

SCREWLine³

Condenserless liquid chiller

MDE-SL3 120.1 - 290.1 RANGE

EXCELLENCE version

Nominal cooling capacity from 300 kW to 728 kW

- ▶ Single refrigeration circuit with twin screw compressor R-134a
- ▶ Modulating capacity control (stepless) down to 25% of the load
- ▶ Leaving temperature down to -12°C



Features and Benefits

Excellent operating economy

Cutting-edge energy efficiency in its category

- ▶ Eurovent Class A energy efficiency
- ▶ EER up to 4.4 at full load operation
- ▶ High efficiency at part loads with continuous capacity partialization

Perfect matching of the supplied capacity to the load

- ▶ Modulating capacity control (stepless) down to 25% of the load
- ▶ Electronic expansion valve: it quickly adapts to the actual load, controls in a more precise and firmer way than mechanical thermostatic valves, controls the superheating and increases the efficiency and compressor lifetime

Superior heat exchange efficiency

- ▶ Dry expansion shell and tube evaporator at single pass in perfect counterflow: higher exchange efficiency

DST Control (Dynamic Supply Temperature) available for additional energy saving

Great application versatility

Chilled water down to -8°C (Brine configuration). On request: chilled water down to -12°C

Environmental care

Ecological refrigerant R-134a

- ▶ It does not contain chlorine: ODP (Ozone Depletion Potential) equal to 0 Reduced quantity: it contributes to LEED credits for Green Buildings
- ▶ Reduced quantity: it contributes to LEED credits for Green Buildings

Safety against refrigerant leaks

- ▶ All pressure gauges and equipment are already on board
- ▶ PED Certification (Pressure Equipment Directive)

Easy and fast installation and start-up

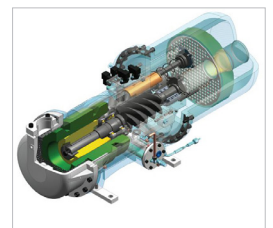
Compact design: the reduced width permits an easy access to plant rooms

Quick installation

- ▶ Easily accessible lifting points
- ▶ Simplified hydronic connections, Victaulic type
- ▶ Practical reference marks for entering and leaving water connections

Easy electrical connection

- ▶ Just one power supply point for the unit
- ▶ Power supply to low voltage control devices integrated into the unit
- ▶ Multifunction phase monitor supplied as standard: it controls the presence and the correct phase sequences, verifies possible voltage anomalies ($\sim 10\%$), it automatically resets the unit operation, when the correct power supply is re-established
- ▶ User contacts are easily accessible and with connection details available on the Installation, Use and Maintenance Manual.



Absolute reliability

Compliance to the most restrictive quality standards

- ▶ CE label that certifies the whole operation process and the conformity to the security rules
- ▶ Individual test to certify the correct operation prior to shipment

Double screw compressors with industrial quality

- ▶ Five long-life shaft bearings
- ▶ Just two rotating parts, protected against wear by an oil film
- ▶ Star-triangle start-up: longer life to the motor and current peak reduction
- ▶ Gradual activation of the capacity control valve
- ▶ Oil separator and electronic oil level sensor: proper lubrication in any operating condition
- ▶ Non return valve: no reverse rotation, no screw wearing

Uninterrupted operation

- ▶ Automatic compressor unloading whenever operating limits are approached: it avoids the unit to shut down
- ▶ Robust evaporator with redundant ice protection: temperature sensors and differential pressure switch
- ▶ Self-adaptive PID control (Proportional-Integral-Derivative): precise temperature control (+/- 1°C) also when fast load changes occur or compressors are activated

Automatic control

Integrated microprocessor control:

- ▶ Automatic operation with best efficiency control
- ▶ Integrated diagnostics and alarm management
- ▶ Back-up of factory settings on static memory card for safe data protection and speed up control programming
- ▶ Automatic compressor sequencer to equalize operating time

Very user-friendly interface

- ▶ Backlit graphic display
- ▶ Several languages available
- ▶ Multilevel menu, password protected

Integrated Energy management

- ▶ Operation scheduler: the unit is activated only when capacity is needed
- ▶ Double set-point
- ▶ Demand limit (either 0-10V or 4-20 mA input) to limit the unit capacity to a predefined value

ECOSHARE function (option) for automatic teamworking (up to 7 units)

- ▶ Further saving: the group of units matches the load with global maximum efficiency
- ▶ Higher reliability: any fault on one unit does not stop operation on other units

Remote system management

- ▶ Standard volt-free contacts: remote on/off, compressor mode, refrigeration circuit enabled/disabled, set-point change, alarm
- ▶ Communication protocols to BMS: Modbus, BACnet-IP, LonWorks
- ▶ Clivet P-Matic, management system

Simplified maintenance

Fast operation on components

- ▶ Simplified access to all section requiring routine maintenance
- ▶ Pump-Down integrated function, with no-leak electronic expansion valve, discharge line shut-off valve, liquid line shut-off valve: refrigerant is stored in the remote condenser for simplified maintenance on the refrigeration circuit

Fast access to unit information

- ▶ Double reading of refrigerant pressures: digital on the user interface, analog on high pressure and low pressure manometers
- ▶ Ethernet connection to provide diagnostics and monitoring via PC

Unit configurability

MDE-SL3 **120 . 1** **EXC** **ST** **=**
 | | | | |
(1) **(2)** **(3)** **(4)** **(5)** **(6)**

(1) Range

MDE = Liquid chiller, water cooled, with screw compressors
SL3 = SCREWLine³ range

(2) Size

120 = Nominal compressor capacity (HP)

(3) Compressors

1 = Compressor quantity

(4) Energy efficiency

EXC = EXCELLENCE version: high energy efficiency

(5) Acoustic configuration

ST = Standard acoustic configuration (standard)

EN = Super-silenced acoustic configuration

(6) Low evaporator water temperature

- = Low water temperature: not required (standard)

B = Low water temperature, down to -8°C (Brine)

'Very low water temperature', down to -12°C, is available on request

Configurations

EN - Super-silenced configuration

Configuration used to increase the unit's silent operation by acting on the source of the noise. It consists of suitable steel casings lined with high-density material designed to provide sound insulation. The casings are secured to an aluminium frame and painted on the outside with polyester powder (RAL 9001).



To assess the quality of the soundproofing benefit, refer to the 'Sound levels' tables.

B - Water low temperature (Brine)

Configuration also known as "Brine". Enables an "unfreezable" solution to be cooled (for example, water and ethylene glycol in suitable quantities) up to a temperature of between +4°C and -8°C. It includes:

- suitable exchangers with extra-thick closed-cell insulation
- electronic expansion valve, functional calibration and safety devices suitable for particular uses.



During the selection phase it is necessary to indicate the required operating type, the unit will be optimised on the basis of this: - Unit with single operating set-point (only at low temperature) - Unit with double operating set-point



The unit in this configuration has a different operating field, which was reported in the previous pages.



In low temperature operation, some staging steps could not be available.



The glycol concentration must be chosen based on the minimum temperature the water can reach. The presence of glycol influences pressure drops on the water side and the unit's output as indicated in the table reporting the "correction factors for use with glycol".



"The "Extremely low water temperature" option for the chilled water production down to -12°C is available on request.

Correction factor for water low temperature

Evaporator outlet water temperature factor	2	0	-2	-4
Cooling capacity factor	0.860	0.804	0.748	0.692
Compressor power input factor	0.945	0.923	0.901	0.879



The correction coefficients must be applied to condition: internal exchanger water (evaporator) = 12 / 7 °C

Example: Determine the performance with leaving water temperature -4°C for MDE-SL3 160.1 EXC ST B unit ('Excellence' version, 'Water low temperature (Brine)' acoustic configuration), condenser temperature 45 °C, 30% glycol.

From the performance table referred to condenser temperature 45°C and the internal exchanger leaving water temperature (evaporator) 7°C. Cooling capacity = 401 kW, Compressor power input = 90.5 kW

From the correction factor table for water low temperature: 0.692 for the cooling capacity and 0.879 for the compressor power input (leaving water temperature -4°C).

From the glycol correction factor : 0.964 for the cooling capacity , 1.007 for the compressor power input , 1.072 for the glycol solution flow, 1.3 for the evaporator pressure drop (glycol 30%).

Calculation MDE-SL3 160.1 EXC ST B: Cooling capacity = 401 x 0.692 x 0.964 = 267.5 kW, Compressor power input = 90.5 x 0.879 x 1.007 = 80.1 kW, Water flow rate = 12.8 (calculated on 267.5 kW) x 1.072 = 13.7 l/s, Evaporator pressure drop = 23.7 (calculated on 12.8 l/s) x 1.3 = 30.8 kPa

Standard unit technical specifications

Compressor

Compact semi hermetic helicoidal twin screw compressors: the main screw (male, with five lobes) is driven directly by the electric motor, while the secondary screw (female with six vanes) is driven by the primary one. Continuous modulation of the cooling capacity supplied with no-load start-up. The tightness is guaranteed by the extremely accurate tolerances in processing all the moving parts and specific oil circulation between the screws. The free flow lubrication system resulting from pressure differences, is equipped with a highly efficient separator, level indicator and oil filter (replaceable). An oil heater prevents excessive dilution of the oil by the refrigerant, and is automatically activated at all stages where the compressor is switched off. Electronic control of the oil level shown on a graphical display. The asynchronous three-phase two-pole motor is suction gas cooled, reduced load start of star delta type. Fully protected electronic module, with safety sensor for monitoring discharge temperature, sensors for monitoring maximum temperature of the windings, device to monitor the motor rotation direction and device to monitor absence of phase. Cut-off valve on the discharge line of the refrigerant. Filter on the supply line, at the compressor inlet. Built-in attenuator and non return valve on the compressor's drain. Automatic safety valve inside the compressor between the high pressure (HP) and low pressure (LP) areas.

Evaporator

Direct expansion exchanger with refrigerant side independent circuit for each compressor. The exchanger is composed of a cover made of carbon steel. The tubes, anchored to the tube plate by mechanical expansion, are made of copper, high efficiency, internally rifled to improve thermal exchange and specially designed for use with modern ecological refrigerants. This is a single-step exchanger with perfect counter-current between the water and the refrigerant. Moreover, it comes with a protection differential pressure switch on the water side and a coating made with closed-cell thermal-insulating material to prevent condensation and heat transfer towards the outside environment. The exchanger water connections are quick type with splined joint.

Refrigeration circuit

The units are designed with a refrigeration circuit equipped with:

- electronic expansion valve
- high pressure safety pressure switch
- low pressure safety valve (safety valve with shut-off valve sealed with lead, open for possible inspection)
- high pressure safety valve (safety valve with shut-off valve sealed with lead, open for possible inspection)
- high and low pressure gauges
- replaceable anti-acid solid cartridge dehydrator filter with connection for refrigerant quick charge
- sight glass with moisture and liquid indicator
- cutoff valve on compressor supply
- cutoff valve on liquid line

Electrical panel

The capacity section includes:

- main door lock isolator switch (compulsory to have certification CE)
- isolating transformer for auxiliary circuit power supply
- compressor fuses and thermal overload relay
- compressor control contactor

The control section includes:

- derivative-integral-proportional control of the water temperature
- antifreeze protection
- unit switching on management by local or remote (serial)
- compressor overload protection and timer
- potential-free contacts for compressor status and enabling
- self-diagnosis system with immediate display of the error code
- prealarm function for high refrigerant gas pressure that avoids in many cases the unit block
- compressor operating hour display
- multifunction phase monitor
- remote ON/OFF control
- remote COOL control
- second set-point enabling by potential-free contact
- automatic compressor start rotation control
- relay for remote cumulative fault signal
- display of the set values, the error codes and the parameter index
- high refrigerant gas pressure pre-alarm function that in many cases prevents the unit from being shut-down
- inlet for demand limit (power input limitation according to a 0÷10V or 4-20 mA external signal)
- interface terminal with graphic display

Accessories

- Rubber antivibration mounts (separately supplied accessories)
- Progressive compressor start-up device
- Compressor overload circuit breakers
- Power factor correction capacitors (cosφ > 0.9)
- Energy meter
- Set-point compensation with outdoor air temperature probe
- Set-point compensation with signal 0-10 V
- Set-point compensation with signal 4-20 mA
- BACnet-IP serial communication module
- LonWorks serial communication module
- Modbus serial communication module
- Remote microprocessor control unit (separately supplied accessories)
- Mains power supply unit (accessory separately supplied)
- ECOSHARE function

Test

All the units are factory-tested in specific steps, before shipping them. After the approval, the moisture contents present in all circuits are analyzed, in order to ensure the respect of the limits set by the manufacturers of the different components.

General technical data

Acoustic treatment: Standard (ST)- Super-silenced(EN)

Size			120.1	140.1	160.1	180.1	200.1	220.1	250.1	270.1	290.1
Cooling											
Cooling capacity	1	kW	300	364	401	466	508	566	620	683	728
Compressor power input	1	kW	69.1	82.4	90.5	104.9	114.0	127.9	140.0	153.9	164.7
Total power input	1	kW	69.6	82.9	91.0	105.4	114.5	128.4	140.5	154.4	165.2
EER	2	-	4.35	4.42	4.43	4.44	4.46	4.42	4.43	4.44	4.42
Compressor											
Type of compressors	3	-	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW
No. of compressors		Nr	1	1	1	1	1	1	1	1	1
Rated power (C1)		HP	120	140	160	180	200	220	250	270	290
Std Capacity control steps	4	Nr	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS
Oil charge (C1)		l	17	21	21	25	25	25	25	25	25
Refrigerant charge (C1)	5	kg	0	0	0	0	0	0	0	0	0
Refrigeration circuits		Nr	1	1	1	1	1	1	1	1	1
Internal exchanger (evaporator)											
Type of internal exchanger	6	-	S&T	S&T	S&T	S&T	S&T	S&T	S&T	S&T	S&T
No. of internal exchangers		Nr	1	1	1	1	1	1	1	1	1
Water flow rate	1	l/s	14.3	17.4	19.2	22.3	24.3	27.0	29.6	32.6	34.8
Internal exchanger pressure drops	1	kPa	29.0	41.0	49.0	24.0	28.0	34.0	40.0	41.0	46.0
Water content		l	190	190	190	307	307	307	307	280	280
Connections											
Gas connection		mm	76	76	76	89	89	89	89	89	89
Liquid connection		mm	42	54	54	54	54	64	64	64	64
Water connections		"	5"	5"	5"	6"	6"	6"	6"	6"	6"
Power supply											
Standard power supply	-	V	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50

- Data referred to the following conditions: internal exchanger water = 12/7 °C. condensing temperature= 45°C.
The data do not consider the part related to the pumps, required to overcome the pressure drop for the solution circulation inside the exchangers. Evaporator fouling factor = 0.44 x 10⁻⁴ m² K/W
- EER referred only to compressors
- DSW = double-screw compressor
- Capacity control with continuous modulation (Stepless)
- The units are shipped with a sealed charge of nitrogen.
- S&T = shell and tube

Electrical data

Acoustic treatment: Standard (ST)- Super-silenced(EN)

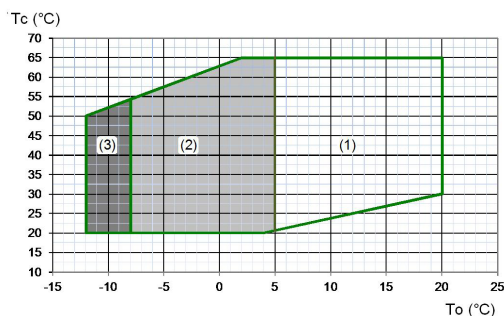
Size			120.1	140.1	160.1	180.1	200.1	220.1	250.1	270.1	290.1
F.L.A. - Full load current at max admissible conditions											
F.L.A. - Total		A	190	236	262	300	327	358	398	429	460
F.L.I. - Full load power input at max admissible conditions											
F.L.I. - Total		kW	118	142	157	180	196	220	241	265	284
M.I.C. Maximum inrush current											
M.I.C. - Value		A	266	262	328	422	422	493	602	717	850
M.I.C. with soft start accessory		A	460	445	555	743	744	852	1026	1290	1450

Power supply: 400/3/50 Hz. Voltage variation: max. +/- 10%)

Voltage unbalance between phases: max 2 %

Electrical data refer to standard units; according to the installed accessories, the data can suffer some variations.

Operating range (cooling)



Tc = condensing temperature (°C)
To (°C) = leaving internal exchanger water temperature (evaporator)

- Standard unit operating range at full load
- Unit operating range in 'B' - Liquid low temperature configuration (40% ethylene glycol)
- Operation range extension (extremely low water temperature option available on request)

Performances in cooling

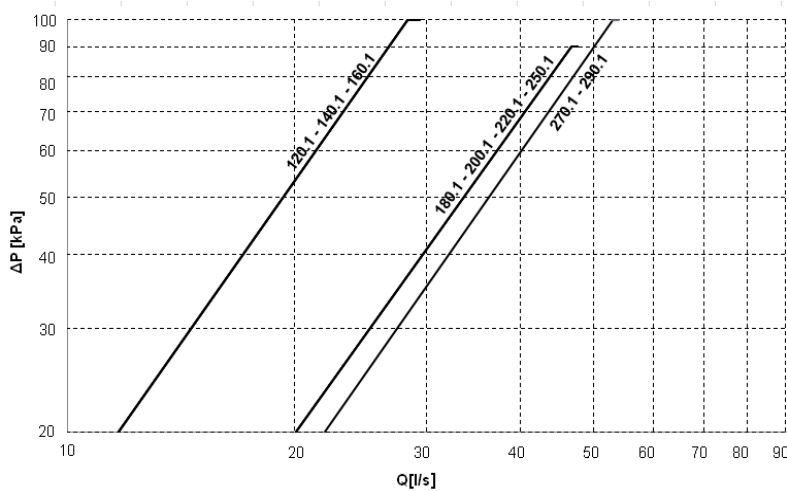
Size	To (°C)	Condensing air temperature (°C)											
		30		35		40		45		50		55	
		kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe
120.1	5	330	54.9	314	57.7	296	62.2	277	68.1	257	76.1	237	84.1
	6	341	55.5	325	58.2	307	62.6	289	68.6	268	76.7	247	84.8
	7	354	56.2	338	58.8	320	63.2	300	69.1	279	77.2	258	85.4
	10	397	58.6	381	60.8	360	64.8	339	70.6	317	79.1	295	87.5
	15	463	62.2	448	63.9	427	67.5	404	73.1	379	81.9	354	90.8
	20	531	65.9	517	67.0	496	70.2	473	75.6	445	84.9	417	94.3
140.1	5	398	65.5	378	69.0	359	74.3	337	81.4	315	89.9	293	98.4
	6	411	66.2	392	69.6	370	74.7	349	81.8	326	90.4	304	98.9
	7	427	67.1	407	70.2	385	75.3	364	82.4	341	91.0	318	99.5
	10	479	69.9	459	72.6	436	77.3	411	84.1	387	92.8	362	101
	15	563	74.5	546	76.8	522	80.9	495	87.3	466	95.8	437	104
	20	646	79.1	634	81.2	612	84.7	579	90.5	552	99.1	525	108
160.1	5	440	71.9	418	75.7	396	81.6	371	89.4	347	98.8	324	108
	6	453	72.6	430	76.3	408	82.1	385	89.9	360	99.3	335	109
	7	470	73.5	447	77.0	424	82.7	401	90.5	376	99.9	350	109
	10	526	76.5	506	79.7	481	84.9	453	92.4	426	102	398	111
	15	618	81.5	598	84.0	575	88.7	545	95.8	514	105	484	115
	20	714	86.4	698	88.9	667	94.1	638	99.3	604	109	571	118
180.1	5	508	83.5	484	87.9	455	94.5	429	103	400	114	372	125
	6	524	84.4	499	88.5	473	95.2	447	104	418	115	389	126
	7	547	85.6	521	89.5	493	95.9	466	105	437	116	407	127
	10	608	89.0	582	92.3	556	98.4	521	107	491	118	461	129
	15	721	94.9	696	97.8	665	103	631	111	596	122	561	133
	20	835	101	812	104	776	108	742	115	704	126	665	137
200.1	5	555	90.6	528	95.4	499	103	468	112	438	124	408	136
	6	573	91.5	545	96.1	517	103	488	113	456	125	424	137
	7	599	92.9	571	97.3	538	104	508	114	476	126	444	138
	10	664	96.5	638	100	606	107	572	116	538	128	505	140
	15	786	103	759	106	725	112	687	121	649	133	611	144
	20	911	109	885	112	846	117	809	125	767	137	724	149
220.1	5	616	101	584	107	553	115	521	126	487	140	452	153
	6	636	102	607	108	576	116	538	127	505	140	472	154
	7	663	104	630	109	599	117	566	128	530	141	494	155
	10	738	108	707	112	675	120	633	130	598	144	562	157
	15	865	115	835	118	802	125	764	135	722	149	679	162
	20	999	122	974	125	941	131	889	140	847	153	805	167
250.1	5	675	111	642	117	607	126	572	138	536	153	500	167
	6	697	112	666	118	626	127	590	139	554	154	517	168
	7	723	113	691	119	656	128	620	140	580	155	540	169
	10	805	118	775	123	732	131	694	143	654	158	615	172
	15	934	125	903	129	867	136	826	148	784	162	742	177
	20	1095	133	1066	137	1018	143	973	153	927	168	881	182
270.1	5	747	122	710	129	670	139	632	152	590	168	548	184
	6	772	124	735	130	698	140	658	153	615	169	572	185
	7	802	125	764	131	726	141	683	154	641	170	599	186
	10	894	130	857	135	818	144	768	157	723	173	678	189
	15	1041	138	1007	142	966	150	919	162	867	179	816	195
	20	1191	146	1158	149	1115	156	1064	167	1008	184	951	200
290.1	5	796	131	758	138	715	148	671	163	629	180	587	197
	6	822	132	781	139	741	149	699	164	653	181	608	198
	7	857	134	819	140	771	151	728	165	682	182	635	199
	10	950	139	910	145	869	154	819	168	771	185	723	203
	15	1120	148	1074	152	1032	161	984	174	929	191	874	209
	20	1297	157	1254	161	1211	169	1145	180	1090	197	1036	215

kWf = Cooling capacity in kW. The data do not consider the pump share, required to overcome the pressure drop for the solution circulation inside the exchangers

kWe = Electrical power absorbed by compressors (kW)

To (°C) = internal exchanger (evaporator) water leaving temperature. Water temperature differential = 5°C

Internal exchanger (evaporator) pressure drops



The pressure drops are calculated considering a water temperature of 7°C

Q = water flow rate [l/s]
DP = water side pressure drops (kPa)

The water flow rate must be calculated with the following formula

$$Q \text{ [l/s]} = kWf / (4,186 \times DT)$$

kWf = Cooling capacity in kW
DT = Temperature difference between inlet / outlet water



To the internal exchanger pressure drops must be added the pressure drops of the steel mesh mechanical filter (not supplied) that must be placed on the water input line. It is a device compulsory for the correct unit operation and it must be selected and installed by the Customer. It is forbidden the use of filters with the mesh pitch higher than 1,0 mm. Filters with higher mesh pitch can cause a bad unit operation and also its serious damaging.

Admissible water flow rates

Min. (Qmin) and max. (Qmax) water flow-rates admissible for the correct unit operation.

		120.1	140.1	160.1	180.1	200.1	220.1	250.1	270.1	290.1
Qmin	[l/s]	11,7	11,7	11,7	20,1	20,1	20,1	20,1	21,9	21,9
Qmax	[l/s]	28,3	28,3	28,3	46,6	46,6	46,6	46,6	52,9	52,9

Minimum system water content

For a proper functioning of the unit a minimum water content has to be provided to the system, using the formula:

$$\begin{aligned} \text{Minimum water content [l]} &= 7 \times kWf \text{ (air conditioning application)} \\ &= 14 \times kWf \text{ (application with low outdoor temperature or low loads required)} \end{aligned}$$

kWf = Nominal cooling capacity unit



Volume calculated does not consider internal heat exchanger (evaporator) water content.

Sound levels

Standard acoustic configuration (ST)

Size	Sound power level (dB)								Sound power level	Sound pressure level
	Octave band (Hz)									
	63	125	250	500	1000	2000	4000	8000		
120.1	91	84	88	82	89	82	72	65	91	71
140.1	92	83	87	82	93	90	80	68	95	76
160.1	92	83	87	82	93	90	80	68	96	76
180.1	92	84	90	84	95	93	81	69	98	79
200.1	92	84	92	82	97	90	79	67	98	79
220.1	93	84	87	86	99	87	73	62	99	80
250.1	94	84	86	78	100	91	76	61	101	81
270.1	93	83	90	77	101	88	76	61	101	82
290.1	94	86	86	80	101	90	76	61	101	82

Sound levels refer to full load units, in test nominal conditions. The sound pressure level refers to 1 m. from the standard unit outer surface operating in open field. Measurements are carried out according to the UNI EN ISO 9614-2 standard, in compliance with the EUROVENT 8/1 certification.

Data referred to the following conditions:
- internal exchanger water = 12/7°C
- condensing temperature = 45°C

Acoustic configuration: Super-silenced (EN)

Size	Sound power level (dB)								Sound power level	Sound pressure level
	Octave band (Hz)									
	63	125	250	500	1000	2000	4000	8000		
120.1	87	79	83	77	83	76	66	58	85	66
140.1	88	78	82	77	87	84	74	61	89	70
160.1	88	78	82	77	87	84	74	61	90	71
180.1	88	79	85	79	89	87	75	62	92	73
200.1	88	79	87	77	91	84	73	60	92	73
220.1	89	79	82	81	93	81	67	55	93	74
250.1	90	79	81	73	94	85	70	54	95	75
270.1	89	78	85	72	95	82	70	54	95	76
290.1	90	81	81	75	95	84	70	54	95	76

Sound levels refer to full load units, in test nominal conditions. The sound pressure level refers to 1 m. from the standard unit outer surface operating in open field. Measurements are carried out according to the UNI EN ISO 9614-2 standard, in compliance with the EUROVENT 8/1 certification.

Data referred to the following conditions:

- internal exchanger water = 12/7°C

- condensing temperature = 45°C

Correction factors for glycol use

Internal exchanger (evaporator)

% ethylene glycol by weight		5%	10%	15%	20%	25%	30%	35%	40%
Freezing temperature	°C	-2,0	-3,9	-6,5	-8,9	-11,8	-15,6	-19,0	-23,4
Safety temperature	°C	3,0	1,0	-1,0	-4,0	-6,0	-10,0	-14,0	-19,0
Cooling Capacity Factor	Nr	0,995	0,989	0,983	0,977	0,971	0,964	0,956	0,949
Compressor power input Factor	Nr	1,0011	1,0022	1,003	1,004	1,006	1,007	1,008	1,009
Internal exchanger glycol solution flow factor	Nr	1,003	1,01	1,02	1,033	1,05	1,072	1,095	1,124
Pressure drop Factor	Nr	1,05	1,10	1,15	1,20	1,25	1,30	1,35	1,40

Fouling Correction Factors

	Internal exchanger (evaporator)	
m ² °C / W	F1	FK1
0.44 x 10⁻⁴	1	1
0.88 x 10⁻⁴	0,97	0,99
1.76 x 10⁻⁴	0,94	0,98

F1 = Cooling capacity correction factors

FK1 = Compressor power input correction factor

F2 = Cooling capacity correction factors

FK2 = Compressors input power correction factors

Exchanger operating range

	Internal exchanger	
	DPr	DPw
PED (CE)	1650	1050

DPr = Maximum operating pressure on refrigerant side in kPa

DPw = Maximum operating pressure on water side in kPa

Overload and control device calibrations

		open	closed	value
High pressure switch	[kPa]	2100	1550	–
Antifreeze protection	[°C]	3	5,5	–
High pressure safety valve	[kPa]	–	–	2500
Low pressure safety valve	[kPa]	–	–	1650
Max no. of compressor starts per hour	[n°]	–	–	6
Discharge safety thermostat	[°C]	–	–	120

Refrigerant circuit specifications (for refrigerant line and remote condenser dimensioning)

Size		120.1	140.1	160.1	180.1	200.1	220.1	250.1	270.1	290.1
Capacity to be discharged	[kW]	369	446	492	571	622	694	760	837	893
Theoretic refrigerant charge	[kg]	46	46	62	70	70	70	70	77	77
Liquid receiver volume	[dm³]	25	25	40	40	40	40	40	40	40

Data referred to the following conditions:

- internal exchanger water = 12/7 °C

- condensing temperature = 45°C

The refrigerant charge above indicated is referred only to the evaporator unit

Max equivalent lengths for pipes to remote condenser

Size		120.1	140.1	160.1	180.1	200.1	220.1	250.1	270.1	290.1
Difference in height	–	Max equivalent length of the supply and liquis pipes								
0	[m]	30	40	40	40	38	40	39	33	29
2,5	[m]	30	40	40	40	38	40	37	31	28
5	[m]	30	40	38	40	38	40	36	30	26
7,5	[m]	30	40	36	40	38	40	34	29	25
10	[m]	30	40	35	40	38	39	33	27	24

R-134a refrigerant for each line meter	[kg/m]	1,64	2,52	2,52	2,62	2,62	3,61	3,61	3,61	3,61
--	--------	------	------	------	------	------	------	------	------	------

Values of the max. allowed equivalent length and refrigerant for each line meter considered for pipes with the same diameters indicated in the 'General technical data' table and in the Dimensional drawing section. These values are purely indicatives and, anyway, valid if pipes and their weld joints are correctly operating and realized, and if no leak is present.

Data referred to the following conditions:

- internal exchanger water = 12/7 °C

- condensing temperature = 45°C

The values indicated supply an equivalent pressure drop within the following max. values:

- 1°C on the supply line to the remote condenser
- 0.5°C on the liquid line to the remote condenser

The difference in height is referred to the remote condenser condition in an higher position than the evaporator unit.

Attention. To take all countermeasures to avoid liquid hammers to the compressor and to ensure a correct oil return to the compressor, etc., such as sloping lines, installing traps, insulation, etc., refer to the standard and correct design rules for refrigerant lines; the manufacturer CLIVET declines all responsibilities for these.

Accessories

PFCP - Power-factor capacitors

The component is necessary to lower the phase difference between current and voltage in the electromagnetic components of the unit (e.g. asynchronous motors). The component allows to put the cosφ power factor to values on average higher than 0.9, reducing the network reactive power. This often leads to an economic benefit which the energy provider grants to the final user.

The device is installed and wired built-in the unit.



CMSC9 - Serial communication module for Modbus supervisor

This enables the serial connection of the supervision system, using Modbus as the communication protocol. It enables access to the complete list of operational variables, commands and alarms. Using this accessory every unit can dialogue with the main supervision systems.

The device is installed and wired built-in the unit.



The total length of each serial line do not exceed 1000 meters and the line must be connected in bus typology (in/out)



CMSC10 - Serial communication module for LonWorks supervisor

This enables the serial connection of the supervision system which uses the LonWorks communication protocol. It enables access to a list of operating variables, commands and alarms which comply with the Echelon® standard.

The device is installed and wired built-in the unit.



The configuration and management activities for the LonWorks networks are the responsibility of the client.



LonWorks technology uses the LonTalk® protocol for communicating between the network nodes. Contact the service supplier for further information.



The total length of each serial line do not exceed 1000 meters and the line must be connected in bus typology (in/out)



CMSC11 - Serial communication module for BACnet-IP supervisor

Allows the serial connection to supervision systems by using BACnet-IP as a communication protocol. It allows the access to the entire list of operating variables, controls and alarms. With this accessory every unit can communicate with the main supervision systems.

The device is installed and wired built-in the unit.



The configuration and management activities for the BACnet networks are the responsibility of the client.



The total length of each serial line do not exceed 1000 meters and the line must be connected in bus typology (in/out)



ECS - ECOSHARE function for the automatic management of a group of units

The device allows automatic management of units that operate on the same hydraulic circuit, by creating a local communication network.

There are two control modes that can be set via a parameter during the activation stage. They both distribute the heat load on the available units by following the distribution logic to benefit from efficiency levels at part load.

Moreover:

Mode 1 - it keeps all the pumps active

Mode 2 - it activates only the pumps of the unit required to operate

The device allows for rotation based on the criterion of minimum wear and management of units in stand-by. There are various unit sizes. Every unit must be fitted with the ECOSHARE feature. The set of units is controlled by a Master unit.

The local network can be extended up to 7 units (1 Master and 6 Slave).



The unit supplied with this device can also be equipped at the same time with the RCMRX option and one of the CMSC9 / CMSC10 / CMSC11 options.

CBS - Compressor magnetothermic circuit breakers

The magnetothermic circuit breakers are inserted instead of the fuses for the protection against the short circuit and overload. In case of intervention they do not have to be replaced, as it happens with fuses.



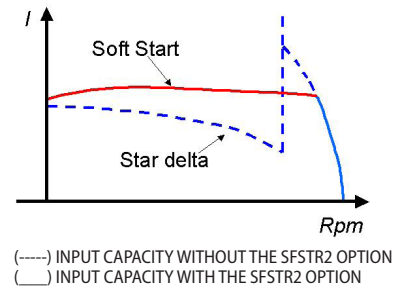
SFSTR2 - Progressive compressor start-up device

This option is also called 'Soft starter'. Electronic device that automatically and gradually starts the compressors, thereby reducing the current peak generated in star-triangle start-ups and therefore reduces the mechanical stress on the motor and the electrodynamic stress on the power cables and on the mains.

The device is installed and wired built-in the unit.



Check availability and compatibility of 'SFSTR2 - Progressive compressor start-up device' with the other accessories in the "Option compatibility" table.



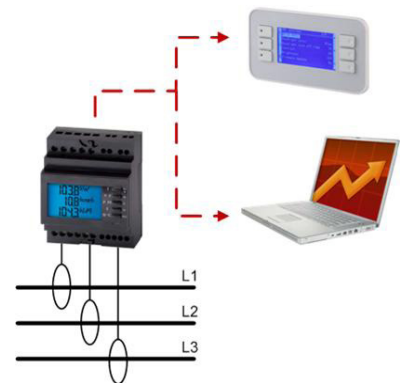
CONTA2 - Energy meter

Allows to display and record the unit's main electrical parameters. The data can be displayed with the user interface on the unit or via the supervisor through the specific protocol variables.

It is possible to control:

- voltage (V),
- absorbed current (A),
- frequency (Hz),
- $\cos\phi$,
- power input (KW),
- absorbed energy (KWh),
- harmonic components (%).

The device is installed and wired built-in the unit.

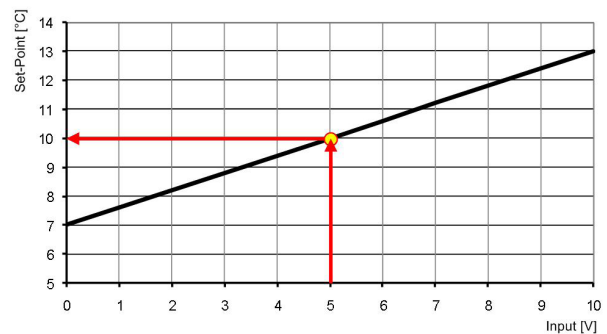


Only the following parameters are available on the LonWorks protocol: power input (kW) and absorbed energy (kWh)

SCP4 - Set-point compensation with 0-10 V signal

This device enables the set-point to be varied which is pre-set using an external 0÷10 V signal.

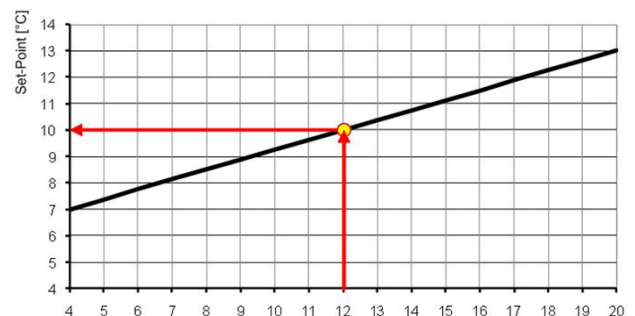
The device is installed and wired built-in the unit.



SPC1 - Set-point compensation with 4-20mA signal

This device enables the set-point to be varied which is pre-set using an external 4-20mA signal.

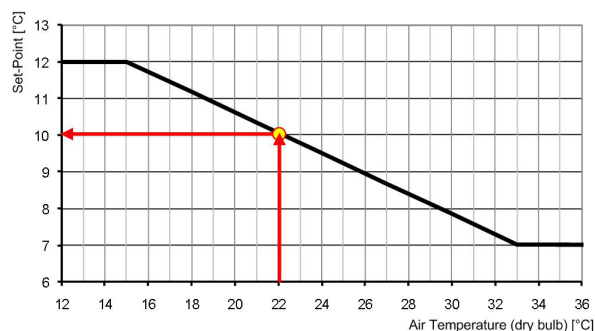
The device is installed and wired built-in the unit.



SPC2 - Set-point compensation with outdoor air temperature probe

This device enables the set-point to be varied automatically which is pre-set depending on the outdoor air temperature. This device enables the liquid flow temperature to be obtained, which varies depending on external conditions, enabling energy savings throughout the entire system.

The device is installed and wired built-in the unit.



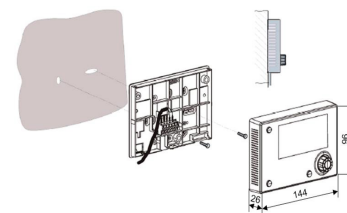
The device includes a probe controlled remotely from outside to measure the outdoor air temperature. (installation to be carried out by the customer). The connection cable length is 16 m.

Accessories separately supplied

RCMRX - Remote control via microprocessor remote control

This option allows to have full control over all the unit functions from a remote position.

It can be easily installed on the wall and has the same aspect and functions of the user interface on the unit.



All device functions can be repeated with a normal portable PC connected to the unit with an Ethernet cable and equipped with an internet navigation browser.



The device must be installed on the wall with suitable plugs and connected to the unit (installation and wiring to be conducted by the Customer). Maximum remote control distance 350 m without auxiliary power supply. For distances greater than 350 m and in any case less than 700 m it is necessary to install the 'PSX - Mains power unit' accessory.



Data and power supply serial connection cable n.1 twisted and shielded pair. Diameter of the individual conductor 0.8 mm.

PSX - Mains power supply unit

The device allows the unit and the remote control to communicate with the user interface even when the serial line is longer than 350m.

It must be connected to the serial line at a distance of 350m from the unit and allows to extend the length to 700m maximum in total. The device requires an external power supply at 230V AC.



Power supply at 230V AC provided by Customer



AMRX - Rubber anti-vibrating dampers

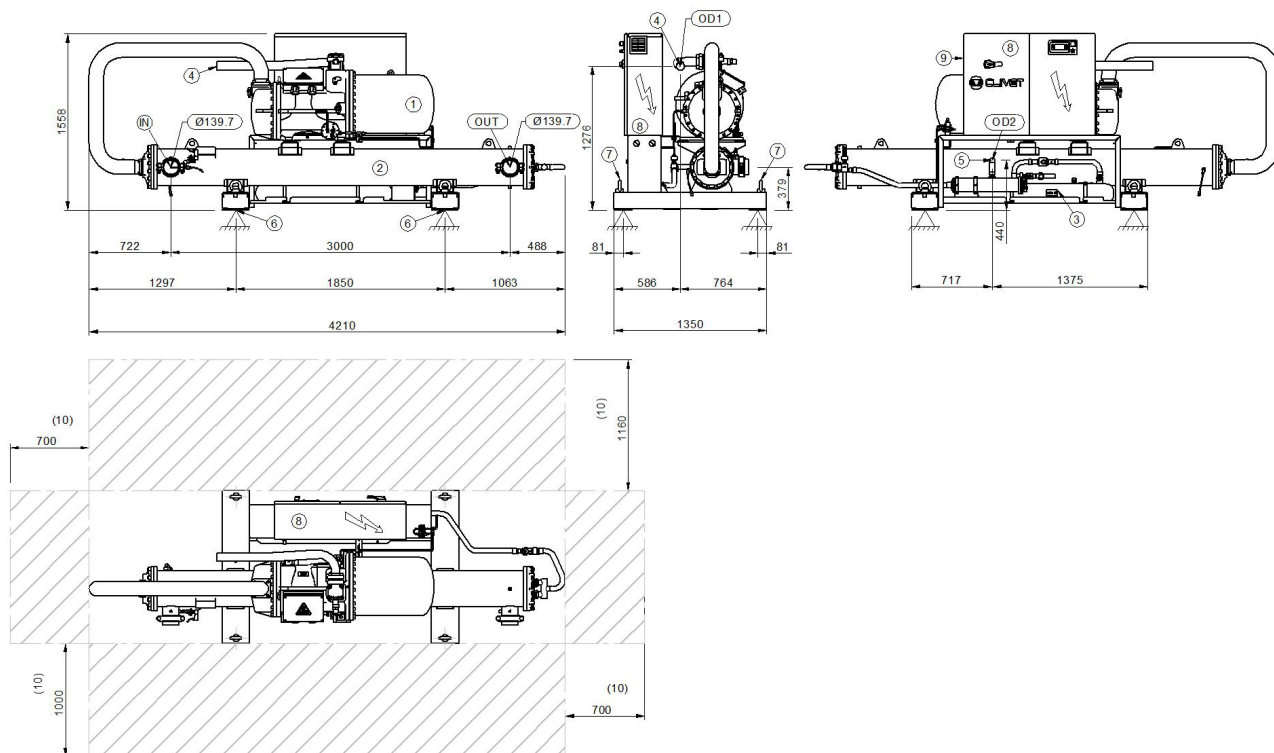
The rubber antivibration mounts must be fixed to designated housings on the support stringers and are used to dampen vibrations produced by the machine, thereby reducing the noise transmitted to the support structures.



Dimensional Drawing

Size 120.1-160.1 Acoustic configuration: Standard (ST)

DAA4J120 1_160 1_ST_0
Date: 18/07/14



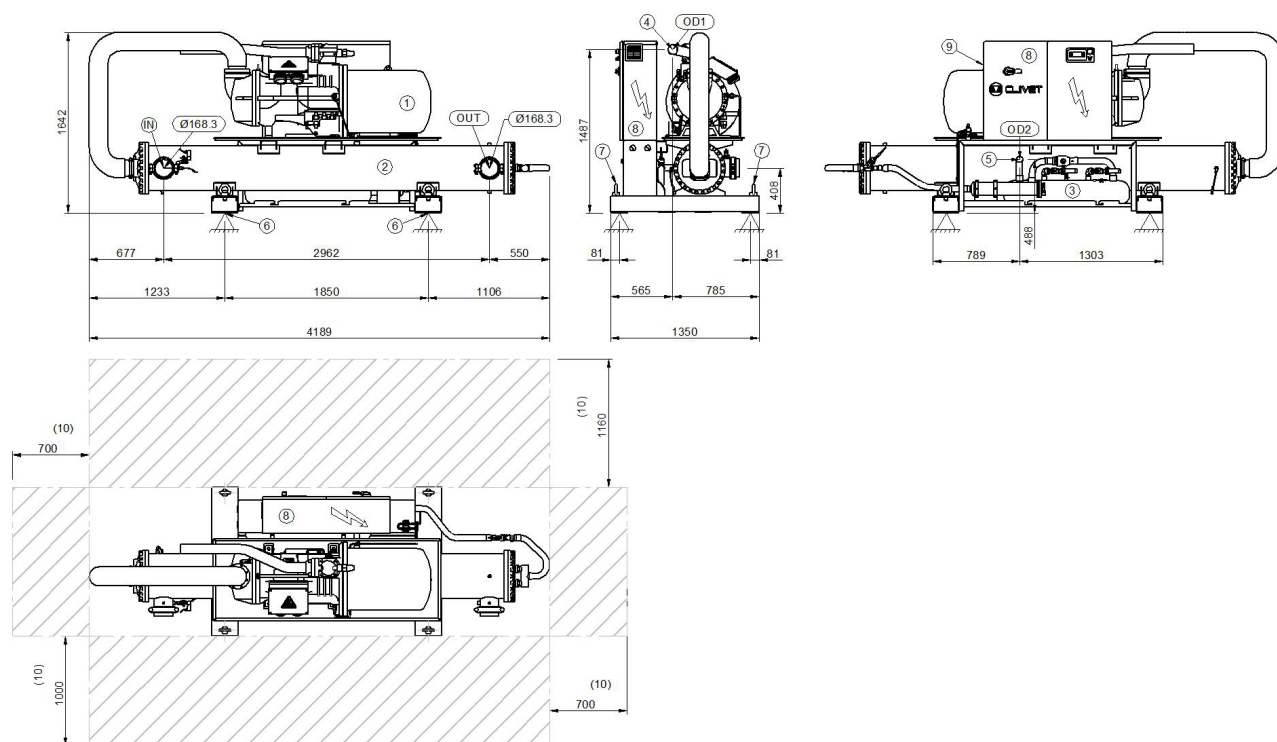
- | | |
|-------------------------------------|--|
| (1) Compressor | (6) Antivibration fixing holes Ø 25mm |
| (2) Internal exchanger (evaporator) | (7) Lifting eyebolt |
| (3) Liquid receiver | (8) Electrical panel |
| (4) Discharge line | (9) Power input |
| (5) Liquid line | (10) Minimum dimension for Maintenance |

Size		ST-EXC		
		120.1	140.1	160.1
OD1		76	76	76
OD2		42	54	54
A - Length	mm	4210	4210	4210
B - Width	mm	1350	1350	1350
C - Height	mm	1558	1558	1558
Shipping weight	kg	1883	1962	2039
Operating weight	kg	2073	2152	2229

The presence of optional accessories may result in a substantial variation of the weights shown in the table

Size 180.1-250.1 Acoustic configuration: Standard (ST)

DAA4J180 1_250 1_ST_0
Date: 18/07/14



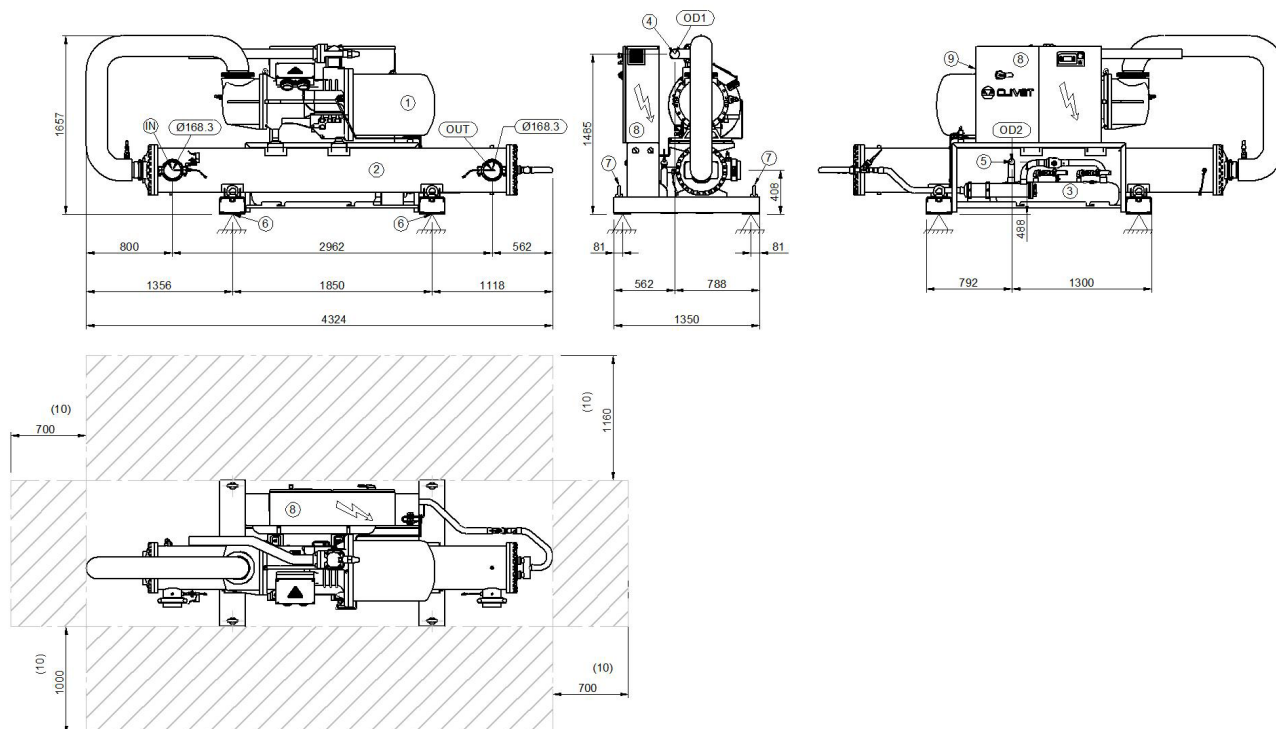
- | | |
|-------------------------------------|--|
| (1) Compressor | (6) Antivibration fixing holes Ø 25mm |
| (2) Internal exchanger (evaporator) | (7) Lifting eyebolt |
| (3) Liquid receiver | (8) Electrical panel |
| (4) Discharge line | (9) Power input |
| (5) Liquid line | (10) Minimum dimension for Maintenance |

Size		ST-EXC			
		180.1	200.1	220.1	250.1
OD1		89	89	89	89
OD2		54	54	64	64
A - Length	mm	4189	4189	4189	4189
B - Width	mm	1350	1350	1350	1350
C - Height	mm	1642	1642	1642	1642
Shipping weight	kg	2514	2525	2536	2588
Operating weight	kg	2821	2832	2843	2895

The presence of optional accessories may result in a substantial variation of the weights shown in the table

Size 270.1-290.1 Acoustic configuration: Standard (ST)

DAA4J270 1_290 1_ST_0
Date: 18/07/14



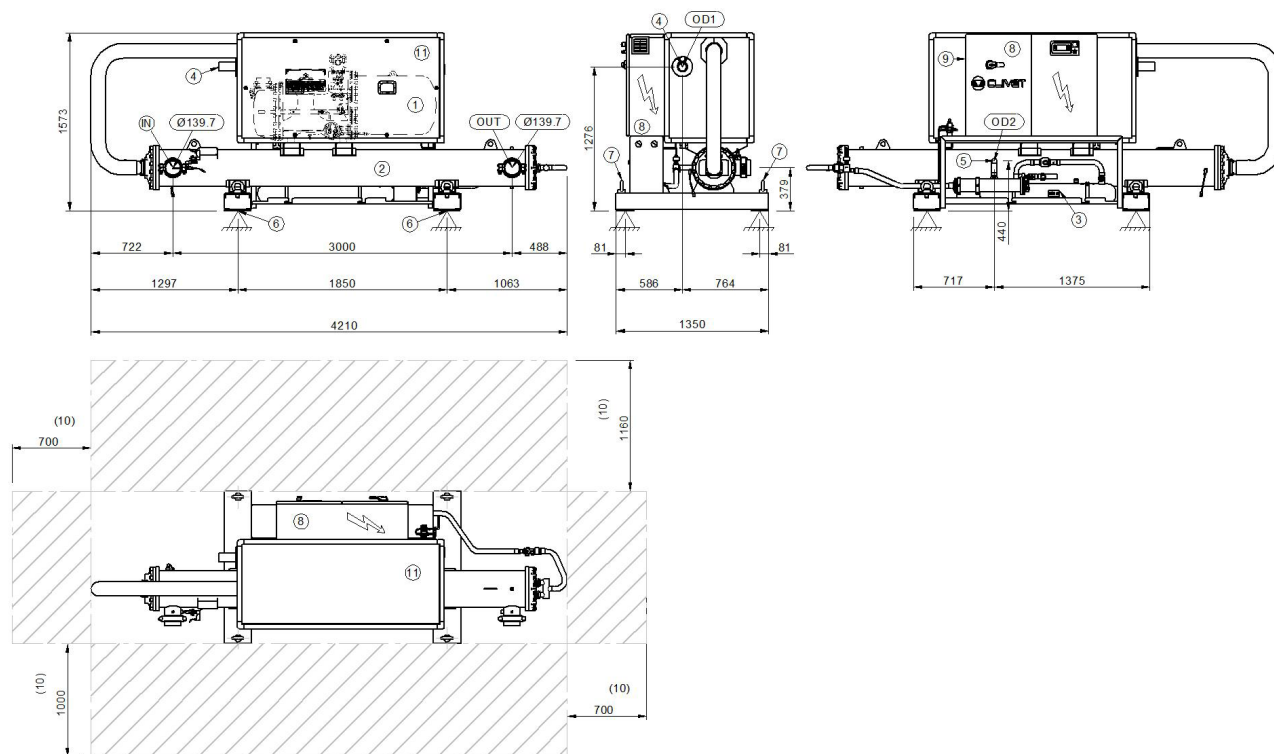
- | | |
|-------------------------------------|--|
| (1) Compressor | (6) Antivibration fixing holes Ø 25mm |
| (2) Internal exchanger (evaporator) | (7) Lifting eyebolt |
| (3) Liquid receiver | (8) Electrical panel |
| (4) Discharge line | (9) Power input |
| (5) Liquid line | (10) Minimum dimension for Maintenance |

Size		ST-EXC	
		270.1	290.1
OD1		89	89
OD2		64	64
A - Length	mm	4324	4324
B - Width	mm	1350	1350
C - Height	mm	1657	1657
Shipping weight	kg	2701	2732
Operating weight	kg	2981	3012

The presence of optional accessories may result in a substantial variation of the weights shown in the table

Size 120.1-160.1 Acoustic configuration: Super-silenced (EN)

DAA4J120 1_160 1_EN_0
Date: 18/07/14



- | | |
|---------------------------------------|--|
| (1) Compressor | (7) Lifting eyebolt |
| (2) Internal exchanger (evaporator) | (8) Electrical panel |
| (3) Liquid receiver | (9) Power input |
| (4) Discharge line | (10) Minimum dimension for Maintenance |
| (5) Liquid line | (11) Soundproofed cabin |
| (6) Antivibration fixing holes Ø 25mm | |

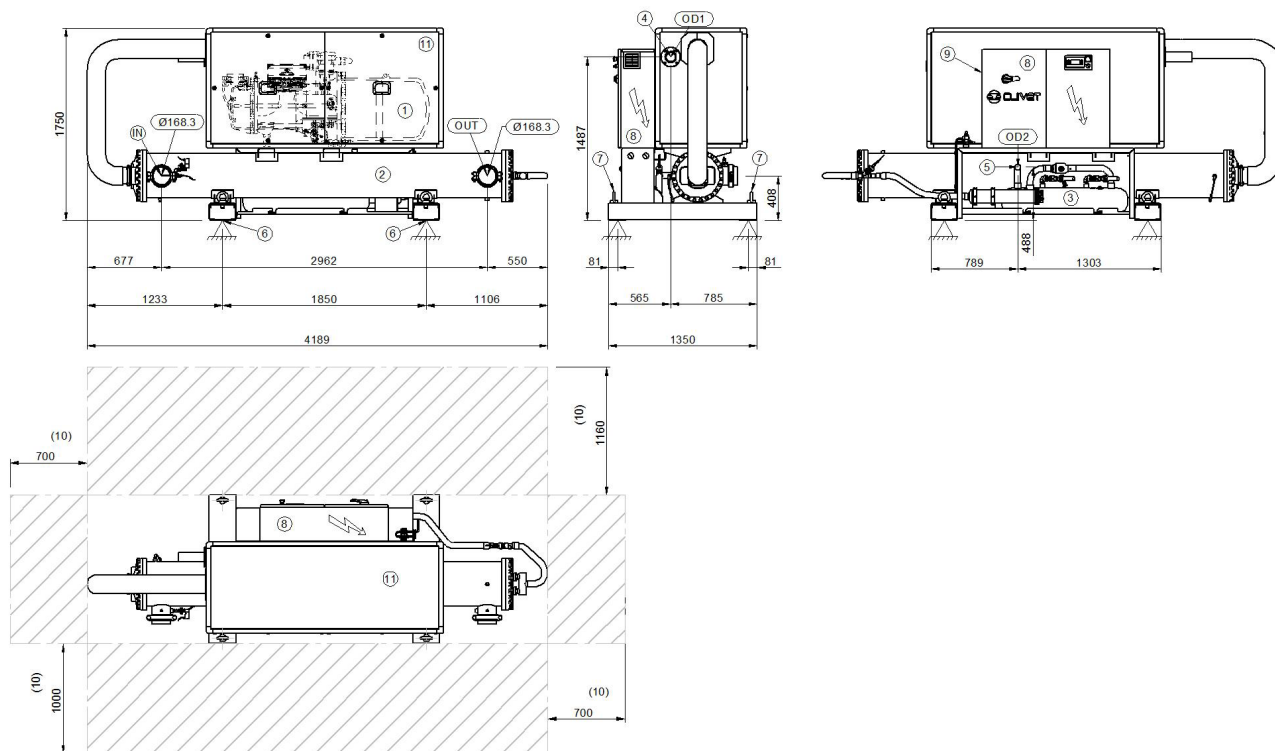
Size		EN-EXC		
		120.1	140.1	160.1
OD1		76	76	76
OD2		42	54	54
A - Length	mm	4210	4210	4210
B - Width	mm	1350	1350	1350
C - Height	mm	1573	1573	1573
Shipping weight	kg	2047	2155	2232
Operating weight	kg	2237	2345	2422

The presence of optional accessories may result in a substantial variation of the weights shown in the table

Size 180.1-250.1 Acoustic configuration: Super-silenced (EN)

DAA4J180 1_250 1_EN_0

Date: 18/07/14



- | | |
|---------------------------------------|--|
| (1) Compressor | (7) Lifting eyebolt |
| (2) Internal exchanger (evaporator) | (8) Electrical panel |
| (3) Liquid receiver | (9) Power input |
| (4) Discharge line | (10) Minimum dimension for Maintenance |
| (5) Liquid line | (11) Soundproofed cabin |
| (6) Antivibration fixing holes Ø 25mm | |

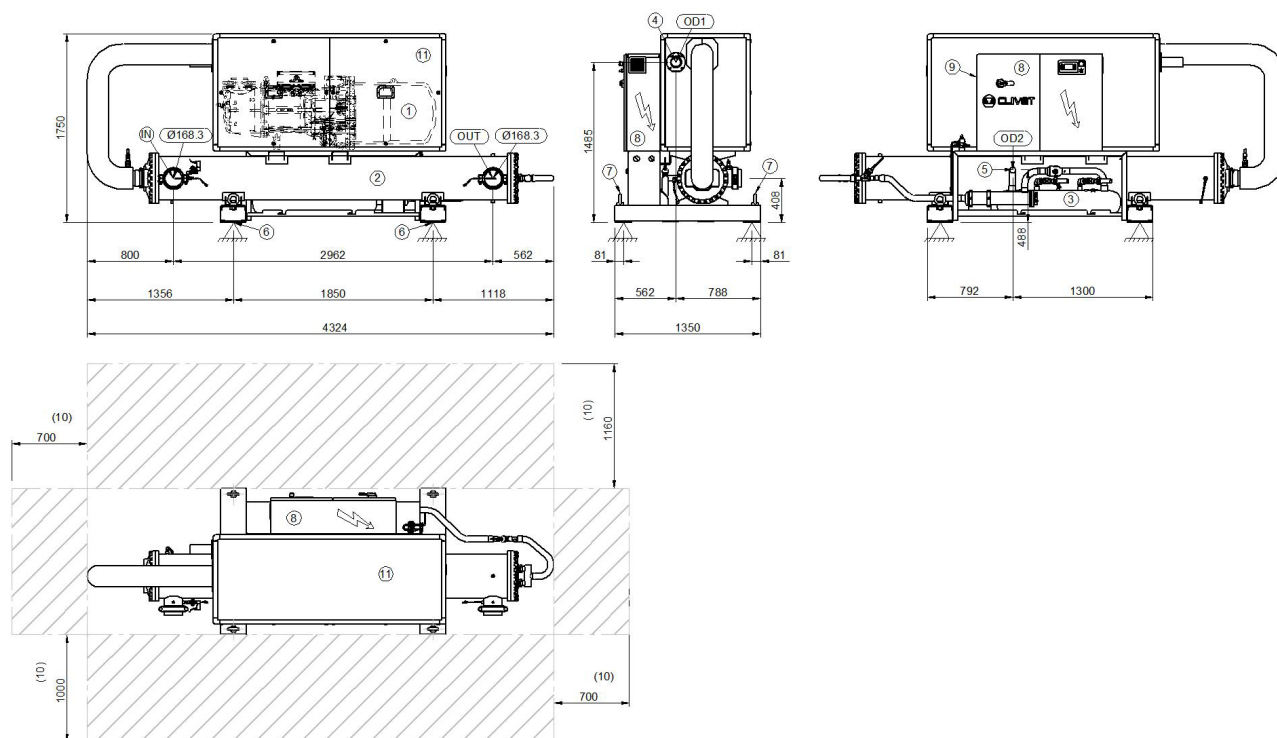
Size		EN-EXC			
		180.1	200.1	220.1	250.1
OD1		89	89	89	89
OD2		54	54	64	64
A - Length	mm	4189	4189	4189	4189
B - Width	mm	1350	1350	1350	1350
C - Height	mm	1750	1750	1750	1750
Shipping weight	kg	2737	2748	2759	2811
Operating weight	kg	3044	3055	3066	3118

The presence of optional accessories may result in a substantial variation of the weights shown in the table

Size 270.1-290.1 Acoustic configuration: Super-silenced (EN)

DAA4J270 1_290 1_EN_0

Date: 18/07/14



- | | |
|---------------------------------------|--|
| (1) Compressor | (7) Lifting eyebolt |
| (2) Internal exchanger (evaporator) | (8) Electrical panel |
| (3) Liquid receiver | (9) Power input |
| (4) Discharge line | (10) Minimum dimension for Maintenance |
| (5) Liquid line | (11) Soundproofed cabin |
| (6) Antivibration fixing holes Ø 25mm | |

Size		EN-EXC	
		270.1	290.1
OD1		89	89
OD2		64	64
A - Length	mm	4324	4324
B - Width	mm	1350	1350
C - Height	mm	1750	1750
Shipping weight	kg	2924	2955
Operating weight	kg	3204	3235

The presence of optional accessories may result in a substantial variation of the weights shown in the table

**CLIVET SPA**

Via Camp Lonc 25, Z.I. Villapaiera - 32032 Feltre (BL) - Italy
Tel. + 39 0439 3131 - Fax + 39 0439 313300 - info@clivet.it

CLIVET UK LTD (Sales)

4 Kingdom Close, Segensworth East - Fareham, Hampshire - PO15 5TJ - United Kingdom
Tel. + 44 (0) 1489 572238 - Fax + 44 (0) 1489 573033 - info@clivet-uk.co.uk

CLIVET AIRCON LTD (Service and Maintenance Division)

Units F5&F6 Railway Triangle Ind EST, Walton Road - Portsmouth, Hampshire - PO6 1 TG - United Kingdom
Tel. + 44 (0) 2392 381235 - Fax + 44 (0) 2392 381243 - info@clivetaircon.co.uk

CLIVET ESPAÑA COMERCIAL S.L. (Sales)

Calle Gurb, 17 1º 1ª - 08500 Vic, Barcelona - España
Tel. + 34 93 8606248 - Fax + 34 93 8855392 - info@clivetcomercial.es

CLIVET ESPAÑA S.A.U. (Service and Maintenance Division)

Calle Real de Burgos nº12 - 28860, Paracuellos del Jarama, Madrid - España
Tel. + 34 91 6658280 - Fax + 34 91 6657806 - info@clivet.es

CLIVET GmbH

Hummelsbütteler Steindamm 84, 22851 Norderstedt - Germany
Tel. + 49 (0) 40 32 59 57-0 - Fax + 49 (0) 40 32 59 57-194 - info.de@clivet.com

CLIVET NEDERLAND B.V.

Siliciumweg 20a, 3812 SX Amersfoort - Netherlands
Tel. + 31 (0) 33 7503420 - Fax + 31 (0) 33 7503424 - info@clivet.nl

CLIVET RUSSIA

Elektrozavodskaya st. 24, office 509 - 107023, Moscow, Russia
Tel. + 74956462009 - Fax + 74956462009 - info.ru@clivet.com

CLIVET MIDEAST FZCO

Dubai Silicon Oasis (DSO), High Bay Complex, Ind Unit No. 3 - PO Box 28178 - DUBAI, UAE
Tel. + 97 14 3208499 - Fax + 97 14 3208216 - info@clivet.ae

CLIVET AIRCONDITIONING SYSTEMS PRIVATE LTD

3C3, Gundecha Onclave - Kherani Road, Saki Naka, Andheri (East), Mumbai 400 072 (INDIA)
Tel. + 91 - 22 - 6193 7000 - Fax + 91 - 22 - 6193 7001 - sales.india@clivet.com