Technical Bulletin

BT14G017GB-01

SCREWLine^3

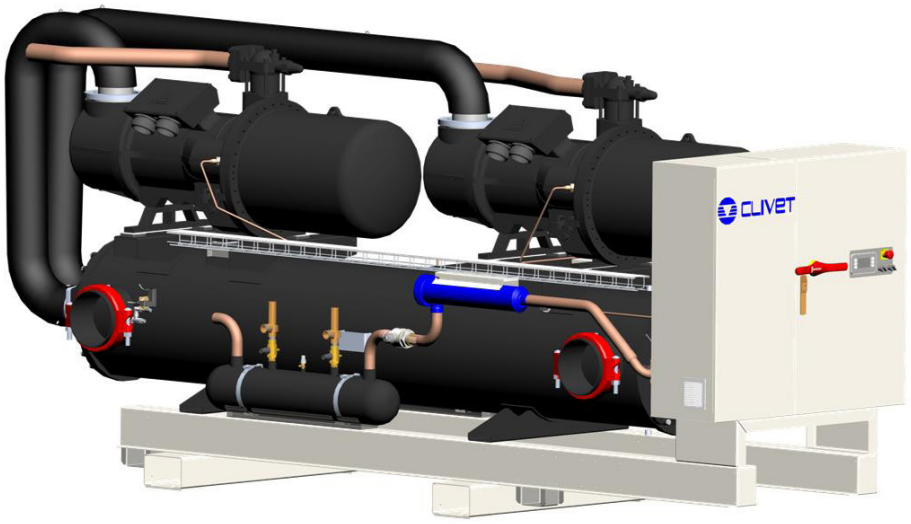
Condenserless liquid chiller

MDE-SL3 220.2 - 580.2 RANGE

EXCELLENCE version

Nominal cooling capacity from 550 kW to 1427 kW

- Single refrigeration circuit with twin screw compressor R-134a
- Modulating capacity control (stepless) down to 12.5% 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 12.5% 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
- Single evaporator for both circuits: it maximizes the efficiency with one compressor in operation

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
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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

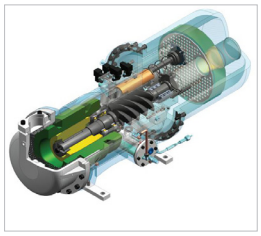
Compact design: the reduced width permits an easy access to plant rooms

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 (-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

- Two independent refrigerant circuits provide partial cooling even if one circuit develops a fault
- 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

Semplified 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 (1) 580 . 2 (2) (3) EXC (4) ST (5) - (6)

(1) Range
MDE = Liquid chiller, water cooled, with screw compressors
SL3 = SCREWLine3 range

(2) Size
580 = Nominal compressor capacity (HP)

(3) Compressors
2 = 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	0.803	0.749	0.691
Compressor power input factor	0.896	0.878	0.859	0.840

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 320.2 EXC ST B unit ('Excellence' version, 'Water low temperature (Brine)' acoustic configuration) with 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 = 794 kW, Compressor power input = 181 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 320.2 EXC ST B: Cooling capacity = 794 x 0.692 x 0.964 = 529.7 kW, Compressor power input = 181 x 0.879 x 1.007 = 160.2 kW, Water flow rate = 25.3 (calcolata su 529.7 kW) x 1.072 = 27.1 l/s, Evaporator pressure drop = 26 (calcolata su 25.3 l/s) x 1.3 = 33.8 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 made with two independent refrigeration circuits, each 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 pressurethat 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 (cosfi > 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			220.2	240.2	260.2	280.2	300.2	320.2	340.2	360.2	400.2	440.2	470.2	500.2	540.2	580.2
Cooling																
Cooling capacity	1	kW	550	585	642	720	757	794	848	899	997	1115	1159	1231	1344	1427
Compressor power input	1	kW	128,0	137,3	150,2	164,5	173,2	181,0	195,3	208,4	227,5	255,4	267,3	280,5	307,0	328,7
Total power input	1	kW	128,5	137,8	150,7	165,0	173,7	181,5	195,8	208,9	228,0	255,9	267,8	281,0	307,5	329,2
EER	2	-	4.30	4.26	4.27	4.38	4.37	4.39	4.34	4.31	4.38	4.37	4.34	4.39	4.38	4.34
Compressor																
Type of compressors	3	-	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW	DSW
No. of compressors		Nr	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Rated power (C1)		HP	110	120	120	140	140	160	160	180	200	220	220	250	270	290
Nominal capacity (C2)		HP	110	120	140	140	160	160	180	180	200	220	250	250	270	290
Std Capacity control steps	4	Nr	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS
Oil charge (C1)		l	17.0	17.0	17.0	21.0	21.0	21.0	21.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Oil charge (C2)		l	17.0	17.0	21.0	21.0	21.0	21.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Refrigerant charge (C1)	5	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigerant charge (C2)	5	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigeration circuits		Nr	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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	S&T	S&T	S&T	S&T	S&T
No. of internal exchangers		Nr	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water flow rate	1	l/s	26.3	28.0	30.7	34.4	36.2	37.9	40.5	43.0	47.6	53.3	55.4	58.8	64.2	68.2
Internal exchanger pressure drops	1	kPa	32	36	42	45	50	54	35	39	41	50	53	41	48	54
Water content		l	307	307	307	280	280	280	481	481	514	514	514	917	917	917
Connections																
Gas connection		mm	76	76	76	76	76	76	76/89	89	89	89	89	89	89	89
Liquid connection		mm	42	42	42/54	54	54	54	54	54	54	64	64	64	64	64
Water connections	4	″	6″	6″	6″	6″	6″	6″	8″	8″	8″	8″	8″	10″	10″	10″
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	400/3~/50	400/3~/50	400/3~/50	400/3~/50	400/3~/50

1. 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
2. EER referred only to compressors
3. DSW = double-screw compressor
4. Capacity control with continuous modulation (Stepless)
5. The units are shipped with a sealed charge of nitrogen.
6. S&T = shell and tube

Electrical data

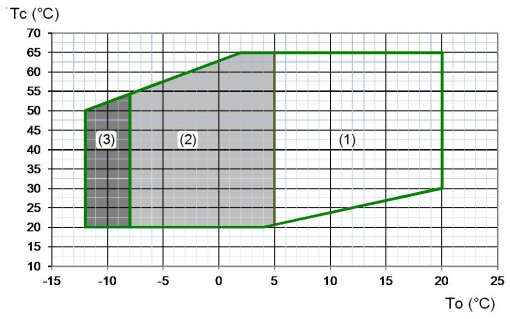
Acoustic treatment: Standard (ST)- Super-silenced(EN)

Size			220.2	240.2	260.2	280.2	300.2	320.2	340.2	360.2	400.2	440.2	470.2	500.2	540.2	580.2
F.L.A. - Full load current at max admissible conditions																
F.L.A. - Total		A	355.1	379.3	425.1	470.9	497.5	524.1	562.2	600.3	652.7	716.5	756.1	795.7	858.1	920.1
F.L.I. - Full load power input at max admissible conditions																
F.L.I. - Total		kW	220.4	235.8	259.5	283.2	298.4	313.6	336.7	359.8	391.6	440.2	461.4	482.6	529.2	567.4
M.I.C. Maximum inrush current																
M.I.C. - Value		A	399	408	404	439	505	525	619	647	667	762	871	901	1039	1195
M.I.C. with soft start accessory		A	588	602	587	622	732	752	940	968	989	1121	1295	1325	1612	1795

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)

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

Performances in cooling

Size	To (°C)	Condensing temperature (°C)											
		30		35		40		45		50		55	
		kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe
220.2	5	601	102	572	107	543	115	507	126	475	140	443	153
	6	621	103	590	108	560	116	528	127	493	140	459	154
	7	647	104	618	109	585	117	550	128	515	141	480	155
	10	717	108	687	112	656	120	622	131	584	144	546	158
	15	844	115	820	119	779	125	742	135	703	149	664	162
	20	965	122	946	125	914	131	874	140	828	154	782	167
240.2	5	643	108	612	114	579	124	544	136	504	151	463	167
	6	663	110	630	115	597	124	562	136	523	152	484	169
	7	690	111	660	117	626	126	585	137	546	154	506	170
	10	765	115	733	120	699	129	661	140	619	157	578	174
	15	894	122	869	126	825	134	784	145	738	163	692	180
	20	1026	129	999	132	952	139	908	150	858	168	808	187
260.2	5	704	119	669	125	633	135	595	148	554	165	513	181
	6	722	120	687	126	651	136	614	149	575	166	536	182
	7	752	121	720	128	680	137	642	150	601	167	560	184
	10	833	126	799	131	761	140	721	153	678	170	635	187
	15	971	133	942	138	899	146	856	158	809	176	762	193
	20	1120	141	1092	145	1048	152	1000	164	949	182	898	199
280.2	5	789	131	749	138	711	148	666	162	623	180	581	197
	6	812	132	772	139	733	149	691	163	649	181	607	198
	7	847	134	809	140	766	150	720	164	676	182	631	199
	10	941	139	904	145	859	154	814	168	764	185	715	202
	15	1101	148	1074	153	1020	161	972	174	920	191	869	209
	20	1268	157	1246	161	1197	168	1144	180	1084	197	1024	214
300.2	5	830	138	789	145	747	156	699	171	655	189	611	207
	6	853	139	812	146	771	157	727	172	682	190	638	208
	7	887	141	847	147	803	158	757	173	711	191	666	210
	10	989	146	948	152	903	162	856	177	804	195	752	213
	15	1154	155	1122	160	1072	169	1022	183	966	201	910	220
	20	1329	165	1306	169	1258	177	1195	190	1136	208	1076	226
320.2	5	870	144	828	151	784	163	732	179	686	198	641	216
	6	893	145	853	153	809	164	763	180	716	199	670	218
	7	927	147	886	154	841	165	794	181	747	200	700	219
	10	1037	153	993	159	947	170	898	185	843	204	788	223
	15	1208	162	1170	167	1124	177	1071	191	1011	210	951	229
	20	1389	172	1366	177	1319	185	1247	198	1187	217	1128	236
340.2	5	929	155	885	163	836	176	785	193	735	213	684	234
	6	961	157	917	165	863	177	814	194	763	214	711	235
	7	998	159	954	166	902	179	848	195	796	216	743	236
	10	1111	165	1065	172	1011	183	956	199	901	220	846	241
	15	1303	175	1263	181	1207	191	1143	206	1082	227	1021	248
	20	1486	185	1458	191	1407	200	1346	214	1275	234	1204	255
360.2	5	987	165	940	174	889	188	837	206	781	228	725	249
	6	1021	167	975	176	916	189	864	207	810	229	757	251
	7	1059	169	1012	177	961	191	899	208	845	230	791	252
	10	1182	176	1135	183	1071	195	1015	213	958	235	901	257
	15	1381	187	1338	193	1284	204	1210	220	1148	242	1087	264
	20	1572	197	1544	203	1490	213	1424	228	1349	250	1274	271
400.2	5	1089	181	1037	190	983	205	922	225	863	248	804	272
	6	1125	183	1069	192	1014	206	957	226	898	250	840	274
	7	1172	185	1120	194	1065	208	997	228	938	251	879	275
	10	1306	192	1258	200	1188	213	1127	232	1058	256	990	280
	15	1516	204	1470	210	1412	222	1346	241	1274	265	1203	289
	20	1751	217	1716	223	1657	233	1575	249	1497	273	1418	297

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

Performances in cooling

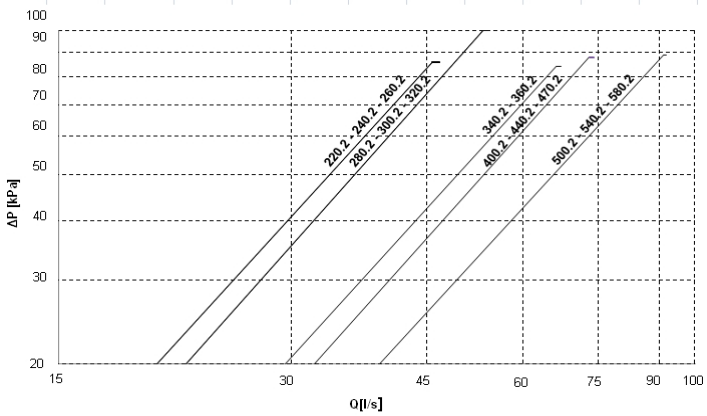
(continued)

Size	To (°C)	Condensing temperature (°C)											
		30		35		40		45		50		55	
		kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe
440.2	5	1213	202	1155	213	1092	230	1028	252	964	279	899	305
	6	1254	204	1197	215	1125	231	1061	253	996	280	931	307
	7	1301	207	1243	217	1180	233	1115	255	1046	282	977	309
	10	1449	215	1394	224	1316	239	1260	261	1184	288	1107	314
	15	1679	227	1625	235	1578	249	1486	269	1411	296	1335	324
	20	1950	242	1918	249	1830	260	1750	279	1657	306	1565	332
470.2	5	1264	211	1203	223	1142	241	1074	264	1007	292	939	320
	6	1305	214	1245	225	1175	242	1108	265	1040	293	972	321
	7	1353	216	1293	227	1233	244	1159	267	1091	296	1023	324
	10	1506	224	1448	234	1374	250	1309	273	1232	301	1155	329
	15	1749	238	1696	246	1636	260	1550	282	1471	310	1393	339
	20	2036	253	2001	261	1910	272	1826	292	1729	320	1632	348
500.2	5	1345	223	1281	235	1203	253	1134	277	1063	306	993	335
	6	1389	225	1320	236	1253	254	1182	279	1104	308	1027	337
	7	1444	228	1377	239	1303	256	1231	280	1152	310	1074	339
	10	1605	237	1538	246	1468	263	1392	286	1307	316	1223	345
	15	1891	252	1836	260	1744	274	1662	297	1569	326	1477	355
	20	2162	267	2119	275	2046	287	1934	307	1843	336	1751	366
540.2	5	1467	243	1391	256	1316	277	1239	303	1161	335	1084	367
	6	1515	246	1443	259	1369	279	1291	305	1206	337	1121	369
	7	1575	249	1498	261	1423	281	1344	307	1258	339	1171	371
	10	1754	259	1680	269	1602	288	1519	313	1426	346	1334	378
	15	2041	274	1973	283	1891	299	1799	324	1697	356	1595	389
	20	2330	289	2268	296	2182	310	2083	333	1972	366	1860	399
580.2	5	1556	260	1481	275	1401	296	1317	325	1234	359	1151	393
	6	1606	263	1533	277	1454	298	1371	327	1286	361	1202	395
	7	1666	266	1592	279	1511	300	1427	329	1341	363	1256	398
	10	1863	277	1783	288	1700	308	1611	335	1513	370	1414	405
	15	2170	293	2099	303	2015	320	1920	347	1822	382	1725	417
	20	2495	311	2450	320	2365	335	2235	359	2128	393	2022	428

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 [l/s] = kWf / (4,186 x 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 admissibles for the correct unit operation.

		220.2	240.2	260.2	280.2	300.2	320.2	340.2	360.2	400.2	440.2	470.2	500.2	540.2	580.2
Qmin	[l/s]	20,1	20,1	20,1	21,9	21,9	21,9	29,5	29,5	32,2	32,2	32,2	39,0	39,0	39,0
Qmax	[l/s]	45,7	45,7	45,7	53,2	53,2	53,2	66,1	66,1	73,0	73,0	73,0	90,9	90,9	90,9

Minimum system water content

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

Minimum water content [l] = 7 x kWf (air conditioning application)
= 14 x kWf (application with low outdoor temperature or low loads required))

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	dB(A)	dB(A)
220.2	94	88	93	84	92	84	73	62	94	74
240.2	94	88	92	85	92	85	76	69	94	74
260.2	95	87	91	85	94	91	81	70	96	77
280.2	95	86	91	86	96	94	83	71	99	79
300.2	95	86	91	86	96	94	83	71	99	79
320.2	95	86	91	86	96	94	83	72	99	79
340.2	95	86	92	86	97	95	84	72	100	80
360.2	96	87	94	88	98	96	85	73	101	82
400.2	96	87	96	86	100	94	83	71	102	82
440.2	80	79	96	103	100	89	76	71	103	84
470.2	81	80	96	102	101	92	79	72	104	84
500.2	82	81	97	96	102	94	81	72	104	84
540.2	82	80	100	96	104	92	81	72	105	85
580.2	83	83	97	99	104	94	81	72	105	85

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	dB(A)	dB(A)
220.2	90	83	88	79	86	78	67	55	88	69
240.2	90	83	87	80	86	79	70	62	88	69
260.2	91	82	86	80	88	85	75	63	91	71
280.2	91	81	86	81	90	88	77	64	93	73
300.2	91	81	86	81	90	88	77	64	93	73
320.2	91	81	86	81	90	88	77	65	93	74
340.2	91	81	87	81	91	89	78	65	94	74
360.2	92	82	89	83	92	90	79	66	95	76
400.2	92	82	91	81	94	88	77	64	96	76
440.2	76	74	91	98	94	83	71	64	98	78
470.2	78	76	92	97	96	86	73	65	98	79
500.2	78	76	92	91	97	88	75	65	98	78
540.2	78	75	96	91	98	86	75	65	99	79
580.2	79	78	92	94	98	88	75	65	99	79

Sound levels refer to full load units, in test nominal conditions. The sound pressure level refers to 1 m. from the 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
- external exchanger water = 30/35°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	No	0,995	0,989	0,983	0,977	0,971	0,964	0,956	0,949
Compressor power input Factor	No	1,022	1,022	1,033	1,044	1,055	1,066	1,077	1,088
Internal exchanger glycol solution flow factor	No	1,013	1,026	1,039	1,053	1,067	1,082	1,097	1,113
Pressure drop Factor	No	1,078	1,153	1,233	1,318	1,408	1,503	1,603	1,708

Fouling Correction Factors

	Internal exchanger (evaporator)	
m2 °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		220.2		240.2		260.2		280.2		300.2		320.2		340.2		360.2		400.2		440.2		470.2		500.2		540.2		580.2	
Circuit	-	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2
Capacity to be discharged	[kW]	339	339	361	361	366	427	442	442	434	496	488	488	491	552	554	554	612	612	685	685	668	759	756	756	826	826	878	878
Theoretic refrigerant charge	[kg]	40	40	40	40	40	40	44	44	44	59	59	59	63	63	63	63	67	67	67	67	67	67	75	75	75	75	75	75
Liquid receiver volume	[dm³]	25	25	25	25	25	25	25	25	25	40	40	40	40	40	40	40	40	40	40	40	40	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		220.2	240.2	260.2	280.2	300.2	320.2	340.2	360.2	400.2	440.2	470.2	500.2	540.2	580.2
Difference in height	-	Max equivalent length of the supply and liquis pipes													
0	[m]	35	30	30	40	40	40	40	40	38	40	39	39	33	29
2,5	[m]	35	30	30	40	40	40	40	40	38	40	37	37	31	28
5	[m]	35	30	30	40	38	38	38	40	38	40	36	36	30	26
7,5	[m]	35	30	30	40	36	36	36	40	38	40	34	34	29	25
10	[m]	35	30	30	40	35	35	35	40	38	39	33	33	27	24
R-134a refrigerant for each line meter	[kg/m]	3,27	3,27	4,16	5,04	5,04	5,04	5,14	5,23	5,23	7,22	7,22	7,22	7,22	7,22

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 cosfi 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

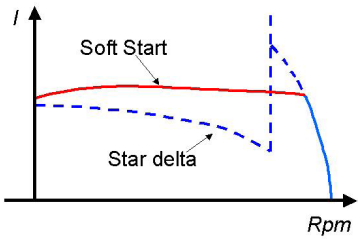
The magnetothermic circuit breakers are inserted instead of the fuses for the protection against the short circuit and overload. In case of intervention they do not have to be replaced, as it happens with fuses.

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.



(-----) INPUT CAPACITY WITHOUT THE SFSTR2 OPTION
(____) INPUT CAPACITY WITH THE SFSTR2 OPTION

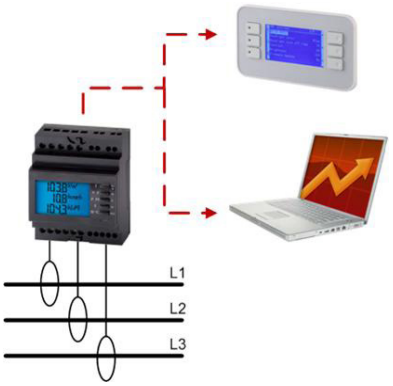
CONTA2 - Energy meter

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),
- cosfi,
- 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

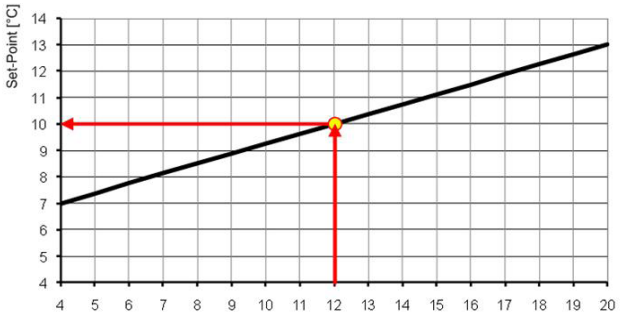
This device enables the set-point to be varied which is pre-set using an external 0÷10 V signal.

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.

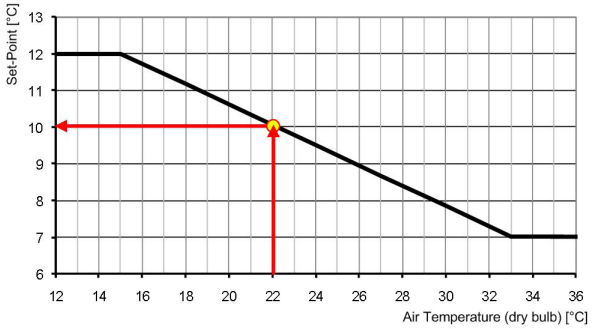
The device is installed and wired built-in the unit.



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.



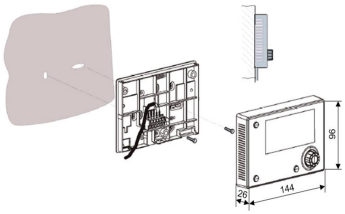
The device includes a probe controlled remotely from outside to measure the outdoor air temperature. (installation to be carried out by the customer). The connection cable length is 16 m.

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

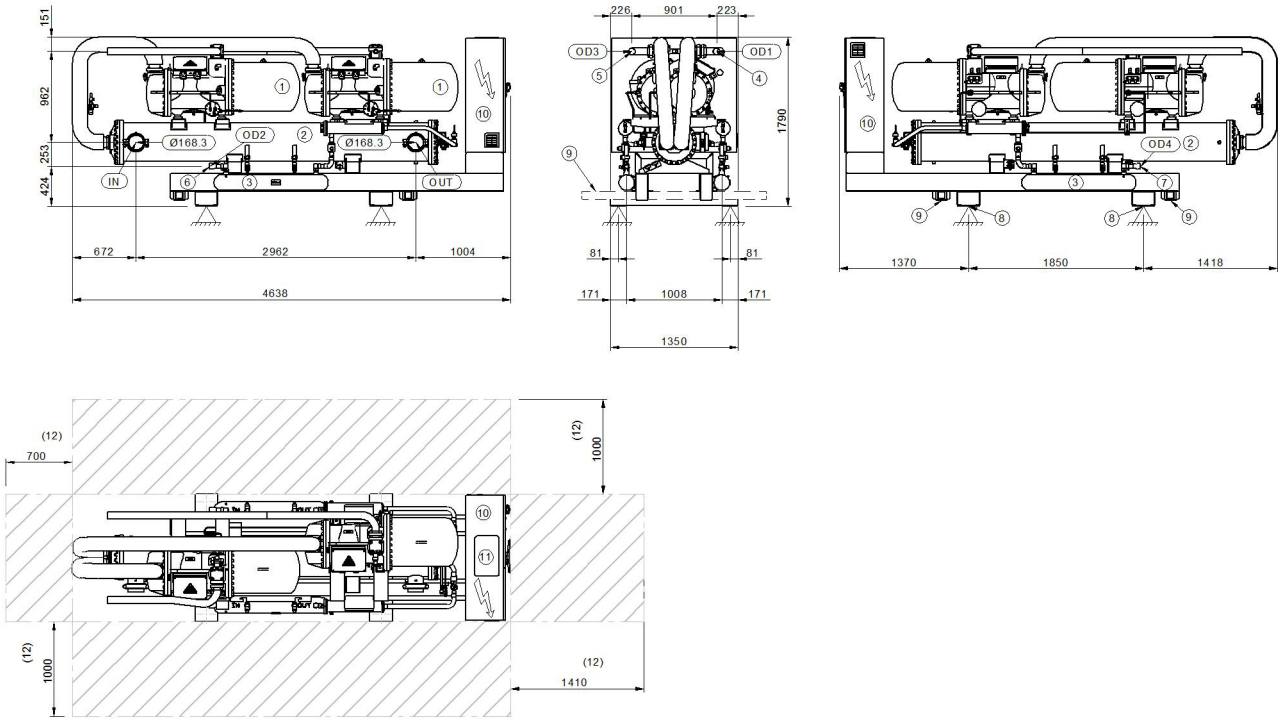
AMRX - Rubber anti-vibrating dampers

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 220.2-280.2 Acoustic configuration: Standard (ST)

DAA4J220 2_280 2_ST_0
Date: 29/07/14



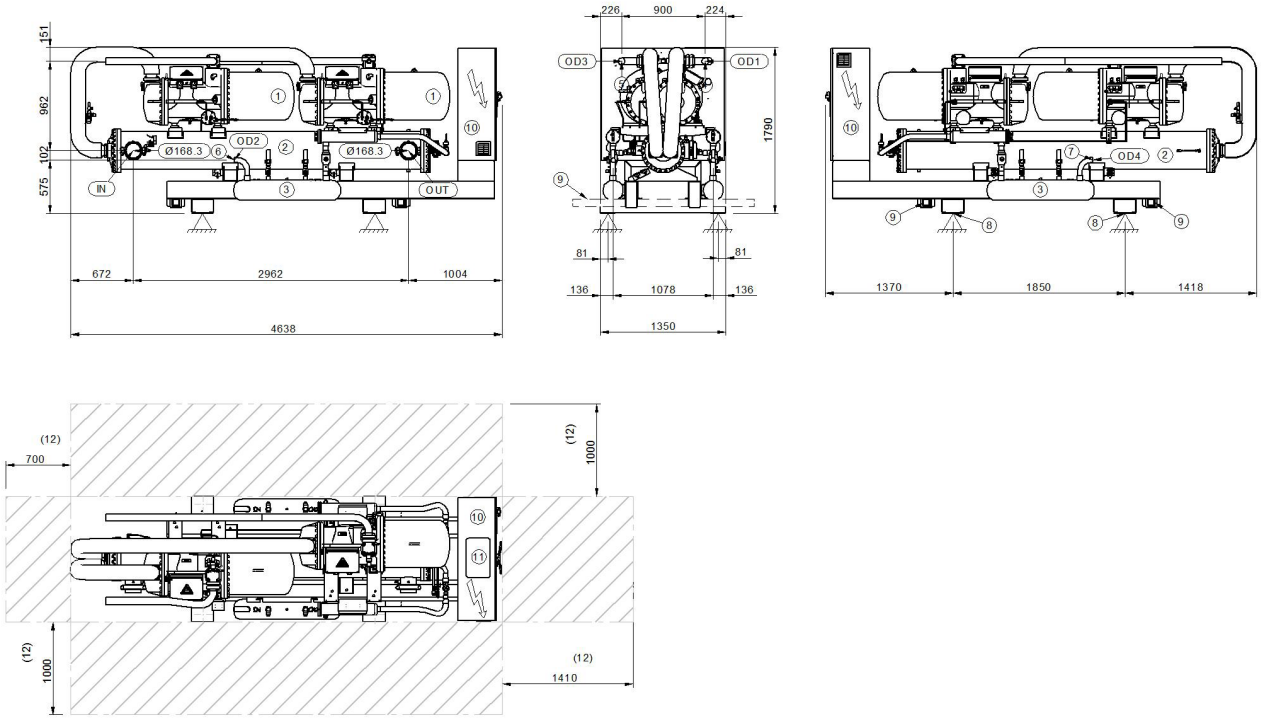
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.

Size		ST-EXC			
		220.2	240.2	260.2	280.2
OD1	mm	76	76	76	76
OD2	mm	42	42	42	54
OD3	mm	76	76	76	76
OD4	mm	42	42	54	54
A - Length	mm	4638	4638	4638	4638
B - Width	mm	1350	1350	1350	1350
C - Height	mm	1790	1790	1790	1790
Shipping weight	kg	3083	3115	3190	3307
Operating weight	kg	3390	3422	3497	3587

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

Size 300.2-320.2 Acoustic configuration: Standard (ST)

DAA4J300 2_320 2_ST_0
Date: 29/07/14



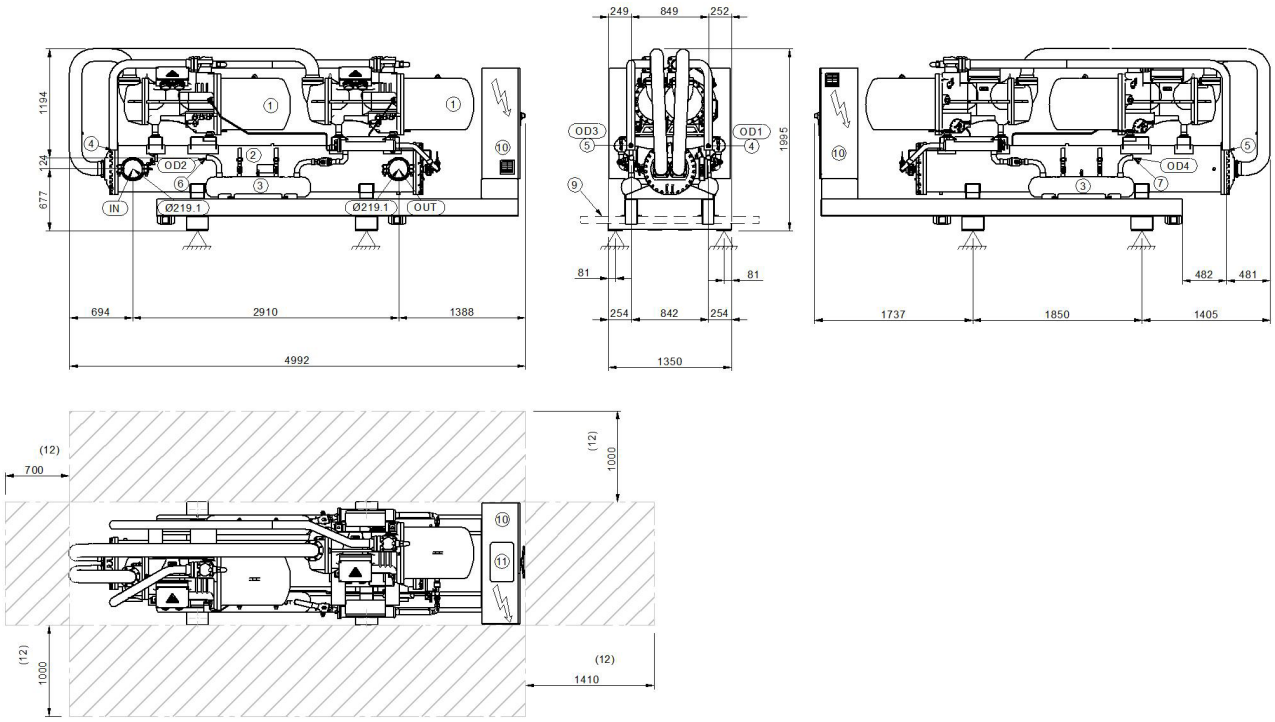
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.

Size		ST-EXC	
		300.2	320.2
OD1	mm	76	76
OD2	mm	54	54
OD3	mm	76	76
OD4	mm	54	54
A - Length	mm	4638	4638
B - Width	mm	1350	1350
C - Height	mm	1790	1790
Shipping weight	kg	3401	3465
Operating weight	kg	3681	3745

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

Size 340.2-360.2 Acoustic configuration: Standard (ST)

DAA4J340 2_360 2_ST_0
Date: 30/07/14



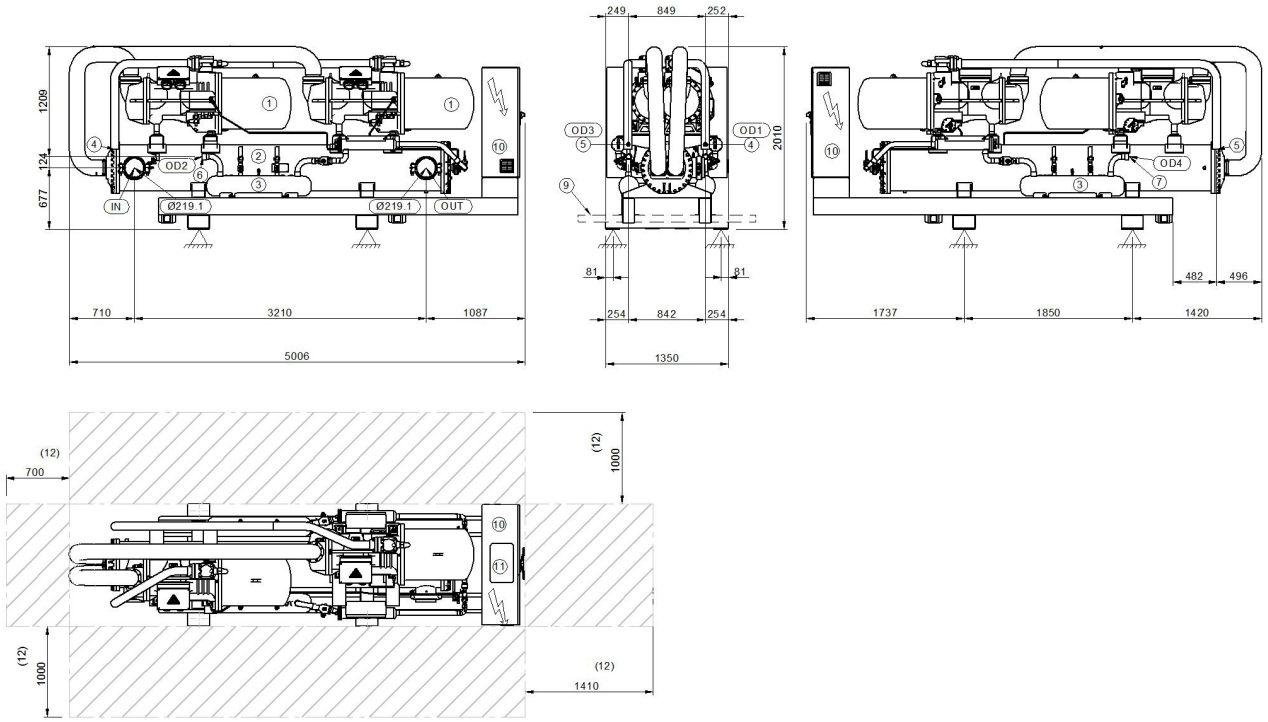
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.

Size		ST-EXC	
		340.2	360.2
OD1	mm	76	89
OD2	mm	54	54
OD3	mm	89	89
OD4	mm	54	54
A - Length	mm	4992	4992
B - Width	mm	1350	1350
C - Height	mm	1995	1995
Shipping weight	kg	3967	4194
Operating weight	kg	4448	4675

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

Size 400.2-470.2 Acoustic configuration: Standard (ST)

DAA4J400 2_470 2_ST_0
Date: 30/07/14



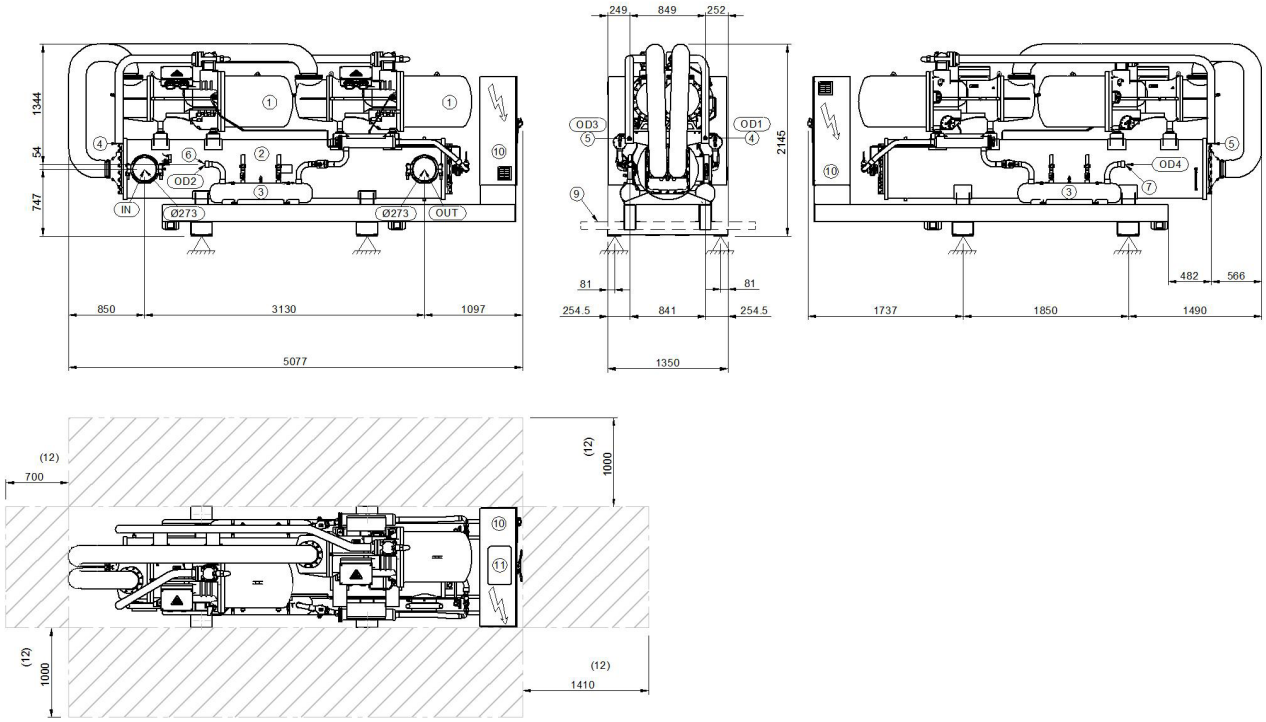
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.

Size		ST-EXC		
		400.2	440.2	470.2
OD1	mm	89	89	89
OD2	mm	54	64	64
OD3	mm	89	89	89
OD4	mm	54	64	64
A - Length	mm	5006	5006	5006
B - Width	mm	1350	1350	1350
C - Height	mm	2010	2010	2010
Shipping weight	kg	4282	4303	4351
Operating weight	kg	4763	4784	4832

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

Size 500.2-580.2 Acoustic configuration: Standard (ST)

DAA4J500 2_580 2_ST_0
Date: 30/07/14



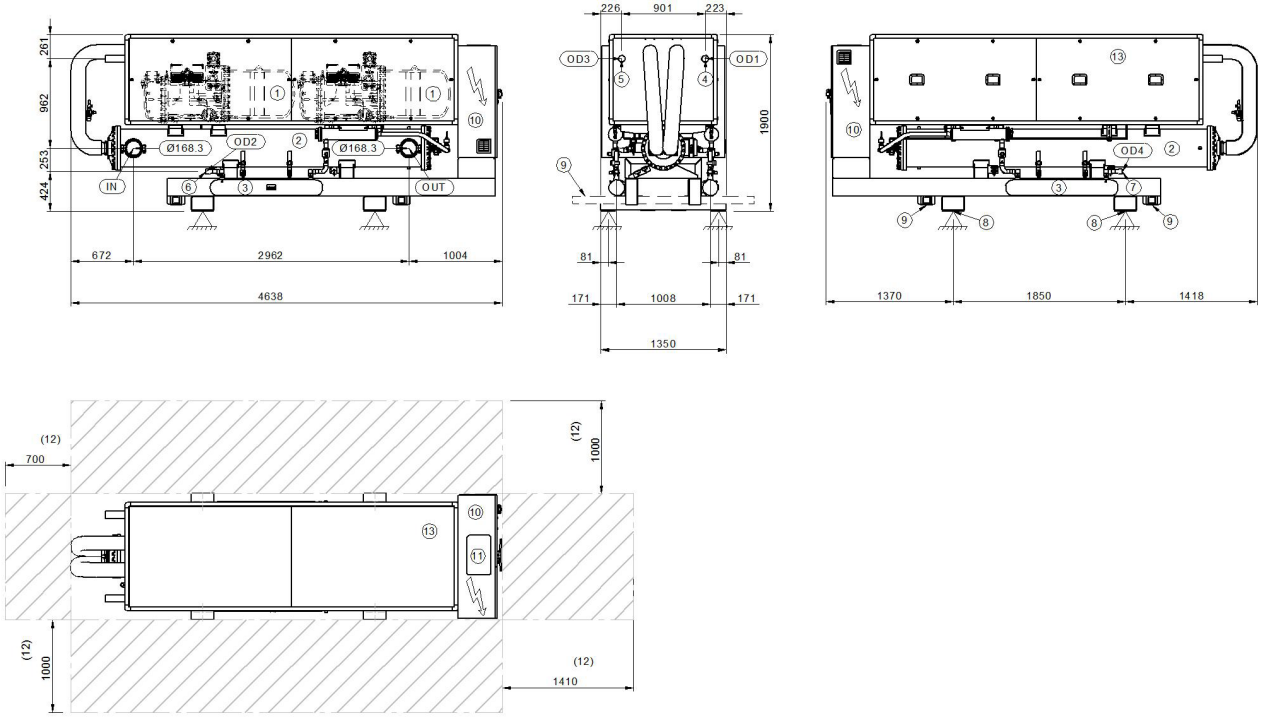
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.

Size		ST-EXC		
		500.2	540.2	580.2
OD1	mm	89	89	89
OD2	mm	64	64	64
OD3	mm	89	89	89
OD4	mm	64	64	64
A - Length	mm	5077	5077	5077
B - Width	mm	1350	1350	1350
C - Height	mm	2145	2145	2145
Shipping weight	kg	4763	4900	4959
Operating weight	kg	5680	5817	5876

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

Size 220.2-280.2 Acoustic configuration: Super-silenced (EN)

DAA4J220 2_280 2_EN_0
Date: 30/07/14



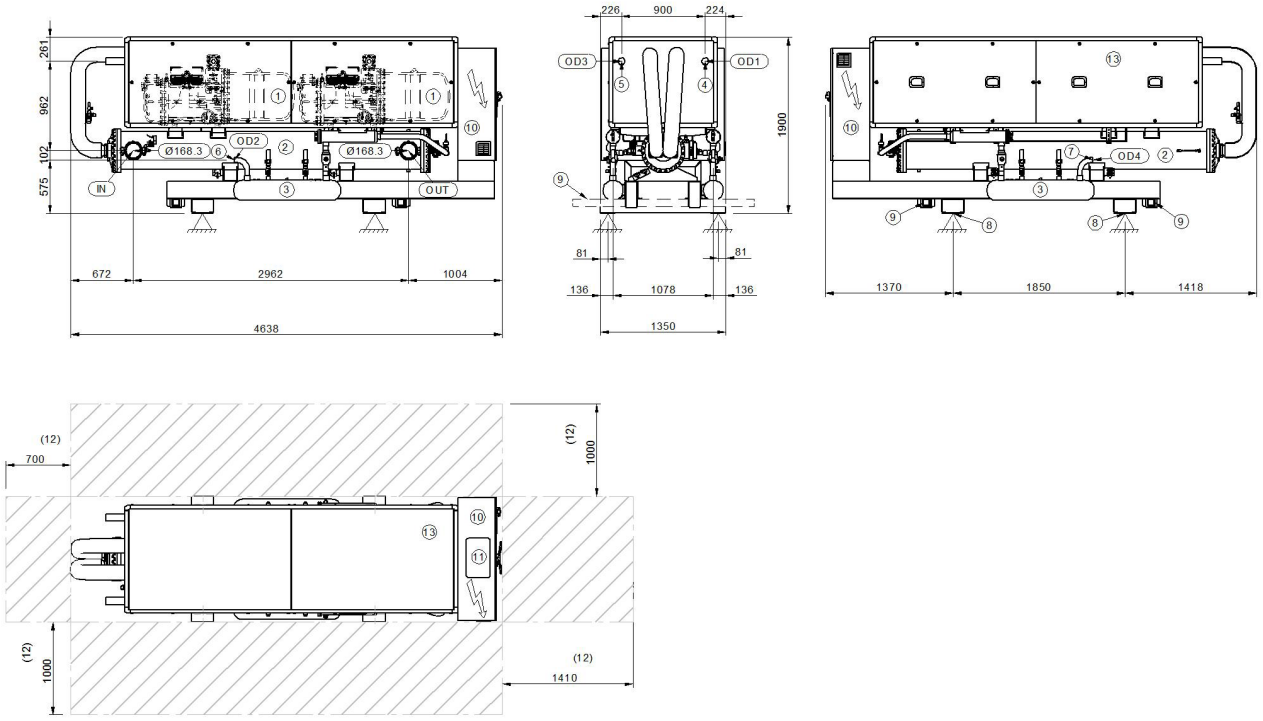
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.
13. Soundproofing cabin

Size		EN-EXC			
		220.2	240.2	260.2	280.2
OD1	mm	76	76	76	76
OD2	mm	42	42	42	54
OD3	mm	76	76	76	76
OD4	mm	42	42	54	54
A - Length	mm	4638	4638	4638	4638
B - Width	mm	1350	1350	1350	1350
C - Height	mm	1900	1900	1900	1900
Shipping weight	kg	3411	3443	3547	3693
Operating weight	kg	3830	3862	3966	4013

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

Size 300.2-320.2 Acoustic configuration: Super-silenced (EN)

DAA4J300 2_320 2_EN_0
Date: 30/07/14



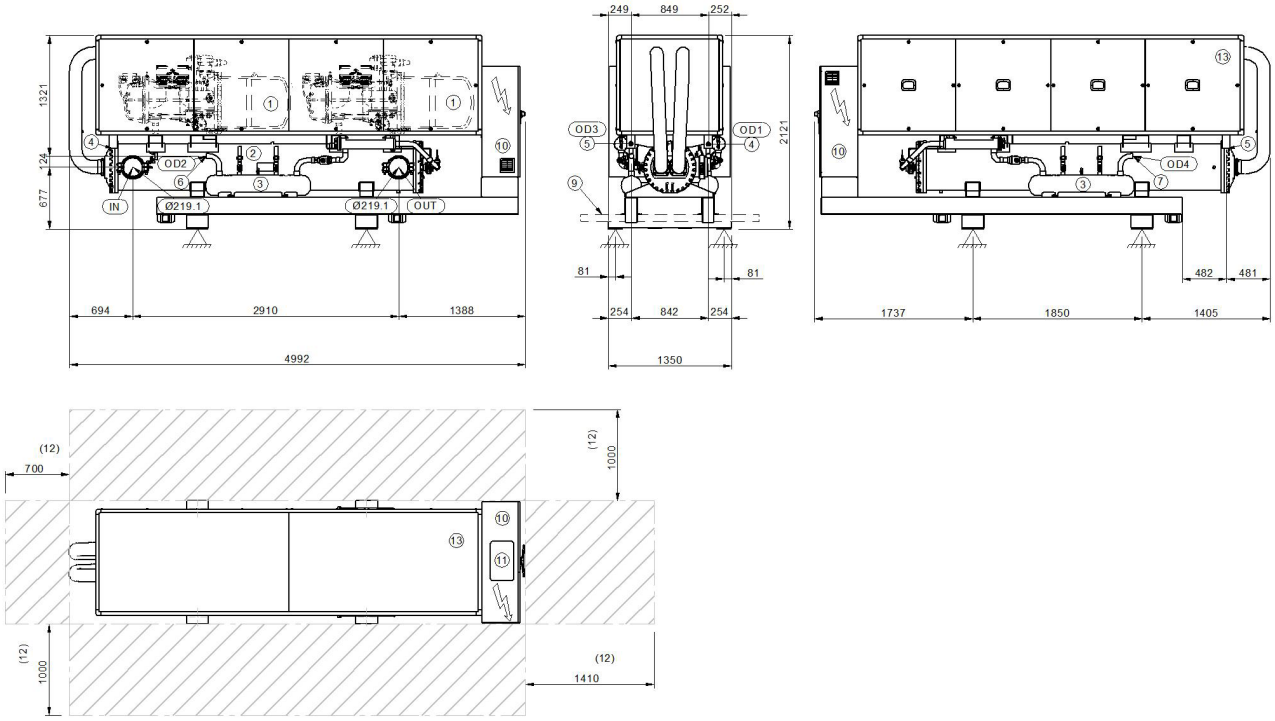
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.
13. Soundproofing cabin

Size		EN-EXC	
		300.2	320.2
OD1	mm	76	76
OD2	mm	54	54
OD3	mm	76	76
OD4	mm	54	54
A - Length	mm	4638	4638
B - Width	mm	1350	1350
C - Height	mm	1900	1900
Shipping weight	kg	3787	3851
Operating weight	kg	4107	4171

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

Size 340.2-360.2 Acoustic configuration: Super-silenced (EN)

DAA4J340 2_360 2_EN_0
Date: 30/07/14



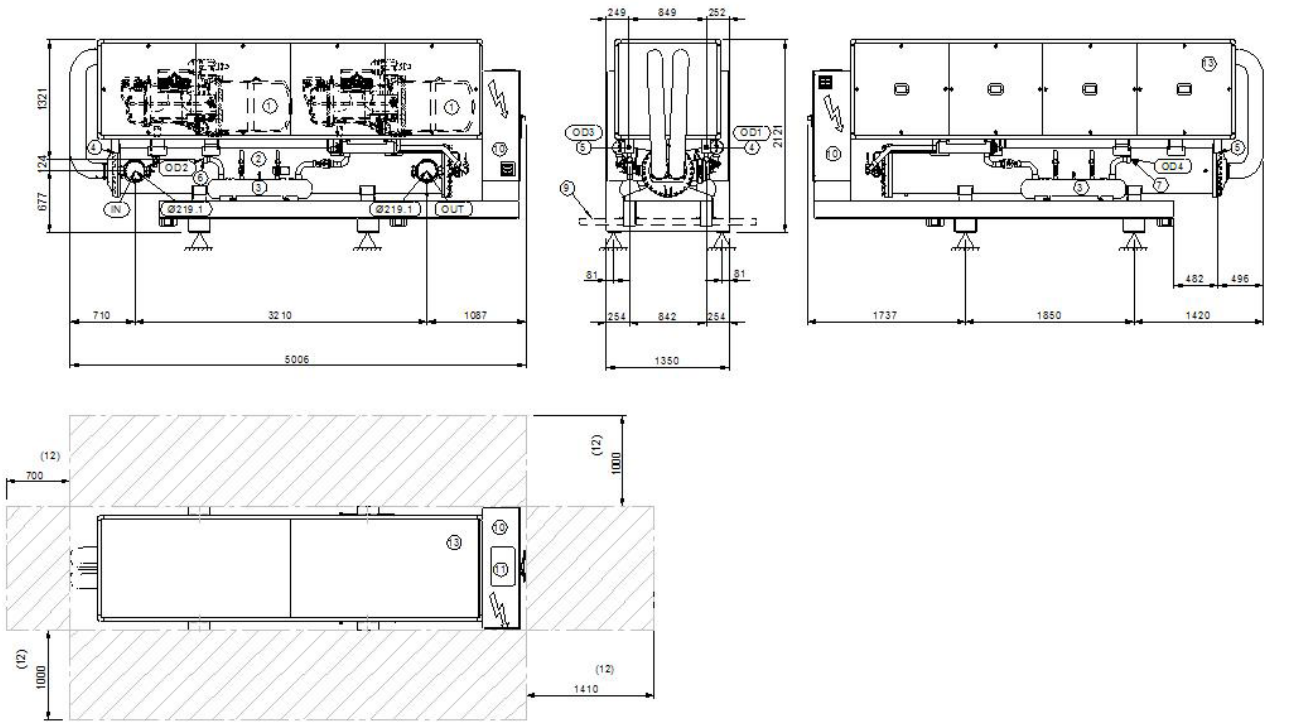
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.
13. Soundproofing cabin

Size		EN-EXC	
		340.2	360.2
OD1	mm	76	89
OD2	mm	54	54
OD3	mm	89	89
OD4	mm	54	54
A - Length	mm	4992	4992
B - Width	mm	1350	1350
C - Height	mm	2121	2121
Shipping weight	kg	4383	4640
Operating weight	kg	5010	5267

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

Size 400.2-470.2 Acoustic configuration: Super-silenced (EN)

DAA4J400 2_470 2_EN_0
Date: 30/07/14



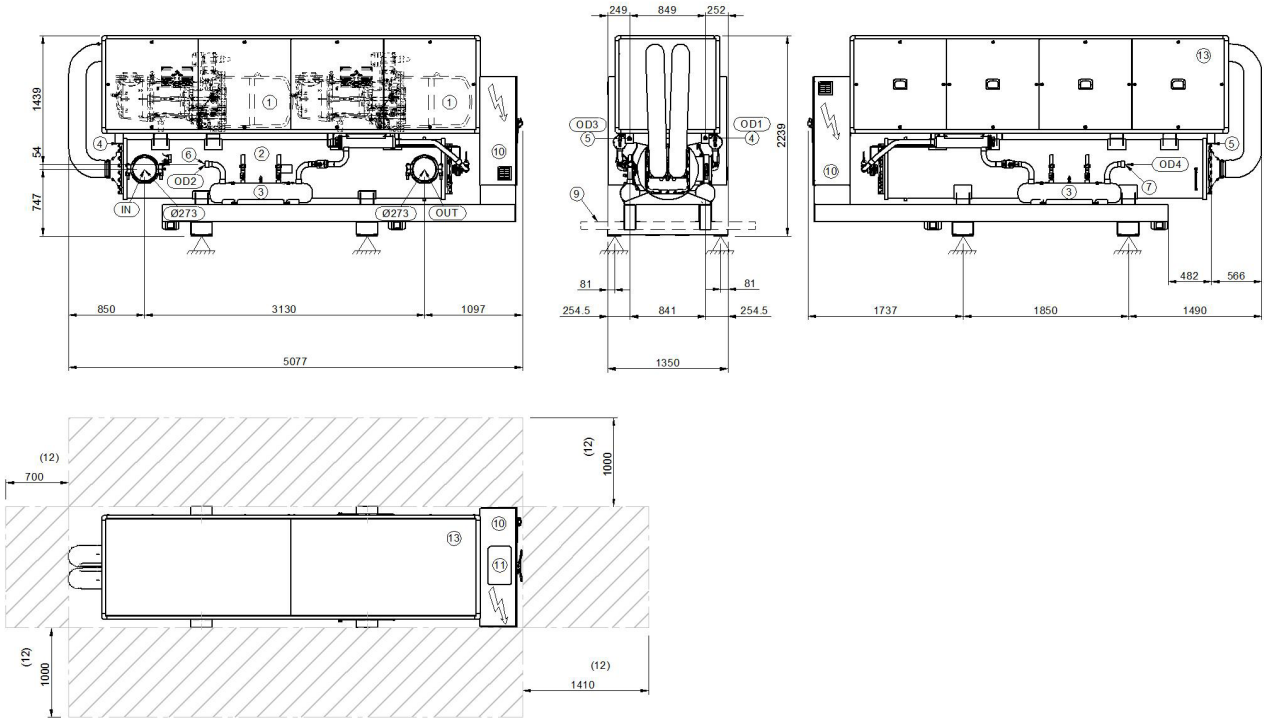
1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.
13. Soundproofing cabin

Size		EN-EXC		
		400.2	440.2	470.2
OD1	mm	89	89	89
OD2	mm	54	64	64
OD3	mm	89	89	89
OD4	mm	54	64	64
A - Length	mm	5006	5006	5006
B - Width	mm	1350	1350	1350
C - Height	mm	2121	2121	2121
Shipping weight	kg	4728	4749	4797
Operating weight	kg	5388	5445	5493

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

Size 500.2-580.2 Acoustic configuration: Super-silenced (EN)

DAA4J500 2_580 2_EN_0
Date: 30/07/14



1. Compressor
2. Internal exchanger (evaporator)
3. Liquid receiver
4. Discharge line C1
5. Discharge line C2
6. Liquid line C1
7. Liquid line C2
8. Antivibration mount fixing holes Ø 25mm
9. Lifting bars
10. Electrical panel
11. Power input
12. Minimum space for maintenance.
13. Soundproofing cabin

Size		EN-EXC		
		500.2	540.2	580.2
OD1	mm	89	89	89
OD2	mm	64	64	64
OD3	mm	89	89	89
OD4	mm	64	64	64
A - Length	mm	5077	5077	5077
B - Width	mm	1350	1350	1350
C - Height	mm	2239	2239	2239
Shipping weight	kg	5209	5346	5405
Operating weight	kg	6318	6455	6514

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

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