

Air cooled screw chillers

ALS F 163.2÷520.4**50Hz – Refrigerant: HFC 134a**

McQuay is participating in the Eurovent Certification Program. Product are as listed in the Eurovent Directory of Certified Products and on the web site www.eurovent-certification.com



Introduction

General description

Each unit is completely assembled, wired, evacuated, charged, tested, ready for installation. The main components are air-cooled condensers with integral sub-cooler sections, accessible semi-hermetic single-screw compressors, shell-and-tube evaporators, shell-and-tube water heat recovery condensers (optional), oil separators, complete refrigerant piping and electrical panel (including control and power sections). Liquid line components are shut-off valves, charging valves, filter-dryers, sight-glass/moisture indicators, electronic expansion valves, liquid receivers (only with total heat recovery option). Other features are compressor heaters, evaporator heater for low ambient water freeze protection, automatic pump-down during circuit shutdown and fully integrated microprocessor control system.

The chiller uses R134a refrigerant and operates at positive pressures.

Purpose of the manual

The manual allows the installer and the operator to perform correctly all the required operations for unit installation and maintenance without any damages to the chiller or to qualified personnel.

Nomenclature

		ALS	F	XE	312	. 3	LN	134
ALS	Air cooled screw chiller							
F	Release							
SE	Standard efficiency							
XE	High efficiency							
163÷520	Unit size							
2	N° of compressors							
3								
4								
ST	Standard version							
LN	Low noise version							
XN	Extra low noise version							
XXN	Super quiet							
134	Refrigerant HFC 134a							

Installation

Receiving and handling

The unit should be inspected immediately after receipt for possible damage.

All items on the bill of lading should be carefully checked to insure a complete shipment. Unit should be carefully checked and shipping damages should be reported to the carrier. Unit serial plate should be checked before unloading the unit to be sure that it agrees with the power supply available. Physical damage to unit after acceptance is not McQuay's responsibility.

Responsibilities

McQuay Italia declines all present and future responsibilities referred to injuries to people and damages to things and to the unit, coming from operators negligence, the un-respected installation/maintenance data carried in this manual, the lacking of the current regulations respect referred to the safety of both the equipment and the qualified personnel in charge for the installation and the maintenance.

Servicing and maintenance personnel

Experienced personnel must carry out servicing and maintenance of the unit with specific training in refrigeration. Regular checking of safety devices should be carried out, but routine maintenance should be carried out in line with the recommendation list in the main section.

The simple design of the refrigeration circuit minimises potential problems during normal unit operation.

Safety

The unit must be suitably clamped to the ground.

It is necessary to follow these cautions and warnings.

- It is possible to lift the unit only using the proper tools fixed in the base frame on the yellow holes able to support the weight of the unit.
- No admittance to unauthorised or unqualified personnel should be allowed.
- No operation on the electrical components is allowed without having switched off the power supply.
- No operation on the electrical components is allowed without using insulated platforms; no water or moisture should be present.
- All the operation on refrigerant circuit and pressurised components are to be performed by qualified personnel only.
- Only qualified personnel should be allowed to perform compressor substitution or oil addition.
- Sharp edges and coil surface are a potential injury hazard. Avoid contact with them.
- Disconnect all electrical power supply to the unit while servicing condenser fan motors. Not respecting that rule may cause body injury.
- Avoid contamination of unrelated bodies into the water piping during the unit connection to the water system.
- It is necessary that a mechanical filter is fitted to the piping connected to the evaporator inlet.
- The unit is equipped with safety relief valves installed on refrigerant circuit both in high and low pressure side.

Warning

Before any operation check the instruction for use.

Installation and maintenance have to be performed only by qualified personnel skilled about chillers, local codes and regulations. Unit installation must be avoided in areas that could be considered dangerous for maintenance operations.

Transport

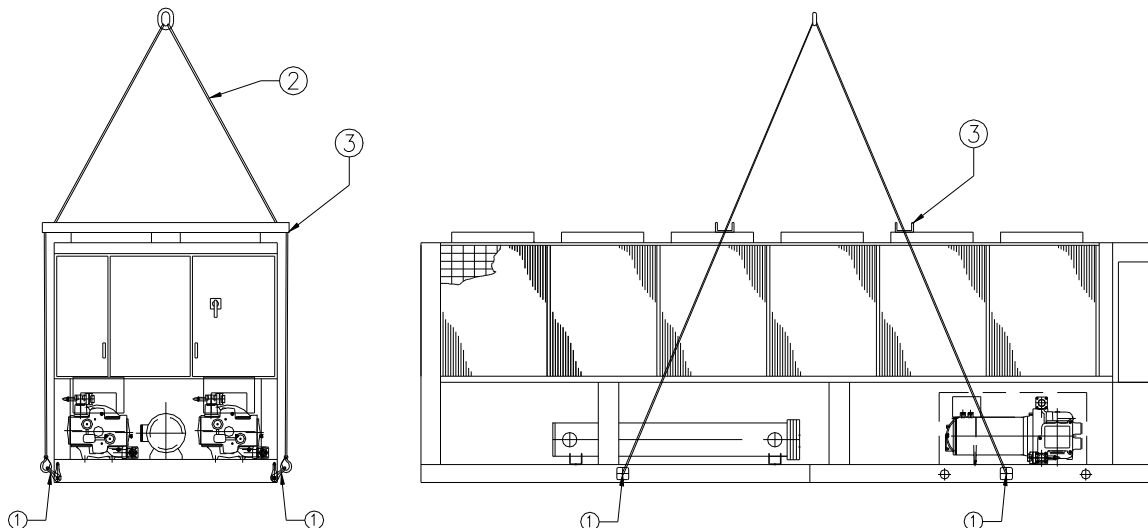
It is necessary to be sure of the stability of the unit during transportation. Therefore the unit is supplied with a transversal wooden beam placed on the unit base that must to be removed only after the final destination. In case the unit has to be moved again, a similar solution is necessary.

Handling and lifting

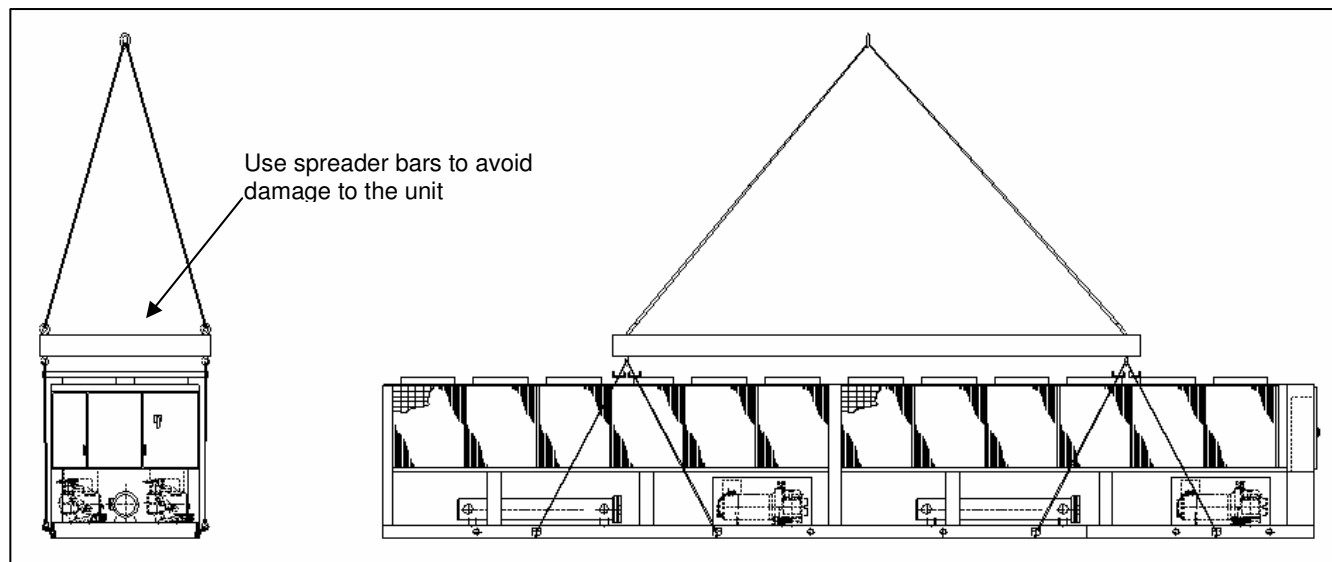
Care should be taken to avoid rough handling or shock due to the unit drop. Do not push or pull the unit from anything else than the base, and block the pushing vehicle away from the unit to prevent damage to the sheet metal cabinet and end frame.

Never allow any part of the unit to fall during unloading or moving as this may result in serious damage.

To lift the unit suitable holes are provided in unit base and spreader bars and cables should be used to prevent damage to the condenser coils or cabinet.



Suggested lifting arrangement for units with 2 compressors



Suggested lifting arrangement for units with 3 & 4 compressors

Location

ALS F is produced for outside installation on roof floors or below ground level on condition that the area is free from obstacles for condenser air flow. The unit should be positioned on solid foundations and perfectly leveled; in case of installation on roofs or floors, it may be advisable to arrange the use of suitable weight distribution beams. When the unit is installed on the ground, concrete base, at least 250 mm wider and longer than the unit's footprint, should be laid. Furthermore this base should withstand the unit weight mentioned in the technical data table. When the unit is positioned in area that is easily accessible by persons or animals, it is advisable to fit guards for condenser coil guards and, when necessary, guards for evaporator area.

To obtain the best performance in the location area, consider as follows.

- Avoid a short airflow re-circulation.
- Take care that obstacles do not obstruct proper airflow.
- To reduce noise and vibration, stiff floor is required.
- Avoid dusty ambient for condenser cleanness protection.
- Chiller water must be quite clean, oil traces and rust particles have to be removed. It is necessary to fit a water filter on the entering water pipes.

Space requirements

ALS F unit is air-cooled, hence it is important to assure a sufficient airflow across the condenser coils.

Two conditions must be avoided to achieve the best performance: warm air re-circulation and coil starvation.

Both these conditions cause condensing pressure increase that results in unit efficiency and capacity reduction.

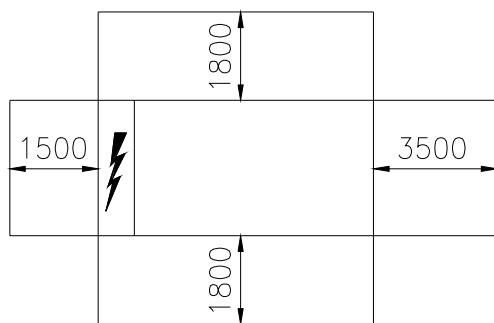
Each side of the unit must be accessible after installation for periodic service. Picture 3 shows minimum clearance requirements.

Vertical condenser air discharge must be unobstructed, because the unit would have its capacity and efficiency significantly reduced.

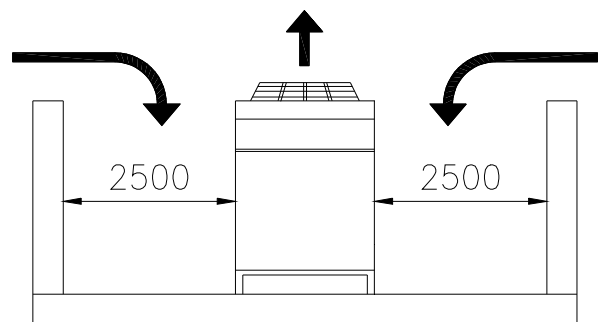
If the unit is positioned in area surrounded by walls or obstacles of the same height as the unit, the unit should be at least 2500 mm from obstacles (picture 4). If obstacles are higher than the unit, the unit should be at least 3000 mm from obstacles (picture 5). Unit installed closer than the minimum recommended distance to wall or other vertical riser may experience a combination of coil starvation and warm air re-circulation, thus causes unit capacity and efficiency reductions.

When two or more units are positioned side by side it is recommended that the condenser coils of each unit are at least at 3600 mm distance (picture 6).

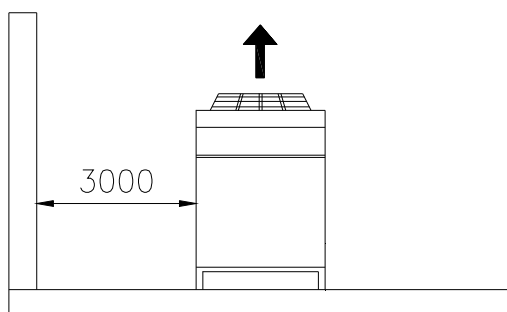
For different installation solutions, consult McQuay technicians.



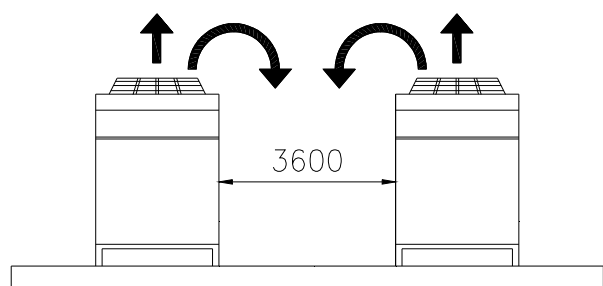
Picture 3



Picture 4



Picture 5



Picture 6

Acoustic protection

When the noise level must meet special requirements it will be necessary to pay the maximum attention to ensure the perfect insulation of the unit from the support base by applying appropriate vibration-dampening devices, applying vibration-dampening mounts on the water pipes and on the electrical connections.

Water piping

Due to the variety of piping practices, it is advisable to follow the recommendations of local authorities. They can supply the installer with the proper building and safety codes required for a safe and proper installation.

Basically, the piping should be designed with a minimum number of bends and changes in elevation to keep system cost down and performance up. It should contain:

1. Vibration eliminators to reduce vibration and noise transmission to the building.
2. Shutoff valves to isolate the unit from the piping system during unit servicing.
3. Manual or automatic air vent valves at the higher points of the system. Drains at the lower points of the system. The evaporator and heat recovery condensers should not be the highest point in the piping system.
4. Devices to maintain adequate system water pressure (e.g., expansion tank or regulating valve).
5. Water temperature and pressure indicators located at the unit to aid in unit servicing.
6. A strainer or devices to remove foreign matter from the water before it enters the pump. The strainer should be placed far enough upstream to prevent cavitation at the pump inlet (consult pump manufacturer for recommendations). The use of a strainer will prolong pump life and help maintain high system performance levels.
7. A strainer should be placed in the supply water line just prior to the inlet of the evaporator and heat recovery condensers. This will aid in preventing foreign material from entering and decreasing the performance of the heat exchangers.
8. The shell-and-tube evaporator has a thermostat and electric heater to prevent freeze-up down to -28°C. Any water piping to the unit must be protected to prevent freezing.
9. The shell-and-tube heat recovery condensers must be empty of water during the winter season, unless you fill the water circuit with ethylene glycol
10. If the unit is used as a replacement chiller on a previously existing piping system, the system should be thoroughly flushed prior to new unit installation and then regular chilled water analysis and chemical water treatment is recommended immediately at equipment start-up.
11. In the event glycol is added to the water system, as an afterthought for freeze protection, recognize that the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. System safety devices such as freeze protection and low pressure protection must be reset.

Prior to insulating the piping and filling the system, a preliminary leak check should be made.

Evaporator/Heat Recovery condenser Freeze Protection

All evaporators are equipped with electric heater thermostatically controlled that provide freeze protection down to -28°C. However, this should not be the only method of freeze protection. Unless the evaporator and heat recovery condensers are flushed and drained as is described below in note 4, two or more of the remaining three recommendations must be followed as part of the system design:

1. Continuous circulation of water through the piping and the heat exchanger.
2. Filling of glycol solution in the chilled water circuit.
3. Additional insulation and heating of the exposed piping.
4. Draining and flushing the chiller vessel with air during winter season.

It is the responsibility of the installing contractor and/or on-site maintenance personnel to insure that this additional protection is provided. Routine checks should be made to insure adequate freeze protection is maintained.

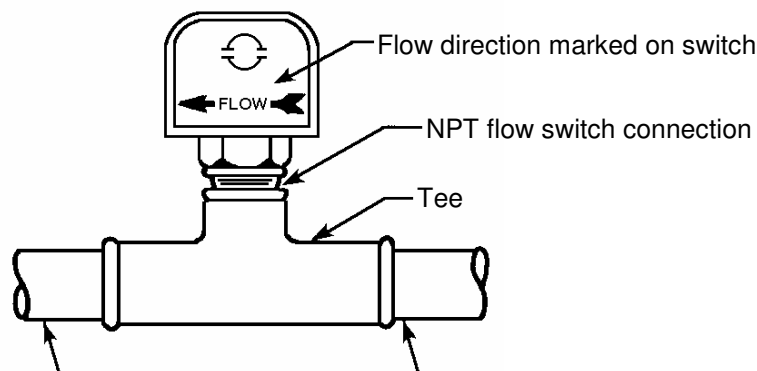
Failure to do so may result in damage to unit components. Freeze damage is not considered a warranty failure.

Flow Switch

A water flow switch must be mounted in either the entering or leaving water line to insure an adequate water flow through the evaporator before starting the unit. This will safeguard against slugging the compressors on start-up. It ALS F serves to shut down the unit in the event that water flow is interrupted to protect against evaporator freeze-up. Whenever the unit is equipped with the heat recovery condensers a water flow switch must be mounted in either the entering or leaving water line to insure an adequate water flow before switching the unit in "Heat recovery mode". It prevents against the unit shut-down for high condensing pressure.

A flow switch is available from McQuay and it is a "paddle" type switch and adaptable to any pipe size from 5" (127mm) to 8" (203mm) nominal.

Certain minimum flow rates are required to close the switch and are listed in Table 1.



NOMINAL PIPE SIZE INCHES (MM)	MINIMUM REQUIRED FLOW TO ACTIVATE SWITCH – LITERS PER SECONDS
5 (127)	3.7
6 (152)	5.0
8 (203)	8.8

Table 1

Table 2 – Operating limits – ALS F SE

Unit version		ST	LN	XN	XXN
Max ambient temperature	°C	+44	+40	+40	+40 (1)
Min ambient temperature	°C	+10 (2)	+10 (2)	+10 (2)	-10 (3)
Max leaving evaporator water temperature	°C	+9	+9	+9	+9
Min leaving evap. water temp. (without glycol)	°C	+4	+4	+4	+4
Min leaving evap. water temp. (with glycol)	°C	-8	-8	-8	-8
Max evaporator ΔT	°C	8	8	8	8
Min evaporator ΔT	°C	4	4	4	4

Notes:

- (1) When air temperature is higher then +32°C fan speed control device (standard on XXN units) sets up speed rotation increasing cooling capacity and sound pressure level.
- (2) When air temperature is lower than +10°C you need the fan speed control device. It allows the unit working with air temperature down to -10°C. Speedtrol allows to reach -18°C.
- (3) Fan speed control device is standard furnished on the XXN units.

Table 3 – Operating limits – ALS F XE

Unit version		ST	LN	XN	XXN
Max ambient temperature	°C	+48	+44	+44	+40
Min ambient temperature	°C	+10 (2)	+10 (2)	+10 (2)	-10 (3)
Max leaving evaporator water temperature	°C	+9	+9	+9	+9
Min leaving evap. water temp. (without glycol)	°C	+4	+4	+4	+4
Min leaving evap. water temp. (with glycol)	°C	-8	-8	-8	-8
Max evaporator ΔT	°C	8	8	8	8
Min evaporator ΔT	°C	4	4	4	4

Notes:

- (2) When air temperature is lower than +10°C you need the fan speed control device. It allows the unit working with air temperature down to -10°C. Speedtrol allows to reach -18°C.
- (3) Fan speed control device is standard furnished on the XXN units.

Physical data ALS F SE ST HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2
Cooling capacity (1)	kW	640	700	761	817	886
Power input (1)	kW	217	233	253	270	282
COP		2,94	3,01	3,01	3,03	3,15
McQuay Screw compressors	N°	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2
Refrigerant charge HFC 134a	kg	99	108	118	128	128
Oil charge	l	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5

Condenser fans

No. of fans / nominal power fan	kW	9/1,7	10/1,7	11/1,7	12/1,7	12/1,7
Fan speed	rpm	860	860	860	860	860
Diameter	mm	800	800	800	800	800
Total air flow	m ³ /s	47,5	52,8	58,1	63,3	64,5

Evaporator

Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes					
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Weight and dimensions

Standard unit shipping weight	kg	4910	4990	5256	5480	5580
Standard unit operating weight	kg	5130	5200	5520	5734	5834
Unit length	mm	5310	5310	6210	6210	6210
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Unit size		Note (2)	279.3	296.3	312.3	327.3	344.3
Cooling capacity (1)	kW		988	1057	1109	1166	1226
Power input (1)	kW		334	345	369	386	404
COP			2,96	3,06	3,01	3,02	3,04
McQuay Screw compressors	N°		3	3	3	3	3
Refrigerant circuits	N°		3	3	3	3	3
Refrigerant charge HFC 134a	kg		153	162	172	182	192
Oil charge	l		42	42	42	42	42
Min % of capacity reduction	%		8,3	8,3	8,3	8,3	8,3

Condenser fans

No. of fans / nominal power fan	kW		14/1,7	16/1,7	16/1,7	18/1,7	18/1,7
Fan speed	rpm		860	860	860	860	860
Diameter	mm		800	800	800	800	800
Total air flow	m ³ /s		73,9	86,0	84,5	89,7	95,0

Evaporator

Evaporators / water volume	N°/l		1/415	1/415	1/402	1/402	1/402
Max operating pressure	bar		10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm		219,1	219,1	219,1	219,1	219,1

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes						
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Weight and dimensions

Standard unit shipping weight	kg		7550	7830	7830	8420	8420
Standard unit operating weight	kg		7970	8250	8250	8830	8830
Unit length	mm		7400	8270	8270	9200	9200
Unit width	mm		2230	2230	2230	2230	2230
Unit height	mm		2520	2520	2520	2520	2520

Notes: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp. Power input is for compressor only.

(2) For cooling capacity in the middle of 886kW and 988kW, select XE unit.

Physical data ALS F SE ST HFC 134a

Unit size		358.3	Note (2)	426.4	460.4	495.4
Cooling capacity (1)	kW	1322		1520	1641	1772
Power input (1)	kW	421		503	539	564
COP		3,14		3,02	3,05	3,15
McQuay Screw compressors	N°	3		4	4	4
Refrigerant circuits	N°	3		4	4	4
Refrigerant charge HFC 134a	kg	192		236	256	256
Oil charge	l	42		56	56	56
Min % of capacity reduction	%	8,3		6,25	6,25	6,25

Condenser fans

No. of fans / nominal power fan	kW	18/1,7		22/1,7	24/1,7	24/1,7
Fan speed	rpm	860		860	860	860
Diameter	mm	800		800	800	800
Total air flow	m ³ /s	96,7		116,1	126,7	129

Evaporator

Evaporators / water volume	N°/l	1/402		2/254+246	2/246+246	2/246+246
Max operating pressure	bar	10,5		10,5	10,5	10,5
Water connection diameter	mm	219,1		168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes					
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Weight and dimensions

Standard unit shipping weight	kg	8570		9552	10632	10832
Standard unit operating weight	kg	8980		10024	11140	11340
Unit length	mm	9200		11000	11900	11900
Unit width	mm	2230		2230	2230	2230
Unit height	mm	2520		2520	2520	2520

- Notes:** (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.
(2) For cooling capacity in the middle of 1322kW and 1520kW, select XE unit.

Electrical data ALS F SE ST HFC 134a

Unit size		178.2	196.2	212.2	229.2
Standard voltage (1)		400 V – 3f – 50 Hz			
Nominal unit current (2)	A	414	436	471	502
Max compressor current (3)	A	435	460	501	542
Fans current	A	36	40	44	48
Max unit current (3)	A	471	500	545	590
Max unit inrush current (4)	A	814	834	838	867
Max unit current for wires sizing (5)	A	530	582	625	668

Unit size		241.2	279.3	296.3	312.3	327.3
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	497	632	658	688	726
Max compressor current (3)	A	548	664	687	730	773
Fans current	A	48	56	64	64	72
Max unit current (3)	A	596	720	751	794	845
Max unit inrush current (4)	A	867	998	1022	1022	1055
Max unit current for wires sizing (5)	A	668	821	877	916	963

Unit size		344.3	358.3	426.4	460.4	495.4
Standard voltage (1)		400 V – 3ph – 50 Hz				
Nominal unit current (2)	A	756	744	938	1004	994
Max compressor current (3)	A	816	820	1002	1084	1096
Fans current	A	72	72	88	96	96
Max unit current (3)	A	888	892	1090	1180	1192
Max unit inrush current (4)	A	1079	1079	1284	1292	1292
Max unit current for wires sizing (5)	A	1002	1002	1250	1336	1336

- Notes:** (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
(2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
(3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 44°C ambient temp.
(4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
(5) Compressor FLA + fans current.

Physical data ALS F SE LN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2
Cooling capacity (1)	kW	606	670	730	784	868
Power input (1)	kW	235	250	269	289	305
COP		2,58	2,68	2,71	2,71	2,84
McQuay Screw compressors	N°	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2
Refrigerant charge HFC 134a	kg	99	108	118	128	128
Oil charge	l	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5

Condenser fans

No. of fans / nominal power fan	kW	9/1	10/1	11/1	12/1	12/1
Fan speed	rpm	680	680	680	680	680
Diameter	mm	800	800	800	800	800
Total air flow	m ³ /s	36,4	40,5	44,5	48,6	48,6

Evaporator

Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes					
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Weight and dimensions

Standard unit shipping weight	kg	4910	4990	5256	5480	5580
Standard unit operating weight	kg	5130	5200	5520	5734	5834
Unit length	mm	5310	5310	6210	6210	6210
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Unit size		Note (2)	279.3	296.3	312.3	327.3	344.3
Cooling capacity (1)	kW		945	1016	1062	1116	1175
Power input (1)	kW		360	371	395	414	432
COP			2,63	2,74	2,69	2,70	2,72
McQuay Screw compressors	N°		3	3	3	3	3
Refrigerant circuits	N°		3	3	3	3	3
Refrigerant charge HFC 134a	kg		153	162	172	182	192
Oil charge	l		42	42	42	42	42
Min % of capacity reduction	%		8,3%	8,3%	8,3%	8,3%	8,3

Condenser fans

No. of fans / nominal power fan	kW		14/1	16/1	16/1	18/1	18/1
Fan speed	rpm		680	680	680	680	680
Diameter	mm		800	800	800	800	800
Total air flow	m ³ /s		56,7	66,0	64,8	68,8	72,9

Evaporator

Evaporators / water volume	N°/l		1/415	1/415	1/402	1/402	1/402
Max operating pressure	bar		10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm		219,1	219,1	219,1	219,1	219,1

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes						
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Weight and dimensions

Standard unit shipping weight	kg		7550	7830	7830	8420	8420
Standard unit operating weight	kg		7970	8250	8250	8830	8830
Unit length	mm		7400	8270	8270	9200	9200
Unit width	mm		2230	2230	2230	2230	2230
Unit height	mm		2520	2520	2520	2520	2520

- Notes: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp. Power input is for compressor only.
(2) For cooling capacity in the middle of 868kW and 945kW, select XE unit.

Physical data ALS F SE LN HFC 134a

Unit size		358.3	Note (2)	426.4	460.4	495.4
Cooling capacity (1)	kW	1296		1457	1553	1735
Power input (1)	kW	456		546	573	610
COP		2,84		2,67	2,71	2,84
McQuay Screw compressors	N°	3		4	4	4
Refrigerant circuits	N°	3		4	4	4
Refrigerant charge HFC 134a	kg	192		236	256	256
Oil charge	l	42		56	56	56
Min % of capacity reduction	%	8,3		6,25	6,25	6,25

Condenser fans

No. of fans / nominal power fan	kW	18/1		22/1	24/1	24/1
Fan speed	rpm	680		680	680	680
Diameter	mm	800		800	800	800
Total air flow	m ³ /s	73,6		89,0	97,1	98,0

Evaporator

Evaporators / water volume	N°/l	1/402		2/254+246	2/246+246	2/246+246
Max operating pressure	bar	10,5		10,5	10,5	10,5
Water connection diameter	mm	219,1		168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes					
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Weight and dimensions

Standard unit shipping weight	kg	8570		9552	10632	10832
Standard unit operating weight	kg	8980		10024	11140	11340
Unit length	mm	9200		11000	11900	11900
Unit width	mm	2230		2230	2230	2230
Unit height	mm	2520		2520	2520	2520

- Notes:** (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.
(2) For cooling capacity in the middle of 1296kW and 1457kW, select XE unit.

Electrical data ALS F SE LN HFC 134a

Unit size		178.2	196.2	212.2	229.2
Standard voltage (1)		400 V – 3f – 50 Hz			
Nominal unit current (2)	A	416	438	474	510
Max compressor current (3)	A	443	470	504	538
Fans current	A	18	20	22	24
Max unit current (3)	A	461	490	526	562
Max unit inrush current (4)	A	797	815	817	846
Max unit current for wires sizing (5)	A	512	562	603	644

Unit size		241.2	279.3	296.3	312.3	327.3
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	508	638	662	701	733
Max compressor current (3)	A	549	678	705	739	773
Fans current	A	24	28	32	32	34
Max unit current (3)	A	573	706	737	771	807
Max unit inrush current (4)	A	846	971	992	992	1021
Max unit current for wires sizing (5)	A	644	793	845	884	925

Unit size		344.3	358.3	426.4	460.4	495.4
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	765	760	948	1020	1016
Max compressor current (3)	A	807	821	1008	1076	1097
Fans current	A	36	36	44	48	48
Max unit current (3)	A	843	857	1052	1124	1145
Max unit inrush current (4)	A	1050	1050	1249	1253	1253
Max unit current for wires sizing (5)	A	966	966	1206	1288	1288

- Notes:** (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
(2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
(3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 40°C ambient temp.
(4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
(5) Compressor FLA + fans current.

Physical data ALS F SE XN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2
Cooling capacity (1)	kW	606	670	730	784	868
Power input (1)	kW	235	250	269	289	305
COP		2,58	2,68	2,71	2,71	2,84
McQuay Screw compressors	N°	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2
Refrigerant charge HFC 134a	kg	99	108	118	128	128
Oil charge	l	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5
Condenser fans						
No. of fans / nominal power fan	kW	9/1	10/1	11/1	12/1	12/1
Fan speed	rpm	680	680	680	680	680
Diameter	mm	800	800	800	800	800
Total air flow	m³/s	36,4	40,5	44,5	48,6	48,6
Evaporator						
Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3
Condenser coil						
Coil type		Lanced fins – internally spiral wound tubes				
Weight and dimensions						
Standard unit shipping weight	kg	5150	5230	5496	5720	5820
Standard unit operating weight	kg	5370	5440	5760	5974	6074
Unit length	mm	5310	5310	6210	6210	6210
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Unit size		Note (2)	279.3	296.3	312.3	327.3	344.3
Cooling capacity (1)	kW		945	1016	1062	1116	1175
Power input (1)	kW		360	371	395	414	432
COP			2,63	2,74	2,69	2,70	2,72
McQuay Screw compressors	N°		3	3	3	3	3
Refrigerant circuits	N°		3	3	3	3	3
Refrigerant charge HFC 134a	kg		153	162	172	182	192
Oil charge	l		42	42	42	42	42
Min % of capacity reduction	%		8,3	8,3	8,3	8,3	8,3
Condenser fans							
No. of fans / nominal power fan	kW		14/1	16/1	16/1	18/1	18/1
Fan speed	rpm		680	680	680	680	680
Diameter	mm		800	800	800	800	800
Total air flow	m³/s		56,7	66,0	64,8	68,8	72,9
Evaporator							
Evaporators / water volume	N°/l		1/415	1/415	1/402	1/402	1/402
Max operating pressure	bar		10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm		219,1	219,1	219,1	219,1	219,1
Condenser coil							
Coil type		Lanced fins – internally spiral wound tubes					
Weight and dimensions							
Standard unit shipping weight	kg		7910	8190	8190	8780	8930
Standard unit operating weight	kg		8330	8610	8610	9190	9340
Unit length	mm		7400	8270	8270	9200	9200
Unit width	mm		2230	2230	2230	2230	2230
Unit height	mm		2520	2520	2520	2520	2520

- Notes:** (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp. Power input is for compressor only.
(2) For cooling capacity in the middle of 868kW and 945kW, select XE unit.

Physical data ALS F SE XN HFC 134a

Unit size		358.3	Note (2)	426.4	460.4	495.4
Cooling capacity (1)	kW	1296		1457	1553	1735
Power input (1)	kW	456		546	573	610
COP		2,84		2,67	2,71	2,84
McQuay Screw compressors	N°	3		4	4	4
Refrigerant circuits	N°	3		4	4	4
Refrigerant charge HFC 134a	kg	192		236	256	256
Oil charge	l	42		56	56	56
Min % of capacity reduction	%	8,3		6,25	6,25	6,25

Condenser fans

No. of fans / nominal power fan	kW	18/1		22/1	24/1	24/1
Fan speed	rpm	680		680	680	680
Diameter	mm	800		800	800	800
Total air flow	m³/s	73,6		89,0	97,1	98,0

Evaporator

Evaporators / water volume	N°/l	1/402		2/254+246	2/246+246	2/246+246
Max operating pressure	bar	10,5		10,5	10,5	10,5
Water connection diameter	mm	219,1		168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes					
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Weight and dimensions

Standard unit shipping weight	kg	9080		10032	11112	11312
Standard unit operating weight	kg	9490		10504	11620	11820
Unit length	mm	9200		11000	11900	11900
Unit width	mm	2230		2230	2230	2230
Unit height	mm	2520		2520	2520	2520

- Notes:** (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.
(2) For cooling capacity in the middle of 1296kW and 1457kW, select XE unit.

Electrical data ALS F SE XN HFC 134a

Unit size		178.2	196.2	212.2	229.2
Standard voltage (1)		400 V – 3f – 50 Hz			
Nominal unit current (2)	A	416	438	474	510
Max compressor current (3)	A	443	470	504	538
Fans current	A	18	20	22	24
Max unit current (3)	A	461	490	526	562
Max unit inrush current (4)	A	797	815	817	846
Max unit current for wires sizing (5)	A	512	562	603	644

Unit size		241.2	279.3	296.3	312.3	327.3
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	508	638	662	701	733
Max compressor current (3)	A	549	678	705	739	773
Fans current	A	24	28	32	32	34
Max unit current (3)	A	573	706	737	771	807
Max unit inrush current (4)	A	846	971	992	992	1021
Max unit current for wires sizing (5)	A	644	793	845	884	925

Unit size		344.3	358.3	426.4	460.4	495.4
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	765	760	948	1020	1016
Max compressor current (3)	A	807	821	1008	1076	1097
Fans current	A	36	36	44	48	48
Max unit current (3)	A	843	857	1052	1124	1145
Max unit inrush current (4)	A	1050	1050	1249	1253	1253
Max unit current for wires sizing (5)	A	966	966	1206	1288	1288

- Notes:** (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
(2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
(3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 40°C ambient temp.
(4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
(5) Compressor FLA + fans current.

Physical data ALS F SE XXN HFC 134a

Unit size		163.2	178.2	196.2	212.2	229.2	240.3
Cooling capacity (1)	kW	539	597	650	709	759	812
Power input (1)	kW	229	246	262	285	307	340
COP		2,35	2,43	2,48	2,48	2,47	2,39
McQuay Screw compressors	N°	2	2	2	2	2	3
Refrigerant circuits	N°	2	2	2	2	2	3
Refrigerant charge HFC 134a	kg	98	107	116	126	136	147
Oil charge	l	28	28	28	28	28	42
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5	8,3
Condenser fans							
No. of fans / nominal power fan	kW	10/0,3	11/0,3	12/0,3	13/0,3	14/0,3	16/0,3
Fan speed	rpm	500	500	500	500	500	500
Diameter	mm	800	800	800	800	800	800
Total air flow	m³/s	25,6	28,2	30,8	33,3	35,9	42,1
Evaporator							
Evaporators / water volume	N°/l	1/261	1/254	1/254	1/246	1/246	1/424
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3	219,1
Condenser coil							
Coil type		Lanced fins – internally spiral wound tubes					
Weight and dimensions							
Standard unit shipping weight	kg	5230	5445	5659	5900	6030	8190
Standard unit operating weight	kg	5440	5650	5864	6150	6280	8610
Unit length	mm	5310	6210	6210	7110	7110	8300
Unit width	mm	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520

Unit size		260.3	279.3	296.3	312.3	327.3	344.3
Cooling capacity (1)	kW	869	921	974	1055	1086	1152
Power input (1)	kW	361	377	393	406	438	449
COP		2,41	2,45	2,48	2,60	2,48	2,57
McQuay Screw compressors	N°	3	3	3	3	3	3
Refrigerant circuits	N°	3	3	3	3	3	3
Refrigerant charge HFC 134a	kg	156	165	174	184	194	204
Oil charge	l	42	42	42	42	42	42
Min % of capacity reduction	%	8,3	8,3	8,3	8,3	8,3	8,3
Condenser fans							
No. of fans / nominal power fan	kW	16/0,3	18/0,3	18/0,3	20/0,3	20/0,3	22/0,3
Fan speed	rpm	500	500	500	500	500	500
Diameter	mm	800	800	800	800	800	800
Total air flow	m³/s	41,0	43,6	46,1	51,3	51,3	56,4
Evaporator							
Evaporators / water volume	N°/l	1/415	1/415	1/415	1/402	1/402	1/402
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	219,1	219,1	219,1	219,1	219,1
Condenser coil							
Coil type		Lanced fins – internally spiral wound tubes					
Weight and dimensions							
Standard unit shipping weight	kg	8190	8725	8725	9310	9310	9750
Standard unit operating weight	kg	8610	9150	9150	9720	9720	10160
Unit length	mm	8300	9200	9200	10100	10100	11000
Unit width	mm	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 32°C air ambient temp.
Power input is for compressor only.

Electrical data ALS F SE XXN HFC 134a

Unit size		163.2	178.2	196.2	212.2	229.2	240.3
Standard voltage (1)		400 V – 3f – 50 Hz					
Nominal unit current (2)	A	414	439	468	512	556	605
Max compressor current (3)	A	440	473	506	558	610	660
Fans current	A	10	11	12	13	14	16
Max unit current (3)	A	450	484	518	571	624	676
Max unit inrush current (4)	A	796	797	819	820	854	958
Max unit current for wires sizing (5)	A	456	505	554	594	634	685

Unit size		260.3	279.3	296.3	312.3	327.3	344.3
Standard voltage (1)		400 V – 3f – 50 Hz					
Nominal unit current (2)	A	640	666	702	733	791	818
Max compressor current (3)	A	693	726	759	811	863	895
Fans current	A	16	18	18	20	20	22
Max unit current (3)	A	709	744	777	831	883	917
Max unit inrush current (4)	A	958	980	1000	1002	1035	1070
Max unit current for wires sizing (5)	A	733	783	831	872	911	952

- Notes:**
- (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
 - (2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
 - (3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 40°C ambient temp.
 - (4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
 - (5) Compressor FLA + fans current.

Physical data ALS F XE ST HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2	258.2
Cooling capacity (1)	kW	667	723	800	855	903	926
Power input (1)	kW	204	217	237	255	268	260
COP		3,27	3,33	3,38	3,36	3,37	3,57
McQuay Screw compressors	N°	2	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2	2
Refrigerant charge HFC 134a	kg	107	116	126	136	136	146
Oil charge	l	28	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5	12,5

Condenser fans

No. of fans / nominal power fan	kW	11/1,7	12/1,7	13/1,7	14/1,7	14/1,7	16/1,7
Fan speed	rpm	860	860	860	860	860	860
Diameter	mm	800	800	800	800	800	800
Total air flow	m³/s	58,1	63,3	68,6	73,9	75,2	86,0

Evaporator

Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246	1/244
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes						
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Weight and dimensions

Standard unit shipping weight	kg	5205	5419	5660	5790	5890	6333
Standard unit operating weight	kg	5410	5624	5910	6040	6140	6589
Unit length	mm	6210	6210	7110	7110	7110	8300
Unit width	mm	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520

Unit size		273.2	279.3	296.3	312.3	327.3	344.3	358.3
Cooling capacity (1)	kW	974	1038	1094	1177	1222	1282	1354
Power input (1)	kW	267	312	325	343	365	378	396
COP		3,65	3,33	3,37	3,43	3,35	3,40	3,42
McQuay Screw compressors	N°	2	3	3	3	3	3	3
Refrigerant circuits	N°	2	3	3	3	3	3	3
Refrigerant charge HFC 134a	kg	156	165	174	184	194	204	214
Oil charge	l	28	42	42	42	42	42	42
Min % of capacity reduction	%	12,5	8,3	8,3	8,3	8,3	8,3	8,3

Condenser fans

No. of fans / nominal power fan	kW	16/1,7	18/1,7	18/1,7	20/1,7	20/1,7	22/1,7	22/1,7
Fan speed	rpm	860	860	860	860	860	860	860
Diameter	mm	800	800	800	800	800	800	800
Total air flow	m³/s	86,0	100,6	95,0	105,6	105,6	116,1	118,3

Evaporator

Evaporators / water volume	N°/l	1/392	1/415	1/415	1/402	1/402	1/402	1/402
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	219,1	219,1	219,1	219,1	219,1	219,1

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes							
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Weight and dimensions

Standard unit shipping weight	kg	6563	8420	8420	8950	8950	9390	9540
Standard unit operating weight	kg	6967	8830	8830	9360	9360	9800	9950
Unit length	mm	8300	9200	9200	10100	10100	11000	11000
Unit width	mm	2230	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.

Physical data ALS F XE ST HFC 134a

Unit size		392.3	426.4	460.4	495.4	520.4
Cooling capacity (1)	kW	1430	1557	1710	1806	1920
Power input (1)	kW	386	476	510	536	555
COP		3,70	3,27	3,35	3,37	3,46
McQuay Screw compressors	N°	3	4	4	4	4
Refrigerant circuits	N°	3	4	4	4	4
Refrigerant charge HFC 134a	kg	224	252	272	272	282
Oil charge	l	42	56	56	56	56
Min % of capacity reduction	%	8,3	6,25	6,25	6,25	6,25
Condenser fans						
No. of fans / nominal power fan	kW	26/1,7	26/1,7	28/1,7	28/1,7	28/1,7
Fan speed	rpm	860	860	860	860	860
Diameter	mm	800	800	800	800	800
Total air flow	m³/s	140	137,2	147,8	150,5	150,5
Evaporator						
Evaporators / water volume	N°/l	1/533	2/254+246	2/246+246	2/246+246	2/392+392
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	168,3	168,3	168,3	219,1
Condenser coil						
Coil type		Lanced fins – internally spiral wound tubes				
Weight and dimensions						
Standard unit shipping weight	kg	10355	10960	11168	11368	12144
Standard unit operating weight	kg	10931	11420	11678	11878	13036
Unit length	mm	12800	12800	13670	13670	13670
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.

Electrical data ALS F XE ST HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2			
Standard voltage (1)		400 V – 3f – 50 Hz							
Nominal unit current (2)	A	412	434	464	494	485			
Max compressor current (3)	A	442	468	511	554	547			
Fans current	A	44	48	52	56	56			
Max unit current (3)	A	486	516	563	610	603			
Max unit inrush current (4)	A	821	842	846	872	872			
Max unit current for wires sizing (5)	A	538	590	633	676	676			
Unit size		258.2	273.2	279.3	296.3	312.3	327.3		
Standard voltage (1)		400 V – 3f – 50 Hz							
Nominal unit current (2)	A	480	491	631	651	686	713		
Max compressor current (3)	A	532	545	670	696	742	788		
Fans current	A	64	64	72	72	80	80		
Max unit current (3)	A	596	609	742	768	822	868		
Max unit inrush current (4)	A	872	872	1012	1029	1037	1059		
Max unit current for wires sizing (5)	A	684	684	837	885	932	971		
Unit size		344.3	358.3	392.3	426.4	460.4	495.4	520.4	
Standard voltage (1)		400 V – 3f – 50 Hz							
Nominal unit current (2)	A	748	722	723	928	988	970	998	
Max compressor current (3)	A	834	810	791	1022	1108	1095	1130	
Fans current	A	88	88	104	104	112	112	112	
Max unit current (3)	A	922	898	895	1126	1220	1207	1242	
Max unit inrush current (4)	A	1090	1090	1090	1291	1299	1299	1299	
Max unit current for wires sizing (5)	A	1018	1018	1034	1266	1352	1352	1352	

- Notes:**
- (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
 - (2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
 - (3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 48°C ambient temp.
 - (4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
 - (5) Compressor FLA + fans current.

Physical data ALS F XE LN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2	258.2
Cooling capacity (1)	kW	640	703	769	822	881	907
Power input (1)	kW	216	232	254	271	286	275
COP		2,97	3,02	3,03	3,04	3,08	3,30
McQuay Screw compressors	N°	2	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2	2
Refrigerant charge HFC 134a	kg	107	116	126	136	136	146
Oil charge	l	28	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5	12,5

Condenser fans

No. of fans / nominal power fan	kW	11/1	12/1	13/1	14/1	14/1	16/1
Fan speed	rpm	680	680	680	680	680	680
Diameter	mm	800	800	800	800	800	800
Total air flow	m ³ /s	44,5	48,6	52,6	56,7	57,2	65,4

Evaporator

Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246	1/244
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3	168,3

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes						
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Weight and dimensions

Standard unit shipping weight	kg	5205	5419	5660	5790	5890	6333
Standard unit operating weight	kg	5410	5624	5910	6040	6140	6589
Unit length	mm	6210	6210	7110	7110	7110	8300
Unit width	mm	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520

Unit size		273.2	279.3	296.3	312.3	327.3	344.3	358.3
Cooling capacity (1)	kW	953	998	1053	1135	1177	1238	1323
Power input (1)	kW	283	332	347	362	389	402	421
COP		3,36	3,00	3,03	3,14	3,03	3,08	3,14
McQuay Screw compressors	N°	2	3	3	3	3	3	3
Refrigerant circuits	N°	2	3	3	3	3	3	3
Refrigerant charge HFC 134a	kg	156	165	174	184	194	204	204
Oil charge	l	28	42	42	42	42	42	42
Min % of capacity reduction	%	12,5	8,3	8,3	8,3	8,3	8,3	8,3

Condenser fans

No. of fans / nominal power fan	kW	16/1	18/1	18/1	20/1	20/1	22/1	22/1
Fan speed	rpm	680	680	680	680	680	680	680
Diameter	mm	800	800	800	800	800	800	800
Total air flow	m ³ /s	65,4	77,1	72,8	80,9	80,9	89,0	89,9

Evaporator

Evaporators / water volume	N°/l	1/392	1/415	1/415	1/402	1/402	1/402	1/402
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	219,1	219,1	219,1	219,1	219,1	219,1

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes							
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Weight and dimensions

Standard unit shipping weight	kg	6563	8420	8420	8950	8950	9390	9540
Standard unit operating weight	kg	6967	8830	8830	9360	9360	9800	9950
Unit length	mm	8300	9200	9200	10100	10100	11000	11000
Unit width	mm	2230	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35 °C air ambient temp.
Power input is for compressor only.

Physical data ALS F XE LN HFC 134a

Unit size		392.3	426.4	460.4	495.4	520.4
Cooling capacity (1)	kW	1401	1512	1618	1762	1871
Power input (1)	kW	408	501	541	572	594
COP		3,44	3,02	2,99	3,08	3,15
McQuay Screw compressors	N°	3	4	4	4	4
Refrigerant circuits	N°	3	4	4	4	4
Refrigerant charge HFC 134a	kg	214	252	272	272	282
Oil charge	l	42	56	56	56	56
Min % of capacity reduction	%	8,3	6,25	6,25	6,25	6,25
Condenser fans						
No. of fans / nominal power fan	kW	26/1	26/1	28/1	28/1	28/1
Fan speed	rpm	680	680	680	680	680
Diameter	mm	800	800	800	800	800
Total air flow	m³/s	106,3	105,2	113,3	114,4	114,4
Evaporator						
Evaporators / water volume	N°/l	1/533	2/254+246	2/246+246	2/246+246	2/392+392
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	168,3	168,3	168,3	219,1
Condenser coil						
Coil type		Lanced fins – internally spiral wound tubes				
Weight and dimensions						
Standard unit shipping weight	kg	10355	10960	11168	11368	12144
Standard unit operating weight	kg	10931	11420	11678	11878	13036
Unit length	mm	12800	12800	13670	13670	13670
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.

Electrical data ALS F XE LN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2		
Standard voltage (1)		400 V – 3f – 50 Hz						
Nominal unit current (2)	A	403	428	459	490	484		
Max compressor current (3)	A	443	470	510	550	547		
Fans current	A	22	24	26	28	28		
Max unit current (3)	A	465	494	536	578	575		
Max unit inrush current (4)	A	796	815	817	843	843		
Max unit current for wires sizing (5)	A	516	566	607	648	648		
Unit size		258.2	273.2	279.3	296.3	312.3	327.3	
Standard voltage (1)		400 V – 3f – 50 Hz						
Nominal unit current (2)	A	472	484	614	633	669	705	
Max compressor current (3)	A	528	543	678	705	745	785	
Fans current	A	32	32	36	36	40	40	
Max unit current (3)	A	560	575	714	741	785	825	
Max unit inrush current (4)	A	843	843	971	988	992	1015	
Max unit current for wires sizing (5)	A	652	652	801	849	892	931	
Unit size		344.3	358.3	392.3	426.4	460.4	495.4	520.4
Standard voltage (1)		400 V – 3ph – 50 Hz						
Nominal unit current (2)	A	729	716	704	918	980	967	1000
Max compressor current (3)	A	825	807	783	1020	1100	1094	1116
Fans current	A	44	44	52	52	56	56	56
Max unit current (3)	A	869	851	835	1072	1156	1150	1172
Max unit inrush current (4)	A	1043	1043	1043	1234	1238	1238	1238
Max unit current for wires sizing (5)	A	974	974	982	1214	1296	1296	1296

- Notes:**
- (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
 - (2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
 - (3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 44°C ambient temp.
 - (4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
 - (5) Compressor FLA + fans current.

Physical data ALS F XE XN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2	258.2
Cooling capacity (1)	kW	640	703	769	822	881	907
Power input (1)	kW	216	232	254	271	286	275
COP		2,97	3,02	3,03	3,04	3,08	3,30
McQuay Screw compressors	N°	2	2	2	2	2	2
Refrigerant circuits	N°	2	2	2	2	2	2
Refrigerant charge HFC 134a	kg	107	116	126	136	136	146
Oil charge	l	28	28	28	28	28	28
Min % of capacity reduction	%	12,5	12,5	12,5	12,5	12,5	12,5
Condenser fans							
No. of fans / nominal power fan	kW	11/1	12/1	13/1	14/1	14/1	16/1
Fan speed	rpm	680	680	680	680	680	680
Diameter	mm	800	800	800	800	800	800
Total air flow	m³/s	44,5	48,6	52,6	56,7	57,2	65,4
Evaporator							
Evaporators / water volume	N°/l	1/254	1/254	1/246	1/246	1/246	1/244
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	168,3	168,3	168,3
Condenser coil							
Coil type	Lanced fins – internally spiral wound tubes						
Weight and dimensions							
Standard unit shipping weight	kg	5445	5659	5900	6030	6130	6573
Standard unit operating weight	kg	5650	5864	6150	6280	6380	6829
Unit length	mm	6210	6210	7110	7110	7110	8300
Unit width	mm	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520

Unit size		273.2	279.3	296.3	312.3	327.3	344.3	358.3
Cooling capacity (1)	kW	953	998	1053	1135	1177	1238	1323
Power input (1)	kW	283	332	347	362	389	402	421
COP		3,36	3,00	3,03	3,14	3,03	3,08	3,14
McQuay Screw compressors	N°	2	3	3	3	3	3	3
Refrigerant circuits	N°	2	3	3	3	3	3	3
Refrigerant charge HFC 134a	kg	156	165	174	184	194	204	204
Oil charge	l	28	42	42	42	42	42	42
Min % of capacity reduction	%	12,5	8,3	8,3	8,3	8,3	8,3	8,3
Condenser fans								
No. of fans / nominal power fan	kW	16/1	18/1	18/1	20/1	20/1	22/1	22/1
Fan speed	rpm	680	680	680	680	680	680	680
Diameter	mm	800	800	800	800	800	800	800
Total air flow	m³/s	65,4	77,1	72,8	80,9	80,9	89,0	89,9
Evaporator								
Evaporators / water volume	N°/l	1/392	1/415	1/415	1/402	1/402	1/402	1/402
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	219,1	219,1	219,1	219,1	219,1	219,1
Condenser coil								
Coil type	Lanced fins – internally spiral wound tubes							
Weight and dimensions								
Standard unit shipping weight	kg	6803	8780	8780	9310	9310	9750	9900
Standard unit operating weight	kg	7207	9190	9190	9720	9720	10160	10310
Unit length	mm	8300	9200	9200	10100	10100	11000	11000
Unit width	mm	2230	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35 °C air ambient temp.
Power input is for compressor only.

Physical data ALS F XE XN HFC 134a

Unit size		392.3	426.4	460.4	495.4	520.4
Cooling capacity (1)	kW	1401	1512	1618	1762	1871
Power input (1)	kW	408	501	541	572	594
COP		3,44	3,02	2,99	3,08	3,15
McQuay Screw compressors	N°	3	4	4	4	4
Refrigerant circuits	N°	3	4	4	4	4
Refrigerant charge HFC 134a	kg	214	252	272	272	282
Oil charge	l	42	56	56	56	56
Min % of capacity reduction	%	8,3	6,25	6,25	6,25	6,25
Condenser fans						
No. of fans / nominal power fan	kW	26/1	26/1	28/1	28/1	28/1
Fan speed	rpm	680	680	680	680	680
Diameter	mm	800	800	800	800	800
Total air flow	m³/s	106,3	105,2	113,3	114,4	114,4
Evaporator						
Evaporators / water volume	N°/l	1/533	2/254+246	2/246+246	2/246+246	2/392+392
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	219,1	168,3	168,3	168,3	219,1
Condenser coil						
Coil type		Lanced fins – internally spiral wound tubes				
Weight and dimensions						
Standard unit shipping weight	kg	10715	11440	11648	11848	12624
Standard unit operating weight	kg	11291	11900	12158	12358	13516
Unit length	mm	12800	12800	13670	13670	13670
Unit width	mm	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.

Electrical data ALS F XE XN HFC 134a

Unit size		178.2	196.2	212.2	229.2	241.2
Standard voltage (1)		400 V – 3f – 50 Hz				
Nominal unit current (2)	A	403	428	459	490	484
Max compressor current (3)	A	443	470	510	550	547
Fans current	A	22	24	26	28	28
Max unit current (3)	A	465	494	536	578	575
Max unit inrush current (4)	A	796	815	817	843	843
Max unit current for wires sizing (5)	A	516	566	607	648	648

Unit size		258.2	273.2	279.3	296.3	312.3	327.3
Standard voltage (1)		400 V – 3f – 50 Hz					
Nominal unit current (2)	A	472	484	614	633	669	705
Max compressor current (3)	A	528	543	678	705	745	785
Fans current	A	32	32	36	36	40	40
Max unit current (3)	A	560	575	714	741	785	825
Max unit inrush current (4)	A	843	843	971	988	992	1015
Max unit current for wires sizing (5)	A	652	652	801	849	892	931

Unit size		344.3	358.3	392.3	426.4	460.4	495.4	520.4
Standard voltage (1)		400 V – 3ph – 50 Hz						
Nominal unit current (2)	A	729	716	704	918	980	967	1000
Max compressor current (3)	A	825	807	783	1020	1100	1094	1116
Fans current	A	44	44	52	52	56	56	56
Max unit current (3)	A	869	851	835	1072	1156	1150	1172
Max unit inrush current (4)	A	1043	1043	1043	1234	1238	1238	1238
Max unit current for wires sizing (5)	A	974	974	982	1214	1296	1296	1296

- Notes:**
- (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
 - (2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
 - (3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 44°C ambient temp.
 - (4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
 - (5) Compressor FLA + fans current.

Physical data ALS F XE XXN HFC 134a

Unit size		163.2	178.2	196.2	240.3	260.3	279.3	296.3
Cooling capacity (1)	kW	569	631	668	840	914	953	1013
Power input (1)	kW	216	237	264	323	336	361	361
COP		2,64	2,66	2,53	2,61	2,72	2,64	2,80
McQuay Screw compressors	No.	2	2	2	3	3	3	3
Refrigerant circuits	No.	2	2	2	3	3	3	3
Refrigerant charge HFC 134a	kg	106	115	124	159	168	177	186
Oil charge	l	28	28	28	42	42	42	42
Min % of capacity reduction	%	12,5	12,5	12,5	8,3	8,3	8,3	8,3

Condenser fans

No. of fans / nominal power fan	kW	12/0,3	13/0,3	14/0,3	18/0,3	20/0,3	20/0,3	22/0,3
Fan speed	rpm	500	500	500	500	500	500	500
Diameter	mm	800	800	800	800	800	800	800
Total air flow	m ³ /s	30,8	33,3	35,9	46,1	51,3	51,3	56,4

Evaporator

Evaporators / water volume	No./l	1/254	1/246	1/246	1/415	1/402	1/402	1/402
Max operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Water connection diameter	mm	168,3	168,3	168,3	219,1	219,1	219,1	219,1

Condenser coil

Coil type	Lanced fins – internally spiral wound tubes							
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Weight and dimensions

Standard unit shipping weight	kg	5659	5900	6030	8725	9310	9310	9750
Standard unit operating weight	kg	5864	6150	6280	9150	9720	9720	10160
Unit length	mm	6210	7110	7110	9200	10100	10100	11000
Unit width	mm	2230	2230	2230	2230	2230	2230	2230
Unit height	mm	2520	2520	2520	2520	2520	2520	2520

Note: (1) Cooling capacity and power input are based on 12/7 °C entering/leaving water temp. and 35°C air ambient temp.
Power input is for compressor only.

Electrical data ALS F XE XXN HFC 134a

Unit size		163.2	178.2	196.2	240.3	260.3	279.3	296.3
Standard voltage (1)		400 V – 3ph – 50 Hz						
Nominal unit current (2)	A	392	420	444	585	604	636	652
Max compressor current (3)	A	416	447	474	618	640	678	705
Fans current	A	12	13	14	18	20	20	22
Max unit current (3)	A	428	460	488	636	660	698	727
Max unit inrush current (4)	A	790	791	812	943	945	965	986
Max unit current for wires sizing (5)	A	458	507	556	687	737	785	835

Notes: (1) Allowed voltage tolerance $\pm 10\%$. Voltage unbalance between phases must be within $\pm 3\%$.
(2) Nominal current are based on: 12/7 °C entering/leaving evaporator water temperature and 35°C ambient temp.
(3) Maximum current are based on: 14/9 °C entering/leaving evaporator water temperature and 40°C ambient temp.
(4) Inrush current of biggest compressor + 75 % of nominal absorbed current of the other compressor + fans current.
(5) Compressor FLA + fans current.

Relief Valves

As a safety precaution and to meet code requirements, each chiller is equipped with pressure relief valves located on the coil condenser , evaporator, heat recovery condenser(if supplied) and liquid receiver for the purpose of relieving excessive refrigerant pressure (caused by equipment malfunctioning, fire etc.) to the atmosphere.

Oil Heater

The oil separator is equipped with an immersion electric heater that is installed in a tube tht it can be removed without disturbing the oil or opening the refrigerant circuit.

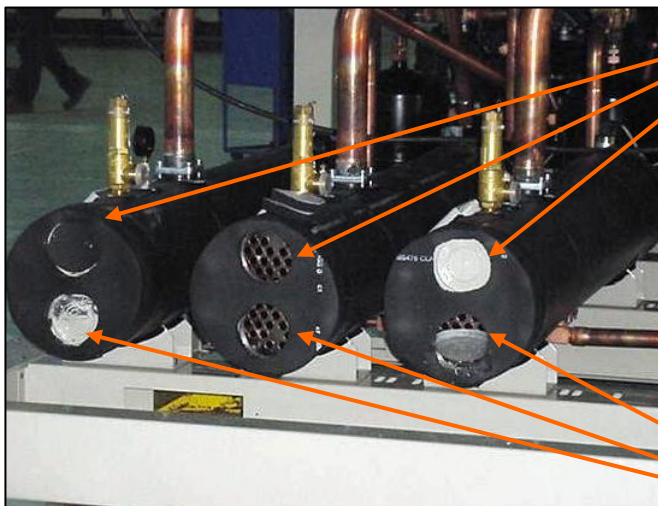
Evaporator water flow and pressure drop

Balance the chilled water flow through the evaporator. The flow rates must fall between the minimum and maximum values. Flow rates below the minimum values shown will result in laminar flow that will reduce efficiency, cause erratic operation of the electronic expansion valve and could cause low temperature cut-out. On the other hand flow rates exceeding the maximum values shown can cause erosion , vibration and may cause the break on the evaporator water connections and tubes. Measure the chilled water pressure drop through the evaporator at field installed pressure taps. It is important not to include valve or strainer pressure drop in these readings. Variable chilled water flow through the evaporator while the compressors are operating is not recommended. Set points are based upon a constant flow and variable temperature.

Heat Recovery Condenser water flow and pressure drop

Heat recovery condensers are supplied without the headers connection on both water side, entering and leaving. These Headers must be provided by the installer locally , including the wells pockets for microprocessor control sensors.

Balance the hot water flow through the heat recovery condenser. The flow rates must fall between the minimum and maximum values. Flow rates below the minimum values shown will result in laminar flow that will reduce efficiency, cause erratic operation of the unit and could cause high pressure cut-out. On the other hand flow rates exceeding the maximum values shown can cause erosion on the condenser water connections and tubes. Measure the hot water pressure drop through the condenser at field installed pressure taps. It is important not to include header, valve or strainer pressure drop in these readings. Variable hot water flow through the condenser while the compressors are operating is not recommended. Set points are based upon a constant flow and variable temperature.



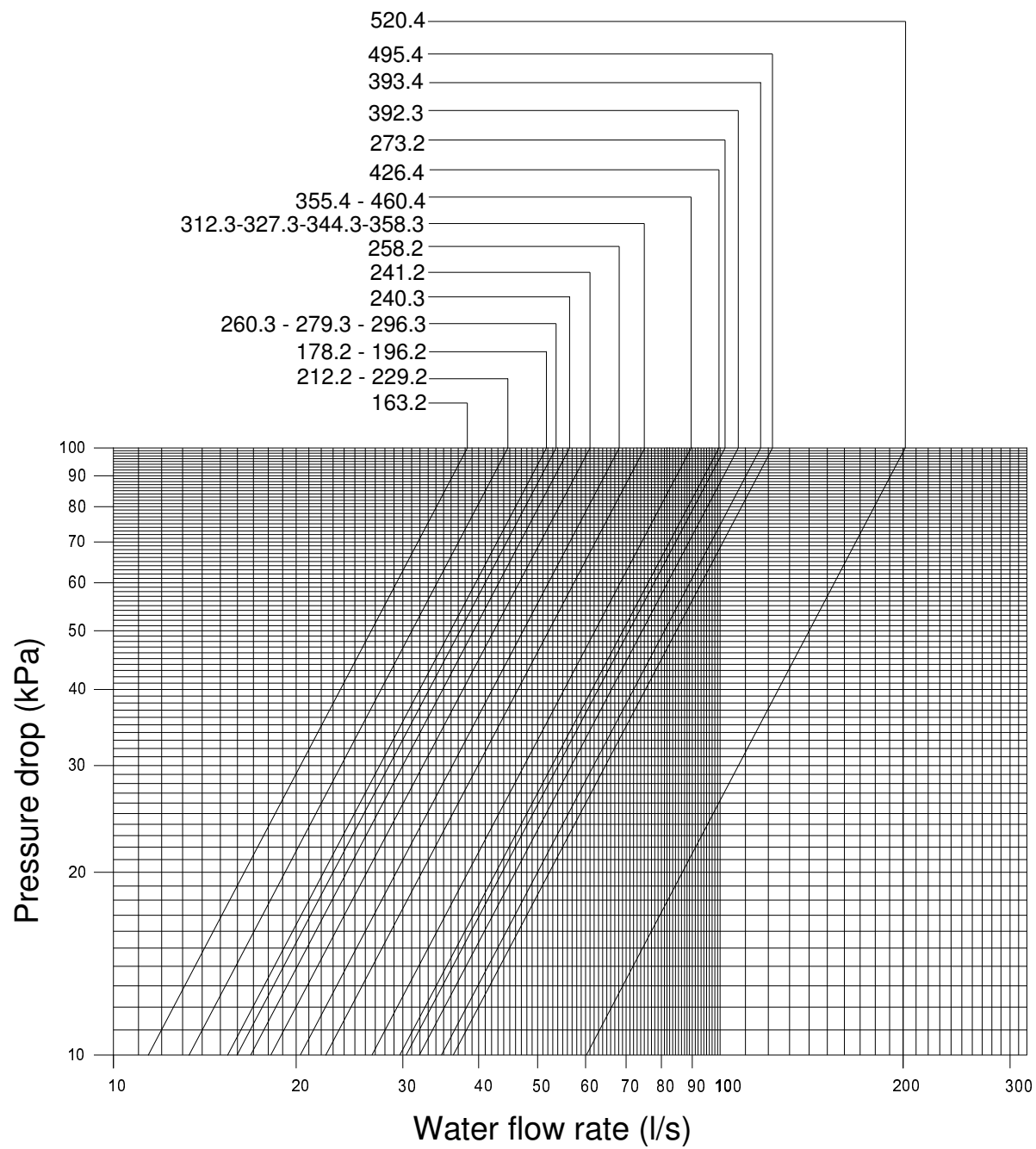
Leaving Connections

Installer must provide the Headers between the heat recovery condenser to have only one supply water connection and one return water connection

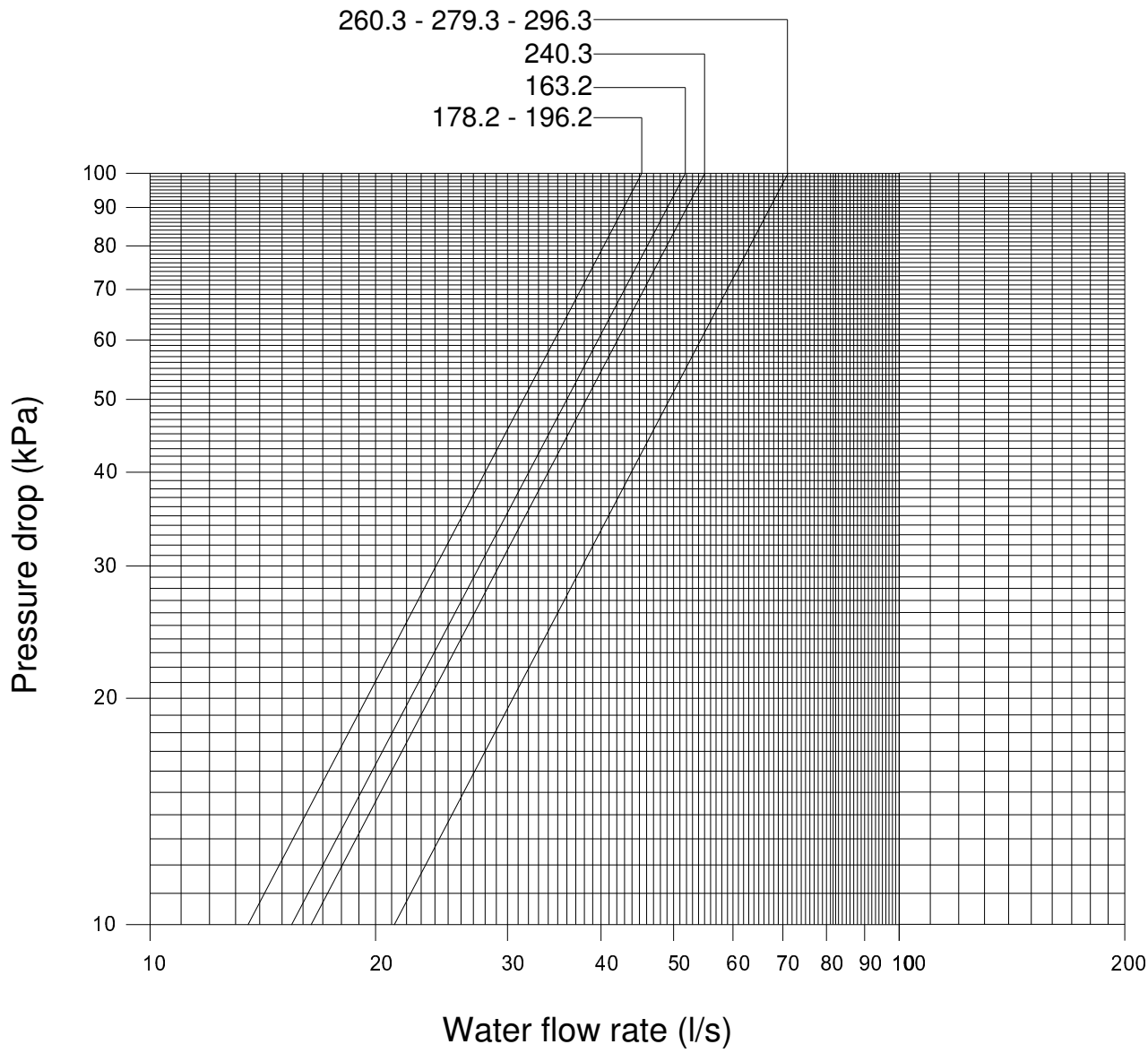
Entering Connections

Heat Recovery Condensers

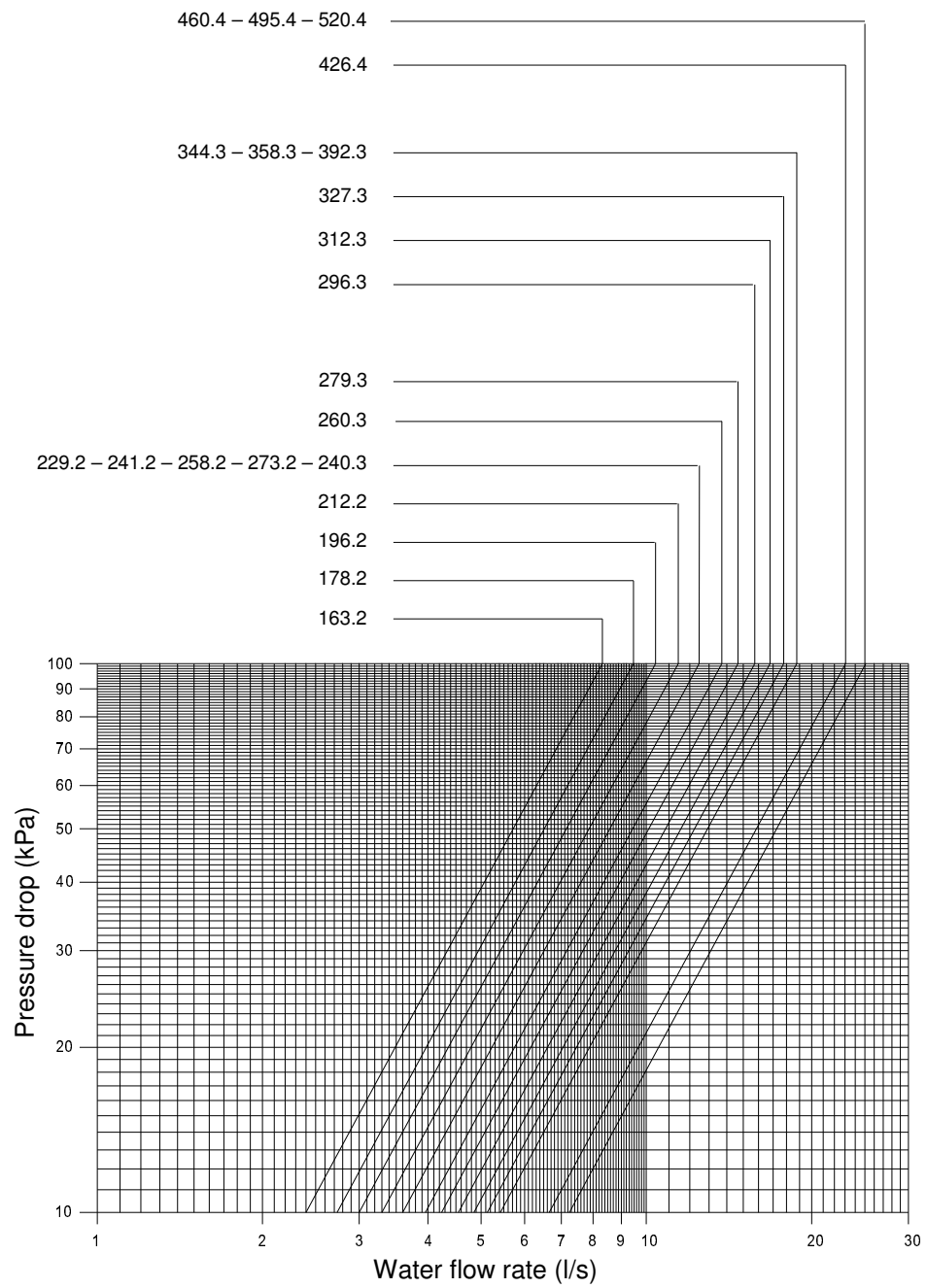
Evaporator pressure drop
ALS F SE ST, LN, XN, XXN - ALS F XE ST, LN, XN



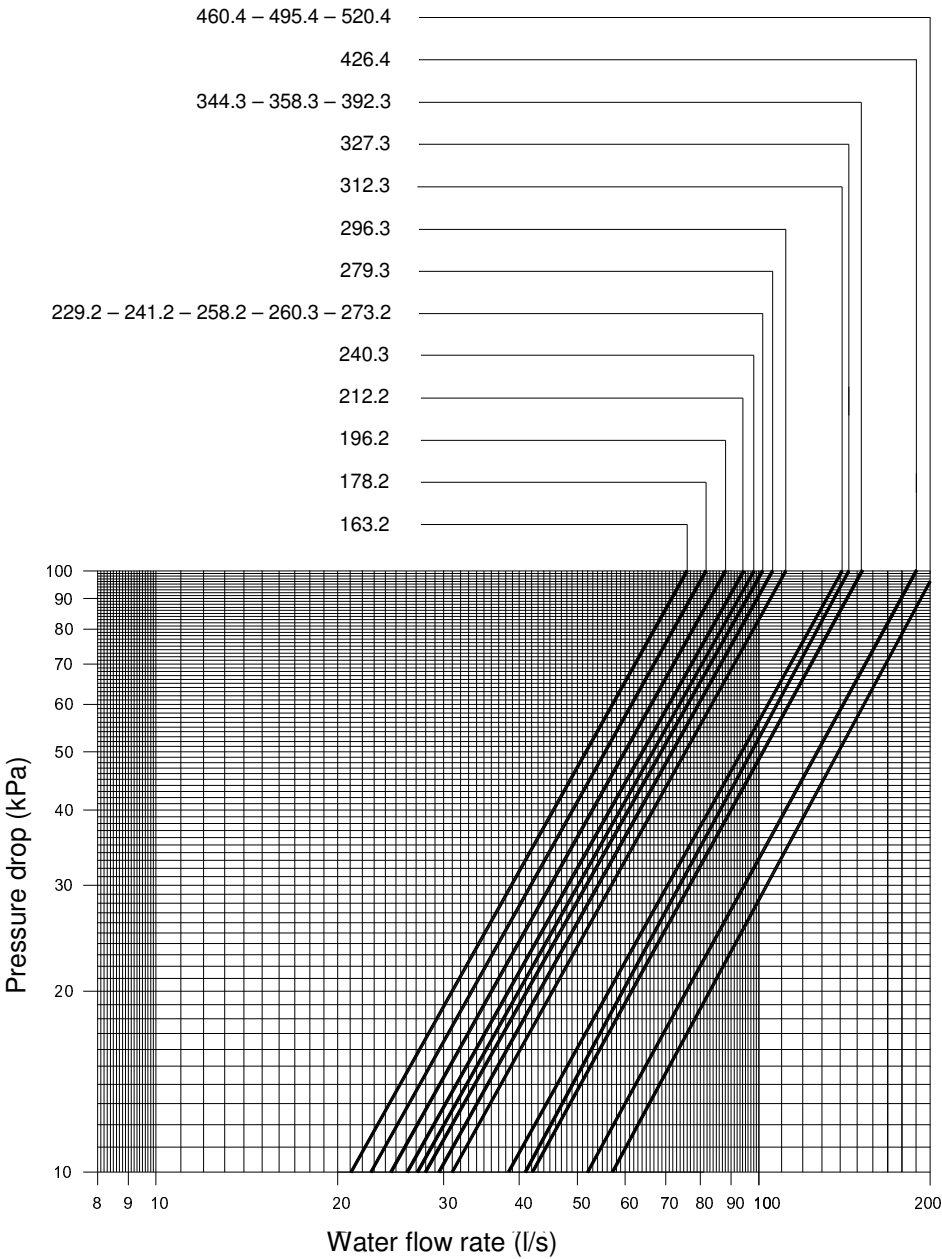
Evaporator pressure drop
ALS F XE XXN



Pressure drop for partial heat recovery
ALS F 163.2 ÷ 520.4



Pressure drop for total heat recovery
ALS F SE ST, LN, XN, XXN - ALS F XE ST, LN, XN



Prestart System Checklist

	Yes	No	N/A
Chilled water			
Piping complete			
Water system filled, vented			
Pump installed,(rotation checked), strainers cleaned			
Controls (3 way valves, face and bypass dampers, bypass valves, etc.) operable			
Water system operated and flow balanced to meet unit design requirements			
Heat recovery Condensers			
Piping and headers complete			
Water system filled, vented			
Temperature sensors installed in the water well pockets			
Pump installed,(rotation checked), strainers cleaned			
Controls (3 way valves, face and bypass dampers, bypass valves, etc.) operable			
Water system operated and flow balanced to meet unit design requirements			
Electrical			
Power leads connected to starter			
All interlock wiring complete between control panel and complies with specification			
Pump starter and interlock wired			
Wiring complies with local codes			
Miscellaneous			
Thermometers wells, thermometers, gauges, control wells, controls, etc., installed			
Minimum system load of 60% of machine capacity available for testing and			
Adjusting controls			

Note: This check list must be completed and sent to the local McQuay service location two weeks prior to start-up.

Operation

Operator Responsibilities

It is important that the operator become familiar with the equipment and the system before attempting to operate the chiller. In addition to reading this manual, the operator should study the operating manual Control Panel Microtech II "C" Plus OM 101C (latest edition) and the electrical wiring diagram furnished with the unit before starting, operating, or shutting it down.

During the initial start up of the chiller the McQuay technician will be available to answer any questions and instruct in the proper operating procedures.

It is recommended that the operator maintain an operating log for each individual chiller unit. In addition, a separate maintenance log should be kept of the periodic maintenance and servicing activities.

If the operator encounters abnormal or unusual operating conditions, it is recommended that a McQuay service technician be consulted.

Refrigeration Cycle

The refrigerant gas, at low pressure, leaving the evaporator enters the screw compressor through the motor winding to cool it. The compressor compresses the refrigerant from low to high pressure and during this phase there is the oil injection to cool, to lubricate and to seal the screw chamber. The effect of the oil injection is that to have a mixture of oil and refrigerant that enter the high efficiency oil separator where by a combined action of centrifugal force and low velocity, both elements are separated.

While the gas is leaving from the top of oil separator, the oil slips down the receiver along the wall and goes back the compressor injection port by the existing differential pressure between the suction and discharge side.

After the oil separator, the high pressure and hot gas crosses the "four way-valve" and according to the unit operation mode, enters inside the air-cooled coil condenser (cooling mode) or heat recovery water condenser (heat recovery mode).

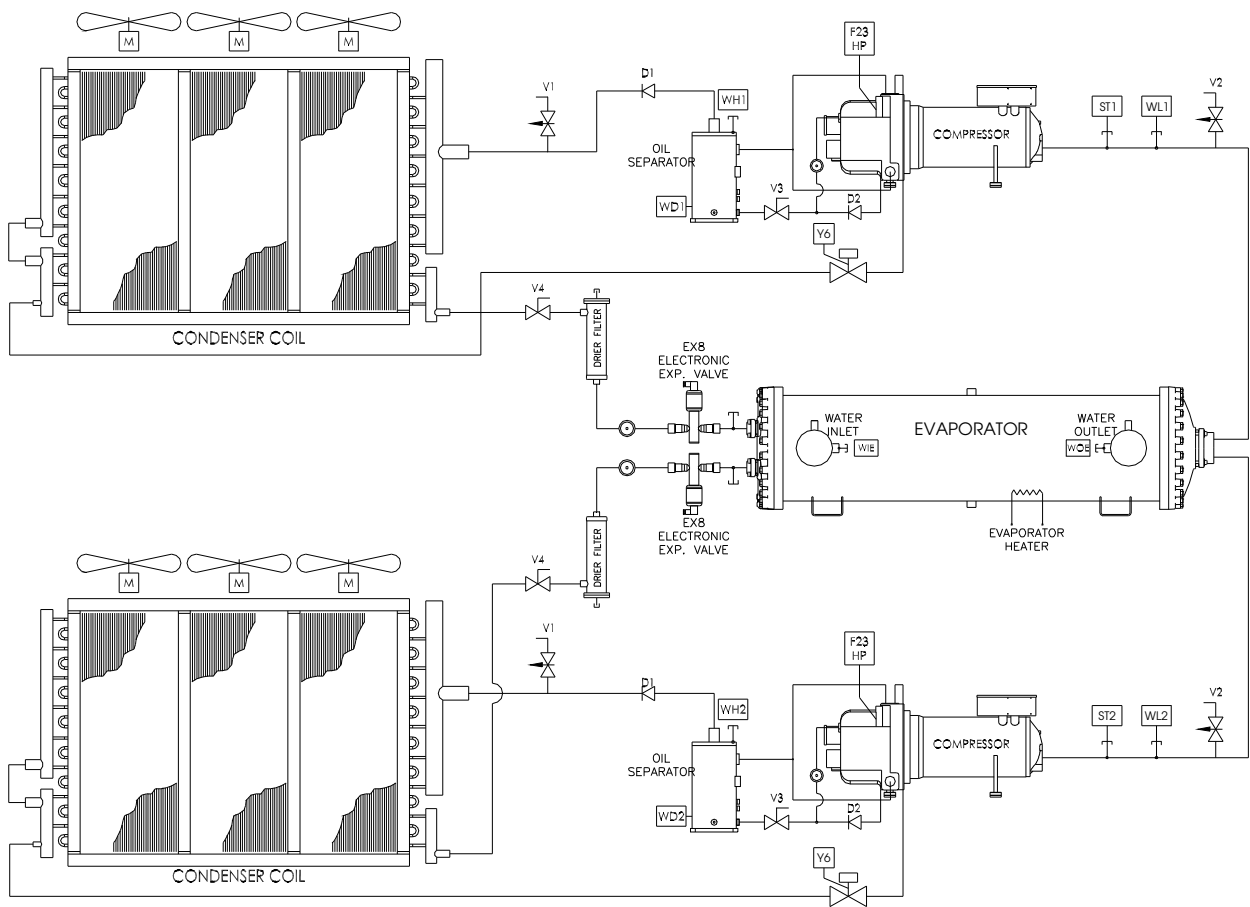
In both heat exchangers the hot gas is cooled by the ambient air in the first case and by the water in the second case changing the status from gas to liquid.

The liquid refrigerant before leaving the condensing section is passing inside the sub-cooler where is cooled below the saturation temperature, to compensate the pressure drops through the liquid line and to increasing the evaporator capacity.

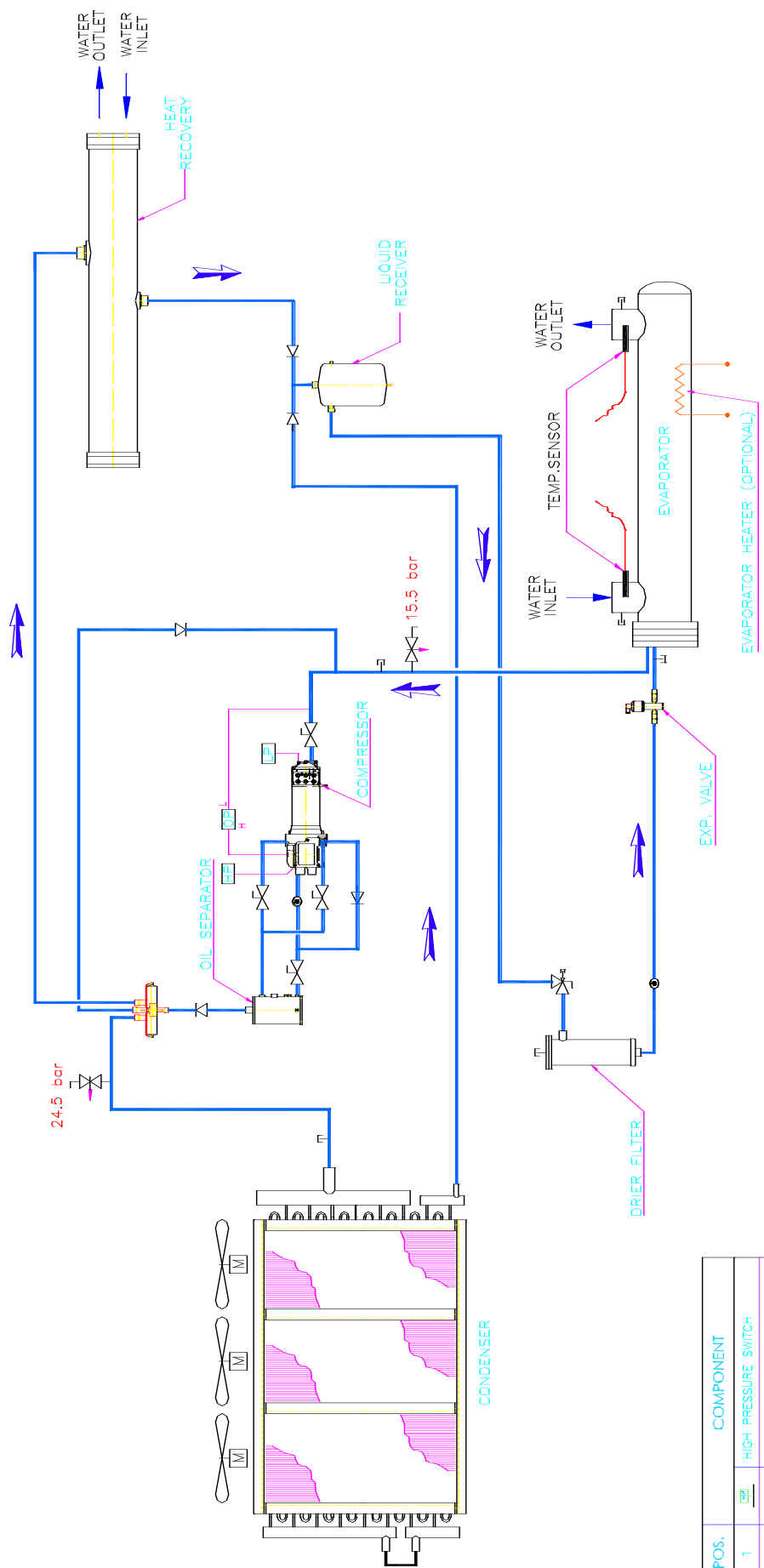
After the sub-cooler the liquid refrigerant enters in the liquid receiver, where the exceeding charge is accumulated during the "cooling mode" in order to compensate the different volume (refrigerant side) between the coil condenser and the heat recovery condenser. The liquid refrigerant passes through the filter dryer, to eliminate eventual particle of humidity, and through the expansion valve where there are the lamination of the refrigerant.

In that situation we have the refrigerant mixture of liquid and gas at low pressure entering the evaporator that absorbs the heat load from chilled water to complete the evaporation and restart the cycle.

Refrigerant circuit – ALS F



Refrigerant circuit – ALS F with Heat Recovery Option



POS.	COMPONENT
1	HIGH PRESSURE SWITCH
2	OIL DIFF. PRESS. SWITCH
3	LOW PRESSURE SWITCH
4	CHECK VALVE
5	SAFETY VALVE
6	2 WAY ANGLE VALVE WITH GAS CHARGE PORT
7	SLIGHT GLASS
8	EXPANSION VALVE
9	2 WAY SHUT-OFF VALVE
10	OIL INJECTION SOLENOID VALVE
11	1/4" SAE FLARE VALVE

MicroTech II C Plus controller

MicroTech II C Plus controller is installed as standard on all the units; it can be used to modify unit set points and check control parameters. A display illustrates the machine's operating status, programmable values and set points e.g. temperatures, and pressures of fluids (water, refrigerant). Device controls maximize the McQuay chillers energy efficiency and reliability characteristics. It uses sophisticated software with predictive logic to select the most energy efficient combination of compressor, EEXV and condenser fan to keep stable operating conditions and maximize energy efficiency. The compressors are automatically rotated to ensure equal operating hours. MicroTech II protects critical components in response to external signals from its system sensors measuring: motor temperatures, refrigerant gas and oil pressures, correct phases sequence and phase loss.

Control section - main features:

- Management of the compressor capacity slide and the EEX valve according to the distributed multiprocessor logic system
- Chillers enabled to work in partial failure condition thanks to the distributed multiprocessor logic system
- Full routine operation at condition of:
 - High ambient temperature value
 - High thermal load
 - High evaporator entering water temperature (start-up)
- Display of evaporator entering/leaving water temperature
- Display of condensing-evaporating temperature and pressure, suction and discharge superheat temperature for each circuit
- Leaving water cooled temperature regulation. Temperature tolerance $\pm 0,1^{\circ}\text{C}$
- Compressors and evaporator/condenser pumps hours counter
- Display of Status Safety Devices
- Start up numbers and compressors working hours equalization
- Excellent management of compressors load
- Cooling tower's fans management according to condensing pressure
- Automatic re-start in case of power supply interruption (adjustable)
- Soft Load
- Return Reset
- AOT Reset (optional)
- Set-point Reset
- Demand limit or Current limit (optional)
- Speedtrol control (optional)

Safety for each refrigerant circuit

High pressure (pressure switch)

Low pressure (pressure switch)

Compressor overload (optional)

Condensation fan Magneto-thermal

High Discharge Temperature on the compressor

Phase Monitor

Star / Delta Transition Failed

Low Delta Pressure between Suction and Discharge

Low pressure ratio

High oil pressure drop

Low oil pressure

System security

Phase monitor

Freeze protection

An evaporator's flow controller input (stops the unit)

Remote on/off input.

Regulation type

Proportional + integral + derivative regulation on the input probe of the evaporator water leaving temperature.

Condensation

The condensation can be carried out according to temperature or pressure. The fans can be managed according to ON/OFF mode or with a 0/10 V modulating signal.

MicroTech II C Plus terminal

The MicroTech II C Plus terminal has following features:

- 4-lines by 20-character liquid crystal display back lighted
- Key-pad consisting of 15 keys " clear language display "
- Memory to protect the data
- General faults alarm led
- 4-level password access to modify the setting
- Service report displaying all running hours and general conditions
- Memorized alarm history to facilitate the fault's analysis.

MicroPlant™:

Solution for: tele-maintenance and supervisory systems

MicroTech II C Plus can be monitored locally or via modem by MicroPlant™ supervision program that runs on PC systems under Windows '95 – '98.

MicroPlant™ is the best solution:

- To centralize all the information in just one local and/or remote PC
- To check all the parameters for each unit connected
- Data logging of temperature - pressure
- Printouts of alarms, parameters and graphs
- To control several plants located in different geographical areas from a central station
- To manage the Service centers

MicroPlant™ allows:

- Visualization of all working conditions for each controller
- Visualization of their graphics
- Display, print-out of the actual alarms
- Connection between local and remote computer via telephone line (Modem)
- Units ON / OFF
- Set point change.

MicroTech II C Plus remote control

Compatibility with supervisory systems is becoming increasingly important in HVAC. MicroTech II C Plus allows easy interfacing with BMS (Building Management Systems), the external world that can be:

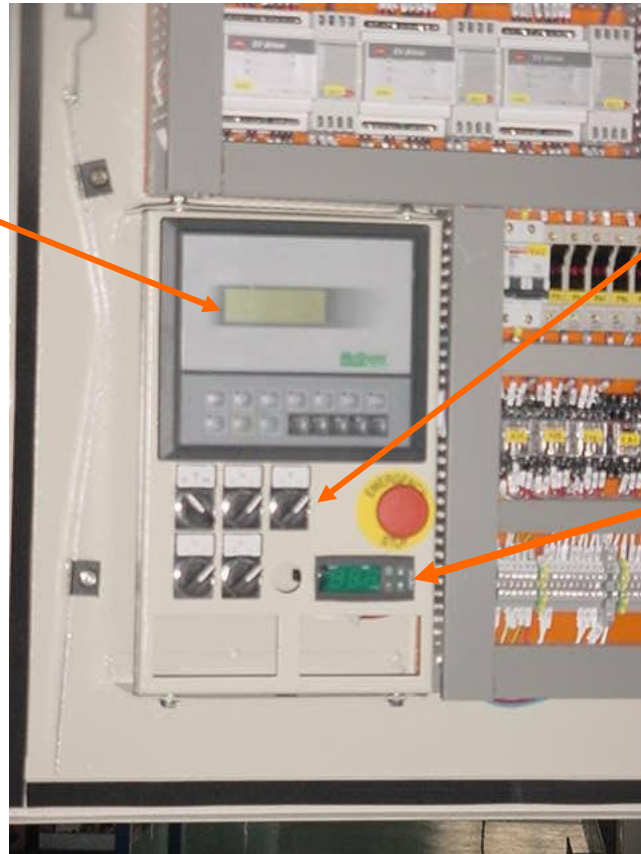
- full compatible Siemens, Johnson;
- every MODBUS compatible system (Satchwell, Honeywell);
- BacNet point to point, ECHELON FTT10 (available on request).

Heat Recovery Microprocessor Control

All the units equipped with the heat recovery water condensers have an additional “microprocessor control” to manage the heat recovery function of the unit .

The microprocessor is installed inside the main control box below the Microtech key pad.(see the picture below)

**Microtech Key Pad
Chiller Operation**



**HEAT RECOVERY
OPERATION**

Switch Selector “Q7”
“0” Cooling Mode
“1” Heat Recovery
Mode

**Heat Recovery
Microprocessor
Control**

Carel type “ IR32”

We use two different models of microprocessor control.

IR32W units with two Heat recovery condensers

IR32Z Units with three or four Heat recovery Condensers

Both models are equipped with the temperature sensors NTC, PT100 to control the entering water temperature to the heat recovery condenser and metering the temperature of leaving hot water .

Temperature sensors are supplied electrically connected to the microprocessor but not installed in the pipes well pocket, the realization of that devices must done locally by the installer.

The identification of the sensors are the following:

“W10” to be installed at the entering of the condenser

“W11” to be installed at the leaving of the condenser

Function

When the selector switch Q7 enable the heat recovery mode, if the sensor “W10” is measuring the hot water temperature value below the set point allow the first step to switch the four-way valve from chiller to heat recovery cycle. If the set point temperature is not achieved the microprocessor control insert all the other steps available according to the number of refrigerant circuits. On the contrary if the water temperature exceed the set point value the microprocessor control switch off the steps until the temperature is inside the band.

Of course it is mandatory that the heat recovery condenser flow switch is on, otherwise the unit never switches on the heat recovery cycle.

The Microprocessor control is normally settled , at the factory, to verify or change the set points see the user manual supplied with the unit.

Heat Recovery Operation

The unit supplied with the heat recovery condensers is equipped with an additional microprocessor (TC10 see electrical wiring diagram) with two, three or four steps to control the hot water temperature, according to the number of the heat exchangers installed on the unit(one step for each compressor). For reference how to set this microprocessor see the Specific manual supplied with the unit. The heat recovery mode is available only if there is the request of cooling load and the capacity is depending from the number of the compressors running and the unloading position of them.

To run the unit in heat recovery mode follow the items listed below:

- 1) Verify the installation of the water flow switch done by the installer and check the electrical connection at M3.426 and M3.427 terminal blocks inside the electrical panel
- 2) Verify the installation of the microprocessor sensor in the pocket well of the water return common header (done by the installer)
- 3) Check the set point of the return water temperature on the display of the microprocessor "TC10" (Carel IR32). Do not exceed the max water temperature allowed (see the operating limits) to avoid the shut-down the unit for high pressure.
- 4) Switch the water pump on
- 5) Switch "ON" the selector "Q7" that allow the unit to run in heat recovery mode. If the microprocessor TC10 is asking for hot water, the 4 ways-valve change the refrigerant circuit from the condenser coil to the heat recovery condenser (first step) and insert the other circuits until the return hot water is matching the set point. In that condition the fan motors of the respective condenser coil are switched "OFF". Vice-versa, when the microprocessor is reducing the steps, the 4 ways-valve change the refrigerant circuit from the heat recovery condenser to the condenser coil and switching on the respective fan motors.
- 6) In case of lack of water in the heat recovery condenser the unit is automatically switched on cooling mode only.

Standard controls

High pressure control

The high pressure switch will shut-down the compressor when the discharge pressure exceeds the setting point value.

Phase/voltage monitor

The phase/voltage monitor is a device which provides protection against three-phase electrical motor loss due to power failure conditions, phase loss, and phase reversal. Whenever any of these conditions occur, a contact opens to the microprocessor which then de-energizes all inputs. When proper power is restored, contacts close and microprocessor enables compressors for operation. When three-phase power has been applied, the output relay should close and the "run light" should come on. If the output relay does not close, perform the following tests:

1. Check the voltages between L1-L2, L1-L3 and L2-L3 (L1, L2, L3 are the three phases). These voltages should be approximately equal and within + 10% of the rated three-phase line-to-line voltage.
2. If these voltages are extremely low or widely unbalanced check the power system to determine the cause of the problem.
3. If the voltages are good, using a phase tester, verify that phases are in A, B, C sequence for L1, L2 and L3. Correct rotation is required for compressor operation. If required to do so by phase sequence, turn off the power and interchange any two of the supply power leads at the disconnect main switch. This may be necessary as the phase voltage monitor is sensitive to phase reversal. Turn on the power. The output relay should now close after the appropriate delay.

Heat Recovery Microprocessor Set-up

The unit supplied with the heat recovery condensers is equipped with an additional microprocessor (TC10 see electrical wiring diagram) with two, three or four steps to control the hot water temperature, according to the number of the heat exchangers installed on the unit (one step for each compressor). For reference how to set this microprocessor see the Specific manual supplied with the unit.

We report below the most important set-up values, for references see the microprocessor manual.

ITEM	Description	Set Point
St1	Inlet water temperature set point	Max 50
St2		N/A
CO	Operating Mode	1
P1	Differential Set point	2
P2		N/A
C4	Authority	0.5
C5		1
C6		0
C7		3
C8		5
C9		0
C10		0
C11		0
C12		20"
C13		1
C14		0
C15		0
C16		100
C17		5
C18		0
C19		0
C21		30
C22		43
C23		N/A
C24		N/A
P25		8
P26		55
P27		2
P28		20
C29		4
C30		N/A
C31		0
C32		1
C33		0
C50		4
C51		0

System Maintenance

General

To ensure proper operation at peak capacity and to avoid damage to package components, a program of periodic inspections should be set up and followed. The following items are intended as a guide and are to be used during inspection and must be combined with sound coming from compressor and electrical practices to ensure trouble-free performance. The liquid line sightglass indicator on all circuits must be checked to be sure the glass is full and clear. If the indicator shows that a wet condition exists and/or there are bubbles in the glass, even with a full refrigerant charge, the filter-drier element must be changed.

Compressor maintenance

The screw Frame 4 compressor does not require frequent maintenance. However, vibration test is an excellent check for proper mechanical operation. Compressor vibration is an indicator of the requirement for maintenance and contributes to a decrease in unit performance and efficiency. It is recommended that the compressor be checked with a vibration analyser at or shortly after start-up and again on an annual basis. When performing the test the load should be maintained as closely as possible to the load of the original test. The vibration analyser test provides a fingerprint of the compressor and when performed routinely can give a warning of impending problems. The compressor is supplied with a cartridge oil filter. It is a good policy to replace this filter anytime the compressor is opened for servicing.

Electrical control

Warning: Electric shock hazard. Turn off all electrical power supplies before continuing with following service.

Caution: It is necessary to de-energise the complete electrical panel, including crankcase heater, before doing any servicing inside.

Prior to attempting any service on the control centre it is advisable to study the wiring diagram so that you understand the operation system of the water chiller. Electrical components do not require particular maintenance other than a monthly tightening of cables.

Warning: The warranty becomes void if the wiring connection to the unit is not in accordance with the specification. A blown fuse or tripped protector indicates a short ground or overload.

Before replacing the fuse or restarting the compressor, the problem must be found and corrected. It is important to have a qualified electrician to service this panel. Unqualified tampering with the controls can cause serious damage to equipment and void the warranty.

Refrigerant sight-glass

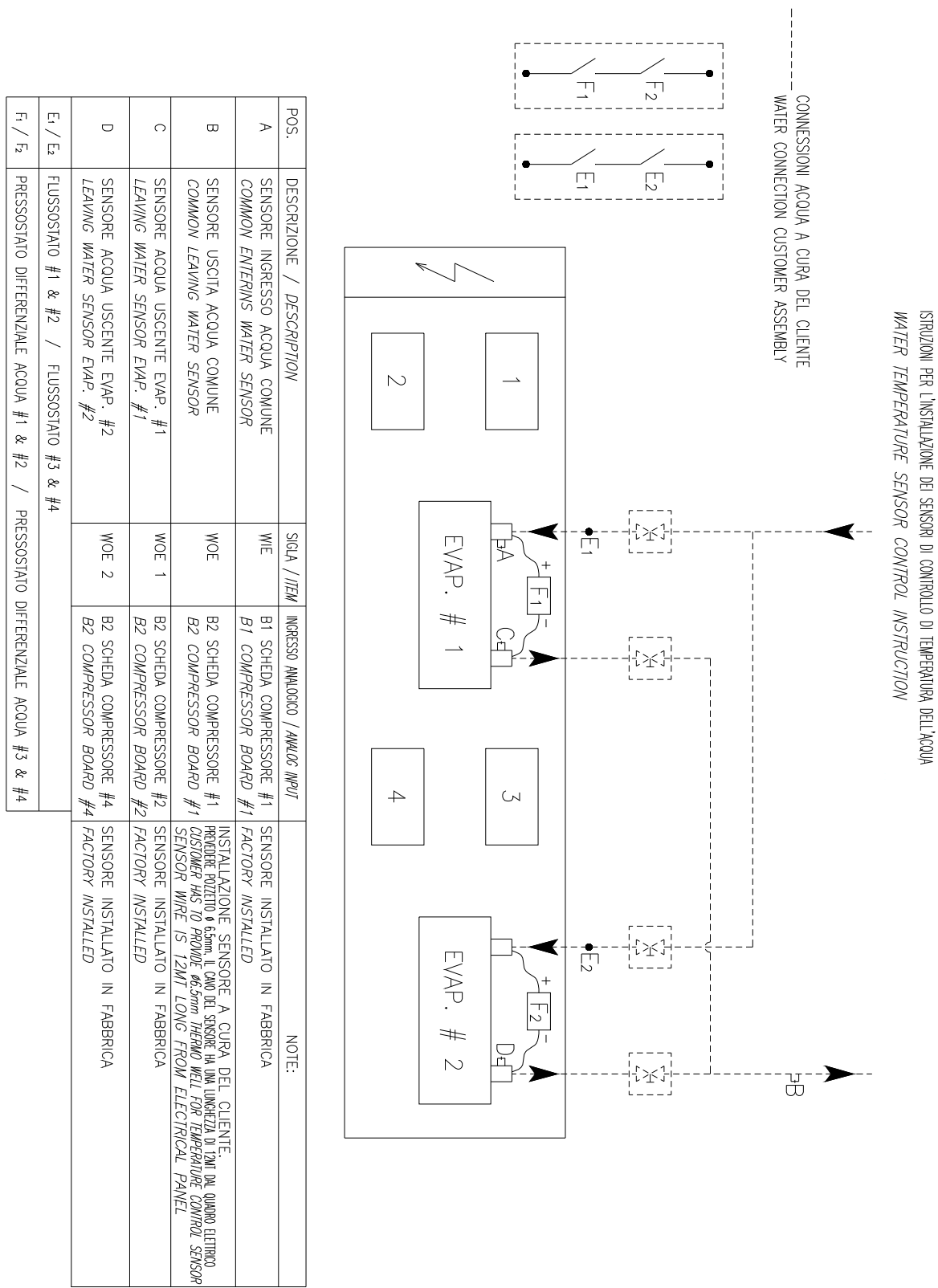
The refrigerant sight-glasses should be observed periodically (a weekly observation should be adequate). A clear liquid sight-glass indicates the right refrigerant charge in the system to insure proper feed through the expansion valve. Bubbling refrigerant in the sight-glass, during stable run conditions, indicates that the system may be short of refrigerant charge. Refrigerant gas flashing in the sight-glass could also indicate an excessive pressure drop in the liquid line, possibly due to a clogged filter-drier or a restriction elsewhere in the liquid line. If sub-cooling is low add charge to clear the sight-glass. If sub-cooling is normal and flashing is visible in the sight-glass replace the filter-drier. An element inside the sight-glass indicates the moisture condition corresponding to a given element colour. If the sight-glass does not indicate a dry condition after about 3 hours of operation, the unit should be pumped down and the filter-driers changed.

The following table is a guide to determine the dry or wet condition of the system:

COLOUR	MEANS
Green (Sky Blue)	Dry
Yellow (Pink)	Wet

Evaporator

The units are supplied with optimised counter-flow evaporator, single refrigerant pass. It is direct expansion (2 evaporators for units with 4 compressors) with refrigerant inside the tubes and water outside (shell side) with carbon steel tube sheets, with straight copper tubes that are spirally wound internally for higher efficiencies, expanded on the tube plates. The external shell, is linked with an electrical heater to prevent freezing to -28 C ambient temperature, energised by a thermostat and is covered with a closed cell insulation material. Each evaporator has 2 or 3 refrigerant circuits one for each compressor. Each evaporator is manufactured in accordance to PED approval. Normally no service work is required on the evaporator.



Filter-dryers

A replacement of the filter-drier is recommended during scheduled service maintenance of the unit when bubbles occur in the sight-glass with normal sub-cooling temperature. The filter-drier should also be changed if the moisture indicator in the sight-glass indicates excess moisture by the wet system colour indicators. During the first few months of operation the filter-drier replacement may be necessary if you have bubbles in liquid line as explained before. Any residual particles from the unit working process, compressor and miscellaneous components are swept by the refrigerant into the liquid line and are caught by the filter-drier.

To change the filter drier, close the manual liquid line shutoff valve, pump the unit down by opening the switches Q1, Q2 (ON/OFF switches compressors) in "off" position.

Move the ON/OFF switch unit Q0 to the "off" position.

Close the suction line valve. Remove and replace the filter-drier. Evacuate the liquid line through the manual shutoff valve removing non-condensable that may have entered during filter replacement.

Open the suction line valve; open the manual liquid line of shutoff valve. A leak check is recommended before returning the unit to operation.

Electronic expansion valve

ALS F air-cooled chiller is equipped with the most advanced electronic expansion valve to achieve precise control of refrigerant mass flow. As today's system requires improved energy efficiency, tighter temperature control, wider range of operating conditions and incorporate features like remote monitoring and diagnostics, the application of electronic expansion valves becomes mandatory. ALS F electronic expansion valve proposes features that makes it unique: short opening and closing time, high resolution, positive shut-off function to eliminate use of additional solenoid valve, highly linear flow capacity, continuous modulation of mass flow without stress in the refrigerant circuit and corrosion resistance stainless steel body.

Heat Recovery Condensers

Condensers are shell and clearable, through-tube types. Standard configuration is 2 passes. The unit has independent exchangers, one per circuit completely assembled. Each heat recovery condenser has a carbon steel and seamless, integrally finned high efficiency copper tubes, roll expanded into heavy carbon steel tube sheets. Water heads are removable and include vent and drain plugs. Condensers are equipped spring loaded relief valves.

Condenser is designed to comply with PED. Waterside working pressure is designed for 10.5 bar. Standard configuration on water connection side is 2 passes.

The installer has to supply the water header connection for all heat recovery condensers installed on the unit, both at the entering and leaving water connections and provide the flow switch. All the heat recovery condenser must be connected together in parallel. At the entering water pipe, must be installed the temperature sensor, supplied spare with the unit, to control the heat recovery cycle.

Condenser coil fans

The condenser fans are helical types with wing-profile blades to achieve a better performance. The direct coupling with the electrical motor reducing vibrations caused by the functioning. The three-phase type motors are supplied as standard with IP54 protection (Insulation class F); they are protected against overloading and short circuits by circuit breakers located inside the electrical control panel.

Air-cooled condenser (Condensing coil)

The condensing coils are constructed with internally enhanced seamless copper tubes arranged in a staggered row pattern and mechanically expanded into McQuay lanced and rippled aluminum condenser fins with full fin collars. An integral sub-cooler circuit provides sub-cooling to effectively eliminate liquid flashing and increases in cooling capacity without increasing the power input.

No maintenance is ordinary required except the occasional removal of dirt and debris from the outside surface of the fins. McQuay recommends the use of foaming coil cleaners available at air conditioning supply outlets. Use caution when selecting such cleaners as some may contain potentially harmful chemical. Care should be taken not to damage the fins during cleaning.

Lubricating oils

Besides lubricating the bearing and other moving parts, the oil has the equally important task of sealing the clearances between the rotors and other potential leakage paths thereby improving pumping efficiency; the oil also assists in dissipating the heat of compression. The amount of oil injected is therefore well in excess of that required for lubrication alone. To reduce the oil circulation in the refrigerant circuit, the oil separator is installed on the compressor discharge line

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

The oil pressure transducer monitors the oil injection pressure on the compressor. If the oil pressure value is below the setting point inside the microprocessor control the compressor stops.

The oil pressure is generated by discharge pressure, a minimum discharge pressure must be maintained; this minimum pressure increases, as the suction pressure increases in order to maintain the pressure difference required.

Crankcase and oil separator heaters

The function of the Oil separator heaters is to prevent oil dilution with refrigerant during compressor shutdown, which would cause foaming and consequent reduction in lubricating oil flow to the moving parts. Electric heaters are energised every time the compressors shuts-down.

Warning: Verify if the heaters have been energised at least 12 hours, prior the start-up.

Refrigerant

Refrigerant charging

ALS F air cooled screw chillers are shipped factory charged with a full operating charge of refrigerant but there may be times that a unit must be recharged at the jobsite. Follow these recommendations when field charging. Refer to the unit operating charge found in the physical data tables on pages from 9 to 15 according to the version of the unit, chiller or heat recovery. The optimum charge is the charge which allows the unit to run with no flashing in the liquid line at all operating conditions. When the liquid line temperature does not drop with the addition of 2,0-4,0 Kg of charge and the discharge pressure goes up 20-35 kPa then the sub-cooler is nearly full and proper charge has been reached. Unit can be charged at any steady load condition, at any outdoor ambient temperature. Unit must be allowed to run 5 minutes or longer so that the condenser fan staging is stabilized at normal operating discharge pressure. For best results charge the unit with 2 or more condenser fans operating per refrigerant.

In case of moisture is noticed in the system, through the moisture indicator, the system must be evacuated to eliminate the cause of trouble. After the trouble solved, the system must be dried by making an almost perfect vacuum. For this purpose, a displacement vacuum pump should be used.

When the system has been opened for extensive repairs, as for an overhaul, it is advisable to use the method of the evacuation as follows:

1. Evacuate the refrigerant system by the vacuum pump reaching the value of 200 Pa (1,5 mm Hg).
2. Break the vacuum with nitrogen until the atmospheric pressure is reached.
3. Repeat operation 1 and 2 for two times.
4. Evacuate the refrigerant system reaching the value of 66,5 Pa.

The dry nitrogen, used to break the vacuum will absorb any moisture and air left in the system, and they will be almost completely removed by the three evacuations. If burnt oil or sludge are found in the refrigerant circuit (caused by the compressor motor burn-out), before the vacuum operation it will be necessary to carefully clean the system using the filter dryer clean-out method; which basically involves the use of special filter dryers including a suitable desiccant in both the liquid and suction lines.

Excessive refrigerant losses can also cause leak of oil from the system. Check the oil level during operation and ensure that oil is visible in the top sight-glass of the oil separator.

1. If the unit is slightly undercharged the unit will show bubbles in the sight-glass. Recharge the unit.
2. If the unit is moderately undercharged the unit will most likely trip on freeze protection. Recharge the unit as described in the charging procedure below.

Procedure to charge a moderately undercharged ALS F unit

1. If a unit is low on refrigerant you must first determine the cause before attempting to recharge the unit. Locate and repair any refrigerant leak. Evidence of oil is a good indicator of leakage however, oil may not be visible at all leaks. Liquid leak detector fluids work well to show bubbles at medium size leaks but electronic leak detector may be needed to locate small leaks.
2. Add the charge to the system through the valve on evaporator entering pipe between the expansion valve and the evaporator head. Follow the procedure reported on "Refrigerant charging".
3. The charge can be added at any load condition.

Charging the refrigerant

1. Connect the refrigerant bottle with a filling pipe to the filling valve on the evaporator head. Before firmly tightening the refrigerant bottle valve, open it and force the air out from the filling pipe. Tighten the charging valve connection and fill the refrigerant.
2. When the refrigerant stops to enter the system, start the compressor and complete the refrigerant charge.
3. If you do not know how much refrigerant has to be added, shut off the bottle valve every 5 minutes and continue to charge the refrigerant until the sight glass is clear and free from bubbles.

Note: Do not discharge the refrigerant into the atmosphere. To recover it, use empty, clean and dry bottles. The liquid refrigerant recovery can be made through the valve provided on the condenser coil sub-cooler outlet. To facilitate the recovery of refrigerant, put the bottle inside a container full of ice; avoid excessive filling of the bottle (70÷80% max).

Preventive maintenance schedule

Operation Ref. No.	TYPE OF OPERATION	SCHEDULE			
		Weekly	Monthly	Six- Monthly	Yearly
1	Reading and recording of suction pressure	X			
2	Reading and recording of discharge pressure	X			
3	Reading and recording of supply voltage	X			
4	Reading and recording of current intensity	X			
5	Check refrigerant charge and possible moisture in the circuit refrigerant through the liquid sight glass	X			
6	Check the suction temperature and the superheating		X		
7	Check setting and operation of safety devices		X		
8	Check setting and proper operation of control devices			X	
9	Inspect the condenser for possible scaling or damages				X

Start-up and shut-down

Start-up

- Verify that all shut-off valves are open.
- Prior to starting the unit, open the water circulation pump(s) and regulate the flow through the evaporator and through the heat recovery condensers (if supplied) in accordance to the setting conditions of the unit. If in the water system is not available the flow meter, the practice suggests to fix the water flow as first step by reaching the differential pressure drops values at the entering/leaving connections of the heat exchangers as reported on the diagram pressure drops. The final set up will be done, when the unit is running, adjusting the water flow to reach the water "ΔT" at full load.
- Verify that the evaporator inlet and outlet water temperature sensors indicate the same temperature or the difference between them and the thermometer does not exceed 0,1 °C.
- Verify that the inlet water temperature sensors of the heat recovery condenser (if supplied) has been installed in a well pocket on the common pipe and indicate the same temperature or the difference between it and the thermometer does not exceed 0,1 °C.
- Verify that the flow switch(es) is(are) connected to the electrical panel at the terminal blocks M3.8 – M3.23 for the evaporator and M3.426 – M3.427 for heat recovery condensers (if supplied)
- Verify the electrical power connection to the electrical panel and put in "OFF" position all the switches. Switch "ON" the main switch isolator "Q10" and the selector "Q12" . In this way the electric heaters of the compressors and the oil separators are energised.
- Check if the software installed on the microprocessor is corresponding to the unit type and the set point are correct. See the Microtech II "C" Plus operating manual 101C for instruction
- Turn the selector switch Q0 in position " Local ". For normal unit operation condition, if the unit is handled by remote place switch Q0 in position "remote".
- Push the "on/off" button on the keypad and wait for the green light on.
- Before turn the Q1 selector to ON position, check that the Q10 and Q12 has been switched ON at least 12 hours before. The controller , if there is a cooling load demand, will start the corresponding compressor. Repeat the sequence for Q2,Q3, Q4 selectors according to the number of compressors installed.

Operational Shut-down

- Push the “On/Off” button on the keypad, or by remote switch, to de-energise the unit, green light become off, all the compressors will carry out its pump-down cycle and then stop.
- Switch off the water pumps

Seasonal Shut-down

- Turn the Q1 selector to Off position. The compressor will carry out its pump-down cycle and then stop.
- Repeat the sequence for all the selectors Q2, (Q3 and Q4) to stop all the other compressors.
- Switch the “Q0” selector from “Local” to off position.
- Push the “On/Off” button on the keypad to de-energise the unit, green light become off.
- Open the circuit breaker Q12 to stop the auxiliary circuit.
- Open the main switch Q10 to remove the power supplier to the unit. In this condition the oil electric heater is off. When you restart the unit before switching on the compressors wait at least 12 hours to heat the oil.
- Close the shut-off valves of the refrigerant circuits.
- Switch off the water pumps
- Empty the water heat exchangers or fill them with glycol for freeze protection.

Maintenance Shut-down

- Turn the Q1 selector to Off position. The compressor will carry out its pump-down cycle and then stop.
- Repeat the sequence for all the selectors Q2, (Q3 and Q4) to stop all the other compressors.
- Switch the “Q0” selector from “Local” to off position.
- Push the “On/Off” button on the keypad to de-energise the unit, green light become off.
- Open the circuit breaker Q12 to stop the auxiliary circuit.
- Open the main switch Q10 to remove the power supplier to the unit. In this condition the oil electric heater is off. When you restart the unit before switching on the compressors wait at least 12 hours to heat the oil.
- Close the shut-off valves of the refrigerant circuits.
- Switch off the water pumps
- Service the unit accordingly to the program

In warranty return material procedure

Material may not be returned except by permission of McQuayService department. A "Return Goods" tag will be included with the returned material to expedite handling at our factory. Return of the parts does not constitute an order for replacement. Therefore, a purchase order must be entered through our nearest Sales Representative. The order should include part name, part number, model number and serial number of the unit involved. After McQuay inspection of the returned part, if the failure is due to faulty material or workmanship, credit will be issued on the customer's purchase order. All defective parts shall be returned to McQuay factory, transportation charges prepaid.

Service & replacement parts

Always report the model number, acknowledgement number and the unit serial number stamped on the nameplate, whenever ordering maintenance service or replacement parts.

When order the replacement parts, state the installing date of the machine and the date of the failure. For an exact definition of the replacement part requested, make reference to the relative code number or, failing that, attach a description of the part being requested.

Troubleshooting chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not run	<ol style="list-style-type: none"> 1. Main power switch open. 2. Unit system switch open. 3. Circuit switch in pump-down position. 4. Evaporator flow switch not closed. 5. Circuit breakers open. 6. Fuse blown or circuit breakers tripped. 7. Unit phase voltage monitor not satisfied. 8. Compressor overload tripped. 9. Defective compressor contactor or contactor coil. 10. System shut down by safety devices. 11. No cooling required. 12. Motor electrical trouble. 13. Loose wiring. 	<ol style="list-style-type: none"> 1. Close switch. 2. Check unit status on Control Panel. Close switch. 3. Check circuit status on Control Panel. Close switch. 4. Check unit status on Control Panel. Close switch. 5. Close circuit breakers. 6. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Check for loose or corroded connections. Reset breakers or replace fuses after fault is corrected. 7. Check unit power wiring to unit for correct phasing. Check voltage. 8. Overloads are manual reset. Reset overload at button on overload. Clear alarm on Microprocessor. 9. Check wiring. Repair or replace contactor. 10. Determine type and cause of shutdown and correct problem before attempting to restart. 11. Check control settings. Wait until unit calls for cooling. 12. See 6, 7, 8 above. 13. Check circuits for voltage at required points. Tighten all power wiring terminals.
Compressor Overload Relay Tripped or Circuit Breaker Trip or Fuses Blown	<ol style="list-style-type: none"> 1. Low voltage during high load condition. 2. Loose power wiring. 3. Power line fault causing unbalanced voltage. 4. Defective or grounded wiring in the motor. 5. High discharge pressure. 	<ol style="list-style-type: none"> 1. Check supply voltage for excessive voltage drop. 2. Check and tighten all connections. 3. Check supply voltage. 4. Check motor and Replace if defective. 5. See Corrective steps for high discharge pressure.
Compressor noisy or vibrating	<ol style="list-style-type: none"> 1. Compressor internal problem 2. Oil injection not adequate. 	<ol style="list-style-type: none"> 1. Contact McQuay 2. Contact McQuay.
Compressor will not load or unload	<ol style="list-style-type: none"> 1. Defective capacity control. 2. Unloader mechanism defective. 3. Control solenoids defective. 	<ol style="list-style-type: none"> 1. See capacity control section. 2. Replace. 3. Replace.

Troubleshooting chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
High discharge pressure	<ol style="list-style-type: none"> 1. Discharge shutoff valve partially closed. 2. Non condensable in the system. 3. Fans not running. 4. Fan control out of adjustment. 5. Heat recovery condensers dirty 6. System overcharged with refrigerant. 7. Dirty condenser coil. 8. Air re-circulation from outlet into unit coils. 9. Air restriction into unit. 	<ol style="list-style-type: none"> 1. Open shutoff valve. 2. Purge the non condensable from the condenser coil after shutdown. 3. Check fan fuses and electrical circuits. 4. Check that unit set-up in Microprocessor matches the unit model number. Check Microprocessor condenser pressure sensor for proper operation. 5. Clean the condenser tubes by mechanical or chemical tools 6. Check for excessive sub-cooling. Remove the excess charge. 7. Clean the condenser coil. 8. Remove the cause of re-circulation. 9. Remove obstructions near unit.
Low discharge pressure	<ol style="list-style-type: none"> 1. Wind effect at low ambient. 2. Condenser fan control not correct. 3. Low suction pressure. 4. Compressor operating unloaded. 	<ol style="list-style-type: none"> 1. Protect unit against excessive wind into vertical coils. 2. Check that unit set-up in Microprocessor matches the unit model number. 3. See Corrective Steps for low suction pressure. 4. See Corrective Steps for failure to load.
Low suction pressure	<ol style="list-style-type: none"> 1. Inadequate refrigerant charge quantity. 2. Evaporator dirty. 3. Clogged liquid line filter-drier. 4. Expansion valve malfunctioning. 5. Insufficient water flow to evaporator. 6. Water temperature leaving evaporator is too low. 7. Evaporator head ring gasket slippage. 	<ol style="list-style-type: none"> 1. Check liquid line sight-glass. Check unit for leaks. 2. Clean chemically. 3. Replace 4. Check expansion valve superheat and valve opening position. Replace valve only if certain valve is not working. 5. Check water pressure drop across the evaporator and Adjust the flow. 6. Adjust water temperature to higher value. 7. Low suction pressure and low superheat both present may indicate an internal problem. Consult factory.
High suction pressure	<ol style="list-style-type: none"> 1. Excessive load - high water temperature. 2. Compressor unloaders open. 3. Superheat is too low. 	<ol style="list-style-type: none"> 1. Reduce load or add additional equipment. 2. See Corrective Steps below for failure of compressor to load. 3. Check superheat on Microprocessor display. Check suction line sensor installation and sensor.
Unit doesn't switch in Heat Recovery operation Mode	<ol style="list-style-type: none"> 1. "Q7" selector switch doesn't work 2. No Heating load required 3. Flow switch not operating 4. 4-way Solenoid valve not working 5. "W10" sensor element not fixed in the well pocket 6. "W10" sensor element gives wrong signal 7. "TC10" Microprocessor control doesn't work 	<ol style="list-style-type: none"> 1. Replace the selector switch 2. Add additional equipment. 3. Check water pump 4. Check the solenoid valve and if the 4-way valve is blocked. Replace the wrong components 5. Fix the element in the well pocket properly 6. Replace the element 7. Check the supply connections or replace it

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