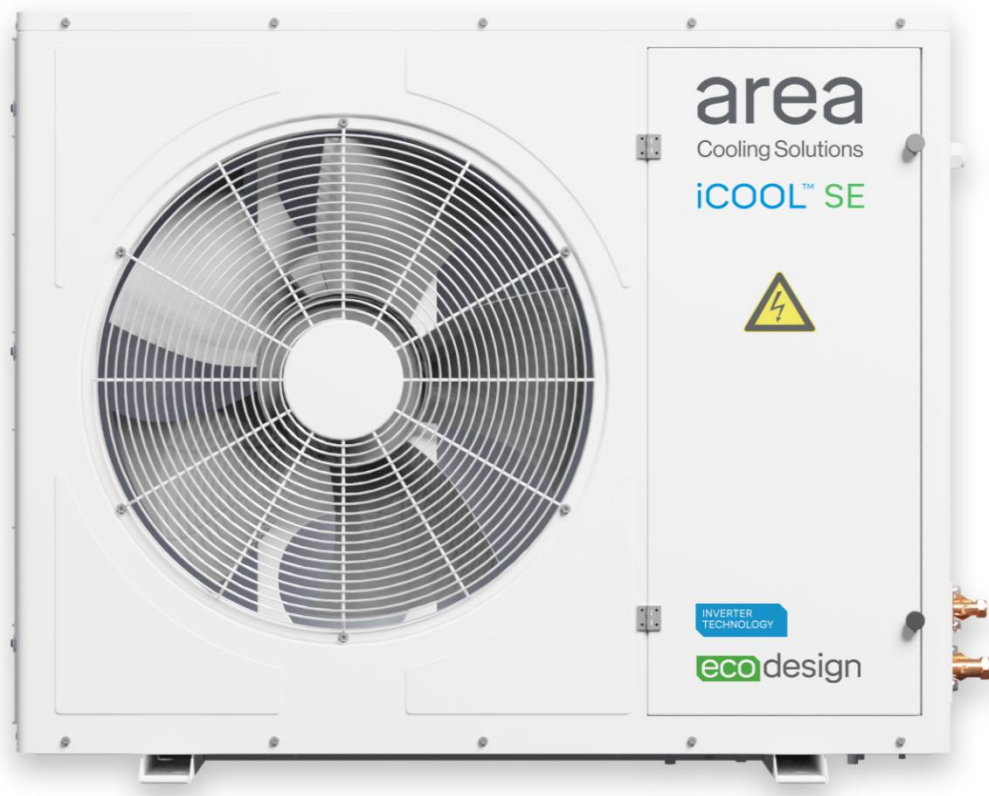


iCOOL SE series Condensing Units

Technical Brochure



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2. General Information

- Refrigeration iCOOL series SE condensing units are designed for automatic operation in refrigerated storage rooms, refrigeration cabinets, liquid coolers, and other equipment the operating parameters of which meet the requirements of the unit's characteristics.
- Condensing units are designed to be used with HFC refrigerants. Refrigerants allowed for specific units are listed in the table below. Filling or refilling these units with any other refrigerant type can cause damage. The units must not operate in conditions exceeding their working parameters. Doing otherwise can cause damage to the unit and will void the warranty.

Table of permitted refrigerants:

	iCOOL SE 2,5 MT (E1)	iCOOL SE 4,5 MT (E1)	iCOOL SE 6,5 MT (E1)	iCOOL SE 1,2 LT (E1)	iCOOL SE 2,2 LT (E1)	iCOOL SE 2,9 LT (E1)
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓
	✓	✓	✓			
	✓	✓	✓			

3. Type code description

iCOOL	SE	4,5	MT	(E1)	
					Power supply E1 – 1 phase E3 – 3 phase
					Range: MT- middle temperature; LT – low temperature
					Approximate capacity, kW 4,5 kW
					Type SE
					Series iCOOL – inverter condensing unit in housing

4. Units specification

4.1. Components

- High-efficient BLDC rotary compressor (Avic) with crankcase heater
- Air-cooled condenser
- EC fans with a speed regulation
- Shut-off valve on suction line
- Insulation on the suction pipeline
- Liquid receiver with shut-off valve on the outlet
- Safety valve
- Liquid line: filter drier, sight glass with moisture indicator, shut-off valve
- Service valves
- HP pressure switch with auto reset – compressor protection
- Inverter – control of compressor's performance
- Controller with dedicated software
- Suction and discharge pressure sensor
- Fully equipped electrical board
- Condenser protective grid
- Liquid injection cooling in LT series



5. Technical data

Condensing unit model				iCOOL SE 2,5 MT (E1)	iCOOL SE 4,5 MT (E1)	iCOOL SE 6,5 MT (E1)	iCOOL SE 1,2 LT (E1)	iCOOL SE 2,2 LT (E1)	iCOOL SE 2,9 MT (E1)
Dimensions	Length	A	[mm]	1000	1000	1100	1000	1000	1000
	Height	B	[mm]	605	605	805	605	605	605
	Width	C	[mm]	450	450	450	450	450	450
Gross weight			[kg]	70	70	80	70	70	80
Condenser	Fans x diameter		[mm]	1x450	1x450	1x500	1x450	1x450	1x500
	Airflow		[m³/h]	3600	3600	5200	3600	3600	5200
	Fan power supply		[V/ph/Hz]	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50
	Fan power consumption		[W]	170	170	230	170	170	230
	Amperage		[A]	1,4	1,4	2,1	1,4	1,4	2,1
Compressor	Model			C-6RVN63L0B	C-7RVN113L0B	C-7RVN153L0B	C-6RVN63L0B	C-7RVN113L0B	C-7RVN153L0B
	Volumetric flow		[m³/h]	0,6-4,1	1,25-7,5	1,7-10,4	0,6-4,1	1,25-7,5	1,7-10,4
	Speed		[RPS]	30-90	30-90	30-90	30-90	30-90	30-90
	Frequency		[Hz]	Inv. /60-180	Inv. /60-180	Inv. /60-180	Inv. /60-180	Inv. /60-180	Inv. /60-180
	Current	MCC	[A]	8	14	18	8	14	18
		LRA	[A]	-	-	-	-	-	-
	Oil type			FV68S	FV68S	FV68S	FV68S	FV68S	FV68S
	Compressor oil fill		[dm³]	0,6	0,7	0,7	0,6	0,7	0,7
	Crankcase heater		[W]	35	35	35	35	35	35
Sound level @10 m*			[dBa]	42,5	42,5	42,5	42,5	42,5	42,5
Connections	Suction line		[in]	1/2	5/8	3/4	1/2	5/8	3/4
	Liquid line		[in]	3/8	3/8	3/8	3/8	3/8	3/8
Liquid receiver			[dm³]	3,9	3,9	5,3	3,9	3,9	3,9
Power supply	Voltage		[V/ph/Hz]	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50	220-240/1/50
	Recommended minimum power cable cross-section			3x1,5mm2	3x2,5mm2	3x4,0mm2	3x1,5mm2	3x2,5mm2	3x4,0mm2
	Recommended minimum circuit breaker			C10	C20	C20	C10	C20	C20

*Sound level is calculated for a condensing unit working with compressor full load and at an ambient temperature 32°C. The sound level may change in a real installation due to surrounding conditions.

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6. Capacity tables

6.1. iCOOL SE MT series Refrigerants R448A/R449A

R448A/R449A		Capacity (subcooling: 3 K, superheat: 10 K)								
Model	Range	$T_e, ^\circ\text{C}$	-15		-10		-5		0	
		$T_a, ^\circ\text{C}$	Q, W	Pe, W	Q, W	Pe, W	Q, W	Pe, W	Q, W	Pe, W
iCOOL SE 2,5 MT (E1)	MIN	27	732	489	875	498	1 035	506	1 211	513
		32	681	514	820	524	974	534	1 144	544
		38	629	547	760	560	906	572	1 066	585
		43	587	577	711	592	848	607	999	622
	MAX	27	2 299	1 208	2 726	1 268	3 186	1 333	3 671	1 405
		32	2 156	1 288	2 558	1 354	2 990	1 425	3 441	1 502
		38	1 977	1 392	2 344	1 463	2 734	1 539	3 116	1 600
		43	1 812	1 483	2 056	1 466	2 136	1 328	2 254	1 250
iCOOL SE 4,5 MT (E1)	MIN	27	1 443	736	1 724	751	2 037	767	2 381	782
		32	1 343	777	1 615	797	1 918	816	2 249	836
		38	1 241	835	1 498	859	1 783	883	2 096	908
		43	1 158	889	1 400	916	1 669	943	1 962	971
	MAX	27	4 182	2 203	4 945	2 331	5 758	2 471	6 605	2 625
		32	3 915	2 360	4 629	2 497	5 383	2 647	6 164	2 808
		38	3 573	2 560	4 216	2 706	4 777	2 752	4 958	2 474
		43	3 069	2 498	3 070	2 084	3 289	1 914	3 750	1 963
iCOOL SE 6,5 MT (E1)	MIN	27	2 077	960	2 480	979	2 931	997	3 428	1 015
		32	1 931	1 015	2 322	1 039	2 758	1 063	3 237	1 086
		38	1 782	1 090	2 153	1 120	2 566	1 149	3 018	1 179
		43	1 665	1 159	2 015	1 193	2 404	1 227	2 830	1 262
	MAX	27	6 004	2 766	7 125	2 906	8 188	2 981	9 372	3 100
		32	5 632	2 961	6 572	3 039	7 558	3 118	8 652	3 240
		38	5 033	3 100	5 875	3 177	6 819	3 297	7 734	3 374
		43	4 548	3 234	5 309	3 308	5 923	3 240	6 267	2 999

T_e - evaporating temperature, °C

T_a - ambient temperature, °C

(*)

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6.2. iCOOL SE MT series Refrigerant R513A

R513A	Capacity (subcooling: 3 K, superheat: 10 K)											
Model	Range	$T_e, ^\circ\text{C}$	-15		-10		-5		0		5	
		$T_a, ^\circ\text{C}$	Q, W	Pe, W	Q, W	Pe, W	Q, W	Pe, W	Q, W	Pe, W	Q, W	Pe, W
iCOOL SE 2,5 MT (E1)	MIN	27	380	381	485	389	605	398	738	406	885	415
		32	354	387	452	396	563	405	690	415	830	425
		38	323	400	412	410	515	421	632	432	765	444
		43	298	415	379	426	475	439	586	451	712	464
	MAX	27	1 267	783	1 593	814	1 956	848	2 354	886	2 788	930
		32	1 179	812	1 480	847	1 820	887	2 197	931	2 611	981
		38	1 073	858	1 346	900	1 660	946	2 013	997	2 404	1 055
		43	987	905	1 239	952	1 532	1 004	1 865	1 062	2 236	1 128
iCOOL SE 4,5 MT (E1)	MIN	27	714	554	913	569	1 137	584	1 388	600	1 664	617
		32	668	567	851	583	1 061	600	1 298	618	1 562	636
		38	610	591	776	610	970	629	1 191	649	1 440	671
		43	562	618	715	639	896	661	1 104	684	1 340	709
	MAX	27	2 351	1 293	2 952	1 351	3 621	1 415	4 356	1 487	5 155	1 569
		32	2 188	1 347	2 742	1 413	3 369	1 487	4 065	1 570	4 828	1 665
		38	1 990	1 433	2 495	1 510	3 073	1 596	3 724	1 693	4 444	1 803
		43	1 832	1 519	2 296	1 606	2 837	1 703	3 450	1 813	4 134	1 936
iCOOL SE 6,5 MT (E1)	MIN	27	1 034	713	1 324	732	1 651	751	2 015	770	2 415	789
		32	944	731	1 204	752	1 503	773	1 840	794	2 214	817
		38	862	761	1 099	785	1 374	809	1 689	834	2 042	860
		43	795	795	1 012	821	1 269	848	1 566	877	1 901	907
	MAX	27	3 310	1 674	4 168	1 745	5 126	1 823	6 181	1 908	7 330	2 005
		32	3 084	1 740	3 877	1 821	4 774	1 910	5 773	2 009	6 869	2 120
		38	2 809	1 848	3 529	1 942	4 358	2 046	5 292	2 161	6 327	2 291
		43	2 586	1 957	3 250	2 063	4 024	2 180	4 905	2 311	5 889	2 458

 T_e - evaporating temperature, °C T_a - ambient temperature, °C

(*)

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6.3. iCOOL SE LT series Refrigerants R448A/R449A

R448A/R449A		Capacity (subcooling: 3 K, superheat: 10 K)												
Model	Range	Te, °C	-40		-35		-30		-25		-20		-15	
		Ta, °C	Q _e	Pe _e	Q _e	Pe _e	Q _e	Pe _e	Q _e	Pe _e	Q _e	Pe _e	Q _e	Pe _e
			W	W	W	W	W	W	W	W	W	W	W	W
iCOOL SE 1,2 LT (E1)	MIN	27	287	433	342	446	414	457	505	468	614	478	741	486
		32	246	449	300	463	371	476	459	488	565	499	689	510
		38	214	474	265	489	333	503	417	517	518	530	635	542
		43	195	498	244	514	308	529	388	544	483	558	593	572
	MAX	27	912	947	1 090	992	1 327	1 035	1 622	1 079	1 972	1 124	2 373	1 171
		32	805	999	982	1 047	1 215	1 095	1 503	1 144	1 841	1 195	2 226	1 248
		38	717	1 076	886	1 127	1 107	1 180	1 377	1 234	1 693	1 290	2 050	1 349
		43	658	1 150	816	1 204	1 021	1 259	1 271	1 317	1 563	1 376	1 892	1 440
iCOOL SE 2,2 LT (E1)	MIN	27	565	635	672	658	814	679	992	698	1 207	715	1 456	731
		32	485	663	590	688	730	711	904	733	1 112	753	1 354	772
		38	422	706	523	732	657	758	823	782	1 021	806	1 250	829
		43	386	748	481	776	608	803	764	830	951	856	1 167	882
	MAX	27	1 656	1 666	1 985	1 753	2 421	1 841	2 961	1 930	3 600	2 024	4 328	2 124
		32	1 472	1 767	1 798	1 862	2 225	1 958	2 750	2 058	3 364	2 163	4 059	2 274
		38	1 317	1 917	1 626	2 019	2 029	2 124	2 519	2 234	3 088	2 349	3 727	2 471
		43	1 209	2 061	1 495	2 168	1 867	2 278	2 317	2 394	2 838	2 515	3 423	2 644
iCOOL SE 2,9 LT (E1)	MIN	27	787	778	936	810	1 134	839	1 383	867	1 681	892	2 026	917
		32	678	818	826	852	1 022	884	1 265	915	1 555	945	1 890	974
		38	594	876	735	913	922	948	1 154	983	1 429	1 017	1 747	1 051
		43	544	933	678	971	854	1 009	1 072	1 046	1 330	1 083	1 629	1 121
	MAX	27	2 167	2 174	2 604	2 301	3 181	2 434	3 890	2 575	4 716	2 728	5 643	2 896
		32	1 949	2 318	2 381	2 456	2 942	2 601	3 622	2 756	4 405	2 922	5 274	3 102
		38	1 755	2 526	2 160	2 674	2 679	2 829	3 302	2 995	4 012	3 173	4 792	3 363
		43	1 605	2 722	1 973	2 875	2 443	3 036	3 004	3 208	3 642	3 391	4 341	3 586

 T_e - evaporating temperature, °C T_a - ambient temperature, °C

(*)

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7. iCOOL SE series SEPR/COP

7.1. iCOOL SE MT series

		A	B	C	D	E	SEPR [-]	P [kWh/year]
	Ambient temperature	32°C	25°C	15°C	5°C	43°C		
iCOOL SE 6.5 MT R448A	Q [W]	6652	5962	4977	3991	5309	3,80	10749
	P [W]	3111	2199	1354	834	3308		
	COP [-]	2,14	2,71	3,67	4,79	1,60		
iCOOL SE 4.5 MT R448A	Q [W]	4666	4182	-	-	3071	-	-
	P [W]	2462	1722			2085		
	COP [-]	1,89	2,43			1,47		
iCOOL SE 2.5 MT R448A	Q [W]	2543	2279	-	-	2022	-	-
	P [W]	1352	996			1430		
	COP [-]	1,88	2,29			1,41		
iCOOL SE 6.5 MT R513A	Q [W]	3910	3505	-	-	3309	-	-
	P [W]	1822	1415			2065		
	COP [-]	2,15	2,48			1,60		
iCOOL SE 4.5 MT R513A	Q [W]	2768	2481	-	-	2340	-	-
	P [W]	1414	1098			1522		
	COP [-]	1,96	2,26			1,54		
iCOOL SE 2.5 MT R513A	Q [W]	1493	1339	-	-	1262	-	-
	P [W]	848	716			953		
	COP [-]	1,76	1,87			1,32		

7.2. iCOOL SE LT series

		A	B	C	D	E	SEPR [-]	P [kWh/year]
	Ambient temperature	32°C	25°C	15°C	5°C	43°C		
iCOOL SE 2,9 LT R448A	Q [W]	2428	2302	2122	1942	2063	2,14	8475
	P [W]	2460	1809	1081	647	2460		
	COP [-]	0,99	1,27	1,96	3,00	0,84		
iCOOL SE 2,2 LT R448A	Q [W]	1825	1731	-	-	1555	-	-
	P [W]	1864	1393			2172		
	COP [-]	0,98	1,24			0,72		
iCOOL SE 1,2 LT R448A	Q [W]	995	944	-	-	847	-	-

8. Requirement of installation and condensing unit selection

Selection of an inverter driven condensing unit, which operates with variable load conditions, should be done with consideration of maximum and minimum cooling capacity requirements.

8.1. Condensing unit selection – capacity requirements

The cooling capacity of the smallest evaporator, or several evaporators operating simultaneously, (e.g. with one solenoid valve) at operating conditions must be larger than 30% of the nominal (gull load) capacity of the condensing unit at that conditions.

Condensing unit full load capacity at operating conditions should be equal maximum (peak) cooling capacity requirement. The simultaneity factor of evaporators operation should be taken into account.

8.2. Pipelines diameter selection

Pipelines diameters should be selected, to ensure a correct refrigerant velocity for a minimum and for a maximum load.

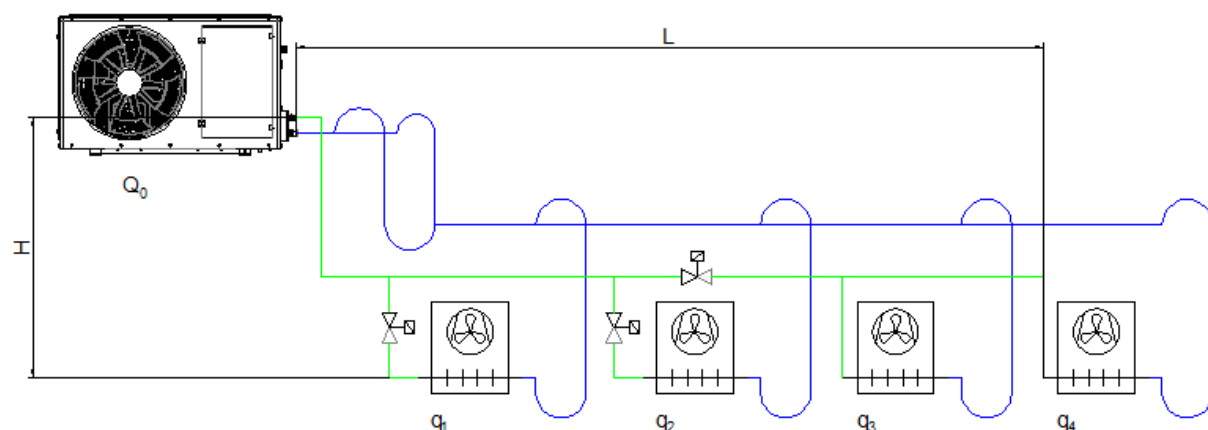
In a suction pipeline, to maintain oil return, the minimum velocity of refrigerant should be 8 m/s in vertical section, and 4 m/s in the horizontal section with 0,5% slope in flow direction. If it is needed use diameter reduction or double riser. In the liquid line section, refrigerant velocity should be lower than 1,5 m/s.

Diameters and lining of a suction section should be done to minimize pressure drop at full load operation. Pressure drop should be lower than 3K for a dew point conditions (e.g. for refrigerant R449A it would be about 0,4 bar for MT condition or 0,2bar for LT conditions).

Due to refrigerant velocity and pressure drop, the recommended maximum length of a suction pipeline and a liquid pipeline (distance from the condensing unit to the evaporator) should be less than 15m.

The maximum allowable suction line distance from a condensing unit to the furthest evaporator is 30m for iCOOL SE MT series and 20m for iCOOL SE LT series, with careful pipeline selection and design.

The maximum height difference between condensing unit and evaporators no larger than 7 m.



$H < 7 \text{ m}$	$H+L < 30 \text{ m}$ dla MT $H+L < 20 \text{ m}$ dla LT	$q_1 \geq 30\% Q_0$	$q_2 \geq 30\% Q_0$	$q_3+q_4 \geq 30\% Q_0$	$q_1+q_2+q_3+q_4 \approx Q_0$
-------------------	--	---------------------	---------------------	-------------------------	-------------------------------

8.3. Condensing unit selection examples

Example 1. In a low temperature system, two evaporators are planned with capacities $Q_1=800\text{W}$ and $Q_2=1400\text{W}$. Both evaporators will be operating at -30°C , using refrigerant R449A and the maximum ambient temperature is 32°C .

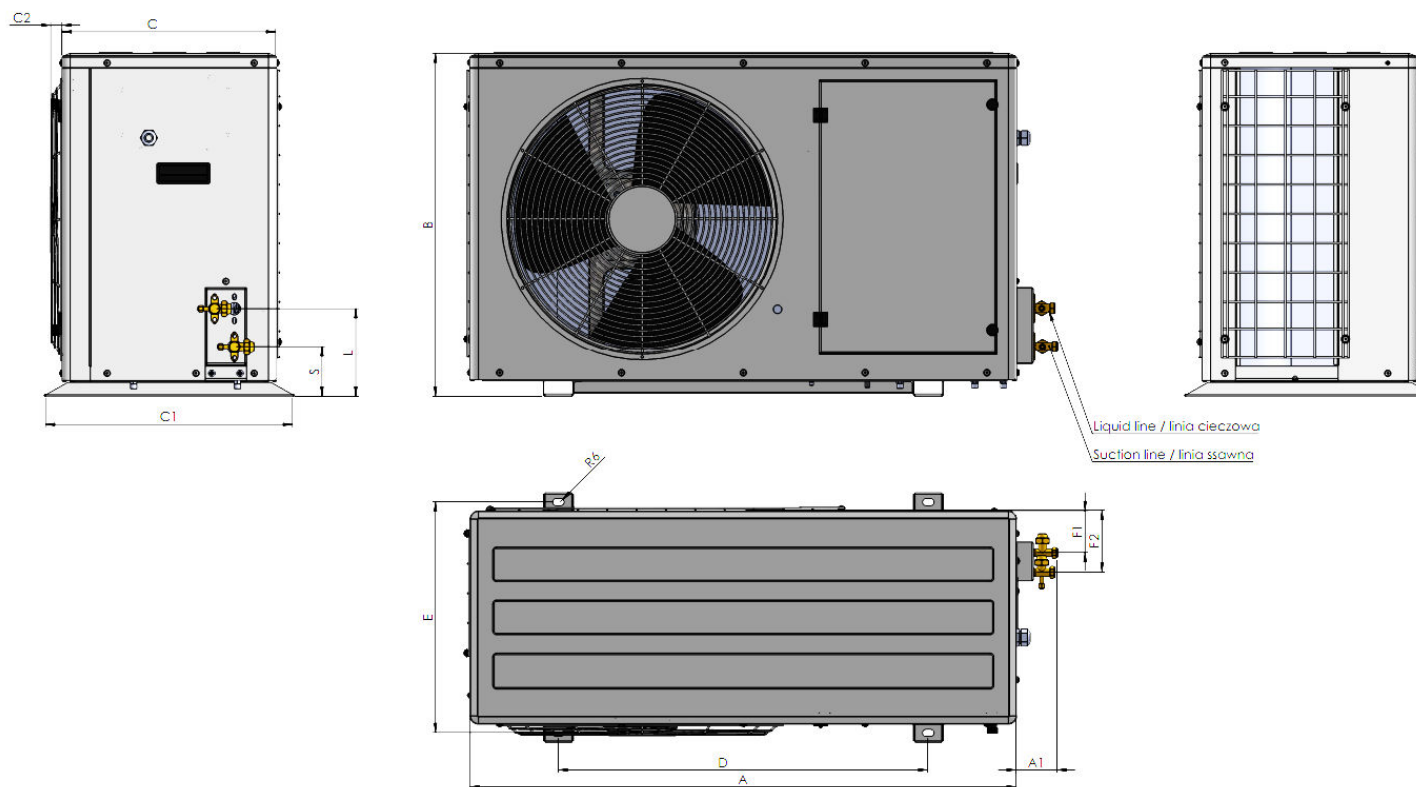
The full load capacity of the system will be $Q=Q_1+Q_2= 2200\text{W}$. A condensing unit that should be good for such conditions would be iCOOL SE 2,2 LT (E1), which has a maximum capacity at the operating point equal 2225 W – slightly higher than the total capacity required. 30% of the condensing unit maximum capacity is equal 668 W and is lower than the capacity of the smallest evaporator, so iCOOL SE 2,2 LT (E1) meets capacity requirement.

Example 2. In a medium temperature system, four evaporators are planned with capacities $Q_1=700\text{ W}$, $Q_2=700\text{W}$, $Q_3=1400\text{W}$ and $Q_4=1400\text{W}$. Each evaporator will be operating at -10°C , using refrigerant R449A and the maximum ambient temperature is 38°C .

The full load capacity of the system will be $Q=Q_1+Q_2+Q_3+Q_4= 4200\text{W}$. A condensing unit that should be good for such conditions would be iCOOL SE 4,5 MT (E1), which has a maximum capacity at the operating point equal 4216 W – slightly higher than the total capacity required. 30% of the condensing unit maximum capacity is equal 1264 W and is higher than the capacity of the smallest evaporators Q_1 and Q_2 . These units should be for example connected together with a common solenoid valve or make pairs Q_1+Q_3 and Q_2+Q_4 , to have the smallest section of at least 1264 W and then using a model iCOOL SE 4,5 MT (E1). If such connecting of evaporators is applicable, there should be used e.g. 2 pcs of an iCOOL SE 2,5 MT (E1).

9. Units drawings

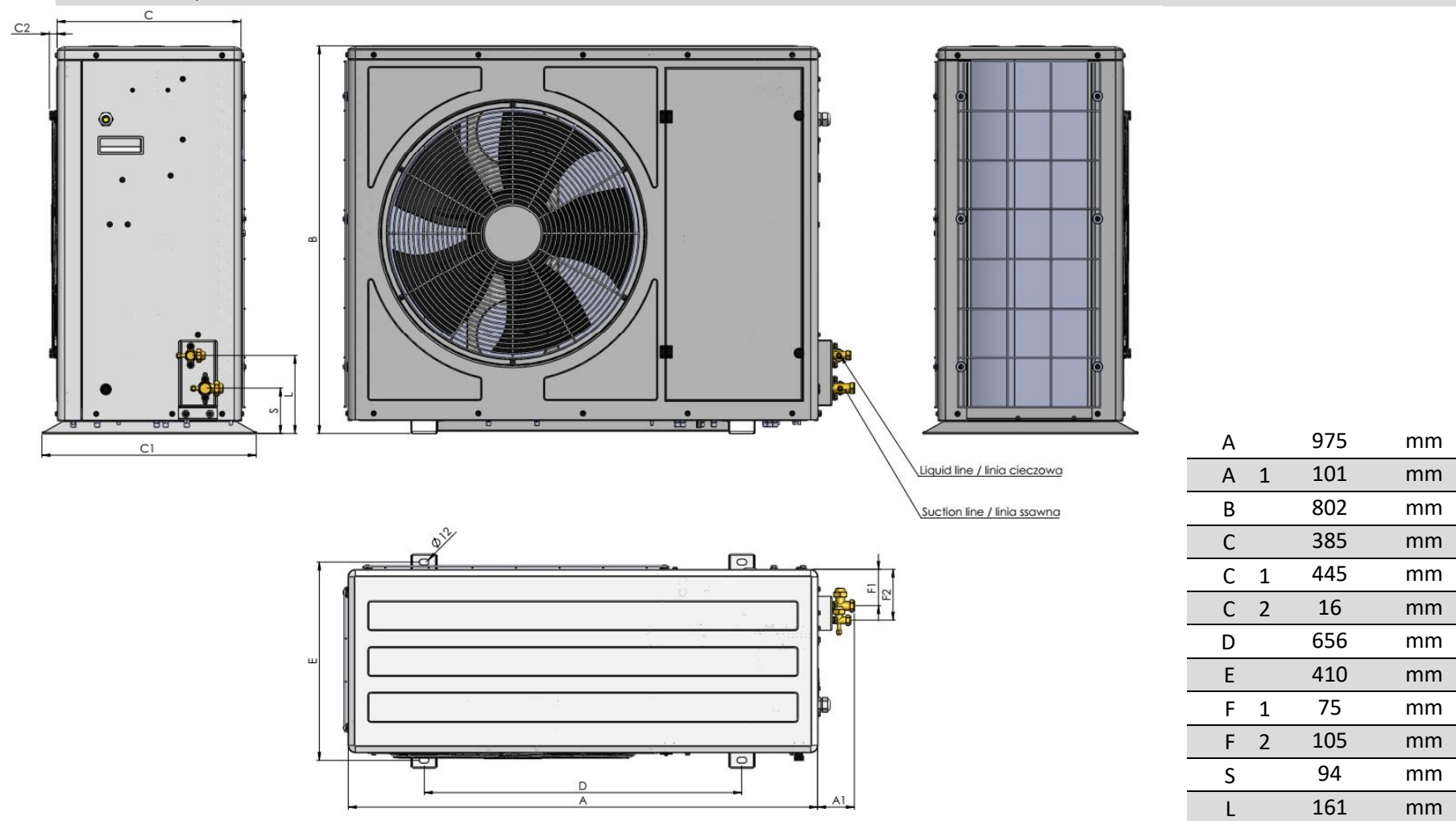
9.1. iCOOL SE 2,5/4,5 MT (E1); iCOOL SE 1,2/2,2;2,9 LT (E1)



A	970	mm
A 1	72,5	mm
B	610	mm
C	380	mm
C 1	445	mm
C 2	20	mm
D	656	mm
E	410	mm
F 1	75	mm
F 2	110	mm
S	88	mm
L	156	mm

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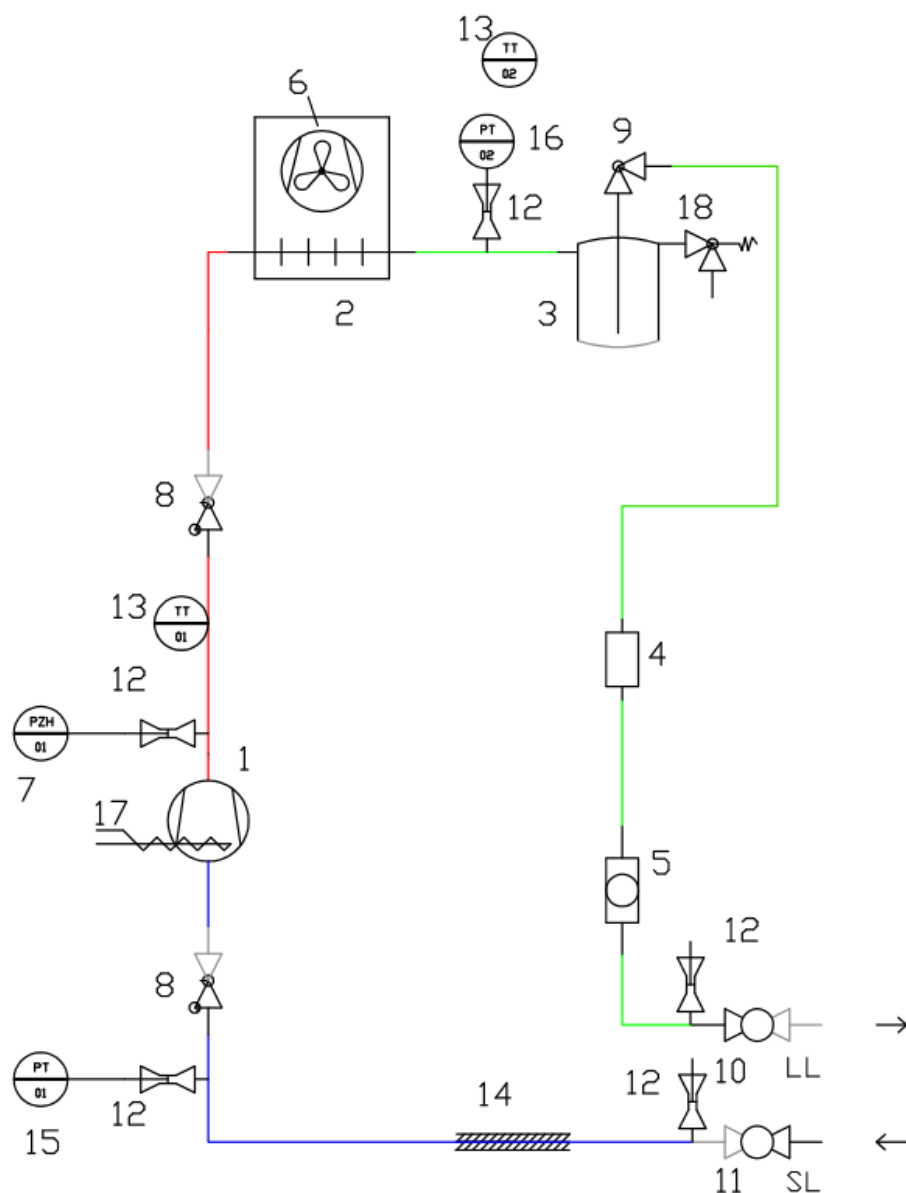
9.2. iCOOL 6,5 SE



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10. Schematic diagrams

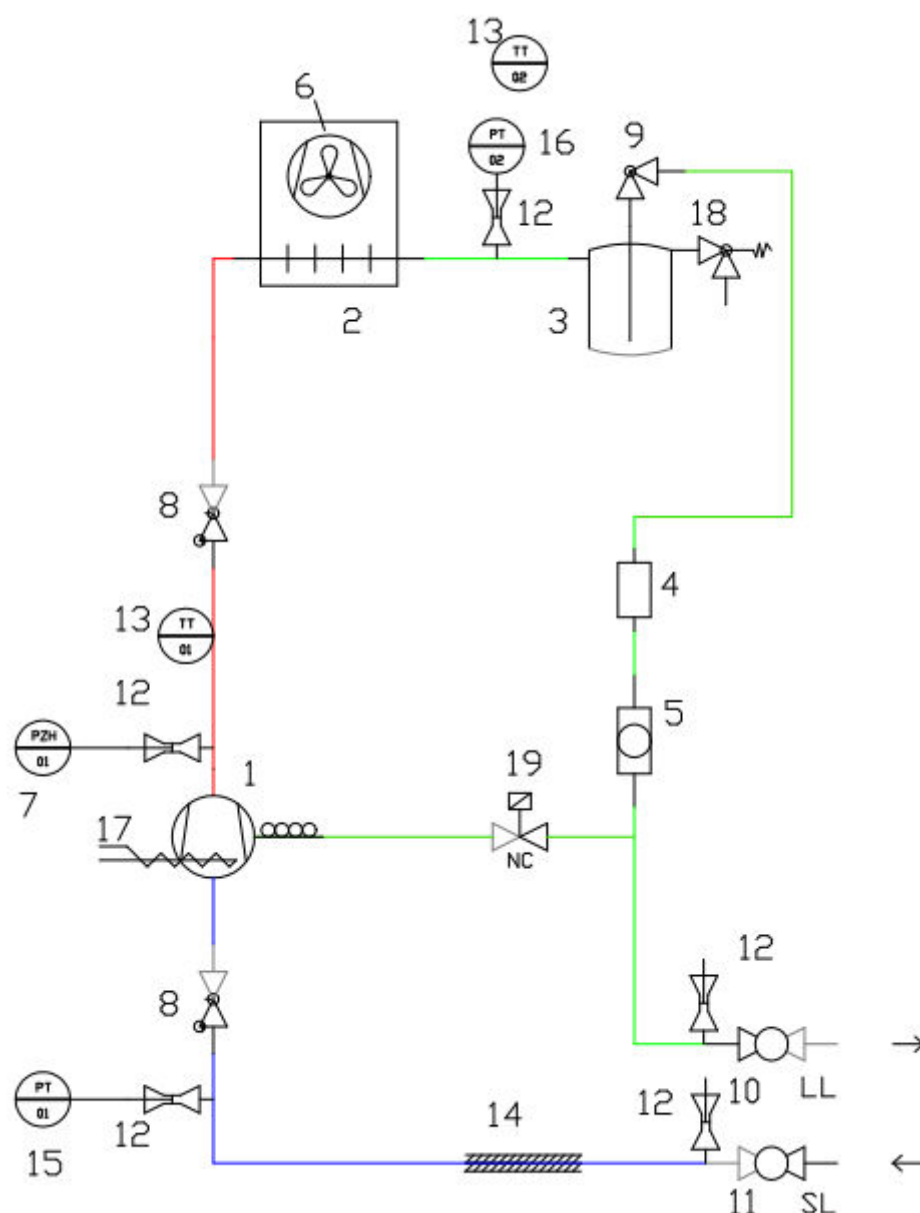
10.1. iCOOL series SE MT



1	Rotary inverter compressor
2	Condenser coil
3	Liquid receiver
4	Filter dryer
5	Sight glass
6	Fan
7	HP pressure switch
8	Check valve
9	Rotalock valve
10	Shut-off valve liquid line
11	Shut-off valve suction line
12	Service valve
13	Temperature sensor
14	Thermal insulation
15	Pressure transducer LP
16	Pressure transducer HP
17	Crankcase heater
18	Safety valve

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10.2. iCOOL series SE LT



1	Rotary inverter compressor
2	Condenser coil
3	Liquid receiver
4	Filter dryer
5	Sight glass
6	Fan
7	HP pressure switch
8	Check valve
9	Rotalock valve
10	Shut-off valve liquid line
11	Shut-off valve suction line
12	Service valve
13	Temperature sensor
14	Thermal insulation
15	Pressure transducer LP
16	Pressure transducer HP
17	Crankcase heater
18	Safety valve
19	Solenoid valve – liquid injection

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