reason	???
Countermeasure	???

1.23 Demand Limit Input Fault

Symbol	036
Reason	???
Countermeasure	???

1.24 Condensation Pressure Sensor Fault

Symbol	037
Reason	Pressure sensor defect
Countermeasure	???

1.25 Evaporator Inlet Temperature Sensor Fault

Symbol 038

Indication on screen Bad Evap Ent Temp Sensor

Reason 1. Possible bad electrical connection of the sensor (indication -99,9).

Countermeasure 1. Check the electrical connections of the sensor.

Remark The unit switches OFF in the cooling and heating mode if the value of the sensor is -99,9°C.
The unit switches OFF in the cooling and heating mode if the value of the sensor is +99,9°C.

1.26 Evaporator Outlet Temperature Sensor Fault

Symbol	039
Indication on screen	Bad Evap Lvg Temp
Reason	1. Possible bad electrical connection of the sensor (indication -99,9).
Countermeasure	1. Check the electrical connections of the sensor.
Remark	The unit switches OFF in the cooling and heating mode if the value of the sensor is -99,9°C and indicates leaving water freeze alarm. The unit keeps on running in the cooling and heating mode if the value of the sensor is +99,9°C.

1.27 Condenser Pump Maintenance

Symbol	040
Reason	Running hours pump exceeds the programmed maintenance hours.
Countermeasure	Do maintenance on the pump and reset the running hours of the pump.

1.28 Compressor Maintenance

Symbol	041
Reason	Running hours compressor exceeds the programmed maintenance hours.
Countermeasure	Do maintenance on the compressor and reset the running hours of the compressor.

1.29 Evaporator Pump Maintenance

Symbol	042
Reason	Running hours evaporator pump exceeds the programmed maintenance hours.
Countermeasure	Do maintenance on the evaporator pump and reset the running hours of the pump.

1.30 Unit 1 Offline

Symbol	051
Reason	???
Countermeasure	???

1.31 Unit 2 Offline

Symbol	051
Reason	???
Countermeasure	???

1.32 Clock Card Alarm

Symbol	055
Reason	???
Countermeasure	???

2 Additional Checks for Troubleshooting

2.1 What Is in This Chapter?

Introduction	???						
Overview	This chapter contains the following topics: <table><tr><th>Topic</th><th>See page</th></tr><tr><td>2.2–PMFH Regulating Valve</td><td>3–40</td></tr><tr><td>2.3–Oil Flow Switch</td><td>3–42</td></tr></table>	Topic	See page	2.2–PMFH Regulating Valve	3–40	2.3–Oil Flow Switch	3–42
Topic	See page						
2.2–PMFH Regulating Valve	3–40						
2.3–Oil Flow Switch	3–42						

2.2 PMFH Regulating Valve

Introduction

The Danfoss SV(H) float valve + PMFH main valve + pilot solenoid valve in combination is used to maintain a constant liquid level within a shell and tube condenser on the high pressure of the unit.

The float valve is attached to the vessel by branch connections at a point corresponding to the desired liquid level. The float valve functions as a throttle between the high and low pressure sides of the system, passing liquid at reduced pressure through the PMFH main valve as fast as it accumulates in the float chamber, without letting any vapour through. Nearly all the system refrigerant charge is therefore in the evaporator on the low pressure (low side) of the system.

Principal

LIQUID LEVEL IN VESSEL	SV(H) FLOAT VALVE	PMFH MAIN VALVE	PILOT SOLENOID VALVE (IF FITTED)	FLOW THROUGH PMFH MAIN VALVE
 Liquid Level Rises	Opens	Opens	Energised (Open)	Opens to Flow
 Liquid Level Falls	Closes	Closes	Energised (Open)	Closes to Flow
De-energise (Close) Pilot Valve to Close PMFH Main Valve				Closed

Faults

1. Fault: ¹Liquid level in vessel abnormally high

SYMPTOMS	PROBABLE CAUSE	REMEDY
Level gauge shows abnormally high liquid level. High level switch (if fitted) may trip and stop compressor(s).	SV(H) needle valve jammed in 'closed' position.	Dismantle SV(H) and check needle valve assembly.
	SV(H) float leaking, needle valve not closing properly.	Dismantle SV(H) and check float valve operation.
	Pilot solenoid valve faulty (closed).	Check solenoid valve control signal, check valve operation.
	Stop valve (if fitted) closed in pilot line.	Open stop valve.
	PMFH main valve jammed closed.	Dismantle and clean PMFH main valve.
	Obstruction in main liquid line upstream from PMFH main valve.	Check for obstruction (closed stop valve or choked strainer).
	Obstruction in main liquid line downstream from PMFH main valve.	Check for obstruction (closed stop valve etc.).

2. Fault: ¹Liquid level in vessel abnormally low

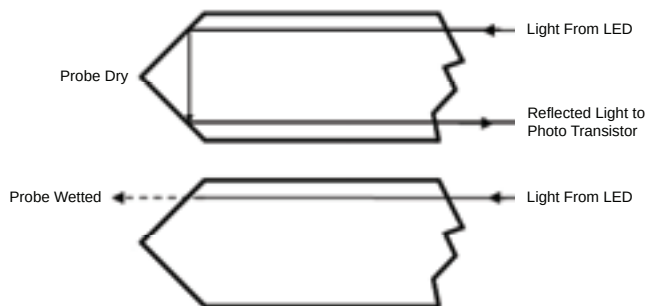
SYMPTOMS	PROBABLE CAUSE	REMEDY
Level gauge shows abnormally low liquid level. Low level switch (if fitted) may trip and stop compressor(s) or liquid pump(s). Flooded evaporator only - if the tube nest is uncovered, the cooling duty will fall and the suction superheat rise.	SV(H) needle valve leaking: worn, damaged or jammed in 'open' position.	Dismantle SV(H) and check needle valve assembly.
	Pilot solenoid valve faulty (open).	Check solenoid valve control signal, check valve operation.
	PMFH main valve jammed open.	Dismantle and clean PMFH main valve.

2.3 Oil Flow Switch

Introduction

The opto-electronic sensor detects the absence or presence of oil and is used to switch an electrical circuit.

Principal



An infra-red light-emitting diode (LED) is used as the light source. Light from the LED travels down the glass guide probe and is reflected off the V-shaped end of the probe to a phototransistor.

The intensity of the reflected light depends on the refractive index of the media surrounding the tip of the glass guide probe. As the refractive index of liquids differs from that of vapours or gases, it is possible to distinguish by photoelectric measurement of the reflected light whether the probe tip is surrounded by liquid or gaseous media. If the probe tip is covered with liquid, insufficient light is reflected to actuate the phototransistor, i.e. an electrical current is no longer generated, breaking or failing to make an electrical circuit.

Part 4

Commissioning

What is in this part?

This part contains the following chapters:

Chapter	See page
1-???	4-3

4

1 ???

1.1 What Is in This Chapter?

Introduction

???

Overview

This chapter contains the following topics:

Topic	See page
1.2-???	4-4

1.2 ???

Label

???

Phase reverse
protector

???

Part 5

Maintenance

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Maintenance	5–3

1 Maintenance

1.1 What Is in This Chapter

Introduction

???

Overview

This chapter covers the following topics:

Topic	See page
1.2–Maintenance Schedule	5–4
1.3–Replacing Oil Filter	5–5
1.4–Pumping Out Compressor	5–8
1.5–Replacing Capacity Sensor	5–9
1.6–Calibration of Capacity Sensor	5–10
1.7–PFMH Regulating Valve	5–11
1.8–Replacement of Refrigerant Oil	5–12

1.2 Maintenance Schedule

Maintenance interval	Planned maintenance exercises are initiated at intervals of calendar months or compressor operating hours, whichever time period expires first.														
Daily	1. Check the oil level in the oil separator. 2. Check and record following items: <table><tr><th>Item</th><th>Value</th></tr><tr><td>Water temperature evaporator and condenser</td><td>Should be within the operation limits</td></tr><tr><td>Delta T across evaporator and condenser</td><td>3 – 8 K</td></tr><tr><td>Approach temperature of evaporator and condenser</td><td>0,5 – 2 K</td></tr><tr><td>High, low and oil pressures</td><td></td></tr><tr><td>Discharge superheat</td><td>8 – 12 K</td></tr><tr><td>Pressure difference across the oil filter</td><td>Max 2,5 b</td></tr></table>	Item	Value	Water temperature evaporator and condenser	Should be within the operation limits	Delta T across evaporator and condenser	3 – 8 K	Approach temperature of evaporator and condenser	0,5 – 2 K	High, low and oil pressures		Discharge superheat	8 – 12 K	Pressure difference across the oil filter	Max 2,5 b
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Discharge superheat	8 – 12 K														
Pressure difference across the oil filter	Max 2,5 b														
Weekly	1. Check the unit for refrigerant and oil leaks. 2. Check the sight-glass/moisture indicator. If there is evidence of an increase in the moisture content of the system, corrective action must be taken immediately by changing the refrigerant filter/drier cores, and tracing and rectifying the cause of moisture ingress.														
Monthly	1. Check the operation of the compressor capacity control system; refer to 1.5 HB Linear Variable Displacement Transducer.														

1.3 Replacing Oil Filter

Introduction Replacement of the oil filter is only required if the pressure drop across the oil filter is approximately between the 1,5 and 2,5 bar.

Action prior to replacing oil filter Before removing the oil filter following procedure must be followed:

Step	Action
1	Pump down the unit (refer to chapter pumping down compressor).
2	Switch off the power supply of the unit.
3	Remove the remaining gas from the compressor.

Removing oil filter **Remark:** After the compressor has been pumped down and isolated, the oil contained inside the filter housing will remain hot enough to cause burns for some time afterwards. Always allow sufficient time for the oil to cool down so that it is cool enough not to be a danger when drained off (less than 35°C is recommended).

Step	Action
1	Position a suitable container underneath the filter housing to catch the escaping oil.
2	 (a) Unscrew and remove the hex head cover screws.
3	 (b) Lift away the cover and 'O' ring. Fit a new 'O' ring during reassembly.

4	 (c) Withdraw the oil filter and spindle.
5	 (d) Discard the dirty filter element. Use clean paper to remove dirt and sediment from inside the filter housing.

Replacing oil filter

Step	Action
1	 (e) The new oil filter element inside its protective wrapping.
2	 (f) Fit a new spindle 'O' ring (arrowed). Locate the new filter element over the spindle.

3	 (g) Insert the filter/spindle assembly into the housing.
4	 (h) Locate the oil filter cover onto the housing flange. Insert the hex head cover screws, tighten to 59 N m (44 lbf ft).

Procedure before restarting the unit

Step	Action
1	Charge the compressor with nitrogen for leak test
2	If leak test OK, remove nitrogen
3	Vacuum the compressor
4	Open the valves installed on the compressor
5	Re-commission the unit

1.4 Pumping Out Compressor

Introduction

Pumping out the compressor is required when some repair or maintenance work needs to be done.

Procedure

Remark: This procedure can be used when a discharge and a suction valve is installed on the compressor.

Step	Action
1	Program the unit in manual mode. 1. Go the auxiliary maintenance menu (password: 47). 2. Change the required compressor from "auto" to "manual". 3. Change capacity step to the minimum load position.
2	Start up the unit.
3	Very slowly partially close the suction stop valve while keeping the compressor running. The compressor will pump down, trip and stop on the LP cut-out when suction pressure falls to the trip setting. Close the discharge stop valve after the compressor has stopped.
4	Close the stop valve at the oil outlet line from the oil separator/reservoir and all stop valves in the lubrication and oil injection lines to the compressor.
5	Disconnect the power supply from the unit.
6	Carefully discharge the gas remaining in the compressor and oil separator into a suitable recovery container. Refrigerant should never be discharged to atmosphere.
7	Even after pumping out as described, great care must be exercised when opening up the compressor since pockets of gas will still be in the system.

1.5 Replacing Capacity Sensor

Introduction In the event of malfunction, the HBLVDT electronics module can be replaced without opening the refrigerant circuit.

Remark The electronics inside the module can be damaged by static discharges so take all relevant precautions, including earthing yourself before touching the module. Also, it is important that the 24 Vdc power supply to the HBLVDT is turned off before removing the old module or fitting the new one.

Procedure

Step	Action
1	Switch off the 24 Vdc power supply to the HBLVDT.
2	Disconnect the DIN plug.
3	Loosen the 2 hex head socket grub screws which secure the module to the stainless steel pressure containment body. Carefully withdraw the module.
4	Fitting the new module is the reverse of the dismantling sequence. Tighten the 2 grub screws evenly and alternately.
5	Reconnect the DIN plug and switch on the 24 Vdc power supply to the HBLVDT.

1.6 Calibration of Capacity Sensor

Introduction

There are two versions of the HBLVDT depending on the method of calibrating the 4 to 20 mA signal for maximum and minimum load:

- Calibration via suitable software within the pico² controller.
- Calibration at the HBLVDT.

Procedure

Step	Action
1	

1.7 PFMH Regulating Valve

Introduction	No routine maintenance is required.
Interval	The strainer, fitted at the inlet to the liquid line, should be cleaned after the first 200 hours operation, and then annually, or at intervals of 5000 operating hours, whichever is the sooner. Experience of running the plant may suggest that more frequent cleaning is necessary.

1.8 Replacement of Refrigerant Oil

Introduction

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