DAIKIN

Installation, operation and maintenance manual
D - KIMAC00611-09EN

Air-cooled chillers with single-screw compressor

EWAD650-C17 C-SS
EWAD650-C17 C-SL
EWAD620-C16 C-SR

EWAD760-C19 C-XS
EWAD760-C19 C-XL
EWAD740-C19 C-XR

EWAD820-C14 C-PS
EWAD820-C14 C-PL
EWAD810-C14 C-PR

50Hz – Refrigerant: R-134°

Original Instructions

▲ IMPORTANT

This manual has been prepared as technical support only. It is not a binding commitment by Daikin.

Daikin has drawn it up to the best of their knowledge. No explicit or implicit warranty is provided with regard to the completeness, accuracy and reliability of its content.

All data and specifications provided herein are subject to change without notice. All data supplied at the time of order should be taken as reference.

Daikin specifically rejects any liability for any direct or indirect damages, in the broadest sense of the term, arising from or related to the use and/or interpretation of this manual.

⚠ WARNING

Before starting the installation of the unit, please read this manual carefully. Starting up the unit is absolutely forbidden if all instructions contained in this manual are not clear.

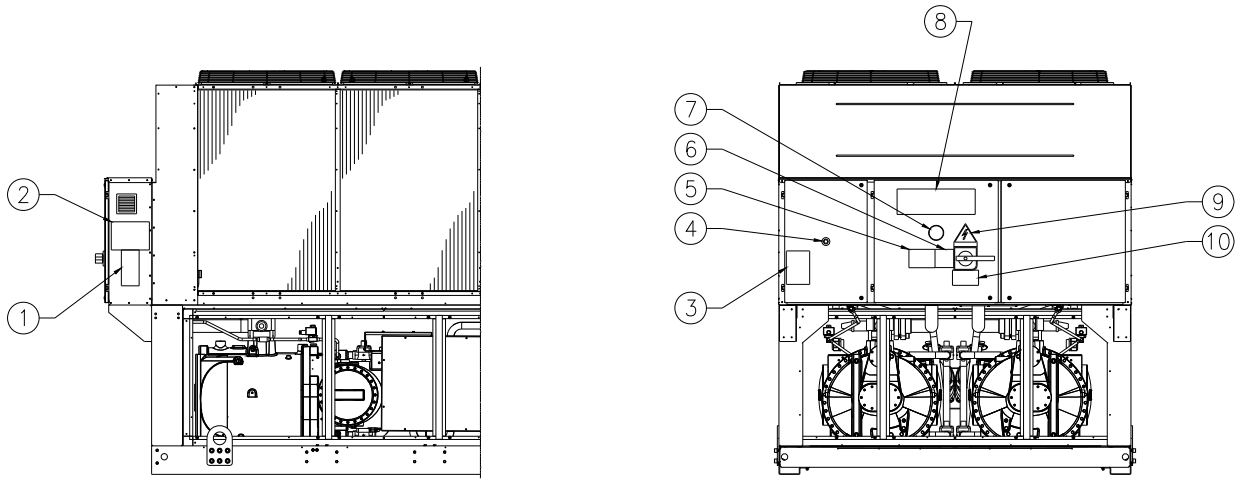
Key to symbols

△ Important note. Failure to comply with this instruction may damage the machine or affect its operation.

⚠ Note concerning safety in general or compliance with laws and regulations

Note concerning electrical safety

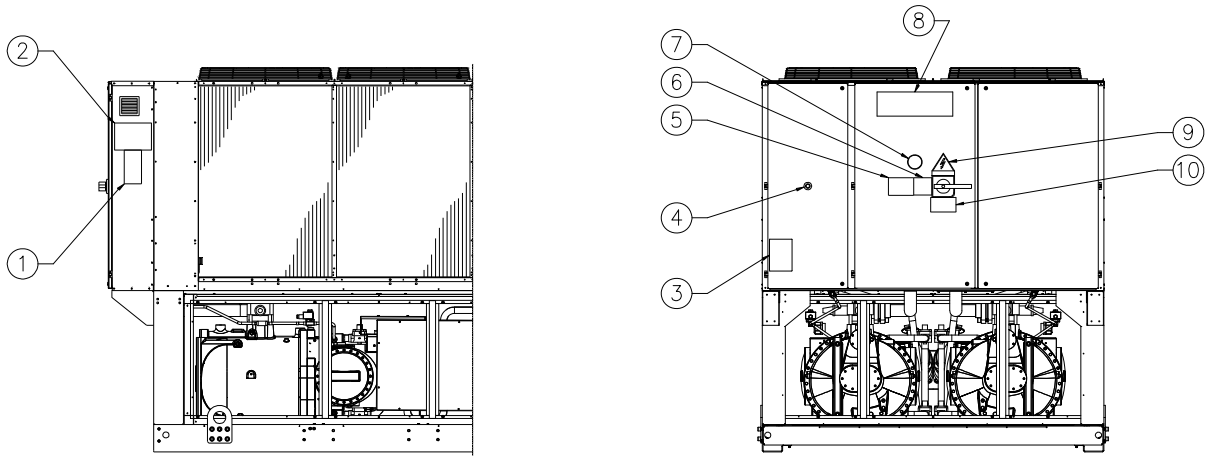
Description of the labels applied to the electrical panel



2 compressors unit

Label Identification

1 – Unit nameplate data	**6** – Cable tightening warning
2 – Lifting instructions	**7** – Gas type
3 – Non flammable gas symbol	**8** – Manufacturer's logo
4 – Emergency stop	**9** – Electrical hazard symbol
5 – Water circuit filling warning	**10 -** Hazardous Voltage warning



3 compressors unit

Label Identification

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General information

▲ IMPORTANT

The machines described by this manual are an excellent investment. Maximum care should be taken to ensure correct installation and to keep them in good working condition.
Correct maintenance of the unit is indispensable for its safety and reliability. Manufacturer's service centres are the only having adequate technical skill for maintenance.

▲ ATTENTION

This manual describes the features and procedures for the complete series.

All units are delivered complete with wiring diagram and dimensional drawings, with size, weight and features of the specific machine.

WIRING DIAGRAMS AND DIMENSIONAL DRAWINGS MUST BE CONSIDERED ESSENTIAL DOCUMENTS OF THIS MANUAL.

Should there be any discrepancy between this manual and the two aforesaid documents, please refer to the wiring diagram and dimensional diagrams.

Receiving the machine

The machine must be inspected for any possible damage immediately upon reaching its final place of installation. All components described in the delivery note must be carefully inspected and checked. any damage must be reported to the carrier. Before connecting the machine to earth, check that the model and power supply voltage shown on the nameplate are correct. Responsibility for any damage after acceptance of the machine cannot be attributed to the manufacturer.

Checks

To prevent the possibility of incomplete delivery (missing parts) or transport damage, please perform the following checks upon receipt of the machine:

a) Before accepting the machine, please verify every single component in the consignment. Check for any damage.
b) In the event that the machine has been damaged, do not remove the damaged material. A set of photographs are helpful in ascertaining responsibility.
c) Immediately report the extent of the damage to the transportation company and request that they inspect the machine.
d) Immediately report the extent of the damage to the retailer, so that arrangements can be made for the required repairs. In no case must the damage be repaired before the machine has been inspected by the representative of the transport company.

Purpose of the manual

The purpose of this manual is to allow the installer and the qualified operator to carry out all required operations in order to ensure proper installation and maintenance of the machine, without any risk to people, animals and/or objects.
The manual is an important supporting document for qualified personnel but it is not intended to replace such personnel.
All activities must be carried out in compliance with local laws and regulations.

Warning

This manual has been prepared as technical support only. It is not a binding offer by Daikin. Daikin has drawn it up to the best of their knowledge. No explicit or implicit warranty is provided with regard to the completeness, accuracy and reliability of its content. All data and specifications provided herein are subject to change without notice. Daikin specifically rejects any liability for any direct or indirect damages, in the broadest sense of the term, arising from or related to the use and/or interpretation of this manual.

Nomenclatura

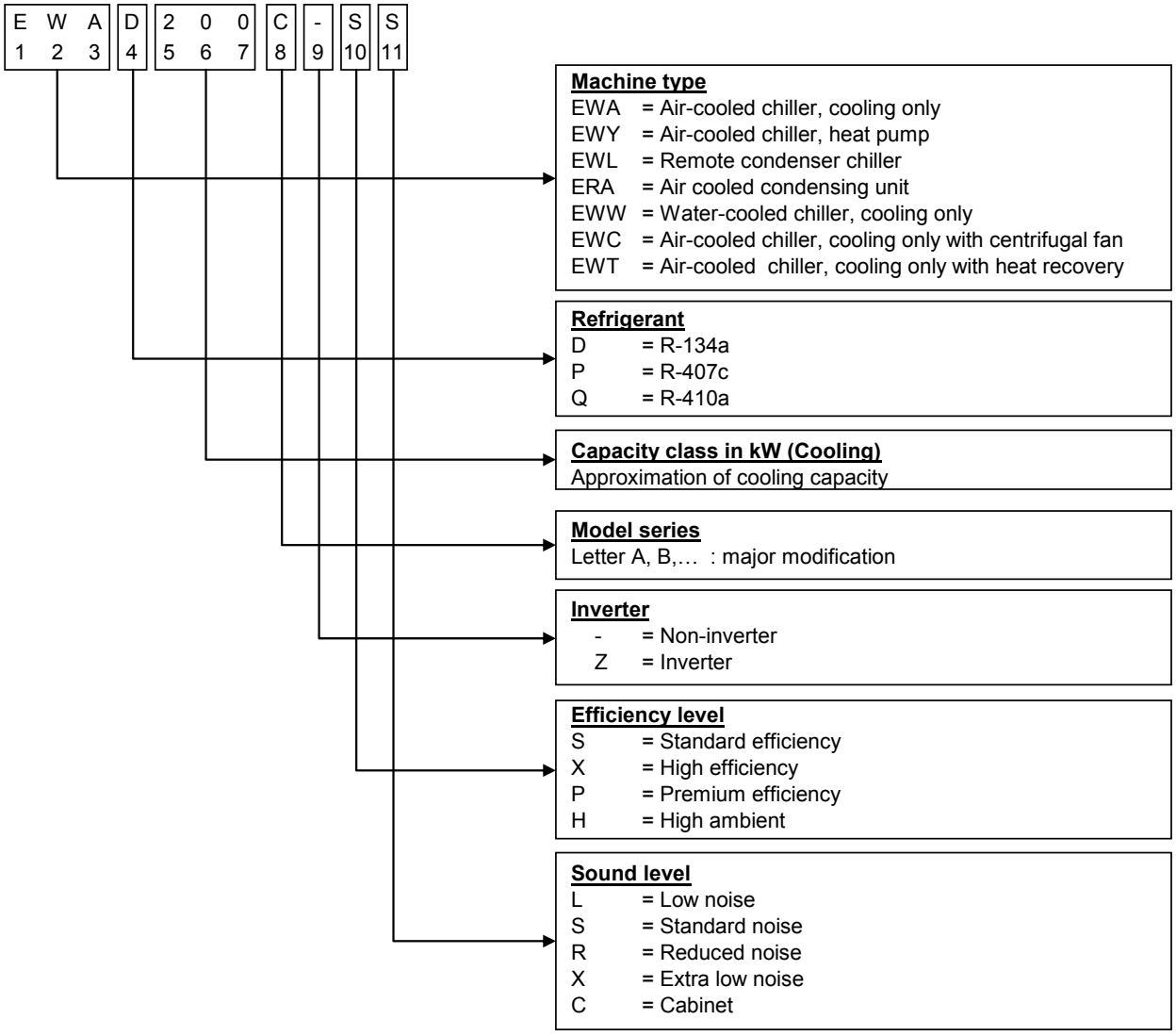


Tabella 1 - Nomenclatura serie EWAD~C-

Technical Specifications EWAD~C-SS & EWAD~C-SL

TECHNICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			650	740	830	910
Capacity (1)	Cooling		kW	647	744	832	912
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	221	262	299	318
EER (1)			---	2.93	2.84	2.78	2.87
ESEER			---	3.95	3.87	3.89	3.84
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	6185	6185	6185	6185
Weight (EWAD~C-SS)	Unit		kg	5630	5740	5760	6280
	Operating Weight		kg	5910	5990	6010	6530
Weight (EWAD~C-SL)	Unit		kg	5920	6030	6050	6570
	Operating Weight		kg	6200	6280	6300	6820
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	266	266	251	251
	Nominal water flow rate	Cooling	l/s	30.9	35.56	39.74	43.6
	Nominal Water pressure drop	Cooling	kPa	73	59	52	61
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	53444	53444	53444	64133
	Model	Quantity	No.	10	10	10	12
		Speed	rpm	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	38	38	38	44
	Quantity		No.	2	2	2	2
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	99.5	100.0	100.0	100.9
	Sound Pressure (2)	Cooling	dB(A)	79.0	79.5	79.5	80.4
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	96.0	96.1	96.1	97.5
	Sound Pressure (2)	Cooling	dB(A)	75.5	75.6	75.6	76.5
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	128	128	128	146
	N. of circuits		No.	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	168.3
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			970	C11	C12	C14
Capacity (1)	Cooling		kW	967	1064	1152	1419
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	7
Unit power input (1)	Cooling		kW	351	378	402	500
EER (1)			---	2.76	2.82	2.86	2.84
ESEER			---	3.8	3.88	3.84	3.88
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	6185	7085	7985	10185
Weight (EWAD~C-SS)	Unit		kg	6560	7010	7280	10310
	Operating Weight		kg	6810	7250	7520	10730
Weight (EWAD~C-SL)	Unit		kg	6850	7300	7570	10750
	Operating Weight		kg	7100	7540	7810	11170
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	251	243	243	421
	Nominal water flow rate	Cooling	l/s	46.21	50.85	55.04	67.78
	Nominal Water pressure drop	Cooling	kPa	68	63	72	47
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	64133	74822	85510	106888
	Model	Quantity	No.	12	14	16	20
		Speed	rpm	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	50	50	50	75
	Quantity		No.	2	2	2	3
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	101.1	101.5	101.7	102.9
	Sound Pressure (2)	Cooling	dB(A)	80.6	80.6	80.6	81.0
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	97.1	97.6	98.1	99.1
	Sound Pressure (2)	Cooling	dB(A)	76.6	76.8	76.9	77.2
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	144	162	178	260
	N. of circuits		No.	2	2	2	3
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	219.1
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			C15	C16	C17
Capacity (1)	Cooling		kW	1538	1622	1714
Capacity control	Type		---	Stepless		
	Minimum capacity		%	7	7	7
Unit power input (1)	Cooling		kW	551	580	618
EER (1)			---	2.79	2.8	2.77
ESEER			---	3.9	3.87	3.78
Casing	Colour		---	Ivory White		
	Material		---	Galvanized and painted steel sheet		
Dimensions	Unit	Height	mm	2540	2540	2540
		Width	mm	2285	2285	2285
		Length	mm	10185	11085	11085
Weight (EWAD~C-SS)	Unit		kg	10320	10710	10770
	Operating Weight		kg	10730	11110	11260
Weight (EWAD~C-SL)	Unit		kg	10770	11150	11210
	Operating Weight		kg	11170	11550	11700
Water heat exchanger	Type		---	Single Pass Shell&Tube		
	Water volume		l	408	408	474
	Nominal water flow rate	Cooling	l/s	73.5	77.51	81.89
	Nominal Water pressure drop	Cooling	kPa	59	65	73
	Insulation material			Closed cell		
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler		
Fan	Type		---	Direct propeller type		
	Drive		---	DOL		
	Diameter		mm	800	800	800
	Nominal air flow		l/s	106888	117577	117577
	Model	Quantity	No.	20	22	22
		Speed	rpm	920	920	920
		Motor input	W	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor		
	Oil charge		l	75	75	75
	Quantity		No.	3	3	3
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	103.0	103.2	103.3
	Sound Pressure (2)	Cooling	dB(A)	81.1	81.1	81.2
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	99.1	99.5	99.5
	Sound Pressure (2)	Cooling	dB(A)	77.2	77.3	77.4
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	260	261	261
	N. of circuits		No.	3	3	3
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	219.1
Safety devices	High discharge pressure (pressure switch)					
	High discharge pressure (pressure transducer)					
	Low suction pressure (pressure transducer)					
	Compressor motor protection					
	High discharge temperature					
	Low oil pressure					
	Low pressure ratio					
	High oil filter pressure drop					
	Phase monitor					
	Emergency stop button					
	Water freeze protection controller					
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.					
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.					

ELECTRICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			650	740	830	910
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	628.4	665.2	665.2	904.2
	Nominal running current cooling		A	365	432	492	523
	Maximum running current		A	486	532	578	643
	Maximum current for wires sizing		A	535	585	636	707
Fans	Nominal running current in cooling		A	40	40	40	48
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			970	C11	C12	C14
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	949.8	1009	1017	1242.6
	Nominal running current cooling		A	574	624	668	823
	Maximum running current		A	700	772	844	1058
	Maximum current for wires sizing		A	770	849	928	1164
Fans	Nominal running current in cooling		A	48	56	64	80
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+326	326+390	390+390	326+326+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS	EWAD~C-SS & EWAD~C-SL			C15	C16	C17
Power Supply	Phase		---	3	3	3
	Frequency		Hz	50	50	50
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
Unit	Maximum starting current		A	1293.8	1353	1353
	Nominal running current cooling		A	908	959	1023
	Maximum running current		A	1122	1194	1258
	Maximum current for wires sizing		A	1234	1313	1384
Fans	Nominal running current in cooling		A	80	88	88
Compressor	Phase		No.	3	3	3
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
	Maximum running current		A	390+326+326	390+390+326	390+390+390
	Starting method		---	Wye – Delta type (Y – Δ)		

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Technical Specifications EWAD~C-SR

TECHNICAL SPECIFICATIONS			EWAD~C-SR	620	720	790	880
Capacity (1)	Cooling		kW	619	715	789	876
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	223	272	315	331
EER (1)			---	2.77	2.62	2.51	2.65
ESEER			---	4.08	3.96	3.98	3.99
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	6185	6185	6185	6185
Weight (EWAD~C-SR)	Unit		kg	5920	6030	6050	6570
	Operating Weight		kg	6200	6280	6300	6820
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	266	266	251	251
	Nominal water flow rate	Cooling	l/s	29.57	34.15	37.71	41.83
	Nominal Water pressure drop	Cooling	kPa	67	55	47	57
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	41006	41006	41006	49207
	Model	Quantity	No.	10	10	10	12
		Speed	rpm	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	38	38	38	44
	Quantity		No.	2	2	2	2
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	91.5	92.0	92.0	92.5
	Sound Pressure (2)	Cooling	dB(A)	71.0	71.5	71.5	72
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	128	128	128	146
	N. of circuits		No.	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	168.3
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS			EWAD~C-SR	920	C10	C11	C13
Capacity (1)	Cooling		kW	922	1020	1112	1367
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	7
Unit power input (1)	Cooling		kW	369	395	417	517
EER (1)			---	2.5	2.59	2.67	2.64
ESEER			---	4	3.96	3.96	3.9
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	6185	7085	7985	10185
Weight (EWAD~C-SR)	Unit		kg	6850	7300	7570	10750
	Operating Weight		kg	7100	7540	7810	11170
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	251	243	243	421
	Nominal water flow rate	Cooling	l/s	44.05	48.75	53.11	65.32
	Nominal Water pressure drop	Cooling	kPa	62	58	68	44
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	49207	57408	65610	82012
	Model	Quantity	No.	12	14	16	20
		Speed	rpm	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	50	50	50	75
	Quantity		No.	2	2	2	3
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	93.0	93.5	93.8	94.8
	Sound Pressure (2)	Cooling	dB(A)	72.5	72.6	72.7	72.9
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	144	162	178	260
	N. of circuits		No.	2	2	2	3
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	219.1
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS			EWAD~C-SR	C14	C15	C16
Capacity (1)	Cooling		kW	1471	1556	1623
Capacity control	Type		---	Stepless		
	Minimum capacity		%	7	7	7
Unit power input (1)	Cooling		kW	576	603	647
EER (1)			---	2.55	2.58	2.51
ESEER			---	3.87	3.9	3.83
Casing	Colour		---	Ivory White		
	Material		---	Galvanized and painted steel sheet		
Dimensions	Unit	Height	mm	2540	2540	2540
		Width	mm	2285	2285	2285
		Length	mm	10185	11085	11085
Weight (EWAD~C-SR)	Unit		kg	10770	11150	11210
	Operating Weight		kg	11170	11550	11700
Water heat exchanger	Type		---	Single Pass Shell&Tube		
	Water volume		l	408	408	474
	Nominal water flow rate	Cooling	l/s	70.28	74.32	77.57
	Nominal Water pressure drop	Cooling	kPa	54	60	66
	Insulation material			Closed cell		
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler		
Fan	Type		---	Direct propeller type		
	Drive		---	DOL		
	Diameter		mm	800	800	800
	Nominal air flow		l/s	82012	90213	90213
	Model	Quantity	No.	20	22	22
		Speed	rpm	715	715	715
		Motor input	W	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor		
	Oil charge		l	75	75	75
	Quantity		No.	3	3	3
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	94.9	95.1	95.2
	Sound Pressure (2)	Cooling	dB(A)	73.0	73	73.1
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	260	261	261
	N. of circuits		No.	3	3	3
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	219.1
Safety devices	High discharge pressure (pressure switch)					
	High discharge pressure (pressure transducer)					
	Low suction pressure (pressure transducer)					
	Compressor motor protection					
	High discharge temperature					
	Low oil pressure					
	Low pressure ratio					
	High oil filter pressure drop					
	Phase monitor					
	Emergency stop button					
	Water freeze protection controller					
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.					
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.					

ELECTRICAL SPECIFICATIONS			EWAD~C-SR	620	720	790	880
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	614.4	651.2	651.2	887.4
	Nominal running current cooling		A	370	449	518	546
	Maximum running current		A	472	518	564	626
	Maximum current for wires sizing		A	519	570	620	689
Fans	Nominal running current in cooling		A	26	26	26	31
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS			EWAD~C-SR	920	C10	C11	C13
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	933	989.4	994.6	1214.6
	Nominal running current cooling		A	606	653	694	853
	Maximum running current		A	683	752	822	1030
	Maximum current for wires sizing		A	752	828	904	1133
Fans	Nominal running current in cooling		A	31	36	42	52
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+326	326+390	390+390	326+326+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS			EWAD~C-SR	C14	C15	C16
Power Supply	Phase		---	3	3	3
	Frequency		Hz	50	50	50
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
Unit	Maximum starting current		A	1265.8	1322.2	1322.2
	Nominal running current cooling		A	951	1001	1074
	Maximum running current		A	1094	1163	1227
	Maximum current for wires sizing		A	1203	1280	1350
Fans	Nominal running current in cooling		A	52	57	57
Compressor	Phase		No.	3	3	3
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
	Maximum running current		A	390+326+326	390+390+326	390+390+390
	Starting method		---	Wye – Delta type (Y – Δ)		

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Technical Specifications EWAD~C-XS & EWAD~C-XL

TECHNICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			760	830	890	990	C10
Capacity (1)	Cooling		kW	756	830	889	1001	1074
Capacity control	Type		---	Stepless				
	Minimum capacity		%	12.5	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	233	253	278	307	338
EER (1)			---	3.25	3.28	3.2	3.26	3.18
ESEER			---	4.02	4.11	4.02	4.11	4.05
Casing	Colour		---	Ivory White				
	Material		---	Galvanized and painted steel sheet				
Dimensions	Unit	Height	mm	2540	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285	2285
		Length	mm	6185	7085	7085	7985	7985
Weight (EWAD~C-SS)	Unit		kg	5990	6340	6360	7190	7470
	Operating Weight		kg	6240	6580	6600	7600	7870
Weight (EWAD~C-SL)	Unit		kg	6280	6630	6650	7480	7760
	Operating Weight		kg	6520	6870	6890	7880	8160
Water heat exchanger	Type		---	Single Pass Shell&Tube				
	Water volume		l	251	243	243	403	403
	Nominal water flow rate	Cooling	l/s	36.1	39.67	42.49	47.82	51.32
	Nominal Water pressure drop	Cooling	kPa	80	56	64	61	69
	Insulation material			Closed cell				
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler				
Fan	Type		---	Direct propeller type				
	Drive		---	DOL				
	Diameter		mm	800	800	800	800	800
	Nominal air flow		l/s	64133	74822	74822	85510	85510
	Model	Quantity	No.	12	14	14	16	16
		Speed	rpm	920	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor				
	Oil charge		l	38	38	38	44	50
	Quantity		No.	2	2	2	2	2
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	100.2	100.5	100.5	101.4	101.9
	Sound Pressure (2)	Cooling	dB(A)	79.7	79.7	79.7	80.2	80.7
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	96.8	97.4	97.4	98	98.2
	Sound Pressure (2)	Cooling	dB(A)	76.3	76.5	76.5	76.9	77.1
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	146	162	162	182	182
	N. of circuits		No.	2	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	219.1	219.1
Safety devices	High discharge pressure (pressure switch)							
	High discharge pressure (pressure transducer)							
	Low suction pressure (pressure transducer)							
	Compressor motor protection							
	High discharge temperature							
	Low oil pressure							
	Low pressure ratio							
	High oil filter pressure drop							
	Phase monitor							
	Emergency stop button							
	Water freeze protection controller							
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.							
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.							

TECHNICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			C11	C12	C13	C14	C15
Capacity (1)	Cooling		kW	1196	1280	1349	1409	1526
Capacity control	Type		---	Stepless				
	Minimum capacity		%	12.5	12.5	12.5	7	7
Unit power input (1)	Cooling		kW	364	400	411	437	474
EER (1)			---	3.29	3.2	3.29	3.23	3.22
ESEER			---	4.14	4.02	4.28	4.23	4.19
Casing	Colour		---	Ivory White				
	Material		---	Galvanized and painted steel sheet				
Dimensions	Unit	Height	mm	2540	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285	2285
		Length	mm	9785	9785	9785	11985	11985
Weight (EWAD~C-SS)	Unit		kg	8220	8240	8900	10560	11310
	Operating Weight		kg	8610	8630	9890	11040	12170
Weight (EWAD~C-SL)	Unit		kg	8510	8530	9190	11000	11760
	Operating Weight		kg	8900	8920	10180	11490	12610
Water heat exchanger	Type		---	Single Pass Shell&Tube				
	Water volume		l	386	386	979	491	850
	Nominal water flow rate	Cooling	l/s	57.13	61.18	64.45	67.34	72.9
	Nominal Water pressure drop	Cooling	kPa	45	51	71	77	57
	Insulation material			Closed cell				
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler				
Fan	Type		---	Direct propeller type				
	Drive		---	DOL				
	Diameter		mm	800	800	800	800	800
	Nominal air flow		l/s	106888	106888	106888	128266	128266
	Model	Quantity	No.	20	20	20	24	24
		Speed	rpm	920	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor				
	Oil charge		l	50	50	50	63	69
	Quantity		No.	2	2	2	3	3
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	102.4	102.5	102.5	102.9	103.1
	Sound Pressure (2)	Cooling	dB(A)	80.3	80.4	80.4	80.5	80.7
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	98.8	98.9	98.9	99.6	99.6
	Sound Pressure (2)	Cooling	dB(A)	76.7	76.8	76.8	77.1	77.2
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	214	214	225	291	297
	N. of circuits		No.	2	2	2	3	3
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	273	219.1	273
Safety devices	High discharge pressure (pressure switch)							
	High discharge pressure (pressure transducer)							
	Low suction pressure (pressure transducer)							
	Compressor motor protection							
	High discharge temperature							
	Low oil pressure							
	Low pressure ratio							
	High oil filter pressure drop							
	Phase monitor							
	Emergency stop button							
	Water freeze protection controller							
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.							
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.							

TECHNICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			C16	C17	C18	C19
Capacity (1)	Cooling		kW	1596	1685	1768	1858
Capacity control	Type		---	Stepless			
	Minimum capacity		%	7	7	7	7
Unit power input (1)	Cooling		kW	504	533	561	590
EER (1)			---	3.17	3.16	3.15	3.15
ESEER			---	4.17	4.16	4.13	4.13
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	11985	12885	13785	14685
Weight (EWAD~C-SS)	Unit		kg	11570	11900	12260	12600
	Operating Weight		kg	12430	12760	13140	13470
Weight (EWAD~C-SL)	Unit		kg	12010	12350	12700	13040
	Operating Weight		kg	12870	13200	13580	13910
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	850	850	871	850
	Nominal water flow rate	Cooling	l/s	76.24	80.48	84.47	88.79
	Nominal Water pressure drop	Cooling	kPa	62	68	64	37
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	128266	138954	149643	160332
	Model	Quantity	No.	24	26	28	30
		Speed	rpm	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	75	75	75	75
	Quantity		No.	3	3	3	3
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	103.2	103.5	103.7	103.9
	Sound Pressure (2)	Cooling	dB(A)	80.9	80.8	81	81
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	99.6	100	100.2	100.4
	Sound Pressure (2)	Cooling	dB(A)	77.3	77.4	77.5	77.5
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	297	312	328	343
	N. of circuits		No.	3	3	3	3
Piping connections	Evaporator water inlet/outlet		mm	273	273	273	273
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

ELECTRICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			760	830	890	990	C10
Power Supply	Phase		---	3	3	3	3	3
	Frequency		Hz	50	50	50	50	50
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	636.4	681.2	681.2	920.2	965.8
	Nominal running current cooling		A	386	423	463	511	559
	Maximum running current		A	494	548	594	659	716
	Maximum current for wires sizing		A	543	603	653	725	788
Fans	Nominal running current in cooling		A	48	56	56	64	64
Compressor	Phase		No.	3	3	3	3	3
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326	326+326
	Starting method		---	Wye – Delta type (Y – Δ)				

ELECTRICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			C11	C12	C13	C14	C15
Power Supply	Phase		---	3	3	3	3	3
	Frequency		Hz	50	50	50	50	50
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	1033	1033	1033	1167.4	1213
	Nominal running current cooling		A	608	668	686	729	787
	Maximum running current		A	796	860	860	960	1017
	Maximum current for wires sizing		A	876	946	946	1056	1119
Fans	Nominal running current in cooling		A	80	80	80	96	96
Compressor	Phase		No.	3	3	3	3	3
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+390	390+390	390+390	269+269+326	326+326+269
	Starting method		---	Wye – Delta type (Y – Δ)				

ELECTRICAL SPECIFICATIONS	EWAD~C-XS & EWAD~C-XL			C16	C17	C18	C19
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	1258.6	1317.8	1377	1385
	Nominal running current cooling		A	834	885	934	985
	Maximum running current		A	1074	1146	1218	1290
	Maximum current for wires sizing		A	1181	1261	1340	1419
Fans	Nominal running current in cooling		A	96	104	112	120
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+326+326	326+326+390	390+390+326	390+390+390
	Starting method		---	Wye – Delta type (Y – Δ)			

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Technical Specifications EWAD~C-XR

TECHNICAL SPECIFICATIONS			EWAD~C-XR	740	810	870	970	C10
Capacity (1)	Cooling		kW	736	811	866	974	1041
Capacity control	Type		---	Stepless				
	Minimum capacity		%	12.5	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	235	254	281	309	343
EER (1)			---	3.14	3.2	3.08	3.15	3.03
ESEER			---	4.29	4.36	4.23	4.34	4.24
Casing	Colour		---	Ivory White				
	Material		---	Galvanized and painted steel sheet				
Dimensions	Unit	Height	mm	2540	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285	2285
		Length	mm	6185	7085	7085	7985	7985
Weight (EWAD~C-SR)	Unit		kg	6280	6630	6650	7480	7760
	Operating Weight		kg	6520	6870	6890	7880	8160
Water heat exchanger	Type		---	Single Pass Shell&Tube				
	Water volume		l	251	243	243	403	403
	Nominal water flow rate	Cooling	l/s	35.17	38.74	41.36	46.54	49.76
	Nominal Water pressure drop	Cooling	kPa	76	54	61	58	65
	Insulation material			Closed cell				
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler				
Fan	Type		---	Direct propeller type				
	Drive		---	DOL				
	Diameter		mm	800	800	800	800	800
	Nominal air flow		l/s	49207	57408	57408	65610	65610
	Model	Quantity	No.	12	14	14	16	16
		Speed	rpm	715	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor				
	Oil charge		l	38	38	38	44	50
	Quantity		No.	2	2	2	2	2
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	92	92.3	92.3	93.5	93.7
	Sound Pressure (2)	Cooling	dB(A)	71.5	71.5	71.5	72.3	72.5
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	146	162	162	182	182
	N. of circuits		No.	2	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	168.3	168.3	168.3	219.1	219.1
Safety devices	High discharge pressure (pressure switch)							
	High discharge pressure (pressure transducer)							
	Low suction pressure (pressure transducer)							
	Compressor motor protection							
	High discharge temperature							
	Low oil pressure							
	Low pressure ratio							
	High oil filter pressure drop							
	Phase monitor							
	Emergency stop button							
	Water freeze protection controller							
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.							
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.							

TECHNICAL SPECIFICATIONS			EWAD~C-XR	C11	C12	C13	C14	C15
Capacity (1)	Cooling		kW	1168	1247	1302	1378	1486
Capacity control	Type		---	Stepless				
	Minimum capacity		%	12.5	12.5	12.5	7	7
Unit power input (1)	Cooling		kW	365	404	415	438	479
EER (1)			---	3.2	3.08	3.14	3.15	3.1
ESEER			---	4.38	4.25	4.33	4.34	4.26
Casing	Colour		---	Ivory White				
	Material		---	Galvanized and painted steel sheet				
Dimensions	Unit	Height	mm	2540	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285	2285
		Length	mm	9785	9785	9785	11985	11985
Weight (EWAD~C-SR)	Unit		kg	8510	8530	9190	11000	11760
	Operating Weight		kg	8900	8920	10180	11490	12610
Water heat exchanger	Type		---	Single Pass Shell&Tube				
	Water volume		l	386	386	979	491	850
	Nominal water flow rate	Cooling	l/s	55.78	59.56	62.21	65.85	70.98
	Nominal Water pressure drop	Cooling	kPa	43	49	67	74	54
	Insulation material			Closed cell				
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler				
Fan	Type		---	Direct propeller type				
	Drive		---	DOL				
	Diameter		mm	800	800	800	800	800
	Nominal air flow		l/s	82012	82012	82012	98414	98414
	Model	Quantity	No.	20	20	20	24	24
		Speed	rpm	715	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor				
	Oil charge		l	50	50	50	63	69
	Quantity		No.	2	2	2	3	3
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	94.3	94.5	94.4	95.1	95.2
	Sound Pressure (2)	Cooling	dB(A)	72.2	72.3	72.3	72.6	72.8
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	214	214	225	291	297
	N. of circuits		No.	2	2	2	3	3
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	273	219.1	273
Safety devices	High discharge pressure (pressure switch)							
	High discharge pressure (pressure transducer)							
	Low suction pressure (pressure transducer)							
	Compressor motor protection							
	High discharge temperature							
	Low oil pressure							
	Low pressure ratio							
	High oil filter pressure drop							
	Phase monitor							
	Emergency stop button							
	Water freeze protection controller							
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.							
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.							

TECHNICAL SPECIFICATIONS			EWAD~C-XR	C16	C17	C18	C19
Capacity (1)	Cooling		kW	1550	1639	1722	1813
Capacity control	Type		---	Stepless			
	Minimum capacity		%	7	7	7	7
Unit power input (1)	Cooling		kW	513	541	567	595
EER (1)			---	3.03	3.03	3.04	3.04
ESEER			---	4.26	4.2	4.21	4.2
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	11985	12885	13785	14685
Weight (EWAD~C-SR)	Unit		kg	12010	12350	12700	13040
	Operating Weight		kg	12870	13200	13580	13910
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	850	850	871	850
	Nominal water flow rate	Cooling	l/s	74.07	78.32	82.3	86.61
	Nominal Water pressure drop	Cooling	kPa	59	65	61	35
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	98414	106616	114817	123018
	Model	Quantity	No.	24	26	28	30
		Speed	rpm	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	75	75	75	75
	Quantity		No.	3	3	3	3
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	95.3	95.6	95.7	95.9
	Sound Pressure (2)	Cooling	dB(A)	72.9	72.9	73	73
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	297	312	328	343
	N. of circuits		No.	3	3	3	3
Piping connections	Evaporator water inlet/outlet		mm	273	273	273	273
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

ELECTRICAL SPECIFICATIONS			EWAD~C-XR	740	810	870	970	C10
Power Supply	Phase		---	3	3	3	3	3
	Frequency		Hz	50	50	50	50	50
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	619.6	661.6	661.6	897.8	943.4
	Nominal running current cooling		A	391	425	470	517	570
	Maximum running current		A	477	528	574	637	694
	Maximum current for wires sizing		A	525	581	632	700	763
Fans	Nominal running current in cooling		A	31	36	36	42	42
Compressor	Phase		No.	3	3	3	3	3
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326	326+326
	Starting method		---	Wye – Delta type (Y – Δ)				

ELECTRICAL SPECIFICATIONS			EWAD~C-XR	C11	C12	C13	C14	C15
Power Supply	Phase		---	3	3	3	3	3
	Frequency		Hz	50	50	50	50	50
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	1005	1005	1005	1133.8	1179.4
	Nominal running current cooling		A	613	679	697	734	799
	Maximum running current		A	768	832	832	926	983
	Maximum current for wires sizing		A	845	915	915	1019	1082
Fans	Nominal running current in cooling		A	52	52	52	62	62
Compressor	Phase		No.	3	3	3	3	3
	Voltage		V	400	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+390	390+390	390+390	269+269+326	326+326+269
	Starting method		---	Wye – Delta type (Y – Δ)				

ELECTRICAL SPECIFICATIONS			EWAD~C-XR	C16	C17	C18	C19
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	1225	1281.4	1337.8	1343
	Nominal running current cooling		A	851	901	950	1001
	Maximum running current		A	1040	1110	1179	1248
	Maximum current for wires sizing		A	1144	1221	1297	1373
Fans	Nominal running current in cooling		A	62	68	73	78
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	326+326+326	326+326+390	390+390+326	390+390+390
	Starting method		---	Wye – Delta type (Y – Δ)			

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Technical Specifications EWAD~C-PS & EWAD~C-PL

TECHNICAL SPECIFICATIONS EWAD~C-PS & EWAD~C-PL				820	890	980	C11
Capacity (1)	Cooling		kW	821	890	975	1074
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	225	249	274	301
EER (1)			---	3.64	3.58	3.56	3.56
ESEER			---	4.44	4.5	4.41	4.53
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	8885	8885	8885	9785
Weight (EWAD~C-SS)	Unit		kg	7530	7530	7660	8290
	Operating Weight		kg	8130	8130	8700	9330
Weight (EWAD~C-SL)	Unit		kg	7820	7820	7950	8580
	Operating Weight		kg	8420	8420	8990	9620
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	599	599	1043	1027
	Nominal water flow rate	Cooling	l/s	39.22	42.53	46.6	51.3
	Nominal Water pressure drop	Cooling	kPa	57	65	30	61
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	96199	96199	96199	106888
	Model	Quantity	No.	18	18	18	20
		Speed	rpm	920	920	920	920
		Motor input	W	1.75	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	38	38	38	44
	Quantity		No.	2	2	2	2
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	101	101.0	101.0	101.8
	Sound Pressure (2)	Cooling	dB(A)	79.5	79.5	79.5	80
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	98.4	98.4	98.4	98.8
	Sound Pressure (2)	Cooling	dB(A)	76.9	76.9	76.9	77
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	204	202	204	220
	N. of circuits		No.	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	273	273
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS	EWAD~C-PS & EWAD~C-PL			C12	C13	C14
Capacity (1)	Cooling		kW	1158	1279	1390
Capacity control	Type		---	Stepless		
	Minimum capacity		%	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	330	363	396
EER (1)			---	3.51	3.52	3.51
ESEER			---	4.39	4.44	4.31
Casing	Colour		---	Ivory White		
	Material		---	Galvanized and painted steel sheet		
Dimensions	Unit	Height	mm	2540	2540	2540
		Width	mm	2285	2285	2285
		Length	mm	9785	11085	11985
Weight (EWAD~C-SS)	Unit		kg	8550	9390	9730
	Operating Weight		kg	9590	10380	10720
Weight (EWAD~C-SL)	Unit		kg	8840	10380	10020
	Operating Weight		kg	9880	10670	11010
Water heat exchanger	Type		---	Single Pass Shell&Tube		
	Water volume		l	1027	995	979
	Nominal water flow rate	Cooling	l/s	55.31	61.12	66.41
	Nominal Water pressure drop	Cooling	kPa	69	60	73
	Insulation material			Closed cell		
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler		
Fan	Type		---	Direct propeller type		
	Drive		---	DOL		
	Diameter		mm	800	800	800
	Nominal air flow		l/s	106888	117577	128266
	Model	Quantity	No.	20	22	24
		Speed	rpm	920	920	920
		Motor input	W	1.75	1.75	1.75
Compressor	Type		---	Semi-hermetic single screw compressor		
	Oil charge		l	50	50	50
	Quantity		No.	2	2	2
Sound level (EWAD~C-SS)	Sound Power	Cooling	dB(A)	102.3	102.6	102.9
	Sound Pressure (2)	Cooling	dB(A)	80.5	80.4	80.5
Sound level (EWAD~C-SL)	Sound Power	Cooling	dB(A)	99.9	99.3	99.6
	Sound Pressure (2)	Cooling	dB(A)	77.1	77.1	77.2
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	220	252	254
	N. of circuits		No.	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	273	273	273
Safety devices	High discharge pressure (pressure switch)					
	High discharge pressure (pressure transducer)					
	Low suction pressure (pressure transducer)					
	Compressor motor protection					
	High discharge temperature					
	Low oil pressure					
	Low pressure ratio					
	High oil filter pressure drop					
	Phase monitor					
	Emergency stop button					
	Water freeze protection controller					
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.					
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.					

ELECTRICAL SPECIFICATIONS	EWAD~C-PS & EWAD~C-PL			820	890	980	C11
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	660.4	697.2	697.2	936.2
	Nominal running current cooling		A	384	420	461	506
	Maximum running current		A	518	564	610	675
	Maximum current for wires sizing		A	570	620	671	743
Fans	Nominal running current in cooling		A	72	72	72	80
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS	EWAD~C-PS & EWAD~C-PL			C12	C13	C14
Power Supply	Phase		---	3	3	3
	Frequency		Hz	50	50	50
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
Unit	Maximum starting current		A	981.8	1041	1049
	Nominal running current cooling		A	551	609	665
	Maximum running current		A	732	804	876
	Maximum current for wires sizing		A	805	884	964
Fans	Nominal running current in cooling		A	80	88	96
Compressor	Phase		No.	3	3	3
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
	Maximum running current		A	326+326	390+326	390+390
	Starting method		---	Wye – Delta type (Y – Δ)		

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Technical Specifications EWAD~C-PR

TECHNICAL SPECIFICATIONS			EWAD~C-PR	810	880	960	C10
Capacity (1)	Cooling		kW	809	875	956	1053
Capacity control	Type		---	Stepless			
	Minimum capacity		%	12.5	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	219	244	272	299
EER (1)			---	3.7	3.58	3.51	3.52
ESEER			---	4.63	4.59	4.54	4.59
Casing	Colour		---	Ivory White			
	Material		---	Galvanized and painted steel sheet			
Dimensions	Unit	Height	mm	2540	2540	2540	2540
		Width	mm	2285	2285	2285	2285
		Length	mm	8885	8885	8885	9785
Weight (EWAD~C-SR)	Unit		kg	7820	7820	7950	8580
	Operating Weight		kg	8420	8420	8990	9620
Water heat exchanger	Type		---	Single Pass Shell&Tube			
	Water volume		l	599	599	1043	1027
	Nominal water flow rate	Cooling	l/s	38.65	41.81	45.69	50.3
	Nominal Water pressure drop	Cooling	kPa	56	63	29	59
	Insulation material			Closed cell			
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler			
Fan	Type		---	Direct propeller type			
	Drive		---	DOL			
	Diameter		mm	800	800	800	800
	Nominal air flow		l/s	73811	73811	73811	82012
	Model	Quantity	No.	18	18	18	20
		Speed	rpm	715	715	715	715
		Motor input	W	0.78	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor			
	Oil charge		l	38	38	38	44
	Quantity		No.	2	2	2	2
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	92.7	92.7	92.7	93.4
	Sound Pressure (2)	Cooling	dB(A)	71.2	71.2	71.2	71.7
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	204	202	204	220
	N. of circuits		No.	2	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	219.1	219.1	273	273
Safety devices	High discharge pressure (pressure switch)						
	High discharge pressure (pressure transducer)						
	Low suction pressure (pressure transducer)						
	Compressor motor protection						
	High discharge temperature						
	Low oil pressure						
	Low pressure ratio						
	High oil filter pressure drop						
	Phase monitor						
	Emergency stop button						
	Water freeze protection controller						
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.						
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.						

TECHNICAL SPECIFICATIONS			EWAD~C-PR	C11	C13	C14
Capacity (1)	Cooling		kW	1132	1251	1359
Capacity control	Type		---	Stepless		
	Minimum capacity		%	12.5	12.5	12.5
Unit power input (1)	Cooling		kW	330	364	396
EER (1)			---	3.43	3.44	3.43
ESEER			---	4.5	4.53	4.51
Casing	Colour		---	Ivory White		
	Material		---	Galvanized and painted steel sheet		
Dimensions	Unit	Height	mm	2540	2540	2540
		Width	mm	2285	2285	2285
		Length	mm	9785	11085	11985
Weight (EWAD~C-SR)	Unit		kg	8840	10380	10020
	Operating Weight		kg	9880	10670	11010
Water heat exchanger	Type		---	Single Pass Shell&Tube		
	Water volume		l	1027	995	979
	Nominal water flow rate	Cooling	l/s	54.11	59.76	64.95
	Nominal Water pressure drop	Cooling	kPa	66	58	70
	Insulation material			Closed cell		
Air heat exchanger	Type		---	High efficiency fin and tube type with integral subcooler		
Fan	Type		---	Direct propeller type		
	Drive		---	DOL		
	Diameter		mm	800	800	800
	Nominal air flow		l/s	82012	90213	98414
	Model	Quantity	No.	20	22	24
		Speed	rpm	715	715	715
		Motor input	W	0.78	0.78	0.78
Compressor	Type		---	Semi-hermetic single screw compressor		
	Oil charge		l	50	50	50
	Quantity		No.	2	2	2
Sound level (EWAD~C-SR)	Sound Power	Cooling	dB(A)	93.8	94.1	94.4
	Sound Pressure (2)	Cooling	dB(A)	72.0	72	72
Refrigerant circuit	Refrigerant type		---	R-134a	R-134a	R-134a
	Refrigerant charge		kg.	220	252	254
	N. of circuits		No.	2	2	2
Piping connections	Evaporator water inlet/outlet		mm	273	273	273
Safety devices	High discharge pressure (pressure switch)					
	High discharge pressure (pressure transducer)					
	Low suction pressure (pressure transducer)					
	Compressor motor protection					
	High discharge temperature					
	Low oil pressure					
	Low pressure ratio					
	High oil filter pressure drop					
	Phase monitor					
	Emergency stop button					
	Water freeze protection controller					
Notes (1)	Cooling capacity, unit power input in cooling and EER are based on the following conditions: evaporator 12/7°C; ambient 35°C, unit at full load operation.					
Notes (2)	The values are according to ISO 3744 and are referred to: evaporator 12/7°C, ambient 35°C, full load operation.					

ELECTRICAL SPECIFICATIONS			EWAD~C-PR	820	890	980	C11
Power Supply	Phase		---	3	3	3	3
	Frequency		Hz	50	50	50	50
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
Unit	Maximum starting current		A	635.2	672	672	908.2
	Nominal running current cooling		A	376	416	461	505
	Maximum running current		A	493	539	585	647
	Maximum current for wires sizing		A	542	593	643	712
Fans	Nominal running current in cooling		A	47	47	47	52
Compressor	Phase		No.	3	3	3	3
	Voltage		V	400	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%	+10%
	Maximum running current		A	223+223	223+269	269+269	269+326
	Starting method		---	Wye – Delta type (Y – Δ)			

ELECTRICAL SPECIFICATIONS			EWAD~C-PR	C12	C13	C14
Power Supply	Phase		---	3	3	3
	Frequency		Hz	50	50	50
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
Unit	Maximum starting current		A	953.8	1010.2	1015.4
	Nominal running current cooling		A	554	614	671
	Maximum running current		A	704	773	842
	Maximum current for wires sizing		A	774	851	927
Fans	Nominal running current in cooling		A	52	57	62
Compressor	Phase		No.	3	3	3
	Voltage		V	400	400	400
	Voltage Tolerance	Minimum	%	-10%	-10%	-10%
		Maximum	%	+10%	+10%	+10%
	Maximum running current		A	326+326	390+326	390+390
	Starting method		---	Wye – Delta type (Y – Δ)		

Notes	Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
	Maximum starting current: starting current of biggest compressor + current of the compressor at 75% maximum load + fans current for the circuit at 75%.
	Nominal current in cooling mode is referred to the following conditions: evaporator 12°C/7°C; ambient 35°C; compressors + fans current.
	Maximum running current is based on max compressor absorbed current in its envelope and max fans absorbed current
	Maximum unit current for wires sizing is based on minimum allowed voltage
	Maximum current for wires sizing: (compressors full load ampere + fans current) x 1,1.

Operating limits

Storage

The series units can be stored in the following environmental conditions:

Minimum ambient temperature : -20°C
Maximum ambient temperature : 57°C
Maximum RH : 95% not condensing

⚠ ATTENTION

Storage at temperatures below the minimum specified, can damage some parts including the electronic controller and its LCD display.

⚠ WARNING

Storage at temperatures higher than the maximum specified causes the safety valves on the compressor suction line to open.

⚠ ATTENTION

Storage in particularly humid atmospheres can damage the electrical components.

Operation

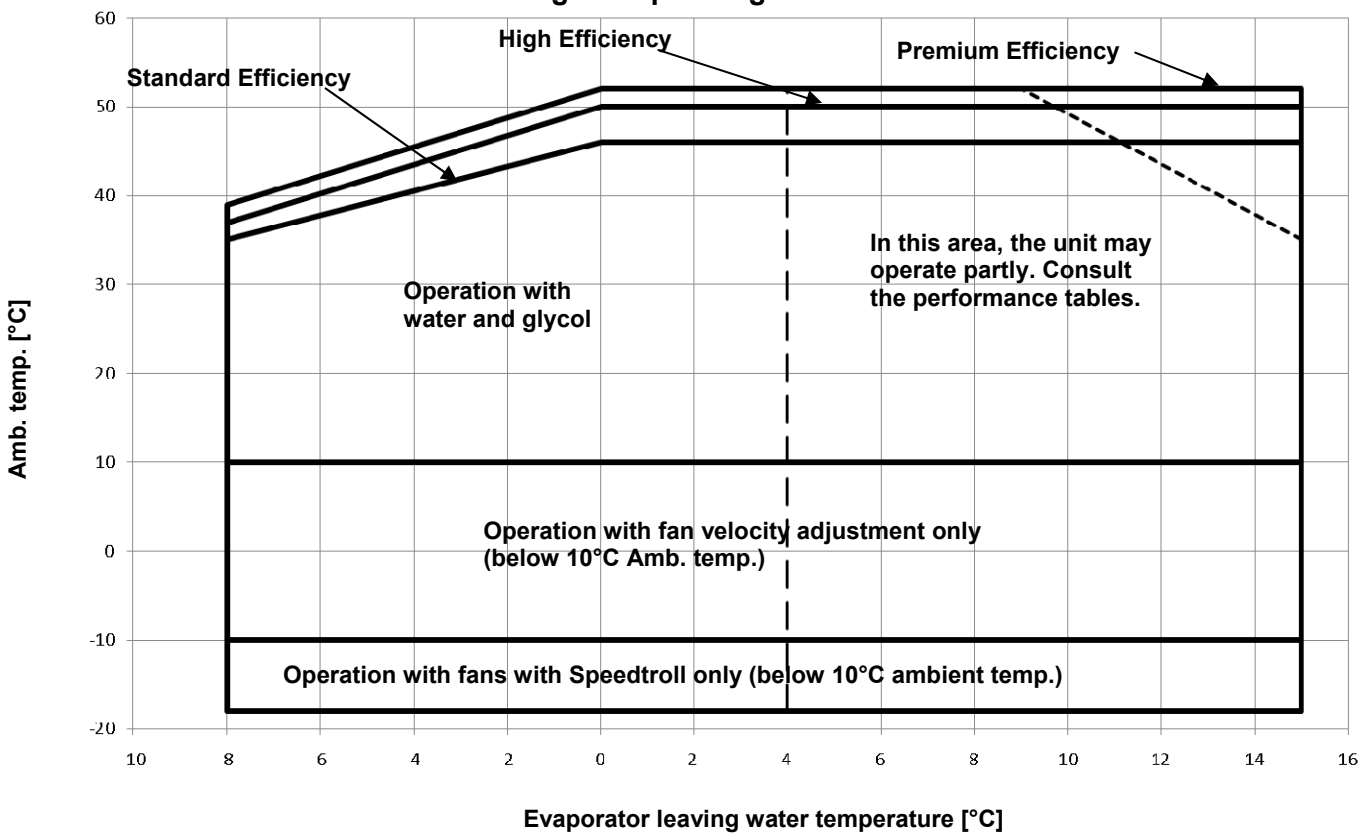
Unit operation is permitted within the limits specified in the following diagram.

⚠ ATTENTION

Operation outside these limits can cause the protective devices to intervene and interrupt unit operation. In extreme cases, damage may also be caused. If in doubt, consult the manufacturer.

These operating limits apply with the machine running on a full load.

Fig. 1 - Operating field



Mechanical installation

Shipping

The stability of the machine during shipping must be ensured. If the machine is shipped with a wooden cross-plank on its base, the cross-plank must be removed only after the final destination has been reached.

Responsibility

The manufacturer declines all responsibility, present and future, for any damage to persons, animals or property caused by negligence of operators failing to follow the installation and maintenance instructions in this manual.
All safety equipment must be regularly and periodically checked in accordance with this manual and with local laws and regulations regarding safety and environmental protection.

Safety

All activities concerning the machine, be they: movement, installation, start-up or maintenance, must in any case comply with all current laws on safety and only be carried out by authorised, qualified personnel.

Thus stated, the following are some warnings, although the list is not intended as exhaustive:

- The machine must be firmly secured to the ground.
- The machine can only be lifted and moved by correctly using the lifting points on the machine base, marked in yellow. These are the only points that can support the entire weight of the unit, and only if used according to the lifting diagram described in this manual.
- The machine can only be used safely once it has been firmly secured to the ground or to an equivalent structure.
- Do not access the electrical components if the machine is not in safe conditions.
- Do not access the electrical components without having opened the machine's general switch to disconnect the power supply.
- An insulating platform must be used.
- Do not access the electrical components if water and/or moisture are present.
- All operations on the refrigerant circuit and on pressurised components must be carried out by qualified personnel only.
- Replacement of a compressor or addition of lubricating oil must be carried out by qualified personnel only.
- Sharp edges and the surfaces of the condensing section, can cause injury. Avoid direct contact.
- Disconnect the machine's electrical supply by opening the general switch, before working on the cooling fans and/or compressors. Failure to comply with this rule may cause serious personal injury.
- Avoid introducing solid bodies into the water pipes while the machine is connected to the system.
- A mechanical filter must be installed on the water pipe connected to the heat exchanger inlet. The filter must have a maximum mesh size of 500 µm.
- The machine is supplied with safety valves installed on both the high and low pressure sides of the refrigerant gas circuit.

In case of sudden stop of the unit, follow the instructions on the **Control Panel Operating Manual** which is part of the on-board documentation delivered to the end user with this manual.
It is recommended to perform installation and maintenance with other people. In case of accidental injury or unease, it is necessary to:

- keep calm
- press the alarm button if present in the installation site
- move the injured person in a warm place far from the unit and in rest position
- contact immediately emergency rescue personnel of the building or if the Health Emergency Service
- wait without leaving the injured person alone until the rescue operators come
- give all necessary information to the the rescue operators

⚠ WARNING

Before carrying out any operation on the machine, please read this instruction and operating manual carefully.
Installation and maintenance must be carried out by qualified personnel familiar with the provisions of law and local regulations, and who has been properly trained or has experience with this type of equipment.

⚠ WARNING

Avoid installing the machine in a place that could be dangerous during maintenance operations, such as (but not only) platforms without parapets or railings, or areas not complying with the clearance requirements.

Moving and lifting

The machine must be moved and lifted by using cables, spacing bars and scales of appropriate dimensions to the machine weight. This is stated on its identification plate. The table of weights included in the manual should be considered as indicative only.
Installation of certain accessories can increase machine weight. Always refer to the dimensional diagrams supplied for any technical information.

Block machine sliding on lorries to prevent damage to the panels and base frame. Avoid bumping, jolting and impacts during unloading and/or moving the machine. Do not push or pull the machine from any part other than the base frame. These falls could cause serious damages for which the manufacturer will not be held liable.

All units of the series are supplied with lifting points market in yellow.
Only use these points to lift the unit, as shown in the figure.

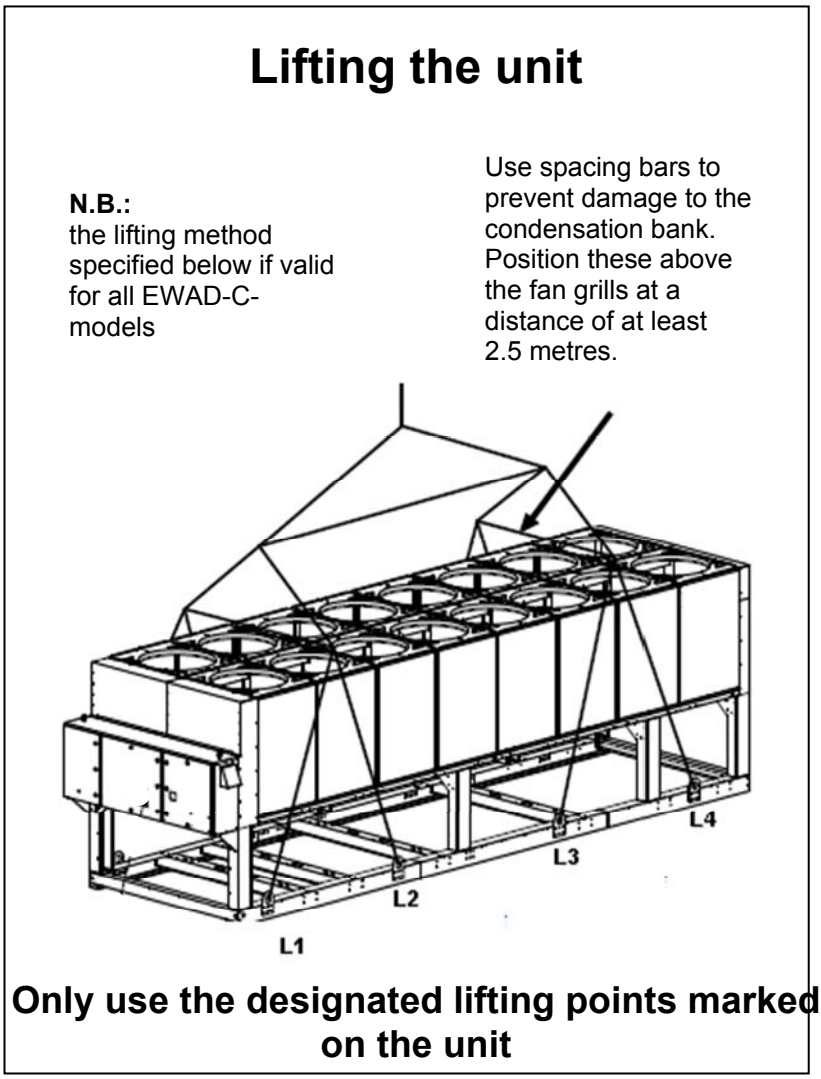


Fig. 2 - Lifting the unit

⚠ WARNING

Both the lifting ropes and the spacing bar and/or scales must be sized to support the machine weight safely. Please check the unit's weight on the machine's nameplate.
The weights shown in the 'Technical data' tables in the 'General information' chapter refer to standard units, without any added accessories.
The specific machine may have accessories that increase its overall weight (pumps, copper banks/copper, etc.).

⚠ WARNING

The machine must be lifted with the utmost attention and care. Avoid jolting when lifting and lift the machine very slowly, keeping it perfectly level.

⚠ WARNING

If the machine is fitted with soundproof cabins for the compressors, remove the side panels at the lifting points to avoid damage and deformation.

Positioning and assembly

All units are designed for installation outdoors on terraces or the ground, as long as the area is free from obstacles that could limit air flow to the condensation banks.
The machine must be installed on a robust and perfectly level foundation. Should the machine be installed on balconies and/or roofs, it may be necessary to use weight distribution beams.
For installation on the ground, there must be a robust cement base that is at least 250 mm longer and wider than the machine. Furthermore, this base must be strong enough to support the weight of the machine as stated in the technical specifications.
Should the machine be installed in places that are easily accessible to people and animals, it is advisable to install protection gratings for the banks and compressors, and guarantee access to the machine only when in a safe condition.
To ensure the best possible performance on the installation site, the following precautions and instructions must be followed:

- Avoid recirculation of air flow out from the fans towards bank suction.
- Ensure there are no obstacles obstructing air flow to the banks, guaranteeing correct suction and expulsion.
- Guarantee a strong, solid foundation to reduce noise and vibration as much as possible.
- Do not install in particularly dusty environments as this will dirty the condensation banks.
- The water in the system must be particularly clean and all traces of oil or rust must be removed. A mechanical water filter must be installed on the machine's inlet piping.

Clearance

Correct machine operation depends on compliance with the minimum clearance requirement for installation, which guarantee correct ventilation of the condensation banks. Reduced installation space could reduce normal air flow, significantly reducing machine performance and increasing the electricity consumed.
In determining the correct machine position, consider the following factors:

- avoid any recirculation of hot air between fans and condensers.
- Avoid under-supplying the air flow to the condensation banks.

Both these conditions can cause the condensation pressure to increase, determining a reduction in energy efficiency and refrigeration capacity (despite the fact that the unit's condenser geometry allows it to partly compensate for poor air distribution, and software is particularly able to calculate machine operating conditions and optimise load in abnormal operating conditions).
Machine installation not only guarantees its correct operation, but also allows for all post-installation and maintenance work to be carried out correctly. Figure 8 shows the minimum clearance requirements.
If the machine is positioned in a place surrounded by walls or obstacles of the same height as the machine, it must be at least 2500 mm away from these. Should the obstacles be higher, the machine must be at least 3,000 mm away from these.
If the machine is installed without complying with these recommended minimum distances from walls and/or vertical obstacles, hot air may re-circulate and/or the air condenser may be under-supplied and this can lead to a loss of efficiency.

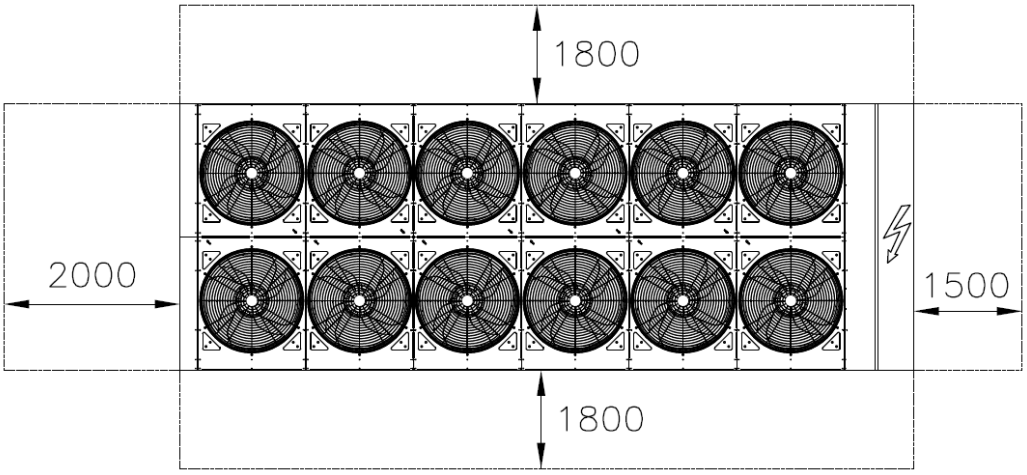


Fig. 3 - Clearance requirements for machine maintenance

When two or more machines are positioned side by side, a space of at least 3,600 mm is recommended between the condensation banks.
For further solutions, please consult authorised technicians.
In any case, the microprocessor will allow the machine to adapt to the new condition, producing maximum capacity available even at side distances of less that the recommended clearance space.

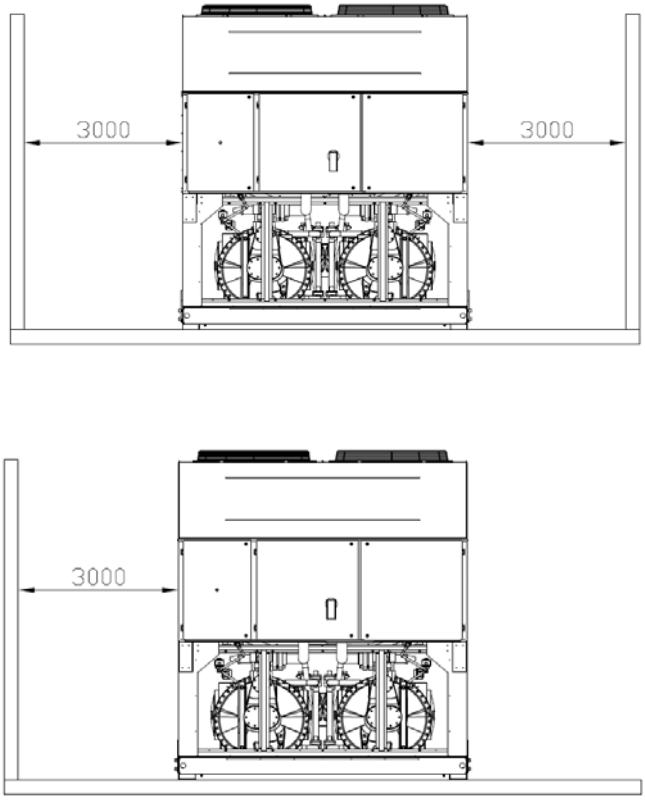


Fig. 4 - Minimum installation clearance of the individual machine

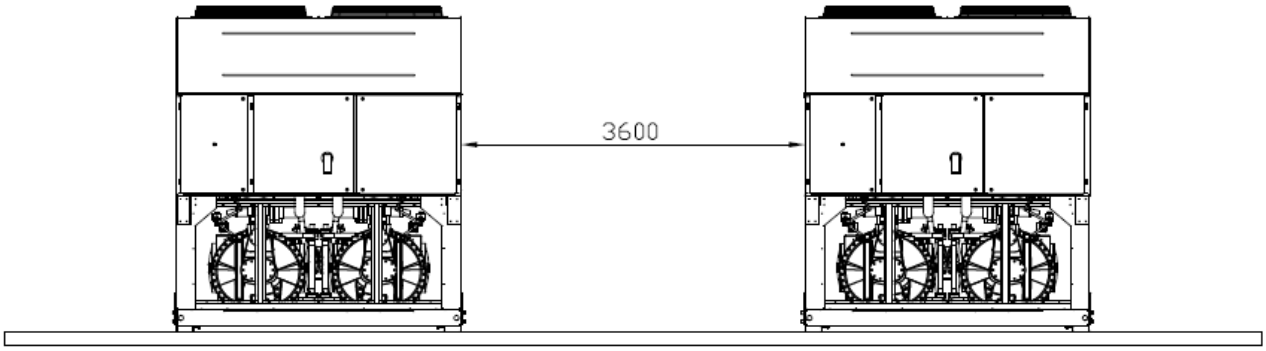


Fig. 5 - Recommended minimum installation clearance

⚠ ATTENTION

The minimum installation clearance spaces described previously are indicative only and not a fundamental requirement. Each installation must be carefully evaluated according to the specific environmental parameters.
For example: should you fail to consider dominant wind at the point of installation, this can affect overall machine function, even where the recommended minimum installation clearance spaces are left.

Sound protection

When sound levels require special control, great care must be exercised to isolate the machine from its base by appropriately applying anti-vibration elements (supplied as an accessory). Flexible joints must be installed on the water connections as well.

Water piping

⚠ ATTENTION

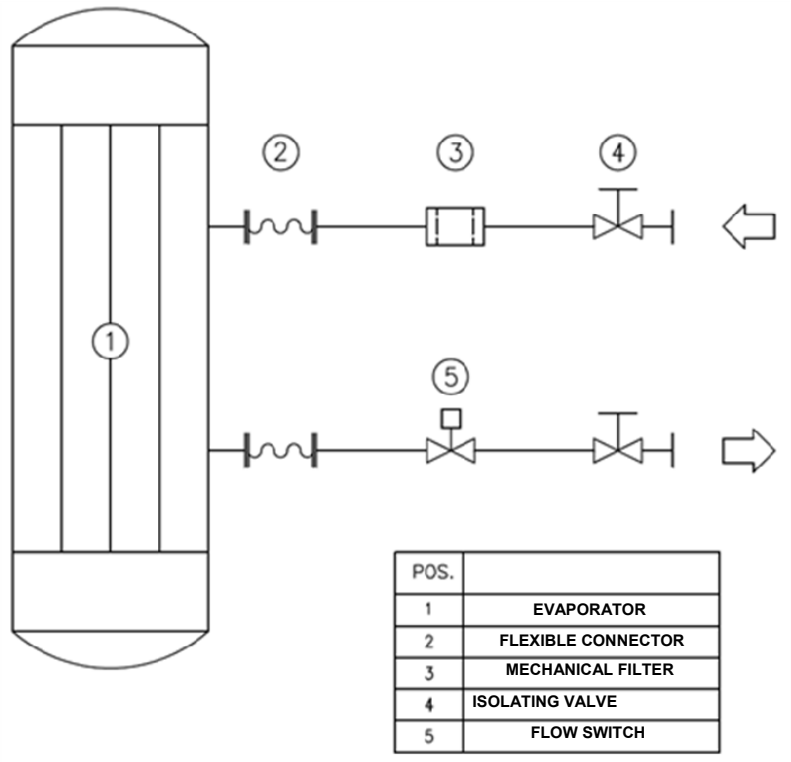
Adjust the anti-vibration mountings beneath the machine before connecting the water circuit.

Piping must be designed with the lowest number of elbows and the lowest number of vertical changes of direction. In this way, installation costs are reduced considerably and system performance is improved.
The water system should have:

1. Anti-vibration mountings in order to reduce transmission of vibrations to the underlying structure.
2. Isolating valves to isolate the machine from the water system during service.
3. Manual or automatic air venting device at the system's highest point. Drain device at the system's lowest point.
4. Neither the evaporator nor the heat recovery device must be positioned at the system's highest point.
5. A suitable device that can maintain the water system under pressure (expansion tank, etc.) and offset temperature changes.
6. Water temperature and pressure indicators on the machine to assist the operator during service and maintenance.
7. A filter or device which can remove foreign particles from the water before it enters the pump (in order to prevent cavitation, please consult the pump manufacturer for the recommended filter type). The use of a filter prolongs the life of the pump and helps keep the water system in better condition.
8. Another filter must be installed on the machine inlet water pipe, near the evaporator and heat recovery (if installed). The filter prevents solid particles from entering the heat exchanger, as they could damage it or reduce its heat exchanging capacity.
9. The shell and tube heat exchanger is fitted with a thermostatic electrical resistance that guarantees protection against water freezing down to external temperatures of -25°C. All other water piping outside the machine must be protected against freezing. To guarantee correct resistance function, the machine must be powered even when not in use.
10. The heat recovery device must be emptied of water during the winter season, unless an appropriate percentage antifreeze mix is added to the water circuit.
11. If the machine is installed to replace another, the entire water system must be emptied and cleaned before the new unit is installed. Regular tests and proper chemical treatment of water are recommended before starting up the new machine.

12. If an antifreeze is added to the water system, machine performance will be lower and water pressure drops will be greater. All machine protection systems, such as antifreeze, and low-pressure protection will need to be readjusted.

Before insulating water piping, check that there are no leaks.



POS.	
1	EVAPORATOR
2	FLEXIBLE CONNECTOR
3	MECHANICAL FILTER
4	ISOLATING VALVE
5	FLOW SWITCH

Fig. 6 - Water connection

▲ ATTENTION

Install a mechanical filter on the inlet to each heat exchanger. Failure to install a mechanical filter allows solid particles and/or welding slag to enter the exchanger. Installation of a filter with mesh size not exceeding 0.5 mm in diameter, is advised. The manufacturer cannot be held responsible for any damage to exchangers ensuring from the lack of a mechanical filter.
Protect all piping from freezing

▲ ATTENTION

Protect all piping from freezing.

Water treatment

Before putting the machine into operation, clean the water circuit. Dirt, scaling, corrosion residue and other foreign material can accumulate inside the heat exchanger and reduce its heat exchanging capacity. Pressure drops can increase as well, thus reducing water flow.
Proper water treatment therefore reduces the risk of corrosion, erosion, scaling, etc.. The most appropriate water treatment must be determined locally, according to the type of system and local characteristics of the process water.
The manufacturer is not responsible for damage to or malfunctioning of equipment caused by failure to treat water or by improperly treated water.

Table 2 - Acceptable water quality limits

QUALITY OF REFRIGERATING WATER					
	Re-circulation water (20°C max)	Filling water		Re-circulation water (20°C max)	Filling water
	MAXIMUM VALUES			MAXIMUM VALUES	
pH (25°C)	6.8 − 8.0	6.8 − 8.0	Iron	1.0	30
Electricity conductivity (mS/m) (25°C) (µS/cm) (25°C)	40 (400)	30 (300)	Copper (mgCu/l)	1.0	0.1
Chloride ion (mgCL-/l)	50	50	Sulphide ion (mgS2-/l)	not detectable	not detectable
Sulphate ion (mgSO22-/l)	50	50	Ammonium ion (mgNH4+/l)	1.0	1.0
Alkalinity (pH4.8)	50	50	Residual chlorine (mgCL/l)	0.3	0.3
Total hardness (mgCaCO3/l)	70	70	Free carbon dioxide (mgCO2/l)	4.0	4
Total calcium (mgCaCO3/l)	50	50			

Evaporator and exchangers antifreeze protection

For correct antifreeze protection, all evaporators are fitted with thermostatically-controlled electrical antifreeze resistance. This provides suitable antifreeze protection down to temperatures of -25°C. The only alternative antifreeze protection consists of draining the heat exchangers completely and cleaning them with antifreeze solution.
Two or more protection methods should be considered when designing the system as a whole:

1. Continuous water flow circulation inside piping and exchangers.
2. Addition of an appropriate amount of glycol inside the water circuit
3. Additional heat insulation and heating of exposed piping
4. Emptying and cleaning of the heat exchanger during the winter season.

It is the responsibility of the installer and/or local maintenance personnel to ensure that two or more of the described antifreeze methods are used. Make sure that appropriate antifreeze protection is maintained at all times.
Failure to follow the instructions above could result in damage to some of the machine's components.
Damage caused by freezing is not covered by warranty.

Correction coefficients for use of ethylenic glycol

Ambient air temperature to °C	-3	-8	-15	-23	-35
Recommended glycol percentage in weight	10	20	30	40	50
Correction of refrigerating power	0.991	0.982	0.972	0.961	0.946
Correction of power absorbed	0.996	0.992	0.986	0.976	0.966
Flow correction	1.013	1.040	1.074	1.121	1.178
Pressure drop correction	1.070	1.129	1.181	1.263	1.308

Table 3 - Correction coefficients for use of ethylenic glycol

Minimum percentage of glycol for low water temperature

Evaporator leaving water temperature °C	2	0	-2	-4	-6	-8
Ethylenic glycol (%)	10	20	20	20	30	30
Propylene glycol (%)	10	20	20	30	30	30

Minimum percentage of glycol for low ambient temperature

Ambient air temperature °C	-3	-8	-15	-23	-35
Ethylenic glycol (%)	10%	20%	30%	40%	50%
Ambient air temperature °C	-3	-7	-12	-20	-32
Propylene glycol (%)	10%	20%	30%	40%	50%

Table 4 - Glycol percentages according to ambient temperature

Installing the flow switch

To ensure sufficient water flow through the evaporator, it is essential that a flow switch be installed on the water circuit. The purpose of the flow switch is to stop the machine in the event of interrupted water flow, thus protecting the evaporator from freezing. The flow switch can be installed either on the inlet or outlet water piping.
A flow switch specifically gauged for this purpose is available as an optional accessory.
This paddle-type flow switch is suitable for heavy-duty outdoor applications (IP67) and is supplied with a clean contact that must be electrically connected to terminals 8 and 23 of the terminal board M5 (check the machine's wiring diagram for further information).
For further information regarding device installation, settings and choice, please read the instruction leaflet in the device box.

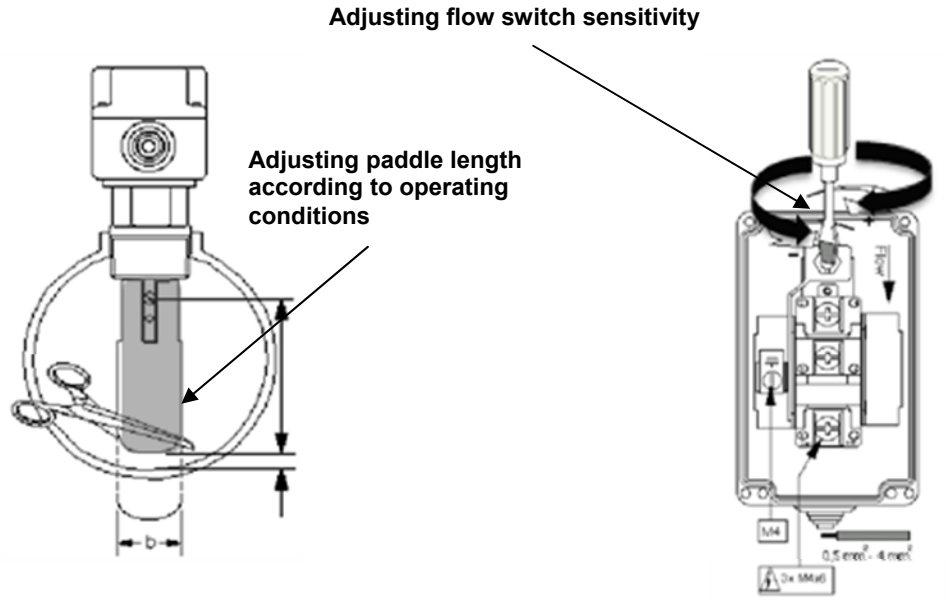
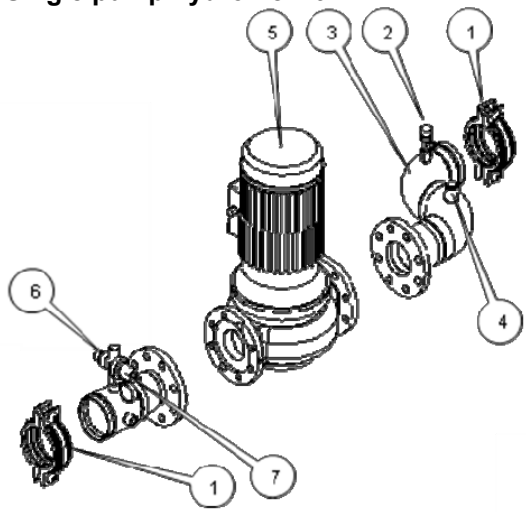


Fig. 7 - Adjusting the safety flow switch

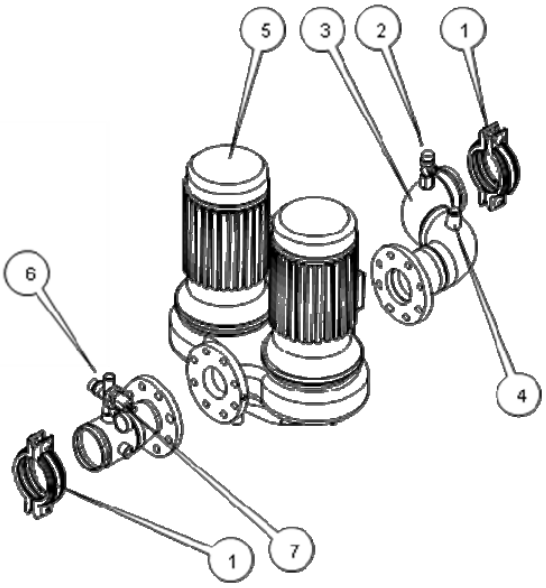
Hydronic kit (optional)

The optional hydronic kit prepared for this machine series can consist of a single line pump, or a two-line pump. Depending on the choice made during machine order, the kit may have the configuration shown in figure 7.
To select the hydronic kit corresponding to the chosen machine, please refer to the catalogue.

Single pump hydronic kit



Two pump hydronic kit



1. Victaulic connection
2. Water safety valve
3. Manifold connection
4. Antifreeze electrical resistance
5. Water pump (single or double)
6. Automatic filling unit

N.B.: Arrangement of components and piping layouts may vary from that shown in the figure.

Fig. 8 - Single and double pump (two pump) hydronic kit

⚠ ATTENTION

Install a suitable size expansion tank on the water circuit that is appropriate to the conditions of machine use.

Refrigerating circuit safety valves

Each system comes with safety valves that are installed on each circuit, both on the evaporator and on the condenser. The purpose of the valves is to release the refrigerant inside the refrigerant circuit in the event of operating malfunction or external fire.

⚠ ATTENTION

The unit is designed for outdoor use. In any case, check there is suitable air circulation around the machine.
Should the machine be installed in closed, or semi-covered environments, prevent possible damage due to inhalation of refrigerant gas. Do not dispose of the refrigerant into the environment.
Safety valves must be connected externally. The installer is responsible for sizing and connecting the safety valves to the venting pipes.

Electrical installation

General specifications

CAUTION

All electrical connections to the machine must be carried out in compliance with laws and regulations in force.
All installation, operating and maintenance activities must be carried out by qualified personnel.
Please refer to the specific wiring diagram for the machine that you have purchased and which was sent with the unit.
Should the wiring diagram not appear on the machine or should it have been lost, please contact your dealer who will provide for a copy to be forwarded.

CAUTION

Use copper conductors only. Failure to use copper conductors could cause overheating or corrosion at the connection points and damage the unit.
To avoid interference, all control wires must be installed separately from the power wires. Use separate electrical conduits for this purpose.

CAUTION

Before servicing the machine in any way, open the general disconnecting switch on the machine's main power supply.
When the machine is off but the disconnector switch is in the closed position, unused circuits are live as well.
Never open the terminal board box of the compressors before having opened the unit's general disconnecting switch.

CAUTION

Series units are fitted with high power non-linear electrical components (VPD compressor supply). These cause superior harmonics and can cause significant leakage towards ground (about 2 A).

The protection for the power supply system must be designed in accordance with the above-mentioned values.

CAUTION

The short circuit current that can be withstood by the electrical board in accordance with EN 60439-1, is 25 kA.
Please therefore check the short-circuit current at the machine power supply line connection terminals to ensure that it is less than or equal to the machine panel hold current.

CAUTION

In installations with power supply lines longer than 50 metres, inductive coupling between phases and between phase and earth generates significant phenomena, namely:

- unbalancing of phase currents
- excessive voltage drop

In order to limit this phenomena, it is good practise to lay out the phase wires symmetrically, as described in the figure.

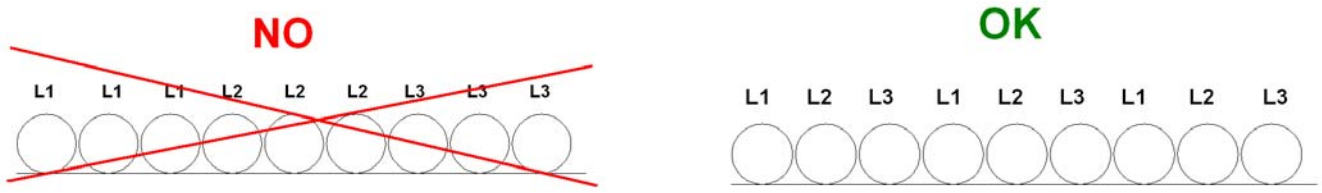


Fig. 9 - Installation of long power supply wires

Electrical components

All power and interface electrical connections are specified in the wiring diagram that is shipped with the machine.
the installer must supply the following components:

- Power supply wires (dedicated conduit)
- Interconnection and interface wires (dedicated conduit)
- thermal-magnetic circuit breaker of suitable size (please see electrical data).

Electrical wiring

Power circuit:

Connect the electrical power supply cables to the terminals of the general circuit breaker on the machine's terminal board. The access panel must have a hole of appropriate diameter for the cable used and its cable gland. A flexible conduit can also be used, containing the three power phases plus earth.
In any case, absolute protection against water penetrating through the connection point must be ensured.

Control circuit:

Every machine of the series is supplied with an auxiliary 400/115V control circuit transformer. No additional cable for the control system power supply is thus required.
Only if the optional separate accumulation tank is requested, the electrical antifreeze resistance must have a separate power supply.

Electrical heaters

The machine has an antifreeze electrical heater installed directly on the evaporator. Each circuit also has an electrical heater installed in the compressor, whose purpose is to keep the oil warm thus preventing the presence of liquid refrigerant mixed with the oil in the compressor. Clearly, the operation of electrical heaters is guaranteed only if there is a constant power supply. If it is not possible to keep the machine powered when inactive during winter, apply at least two of the procedures described in the 'Mechanical installation' section under the 'antifreeze protection of evaporator and exchangers', and power the machine at least 24 hours prior to compressor start-up in order to allow the oil to warm up.

Pump electrical supply

On request, the machine can be fitted with a fully-wired pump kit controlled by the machine microprocessor. In this case, no further checks are required.
Should the system use pumps outside the machine (not supplied with the unit), fit the supply line for each pump with a thermal-magnetic circuit breaker and a command contact.

Water pump control

Connect the control contactor coil power supply to terminals 27 and 28 (pump #1) and 48 and 49 (pump 2) located on terminal board M5, and install the contactor on a power supply with the same voltage as the pump contactor coil. The terminals are connected to a clean microprocessor contact.
The microprocessor contact has the following commutation capacity:

Maximum voltage:	250 V AC
Maximum current:	2 A Resistive - 2 A Inductive
Reference standard:	EN 60730-1

The wiring described above allows the microprocessor to manage the water pump automatically. It is good practice to install a clean status contact pump's thermal-magnetic circuit breaker and to connect it in series with the flow switch.

Alarm relays - Electrical wiring

The unit has a clean-contact digital output that changes state whenever an alarm occurs in one of the refrigerant circuits. Connect this signal to an external visual or sound alarm, or to the BMS, in order to monitor its operation.
See the machine's wiring diagram for wiring.

Unit on/off remote control - Electrical wiring

The machine has a digital input that allows remote control. A start-up timer, a circuit breaker or a BMS can be connected to this input. Once the contact has been closed, the microprocessor launches the start-up sequence by first turning on the water pump and then the compressors. When the contact is opened, the microprocessor launches the machine shut-down sequence. The contact must be clean.

Double setpoint - Electrical wiring

The double setpoint function uses a switch to allow for to change over the unit setpoint between two predefined values in the unit controller. An example of an application is ice production during the night and standard operation during the day. Connect a circuit breaker or timer between terminals 20 and 21 and terminal board M5. The contact must be clean.

External water setpoint reset - Electrical wiring (optional)

The machine's local setpoint can be modified by means of an external analogue 4-20 mA signal. Once this function has been enabled, the microprocessor allows for the modification of the setpoint from the set local value up to a differential of 3°C max. 4 [mA] corresponds to a 0 [°C] reset, 20 [mA] corresponds to the setpoint plus maximum differential.
The signal cable must be directly connected to terminals 35 and 36 of the M5 terminal board.
The signal cable must be of the shielded type and must not be laid in the vicinity of the power cables, so as not to induce interference with the electronic controller.

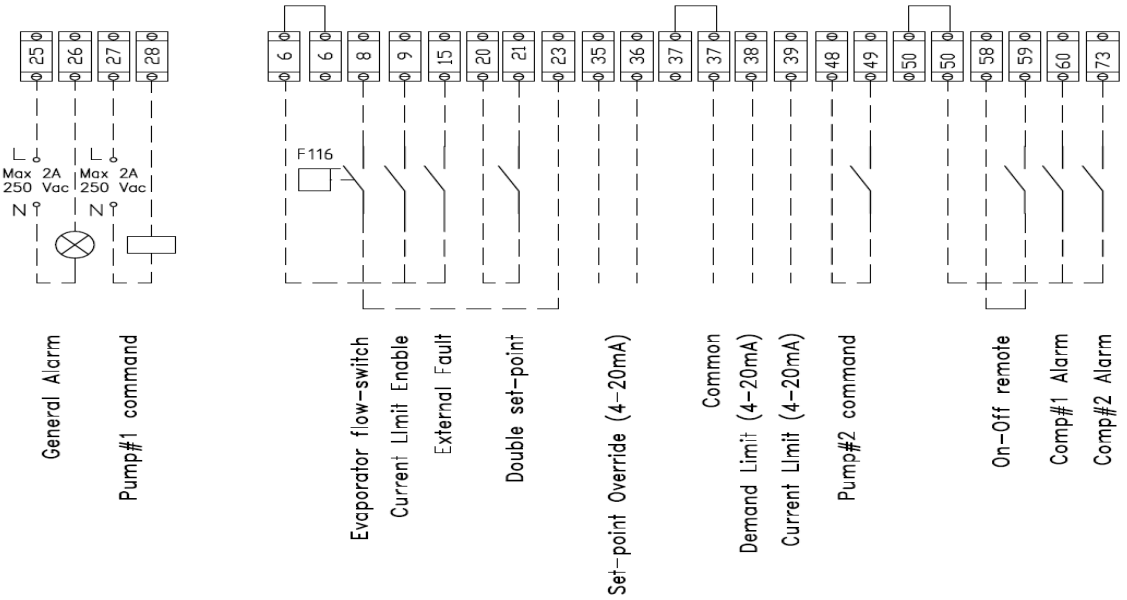
Unit limitation - Electrical wiring (optional)

The machine's microprocessor allows for the limitation of capacity by means of two separate criteria:
Load limitation
The load can be varied directly by means of 4-20 external signal or directly from a BMS.
The signal cable must be directly connected to terminals 37 and 38 of the M5 terminal board.
The signal cable must be of the shielded type and must not be laid in the vicinity of the power cables, so as not to induce interference with the electronic controller.

Current limitation (optional)
This option, if installed, allows for the control of machine load according to current absorbed.
Connect a switch, timer, clean BMS to terminals 37-39 on the terminal board M5. Once the digital input is closed, the microprocessor will limit the current absorbed by the machine according to the command set point set.
The enabling of this control needs enabling by means of a clean contact, using terminals 6-9 on terminal board M5.

Caution: the two options cannot be enabled simultaneously. Setting one function excludes the other.

Fig. 10 - User connection tot he interface M3 terminal board



General alarm	
Pump1 command	
Evaporator flowswitch	
Current limit enable	
External fault	
Double setpoint	
Setpoint override (4-20 mA)	
Common	
Demand limit (4-20 mA)	
Current limit (4-20 mA)	
Pump2 command	
On-off remote	
Comp1 alarm	
Comp2 alarm	

Operation

Operator's responsibilities

It is important that the operator is appropriately trained and becomes familiar with the system before operating the machine. In addition to reading this manual, the operator must study the microprocessor operating manual and the wiring diagram in order to understand the start-up sequence, operation, shut-down sequence and operation of all safety devices.
During the machine's initial start-up phase, an authorised technician is available to answer any questions and to give instructions as to the correct operating procedures.
The operator is advised to keep a record of operating data for every installed machine. Another record should also be kept of all the periodical maintenance and servicing activities.
If the operator notes abnormal or unusual operating conditions, he is advised to consult the authorised technical service.

Description of the machine

This machine, of the air-condensation type, is made up of the following main components:

- **Compressor**: The single-screw compressor of the FR3B or FR4A series is of the semi-hermetic type and utilises gas from the evaporator to cool the motor and allow optimal operation under any expected load conditions. The oil-injection lubrication system does not require an oil pump as oil flow is ensured by the pressure difference between delivery and suction. In addition to ensuring lubrication of ball bearings, oil injection dynamically seals the screw, thus enabling the compression process.
- **Water exchanger**: Direct expansion, shell and tube type for all models.
- **Air exchanger**: Finned type with pipes, internally micro-finned, directly expanded onto the high-efficiency strip fin.
- **Fan**: Axial, high-efficiency type. Allows for quiet system operation even during adjustment.
- **Expansion valve**: As standard, the machine is fitted with an electronic expansion valve controlled by an electronic control device that optimises its operation.

Description of the refrigeration cycle

The low-temperature refrigerant gas from the evaporator is drawn by the compressor through the electric motor, cooling it. It is later compressed, and during this phase the refrigerant mixes with the oil from the separator.

The high-pressure oil-refrigerant mix is drawn into the oil separator, that separates it. The oil accumulated on the bottom of the separator is forced by the pressure difference back into the compressor, while the oil-free refrigerant is sent to the condenser.

The refrigerant liquid is evenly distributed inside the condenser throughout all bank circuits. As it passes through it cools and starts to condense.

The condensed fluid at saturation temperature passes through the subcooling section where it loses even more heat, increasing cycle efficiency. Te heat taken from the fluid during cooling, condensation and subcooling is exchanged with that of the cooling air, which is discharged at higher temperatures.

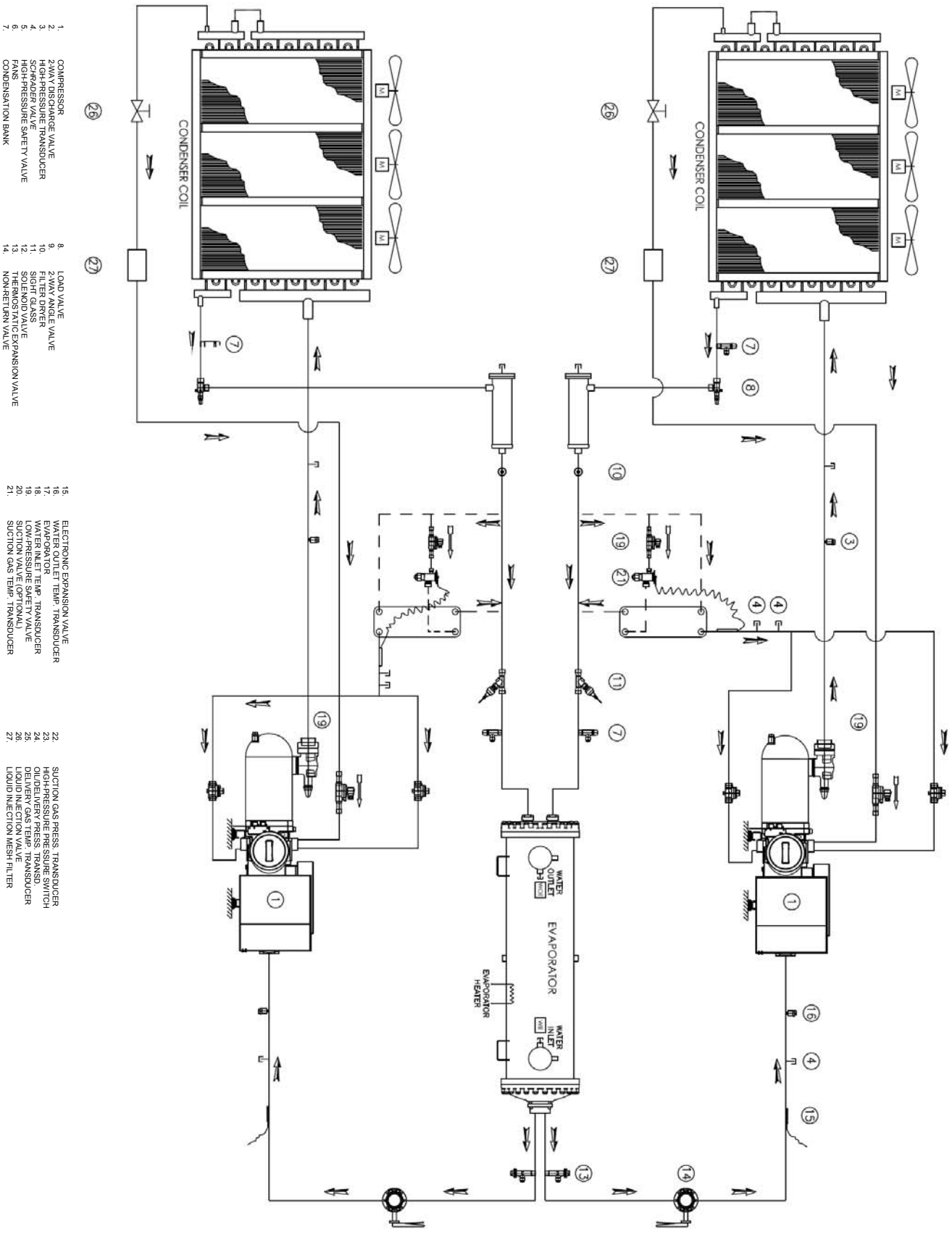
The subcooled fluid flows through the high-efficiency filter dryer and then reaches the lamination element through which a fall in pressure starts the evaporation process.

The result at this point is a low-pressure and low-temperature liquid-gas mixture entering the evaporator.

When the refrigerant liquid-vapour is uniformly distributed in the direct expansion evaporator tubes, heat is exchanged with the cooling water, thus reducing the temperature until complete evaporation, followed by superheating.

Once it has reached the superheated-vapour state, the refrigerant leaves the evaporator and is once again taken into the compressor to repeat the cycle.

Fig. 11 - Unit refrigeration circuit



(*) Water inlet and outlet are indicative. Please refer to the machine dimensional diagrams for exact water connection of the partial recovery exchangers.

Description of the refrigeration cycle with partial heat recovery

The low-temperature refrigerant gas from the evaporator is drawn by the compressor through the electric motor, cooling it. It is subsequently compressed and during this process, the refrigerant mixes with the oil from the oil separator.

The high-pressure oil-refrigerant mix is drawn into the high-efficiency oil separator, that separates it. The oil depositing on the bottom of the separator through pressure difference is sent back to the compressor while the refrigerant that has been separate from the oil is sent to the partial recovery exchanger, where it dissipates the heat from post-overheating cooling, warming the water which travels through the exchanger. On leaving the exchanger, the refrigerant fluid enters the condensation bank where, by forced ventilation, it is condensed.

The condensed fluid at saturation temperature passes through the subcooling section where it loses even more heat, increasing cycle efficiency.

The subcooled fluid then passes through the high-efficiency filter dryer. It subsequently passes through the lamination element, which, by means of a pressure drop, starts the evaporation process.

The result at this point is a low-pressure and low-temperature liquid-gas mixture entering the evaporator.

When the refrigerant liquid-vapour is uniformly distributed in the direct expansion evaporator tubes, heat is exchanged with the cooling water, thus reducing the temperature, changing state until complete evaporation, followed by superheating.

Once it has reached the superheated-vapour state, the refrigerant leaves the evaporator and is once again taken into the compressor to repeat the cycle.

Controlling the partial recovery circuit and installation recommendations

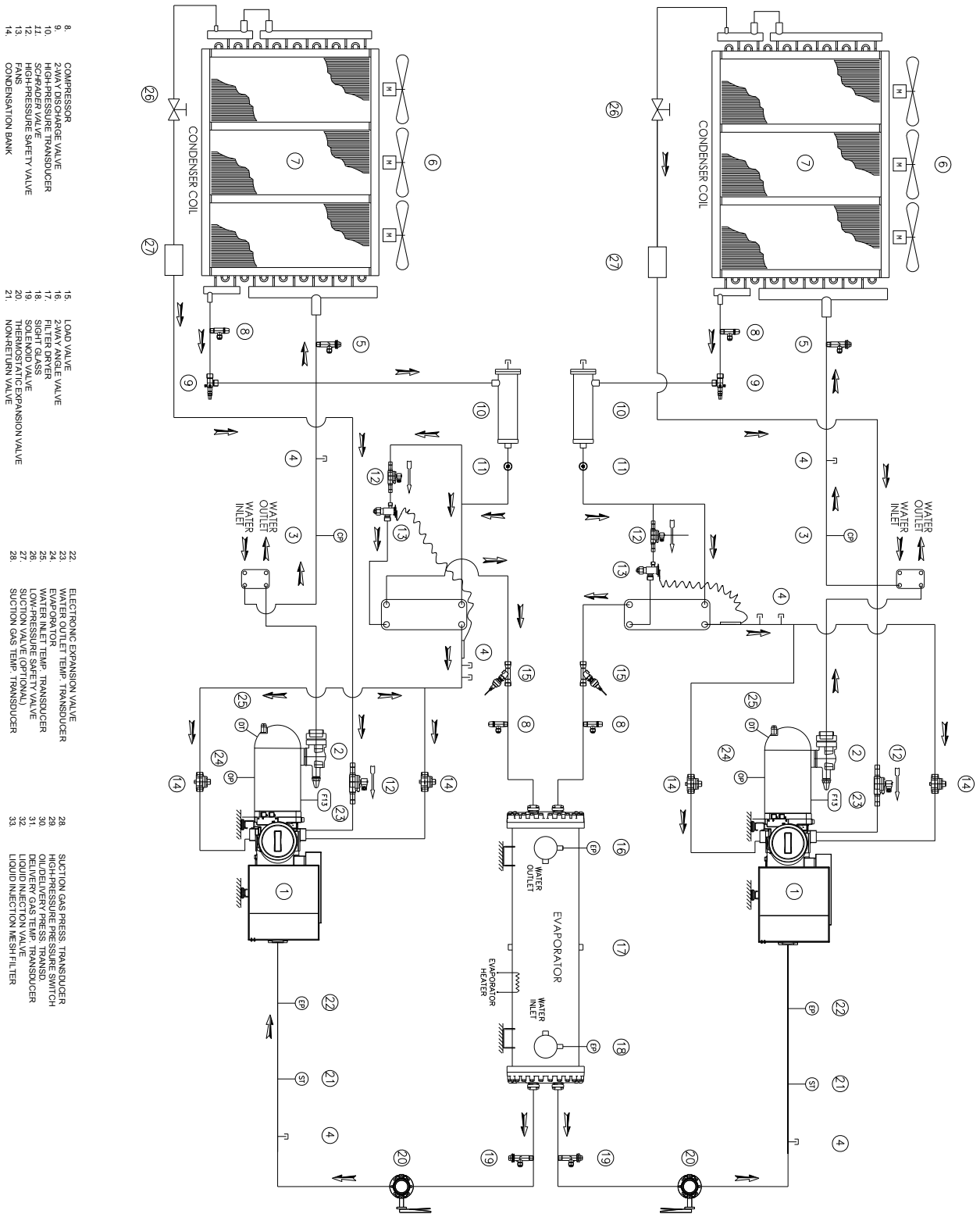
The partial heat recovery system is not managed and/or controlled by the machine. The installer should follow the suggestions below for best system performance and reliability:

1) Install a mechanical filter on the heat exchanger inlet pipe
2) Install shut-off valves to isolate the heat exchanger from the water system during periods of inactivity or system maintenance.
3) Install a drain valve that allows the heat exchanger to be emptied in the event that air temperature is expected to fall below 0°C during periods of machine inactivity.
4) Install flexible anti-vibration joints on the heat recovery water inlet and outlet piping, so that transmission of vibrations, and therefore noise, to the water system is kept as low as possible.
5) Do not load exchanger joints with the weight of the heat recovery piping. The water joints of the exchangers are not designed to support the weight.
6) Should heat recovery water temperature be lower than ambient temperature, it is advised to switch off the heat recovery water pump 3 minutes after having switched off the last compressor.

▲ IMPORTANT

Partial heat recovery, which exploits the post-overheating cooling of the delivery gas, is designed as a source to integrate an external heating source. Recovery availability is only guaranteed with the refrigerating circuit operating upon request of the refrigerated water circuit.
Specifically, it is not suitable for operation with exchanger water inlet temperatures of below 40°C for periods in excess of normal system operation (approx. 30 minutes). Prolonged operation in these conditions can lead to malfunctions of the refrigerating circuit and the intervention of the protective devices.
The installer must ensure that the recovery circuit water reaches the minimum value admitted as quickly as possible.
This is also why the lack of water flow must be ensured in the exchanger when the refrigerating circuit is not running.

Fig. 12 - Refrigeration circuit unit with partial heat recovery



(*) Water inlet and outlet are indicative. Please refer to the machine dimensional diagrams for exact water connection of the partial recovery exchangers.

Compressor

The single-screw compressor is of the semi-hermetic type with an asynchronous three-phase, two-pole motor directly splined on the main shaft. The suction gas from the evaporator cools the electric motor before entering the suction ports. There are temperature sensors inside the electric motor which are completely covered by the coil winding and constantly

monitor motor temperature. Should the coil winding temperature become very high (120°C), a special external device connected to the sensors and to the electronic controller will deactivate the corresponding compressor.
There are only three moving rotating parts and there are no other parts in the compressor with an eccentric and/or alternating movement.
The basic components are therefore only the main rotor and the two satellites that carry out the compression process, meshing perfectly together.
The F3B and F4A compressors are fitted with two satellites arranged horizontally to the screw.
Compression sealing is obtained thanks to a suitably-shaped special composite material that is interposed between the main screw and the satellite. The main shaft on which the main rotor is splined is supported by ball bearings. The system made up in this way is both statically and dynamically balanced before assembly.

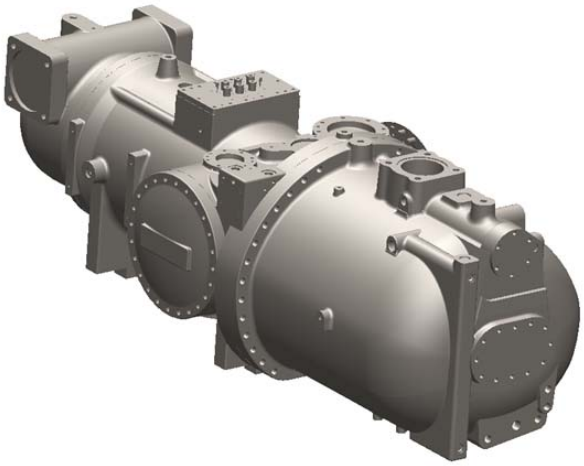


Fig. 13 - Picture of F4AL compressor

Compression process

with the single-screw compressor, the suction, compression and discharge process takes place in a continuous manner thanks to the two satellites. In this process, the suction gas penetrates into the profile between the rotor, teeth of the upper satellite and the compressor body. The volume is gradually reduced by compression of the refrigerant. The compressed gas under high pressure is thus discharged into the built-in oil separator.
In the oil separator, the gas/oil mixture separates and the oil is collected in a cavity in the lower part of the compressor, where it is injected into the compressor mechanisms in order to guarantee compression sealing and lubrication of the ball bearings.

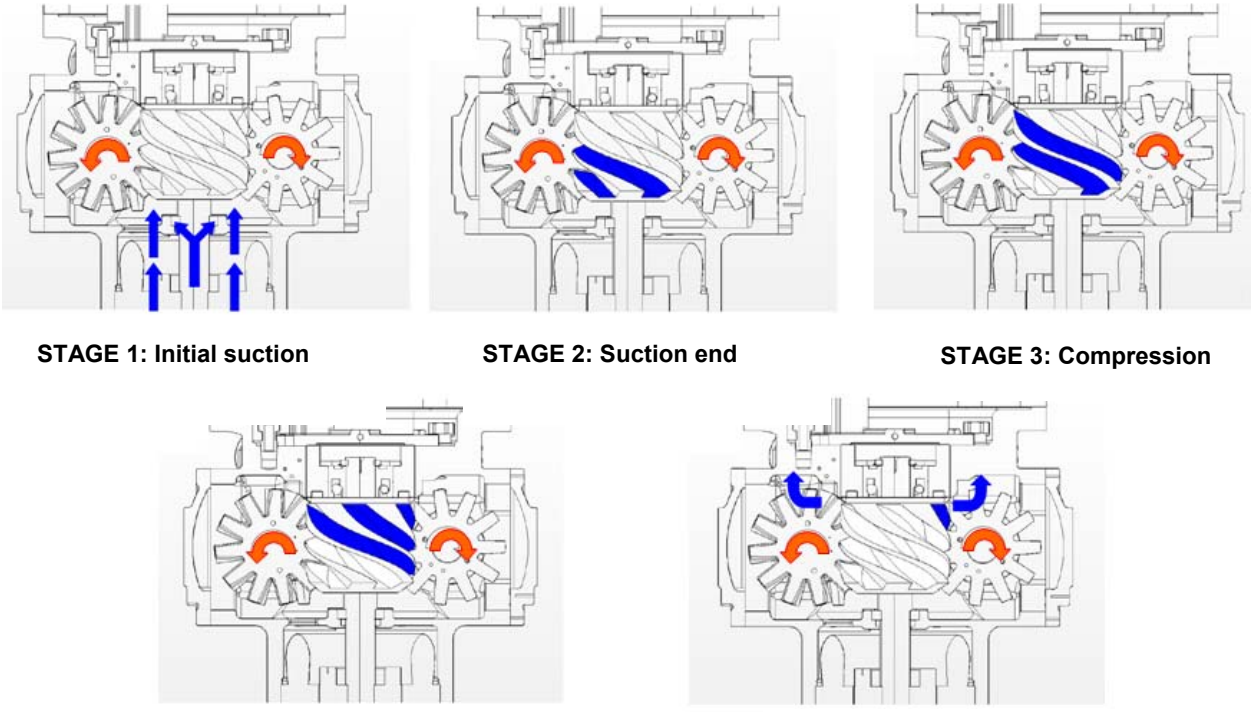


Fig. 14 - Compression process

STAGE 1-2 SUCTION
During screw rotation, the main rotor flutes communicate with the suction chamber, where they begin suction without compressing the gas mixture.
As it rotates, the main rotor increases the effective length of the free flute, thereby increasing the volume open to the suction. This fills the flute up to its closing towards the suction chamber by means of the satellite teeth, which gears onto the screw.
Once the gas is closed into the flute and the suction chamber is separated, the suction stage is complete.

STAGE 3 COMPRESSION
As the main rotor turns, the volume of gas trapped within the screw flute is reduced by the satellite teeth that gear onto the screw, thereby reducing the volume available to the gas mixture.
This entails compression mixture to its maximum value.

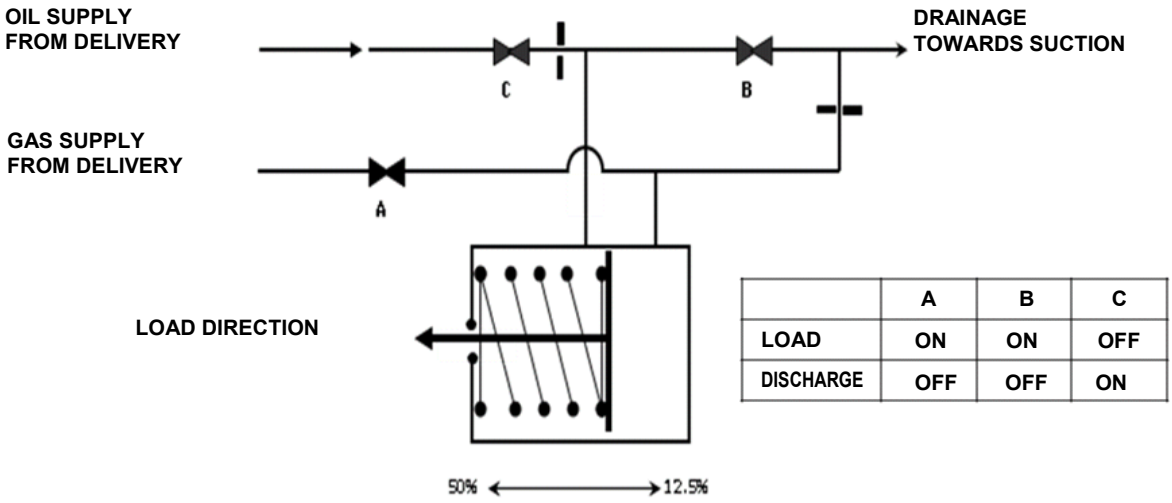
STAGE 4-5 DISCHARGE
As the satellite tooth approaches the end of the flute, the pressure of the trapped vapour reaches a maximum value occurring near the triangular aperture of the discharge port. Compression immediately ceases and the gas is delivered into the discharge manifold. The satellite tooth continues to push the vapour until the flute volume reaches a minimum value.
This compression process is repeated for each screw flute at each turn.

Refrigeration capacity control
The compressors are set up as standard with an infinite control of their capacity.
Two shutters reduce reduce suction capacity, delaying flute closing and decreasing its effective length. These shutters are used to allow the compressor to operate at minimum and maximum loads. The shutters are controlled by the pressure of the oil from the separator or drained towards compressor suction. A spring helps create the force necessary to move the shutter.
The compressors for the EWAD-C- series use two shutters for both load and discharge, controlled by the oil-gas flow through the circuits and directly controlled by the controller through the solenoid valves that are normally closed (NC).
The first shutter allows you to change both the load and discharge continuously. The second, on the other hand, has the on/off operation. Both individually guarantee a 50% change in load/discharge.

Modulating box
The operating diagram of the modulating box is shown in the following figure. The system is controlled by three solenoids, A, B, C, which are normally closed if not powered, and by a spring assembled directly onto the slide.
During loading, solenoid C is closed because it is not excited, whilst the remaining A and B are energised.
With this configuration, the gas from the supply pressure runs through to the chamber on the right of the slide where the pressure wins over the spring resistance, whilst the pipe, passing by the open solenoid B, allows the oil to drain towards suction.
In the drain phase, on the other hand, solenoids A and B are de-excited and therefore closed, whilst solenoid C is opened. In this way, the oil flow, to the delivery pressure, runs towards the chamber to the left of the slide, moving it towards the left helped by the spring action. At the same time, the gasses contained on the right-hand side of the slide discharge in suction, through the free vent pipes.

Non-modulating on/off box
The non-modulating slide operating diagram is shown in the following figure.
The slide is only controlled by means of the opening and closing of two solenoids that always operate by opposition. During the load stage, the solenoid bringing the the slide chamber into communication with the suction is opened, thereby helping pressurised oil drain towards the suction, moving the slide to the load position up to maximum extension.
On the contrary, if closed at the same time as the second slide opens, it allows the pressurised oil flowing from the delivery to move the slide to the discharge position until maximum extension.

MODULATING BOX



	A	B	C
LOAD	ON	ON	OFF
DISCHARGE	OFF	OFF	ON

NON-MODULATING BOX

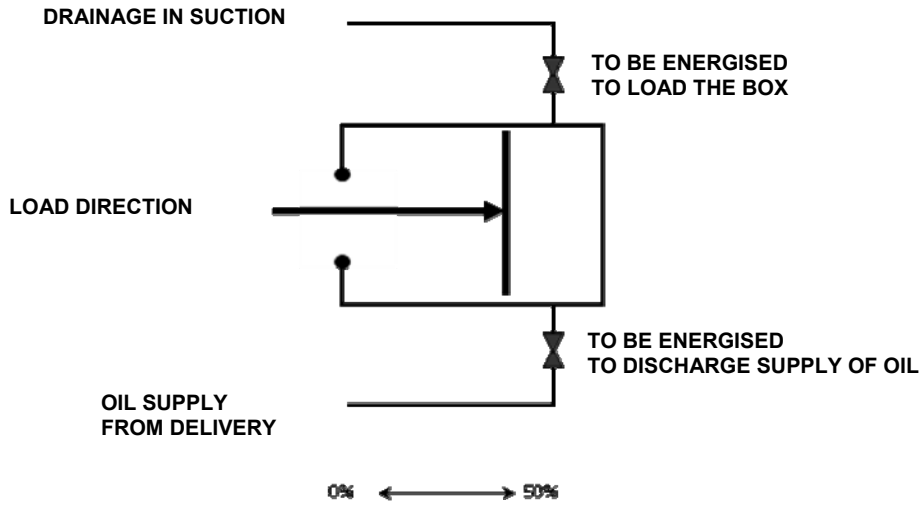


Fig. 15 - Operating layout of load/discharge boxes

Pre-startup checks

General

Once the machine has been installed, use the following procedure to check that it has been done correctly:

⚠ CAUTION

Switch off the power supply of the machine before performing any checks.
As there are condensers inside the VFDs, voltage is supplied at their output for a few minutes after power has been disconnected. Wait for the VFD LEDs to go out before working on the unit. If in doubt, refer to the VFD instruction manuals.

Failure to comply with these rules (failure to open the power switches and failure to wait) can result in serious injury to the operator, or even death.

Inspect all the electrical connections to the power circuits and to the compressors, including the contactors, fuse carriers and electrical terminals and check that they are clean and well-secured. Even though these checks are carried out at the factory on every machine that is shipped, vibrations during transport may loosen some electrical connections.

⚠ CAUTION

Check that the electrical terminals are well-tightened. A loose cable can overheat and give rise to problems with the compressors.

Open the discharge, liquid, liquid injection and suction (if installed) valves.

⚠ WARNING

Do not start-up the compressors if the discharge, liquid, liquid injection and suction valves are closed. Failure to open these valves can cause serious damage to the compressor.

Set all fan thermal-magnetic circuit breakers to on (from Q101 to Q110 and from Q201 to Q210).

▲ IMPORTANT

If the fan thermal-magnetic circuit breakers are left on, at first start-up, both compressors will high-pressure block. To reset the high pressure alarm, you will need to open the compressor room and reset the high pressure mechanical pressure switch.

Check the power supply voltage at the general door-block disconnector switch terminals. The power supply voltage must be the same as that on the nameplate. Maximum tolerance allowed ± 10%.
Voltage unbalance between the three phases must not exceed ± 3%.

The unit comes with a factory-supplied phase monitor that prevents compressors from starting if the phase sequence is incorrect. Properly connect the electrical terminals to the disconnector switch so as to ensure alarm-free operation. If the phase monitor triggers an alarm once the machine has been powered, just invert two phases at the general disconnecting switch supply (unit power supply). Never invert the electrical wiring on the monitor.

▲ ATTENTION

Starting-up with the incorrect phase sequence irreparably compromises operation of some components. Ensure that phases L1, L2 and L3 correspond in sequence to R, S and T.

Fill the water circuit and remove air from the system's highest point and open the air valve above the evaporator shell. Remember to close it again after filling. The design pressure on the water side of the evaporator is 10.5 bar. Never exceed this pressure at any time during the life of the machine.

▲ IMPORTANT

Before putting the machine into operation, clean the water circuit. Dirt, scaling, corrosion residue and other foreign material can accumulate inside the heat exchanger and reduce its heat exchanging capacity. Pressure drops can increase as well, thus reducing water flow. Proper water treatment therefore reduces the risk of corrosion, erosion, scaling, etc.. The most appropriate water treatment
must be determined locally, according to the type of system and local characteristics of the process water.
The manufacturer is not responsible for damage to or malfunctioning of equipment caused by failure to treat water or by improperly treated water.

Units with external water pump

Start the water pump and check the water system for any leaks. Repair if necessary. While the water pump is in operation, adjust the water flow until the design pressure drop for the evaporator is reached. Adjust the flow switch trigger point (not factory-supplied) to ensure operation of the machine within a ± 20% flow range.

Units with built-in water pump

This procedure entails the factory installation of the optional single or two water pump kit.
Check that switches Q0, Q1 and Q2 are in the open position (Off or 0). Also check that the thermal-magnetic circuit breaker Q12 inside the electrical board control area, is in the off position.
Close the general door-block disconnector switch Q10 on the main electrical board hatch and move switch Q12 to the on position.

ITEM	DESCRIPTION	ITEM	DESCRIPTION
Q0	UNIT ON/OFF	**Q10**	MAIN SWITCH
Q1	SWITCH CIRCUIT 1	**Q11**	EMERGENCY BUTTON
Q2	SWITCH CIRCUIT 2	**Q12**	SWITCH THERMAL-MAGNETIC
Q3	SWITCH CIRCUIT 3		

Table 5 - Nomenclature of switches

⚠ CAUTION

From this moment on, the machine will be electrically powered. Take great care over the following operations.
Failure to pay attention during the subsequent activities may lead to serious personal injury.

Single pump To start-up the water pump, press the microprocessor on/off button and wait for the display to show the message 'unit on'. Rotate the switch Q0 to the on position (or 1) to start up the water pump. Adjust water flow until reaching the evaporator design pressure drop. Now adjust the flow switch (not factory-supplied) to ensure operation of the machine within a ± 20% flow range.

Double pump The system provides for the use of a double pump with two motors, one as the other's reserve. The microprocessor enables one of the two pumps according to the fewest number of hours and start-ups. To start-up one of the two water pumps, press the microprocessor on/off button and wait for the display to show the message 'unit on'. Rotate the switch Q0 to the on position (or 1) to start it up. Adjust water flow until reaching the evaporator design pressure drop. Now adjust the flow switch (not factory-supplied) to ensure operation of the machine within a ± 20% flow range. To start-up the pump, open switch QP2. Use the microprocessor keypad to establish pump start-up priority. See the microprocessor manual for the relative procedure.

Use the microprocessor keypad to establish pump start-up priority. See the microprocessor manual for the relative procedure.

Electrical supply

Machine voltage supply must be the same as that specified on the nameplate ± 10%. Voltage unbalancing between phases must not exceed ± 3%. Measure voltage between the phases. If the value reported does not fall within the established limits, correct before starting up the machine.

▲ ATTENTION

Supply appropriate voltage. Unsuitable voltage may cause the control components to malfunction and undesired intervention by the thermal protective devices as well as a substantial
reduction in the life of the contactors and electrical motors.

Unbalancing of the voltage supply

In a three-phase system, excessive unbalancing of phases is the cause of motor overheating. The maximum voltage unbalance permitted is 3%, calculated as follows:

Unbalancing %: $\frac{V_{MAX} - V_{AVG}}{V_{AVG}} x100 = \_\_\_\_\_ \%$ *AVG* = average

Example: the three phases respectively measure 383, 386 and 392 volts, the average is:

$\frac{383+386+392}{3}$ = 387 Volt

the unbalancing percentage is therefore

$\frac{392 - 387}{387} x100 = 1,29\%$ less than the maximum permitted (3%).

Electrical heaters power supply

Each compressor comes with an electrical heater located at the bottom of compressor. Its purpose is to warm up the lubricating oil and thus avoid the mixing of refrigerant fluid within.
It is therefore necessary to ensure that the heaters are powered at least 24 hours before the planned start-up time. To ensure that they are activated, it is sufficient to keep the machine on by closing the general disconnecting switch Q10.
The microprocessor, however, has a series of sensors that prevent the compressor from being started up when the oil temperature is not at least 5°C above the saturation temperature corresponding to the suction pressure.
Keep the Q0, Q1, Q2 and Q12 switches in the off (or 0) position, until the machine is to be started-up.

Start-up procedure

Turning on the machine

1. With the general disconnecting switch Q10 closed, check that switches Q0, Q1, Q2,Q3 and Q12 are in the off (or 0) position.
2. Close the thermal-magnetic switch Q12 and wait for the microprocessor and control to start. Check that the oil temperature is warm enough. The oil temperature must be at least 5°C above the saturation temperature of the refrigerant in the compressor. If the oil is not warm enough, it will not be possible to start the compressors and the phrase 'Oil Heating' will appear on the microprocessor display.
3. Start the water pump, if the machine is not fitted with its own.
4. Turn the Q0 switch to on and wait for 'Unit-on/Compressor stand-by to appear on the display. If the water pump is supplied with the machine, the microprocessor should now start-up.
5. Check that the evaporator pressure drop is the same as the design pressure drop and correct if necessary. The pressure drop must be measured at the factory-supplied charge connections placed on the evaporator piping. Do not measure the pressure drops at points where any valves and/or filters are interposed.
6. When starting-up for the first time, turn the Q0 switch to off to check that the water pump stays on for three minutes before it stops (both the pump on-board the machine and any external pump).
7. Turn the Q0 switch to on again.
8. Check that the local temperature setpoint is set to the required value by pressing the set key.
9. Turn the Q1 switch to on (1) to start compressor #1 or complete the start-up procedure controlled by the processor, by enabling Q1, Q2 and Q3.
10. Once the compressor has started, wait for at least 1 minute for the system to stabilise. During this type the controller will perform a series of operations to empty the evaporator (pre-purge) to ensure a safe start-up.
11. At the end of the pre-purge, the microprocessor will start loading the compressor, now running, in order to reduce the outlet water temperature. Check correct functioning of the capacity control by measuring the compressor's electrical current consumption.
12. Check refrigerant evaporation and condensation pressure.
13. Check cooling fan start-up according to the lowering of the condensation pressure.
14. Once the refrigeration circuit has stabilised, check that the liquid sight glass located on the expansion valve inlet pipe is completely full (without bubbles) and that the humidity indicator shows 'dry'. Any bubbles inside the liquid sight glass may indicate a low refrigerant level or an excessive pressure drop through the filter dryer or an expansion valve that is blocked at the full open position.
15. In addition to checking the liquid sight glass, check circuit operating parameters by verifying:
    a) Superheating of compressor suction
    b) Superheating of compressor discharge
    c) Subcooling of liquid coming out of the condenser banks
    d) Evaporation pressure
    e) Condensation pressure

    All other measurements can be carried out by reading the relevant values directly on the on-board microprocessor display.
16. Turn the Q2 switch to on (1) to start-up compressor #2.
17. Repeat steps 10 to 15 for the second circuit.
18. To turn off the machine temporarily (daily or weekend shut-down), turn the Q0 switch to off (0) or open the remote contact between terminals 58 and 59 of terminal board M5 (installation of a remote switch to be carried out by the customer). the microprocessor will active the shut-down procedure, which will take a few seconds. Three minutes after the compressors have been shut down, the microprocessor will shut down the pump. Do not switch off the main power supply so as not to de-activate the electrical resistances of the compressors and the evaporator.

Table 6 - Typical operating conditions with compressors at 100%

Economised cycle?	Suction superheating	Delivery superheating	Liquid subcooling
NO	5 ÷ 7 °C	20 ÷ 25 °C	5 ÷ 6 °C
YES	5 ÷ 7 °C	18 ÷ 23 °C	15 ÷ 20 °C

⚠ IMPORTANT

The symptoms of low refrigerant charge are:

- low evaporation pressure
- high suction and discharge superheating (beyond the above limits)
- and low subcooling level.

Before adding refrigerant, check the cause of the leak. After repair, add refrigerant R134a to the relevant circuit. The system has been provided with a charge connection between the expansion valve and the evaporator. Charge refrigerant until working conditions return to normal.
Remember to reposition the valve cover when finished.

▲ IMPORTANT

If the machine is not supplied with a built-in pump, do not shut down the external pump before 3 minutes have elapsed after the last compressor shut-down. Early shut-down of the pump triggers a water-flow failure alarm.

Seasonal shut-down

1. Turn switches Q1, Q2 and Q3 to off (or 0) to shut down the compressors, using the normal pump-down procedure.
2. After the compressors have been shut down, turn switch Q0 to off (or 0) and wait for the built-in water pump to shut down. If the pump is managed externally, wait 3 minutes after the compressors have shut down before turning off the pump.
3. Open the Q12 thermal-magnetic switch (off position) inside the control section of the electrical board and then open the general disconnecting switch Q10 to cut off the machine's power supply entirely.
4. Close the compressor intake valves (if any) and delivery valves, as well as the valves located on the liquid and liquid injection line.
5. Place a warning sign on every switch that has been opened, advising to open all valves before starting compressors.
6. If no water and glycol mixture has been introduced into the system, discharge all water from the evaporator and from the connected piping if the machine is to remain inactive during the winter season. Remember that once the machine's power supply has been cut off, the antifreeze electrical resistance cannot function. Do not leave the evaporator and piping exposed to the atmosphere.

Start-up after seasonal shut-down

1. With the general disconnecting switch open, make sure that all electrical connections, cables, terminals and screws are well tightened to ensure good electrical contact.
2. Check that the power supply voltage applied to the machine is within ± 10% of nominal nameplate voltage and that the voltage unbalance between the phases is within the ± 3% range.
3. Check that all control devices are in good condition and functioning and that there is a suitable thermal load for start-up.
4. Check that all connection valves are well tightened and that there are no refrigerant leaks. Always reposition the valve covers.
5. Check that switches Q0, Q1, Q2, Q3 and Q12 are in the open position (Off). Turn the general disconnecting switch Q10 to the on position. Doing this will allow you to turn on the compressor electrical resistances. Wait at least 24 hours for their start-up.
6. Open all suction, delivery, liquid and liquid injection valves. Always reposition the valve covers.
7. Open the water valves to fill the system and vent the air from the evaporator through the vent valve installed on its shell. Check that there are no water leaks from the piping.

System maintenance

⚠ WARNING

All routine and non-routine maintenance activities on the machine must be carried out solely by qualified personnel who have been suitably trained and are familiar with the device, its operation and maintenance, and who are aware of the safety requirements and risks involved.

⚠ WARNING

It 's absolutely forbidden to remove all the protections of the moving parts of the unit

⚠ ATTENTION

The causes of repeated shut-downs deriving from triggering of safety devices must be investigated and corrected. Simply re-starting the alarms may seriously damage the equipment.

⚠ ATTENTION

A correct refrigerant and oil change is essential for optimal operation of the machine and for environmental protection. Any oil and refrigerant recovery must conform to legislation in force.

General

⚠ IMPORTANT

Besides the checks suggested hereto, in order to keep the unit at optimal performance levels and efficiency and prevent malfunction, it is recommended to schedule periodical inspections of the unit by qualified personnel.
Specifically, the following is recommended:

4 inspections per year (every three months) for units running about 365 days per year
2 inspections per year (1 at seasonal start-up and the second mid-season) for units running about 180 days per year
1 inspection per year (at seasonal start-up) for units running about 90 days per year

Regular checks and routine controls should be considered extremely important both during initial start-up and regularly during operation. These checks also include suction and condensation pressures, the sight glass on the liquid line and that the superheating and subcooling parameters, read through the microprocessor installed on the machine, fall within the range of operating parameters.
A recommended ordinary maintenance programme is given at the end of this chapter, whilst an operating data collection card is at the end of the manual. We recommend recording all machine operating parameters on a weekly basis. The collection of this data will also be very useful for technicians, should technical assistance be required.

Compressor maintenance

⚠ IMPORTANT

Although the single-screw compressor is of a semi-hermetic type and therefore does not need scheduled maintenance, for the purposes of keeping the compressor at optimal levels of performance and efficiency and to prevent malfunction, we recommend a visual check on the sate of satellite wear every 10,000 hours of operation, and a measurement of satellite-screw coupling tolerance.
This inspection must be carried out by qualified, trained personnel.

Vibration analysis is a good method for verifying the mechanical conditions of the compressor.
Verification of vibration readings immediately after start-up and periodically on an annual basis is recommended. The compressor load must be similar to the previous measurement's load to ensure measurement reliability.

Lubrication

The units do not require a routine procedure for lubrication of components. The fan bearings are permanently lubricated and as such no additional lubrication is required.
Compressor oil is synthetic and highly hygroscopic. It is therefore advised to limit its exposure to the atmosphere during storage and filling. It is recommended that oil is exposed to the atmosphere for a period of no more than 15 minutes.
The compressor oil filter is positioned above the oil separator (delivery side). Replacement is recommended when its pressure drop exceeds 2.0 bar. The pressure drop across the oil filter is the difference between the compressor discharge pressure and oil pressure. Both these pressures can be monitored through the microprocessor for both compressors.

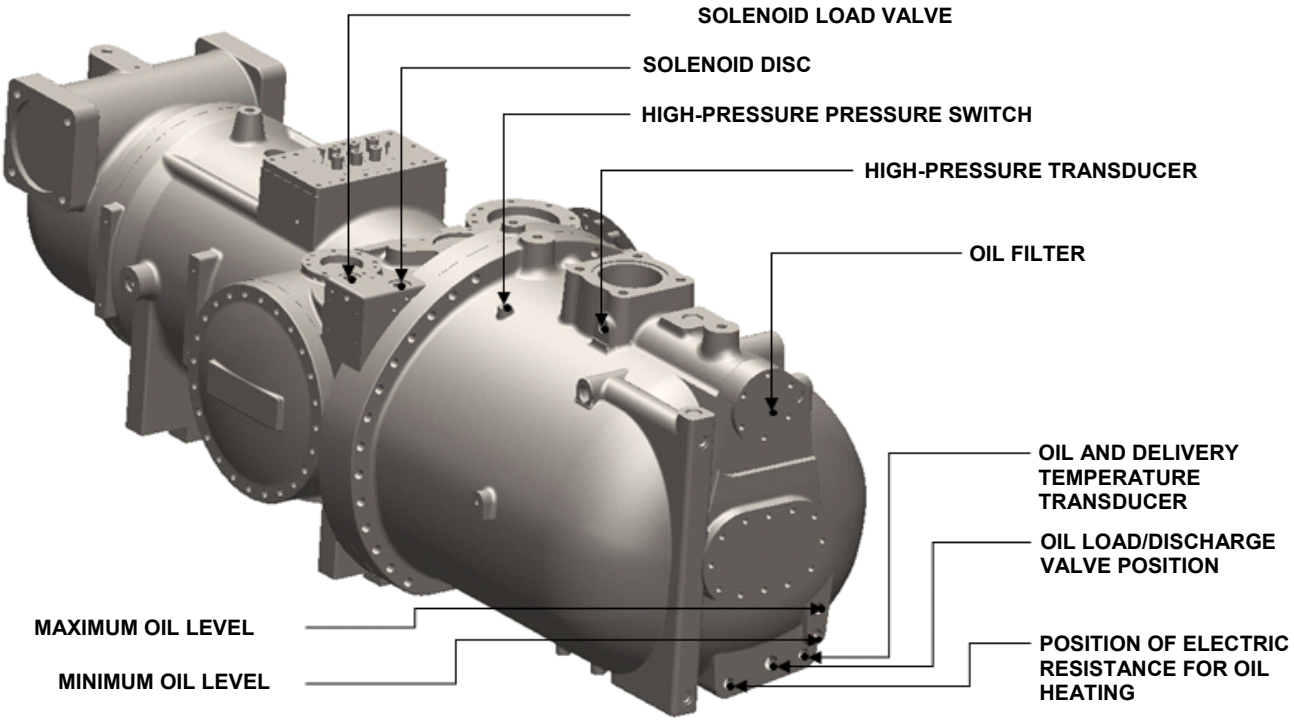


Fig. 16 - Installation of F4AL compressor control devices

Ordinary maintenance

Table 7 - Ordinary maintenance schedule

List of activities	Weekly	Monthly (Note 1)	Yearly (Note 2)
General:			
Collection of operating data (Note 3)	X		
Visual inspection of machine for any damage and/or loosening		X	
Checking of thermal insulation integrity			X
Clean and paint where necessary			X
Water analysis (6)			X
Electrical:			
Checking of correct function of on-board machine instruments			X
Check contactor wear - Replace if necessary			X
Check fastening of all electrical terminals - Tighten if necessary			X
Clean the inside of the electrical control board			X
Visual inspection of components for any signs of overheating		X	
Check operation of compressor and electrical resistance		X	
Measure compressor motor insulation using the Megger			X
Refrigeration circuit:			
Check for any refrigerant leakage		X	
Check refrigerant flow using the liquid sight glass - Sight glass full	X		
Check filter dryer pressure drop		X	
Check oil filter pressure drop (Note 5)		X	
Analyse compressor vibrations			X
Analyse compressor oil acidity (7)			X
Condenser section:			
Clean the condensation banks (Note 4)			X
Check that the fans are properly fastened			X
Check the bank fins - Comb if necessary			X

N.B.:

1) Monthly activities include all weekly ones
2) Yearly (or early season) activities include all weekly and monthly activities
3) Machine operating values should be read on a daily basis thus keeping high observation standards.
4) Bank cleaning may be necessary more frequently in environments with a high percentage of particles in the air.
5) Replace the oil filter when the pressure drop reaches 2.0 bar
6) Check for any dissolved metals
7) TAN (Total Acid Number) : ≤0.10 : No action
   Between 0.10 and 0.19 : Replace anti-acid filters and check after 1,000 running hours. Continue to replace filters until the TAN is lower than 0.10.
   >0.19 : Change oil, replace oil filter and filter dryer. Check at regular intervals.

Filter dryer replacement

It is strongly recommended that the filter dryer cartridges be replaced in the event of a considerable pressure drop across the filter, or if bubbles are observed through the liquid sight glass while the subcooling value is within the accepted limits.
Replacement of the cartridges is advised when the pressure drop across the filter reaches 50 kPa with the compressor under full load.
The cartridges must also be replaced when the humidity indicator in the liquid sight glass changes colour and shows excessive humidity, or when the periodic oil test reveals the presence of acidity (TAN is too high).

Filter dryer cartridge replacement procedure

⚠ ATTENTION

Ensure proper water flow through the evaporator during the entire servicing period. Interrupting the water flow during this procedure would cause the evaporator to freeze, with consequent breakage of internal piping.

1. Shut down the relevant compressor turning the Q1 or Q2 switch to off.
2. Wait until the compressor has stopped and close the valve located on the liquid line.

3. Start up the relevant compressor turning the Q1 or Q2 switch to on.
4. Check the microprocessor display for the corresponding evaporation pressure.
5. When evaporation pressure reaches 100 kPa, turn switch Q1 or Q2 once again, to shut the compressor down.
6. Once the compressor has stopped, place a label on the start-up switch of the compressor being serviced, to avoid undesired start-ups.
7. Close the compressor suction valve (if any).
8. Using a recovery unit, remove surplus refrigerant from the liquid filter until atmospheric pressure is reached. The refrigerant must be stored in a suitable and clean container.

⚠ WARNING

To protect the environment, do not release removed refrigerant into the atmosphere.x Always use a recovery and storage device.

9. Balance internal pressure with external pressure by pressing the vacuum pump valve installed on the filter cover.
10. Remove the filter dryer cover.
11. Remove the filter elements.
12. Install the new filter elements in the filter.
13. Replace the cover gasket. Do not allow any mineral oil onto the filter gasket so as not to contaminate the circuit. Use only compatible oil for this purpose (POE)
14. Close the filter cover.
15. Connect the vacuum pump to the filter and pull vacuum to 230 Pa.
16. Close the vacuum pump valve.
17. Recharge the filter with the refrigerant recovered during emptying.
18. Open the liquid line valve.
19. Open the suction valve (if any).
20. Start up the compressor turning the Q1 or Q2 switch.

Oil filter replacement

▲ IMPORTANT

The lubrication system has been designed to keep most of the oil charge inside the compressor. During operation, however, a small amount of oil circulates freely in the system, conveyed by the refrigerant. The amount of replacement oil going into the compressor should therefore be equal to the quantity removed rather than the amount stated on the nameplate. This will avoid excess oil during the following start-up.
The quantity of oil removed from the compressor must be measured after having allowed the refrigerant present in the oil to evaporate for a suitable amount of time. To reduce the refrigerant content in the oil to a minimum, it is advised that the electrical resistances be kept on and that the oil be removed only when it has reached a temperature of 35÷45°C.

▲ ATTENTION

The replacement of the oil filter requires careful attention with regard to the oil recovery. The oil must not be exposed to air for more than about 30 minutes.
In case of doubts, check oil acidity or, if it is impossible to carry out the measurement, replace the charge of lubricant with fresh oil stored in sealed tanks or as specified by the supplier.

The compressor oil filter is positioned beneath the oil separator (delivery side). Replacement is recommended when its pressure drop exceeds 2.0 bar. The controller stops the compressor in an alarm status when the filter pressure drop reaches 2.5 bar. The pressure drop across the oil filter is the difference between the compressor delivery pressure minus oil pressure. Both these pressures can be monitored through the microprocessor for both compressors.

Compatible oils:

Daphne PVE Hermetic oil FCV 68D

Oil filter replacement procedure

1) Shut down both compressors by turning the Q1 and Q2 switches to the off position.
2) Turn the Q0 switch to off, wait for the circulation pump to turn off and open the general disconnecting switch Q10 to cut off the machine's electrical power supply.
3) Place a label on the handle of the general disconnecting switch in order to prevent accidental start-up.
4) Close the suction, discharge and liquid injection valves.
5) Connect the recovery unit to the compressor and recover the refrigerant in a suitable and clean container.

6) Evacuate the refrigerant until the internal pressure has turned negative (compared to atmospheric pressure). The amount of refrigerant dissolved in the oil is therefore reduced.
7) Drain the oil in the compressor by opening the drain valve located under the oil separator.
8) Remove the oil filter cover and the internal filter element.
9) Replace the cover o-ring and internal sleeve. Do not lubricate the o-ring with mineral oil in order not to contaminate the system.
10) Insert the new filter element.
11) Reposition the filter cover and tighten the screws. The screws must be tightened alternately and progressively, setting the torque wrench at 60 Nm.
12) Charge the oil from the upper cover on the oil separator. Considering the high hygroscopy of ester oil, it should be charged as quickly as possible. Do not expose ester oil to the atmosphere for more than 15 minutes.
13) Close the oil charging cover.
14) Connect the vacuum pump and evacuate the compressor up to a vacuum of 230 Pa.
15) On reaching the above vacuum level, close the vacuum pump valve.
16) Open the suction, discharge and liquid injection system valves.
17) Disconnect the vacuum pump from the compressor.
18) Remove the warning label from the general disconnecting switch.
19) Close the general disconnecting switch Q10 to supply power to the machine.
20) Start the machine by following the start-up procedure described above.

Refrigerant charge

▲ IMPORTANT

The units have been designed to operate with R134a refrigerant. DO NOT USE refrigerants other than R134a.

⚠ WARNING

The addition or removal of refrigerant gas must be in accordance with current regulations and laws.

▲ ATTENTION

When refrigerant gas is added to or removed from the system, ensure proper water flow through the evaporator for the entire charge/discharge time. Interrupting the water flow during this procedure would cause the evaporator to freeze, with consequent breakage of internal piping.
Damage caused by freezing makes the warranty void.

⚠ WARNING

Removal of the refrigerant and replenishing operations must be performed by technicians who are qualified to use the appropriate materials for this unit. Unsuitable maintenance can result in uncontrolled losses in pressure and fluid. Do not disperse the refrigerant and lubricating oil in the environment. Always be equipped with a suitable recovery system.

The units ship with a full refrigerant charge, but in some cases it may be necessary to replenish the machine in the field.

⚠ WARNING

Always check the causes of a loss of refrigerant. Repair the system if necessary, then recharge it.

The machine can be replenished under any stable load condition (preferably between 70 and 100%) and under any ambient temperature condition (preferably above 20°C). The machine should be kept running for at least 5 minutes to allow the fan steps to stabilise and therefore condensation pressure.
The units have approximately 15% of condensation banks devoted to subcooling of the refrigerant liquid. The subcooling value is equal to approx. 5-6°C (10-15°C for the economised machines).
Once the subcooling section has been completely filled, additional refrigerant will not increase system efficiency. However, a small additional quantity of refrigerant (1÷2 kg) makes the system less sensitive.

N.B.: As the load changes and the number of active fans changes, subcooling also changes and takes a few minutes to stabilise. In any case, it must never go below 3°C in any condition. Furthermore, the subcooling value may change slightly as the water temperature and suction superheating vary.

One of the two following scenarios can arise in a machine without refrigerant:

1. If the refrigerant level is slightly low, the flow of bubbles can be seen through the liquid sight glass. Replenish the circuit as described in the replenishment procedure.
2. If the gas level in the machine is moderately low, the corresponding circuit could have some low pressure stops. Replenish the corresponding circuit as described in the replenishment procedure.

Refrigerant replenishment procedure

1) If the machine has lost refrigerant, it is necessary to first establish the causes before carrying out any replenishment operation. the leak must be found and repaired. Oil stains are a good indicator, as they can appear in the vicinity of a leak. However, this is not necessarily always a good search criterion. Searching with soap and water can be a good method for medium to large leaks, while an electronic leak detector is required to find small leaks.
2) Add refrigerant to the system through the service valve on the evaporator inlet pipe.
3) The refrigerant can be added under any load condition between 25 and 100% of the circuit. Suction superheating must be between 4 and 6°C.
4) Add enough refrigerant to fill the liquid sight glass entirely so that no flow of bubbles can be seen any more. Add an extra 2 ÷ 3 kg of refrigerant as a reserve, to fill the subcooler if the compressor is operating at 50 - 100% load.
5) Check the subcooling value by reading the liquid pressure and the liquid temperature near the expansion valve. The subcooling valve must be between 4 and 8°C and 10 and 15°C for the machines with economiser. The subcooling value will be lower at 75 - 100 % load and greater at 50% load.
6) With ambient temperature higher than 16°C, all fans must be on.
7) Overcharging the system will cause a rise in the compressor's discharge pressure, due to excessive filling of the condensation section tubes.

Table 8 - Pressure/Temperature

Pressure/Temperature table of the HFC-134a							
°C	Bar	°C	Bar	°C	Bar	°C	Bar
-14	0.71	12	3.43	38	8.63	64	17.47
-12	0.85	14	3.73	40	9.17	66	18.34
-10	1.01	16	4.04	42	9.72	68	19.24
-8	1.17	18	4.37	44	10.30	70	20.17
-6	1.34	20	4.72	46	10.90	72	21.13
-4	1.53	22	5.08	48	11.53	74	22.13
-2	1.72	24	5.46	50	12.18	76	23.16
0	1.93	26	5.85	52	13.85	78	24.23
2	2.15	28	6.27	54	13.56	80	25.33
4	2.38	30	6.70	56	14.28	82	26.48
6	2.62	32	7.15	58	15.04	84	27.66
8	2.88	34	7.63	60	15.82	86	28.88
10	3.15	36	8.12	62	16.63	88	30.14

Standard checks

Temperature and pressure sensors

The unit comes factory-equipped with all the sensors listed below. Periodically check that their measurements are correct by means of reference instruments (manometers, thermometers) and correct any wrong readings as necessary, using the microprocessor keypad. Well-calibrated sensors guarantee greater machine efficiency and a longer life.
N.B.: refer to the microprocessor use and maintenance manual for a complete description of the applications, settings and adjustments.

All sensors are preassembled and connected to the microprocessor. The descriptions of each sensor are listed below:

Outlet water temperature sensor – This sensor is located on the evaporator outlet water connection and is used by the microprocessor to control the machine load depending on the system's thermal load. It also helps control the evaporator's antifreeze protection.

Inlet water temperature sensor – This sensor is located on the evaporator inlet water connection and is used for monitoring the return water temperature.

External air temperature sensor – Optional. This sensor allows for the monitoring of the external air temperature on the microprocessor display. It is also used to carry out the 'OAT setpoint override'.

Compressor discharge pressure compressor - This is installed on every compressor and allows to monitor the discharge pressure and to control the fans. Should the condensation pressure increase, the microprocessor will control the compressor load in order to allow it to function even if split. It also contributes to the oil control logic.

Oil pressure transducer - This is installed on every compressor and allows you to monitor the oil pressure. The microprocessor uses this sensor to inform the operator on the conditions of the oil filter and on how the lubrication system is functioning. By working together with the high and low pressure transducers, it protects the compressor from problems deriving from poor lubrication.

Low pressure compressor - This is installed on every compressor and allows to monitor the compressor suction pressure along with the low pressure alarms. It also contributes to the oil control logic.

Suction sensor – This is installed optionally (if the electronic expansion valve has been requested) on every compressor, and allows for the monitoring of suction temperature. The microprocessor uses the signal from this sensor to control the electronic expansion valve.

Compressor discharge temperature sensor - This is installed on every compressor and allows to monitor the compressor discharge pressure along with the oil temperature. The microprocessor uses the signal from this sensor to control liquid injection and shut down the compressor should discharge temperature reach 110°C. It also protects the compressor from pumping liquid at start-up.

Test sheet

It is recommended that the following operation data are recorded periodically to check correct operation of the machine over time. This data will also be extremely useful to the technicians who will be performing routine and/or non-routine maintenance on the machine.

Water side measurements

Chilled water setpoints	°C	_____
Evaporator outlet water temperature	°C	_____
Evaporator inlet water temperature	°C	_____
Evaporator pressure drop	kPa	_____
Evaporator water flow rate	m^3/h	_____

Refrigerant side measurements

Circuit #1:

	Compressor load	_____	%
	No. fans enabled	_____	
	No. expansion valve steps (electronic only)	_____	
Refrigerant/oil pressure	Evaporation pressure	_____	Bar
	Condensation pressure	_____	Bar
	Oil pressure	_____	Bar
Refrigerant temperature	Evaporation saturated temperature	_____	°C
	Suction gas temperature	_____	°C
	Suction superheating	_____	°C
	Condensation saturated temperature	_____	°C
	Delivery superheating	_____	°C
	Liquid temperature	_____	°C
	Subcooling	_____	°C

Circuit #2

	Compressor load	_____	%
	No. fans enabled	_____	
	No. expansion valve steps (electronic only)	_____	
Refrigerant/oil pressure	Evaporation pressure	_____	Bar
	Condensation pressure	_____	Bar
	Oil pressure	_____	Bar
Refrigerant temperature	Evaporation saturated temperature	_____	°C
	Suction gas temperature	_____	°C
	Suction superheating	_____	°C
	Condensation saturated temperature	_____	°C
	Delivery superheating	_____	°C
	Liquid temperature	_____	°C
	Subcooling	_____	°C
External air temperature		_____	°C

Electrical measurements

Analysis of the unit's voltage unbalance:

Phases:	***RS***	***ST***	***RT***
	_____ V	**_____ V**	**_____ V**

Unbalancing %: $\frac{V_{MAX} - V_{AVG}}{V_{AVG}} \times 100 = \_\_\_\_\_ \%$ *AVG* = average

Compressor current - Phases:	***R***	***S***	***T***
Compressor #1	_____ A	_____ A	_____ A
Compressor #2	_____ A	_____ A	_____ A

Fan current:				
	#1	_____ A	#2	_____ A
	#3	_____ A	#4	_____ A
	#5	_____ A	#6	_____ A
	#7	_____ A	#8	_____ A

Service and limited warranty

Unless otherwise specifically agreed, all machines are factory-tested and guaranteed for 12 months as of the first start-up or 18 months as of delivery.
These machines have been developed and constructed to high quality standards, ensuring years of failure-free operation. It is important, however, to ensure proper and periodical maintenance in accordance with all the procedures listed in this manual.
We strongly advise stipulating a maintenance contract with an authorised service centre to guarantee efficient, problem-free service, thanks tot he expertise and experience of our personnel.
It must also be taken into consideration that the unit requires maintenance also during the warranty period.
Consider that operating the machine in an inappropriate manner, beyond its operating limits or not performing proper maintenance according to this manual, can void the warranty.
Observe the following points in particular, in order to conform to warranty limits:

1. The machine cannot function beyond the catalogue limits
2. The electrical power supply must be within the voltage limits and without harmonics or sudden changes.
3. The three-phase power supply must not have an unbalance between phases of more than 3%. The machine must stay turned off until the electrical problem has been solved.
4. No mechanical, electrical or electronic safety device must be disabled or overridden.
5. The water used for filling the water circuit must be clean and suitably treated. A mechanical filter must be installed at the point closest to the evaporator inlet.
6. Unless there is a specific agreement at the time of ordering, the evaporator water flow rate must never be above 120% or below 80% of nominal flow rate.

Compulsory routine checks and starting up pressurised devices

The units are included in category IV of the classification according to European Directive PED 97/23/EC

For chillers belonging to this category, some local regulations require a periodic inspection by an authorized agency. Please check with your local requirements.

Important information regarding the refrigerant used

This product contains fluorinated greenhouse gases covered by the Kyoto Protocol.
Do not vent gases into the atmosphere.

Refrigerant type: R134a
GWP[(1)] value: 1300

[(1)] GWP = global warming potential

The refrigerant quantity is indicated on the unit name plate.

Periodical inspections for refrigerant leaks may be required depending on European or local legislation.
Please contact your local dealer for more information.

Disposal

The unit is made of metal and plastic parts. All these parts must be disposed of in accordance with the local regulations in terms of disposal. Lead batteries must be collected and taken to specific refuse collection centres.

Air-cooled chillers with single-screw compressor

EWAD650-C17 C-SS
EWAD650-C17 C-SL
EWAD620-C16 C-SR

EWAD760-C19 C-XS
EWAD760-C19 C-XL
EWAD740-C19 C-XR

EWAD820-C14 C-PS
EWAD820-C14 C-PL
EWAD810-C14 C-PR

Daikin units comply with the European regulations that guarantee the safety of the product.

Daikin Europe N.V. is participating in the EUROVENT Certification Programme. Products are as listed in the EUROVENT Directory of Certified Products.

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