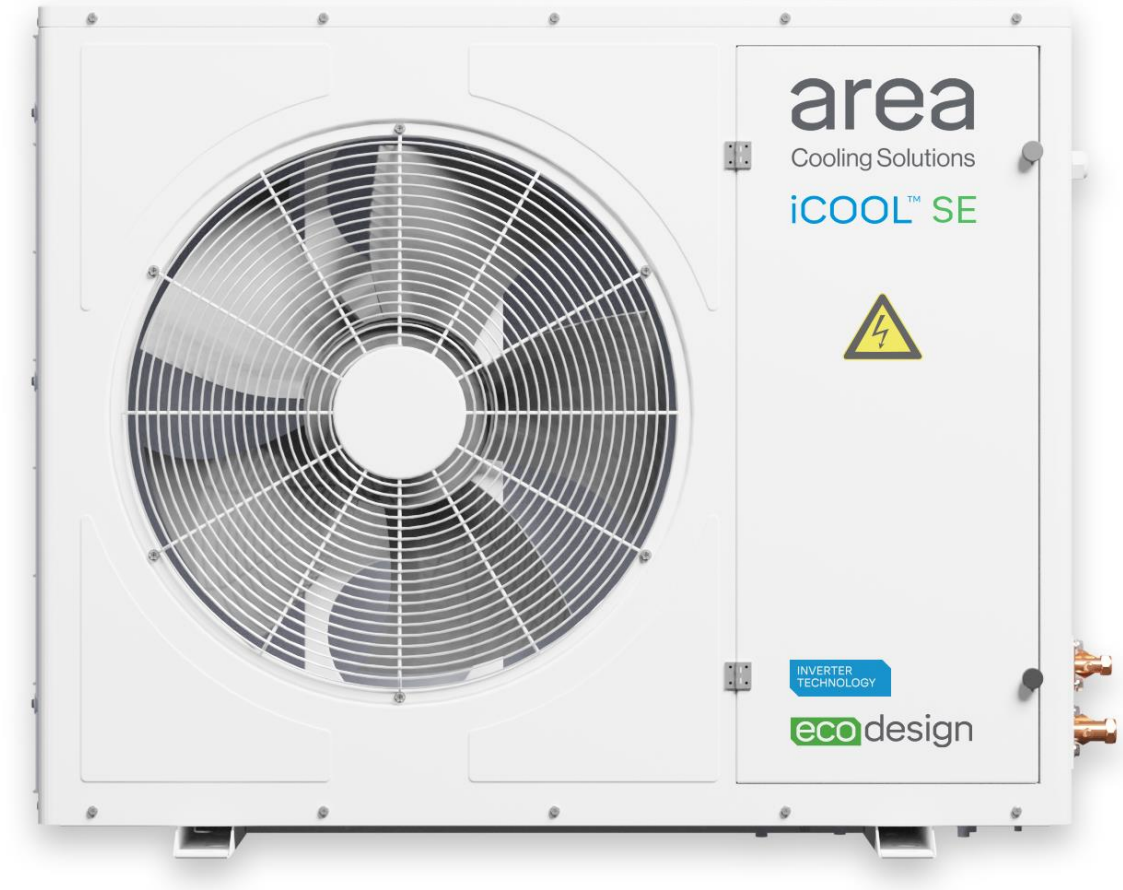
area Cooling Solutions

iCOOL SE
Condensing Units

Unit manual



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Original manual

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1. General Information

- Refrigeration iCOOL 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 performance tables included in the technical brochure and also in a table at the end of this chapter. 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.
- In case of lacking elements, such as safety valves in special versions of units, it may be necessary to equip the installation with them additionally.
- The condensing unit constitutes only a part of a refrigeration system and must be used only with its other components.
- The evaporator capacity, expansion valve, and other components must be selected according to the unit's capacity and the system must be designed to ensure appropriate oil circulation
- Any inconsistencies in delivery must be reported before installing the equipment.
- Before installation and start-up of the unit familiarize yourself with this manual and follow the information provided herein. The manufacturer shall not be responsible for damage or improper operation of the unit resulting from failure to comply with the requirements provided in this manual.
- The general instructions presented below contain certain subjects which must be taken into consideration in order to install units in a correct and safe manner. The guidelines provided are to be used as a checklist: each step must be completed before moving on to the next one. Contact Area Cooling Solutions Technical Department to obtain more information.
- Instructions provided in technical and safety standards (for example EN-378, EN 60204, EN 60335), EU directives, national regulations should also be followed.
- During first start of the unit *The Commissioning Report* should be filled. Form can be found in Appendix D.
- Keep this instruction for the whole period of use the condensing unit.

According to F-gas regulations it is necessary to minimalize and work against refrigerant leakage. In case of a leakage it should be fixed without delay.

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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)
R404A	✓	✓	✓	✓	✓	✓
R448A	✓	✓	✓	✓	✓	✓
R449A	✓	✓	✓	✓	✓	✓
R134a	✓	✓	✓			
R513A	✓	✓	✓			

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2. Safety

All work on the refrigeration system shall be carried out only by personnel, which have been trained and instructed in all work. Personnel, who installs, services, , repairs, checks for leaks and decommissions refrigeration systems shall have f-gas certificate for proper category.

A condensing unit is a pressurized system and as such poses the risk of injuries. Protective clothing and googles should be used. Connections must not be opened before lowering the pressure in the system.

While working with refrigerants precautions shall be taken and personal protective equipment, such as gloves and goggles, shall be used.

During operation, surface temperatures exceeding 60°C or below 0°C can be reached, which may cause burns and frostbites. Before working on the unit switch it off and allow it to cool down.

A condensing unit contains rotating parts – fan blades, which can cause injuries, catching and pulling of clothes, etc. Work should be carried out only when the fan power is disconnected.

Improper handling can cause electric shocks.

Never use oxygen to carry out pressure tests of the refrigerating or the air conditioning circuit. Oxygen can explode upon contact with oil and cause injuries. When carrying out a pressure test with a pressurized gas such as nitrogen (N_2), make sure to use a regulator to control the pressure.

During installation and decommission precautions shall be taken. Safety and health rules shall be obeyed. Special caution is required during work with electrical and pressurized components.

The installation is filled with refrigerant and oil which in specific conditions, for example, while brazing or soldering, can cause fire, explosion or serious injuries and burns.

Instructions provided in technical standard EN-378-3 concerning safety measures, first aid and procedures in case of danger shall be followed.

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3. Type code description

iCOOL SE 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 SE – inverter condensing unit in housing

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4. Units specification

4.1. Components

- High efficient BLDC rotary compressor (Avic) with crankcase heater
- Air-cooled condenser
- EC fans
- Shut-off valve on suction line
- Insulation on 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
-

4.2. Complete unit: IP44

IP 4 4

Second digit – liquid ingress protection

4 – Protection against splashing of water

First digit – solid particle protection

4 – Protection against > 1 mm solid particles

Ingress protection

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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		[m^3/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		[m^3/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		[dm^3]	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			[dm^3]	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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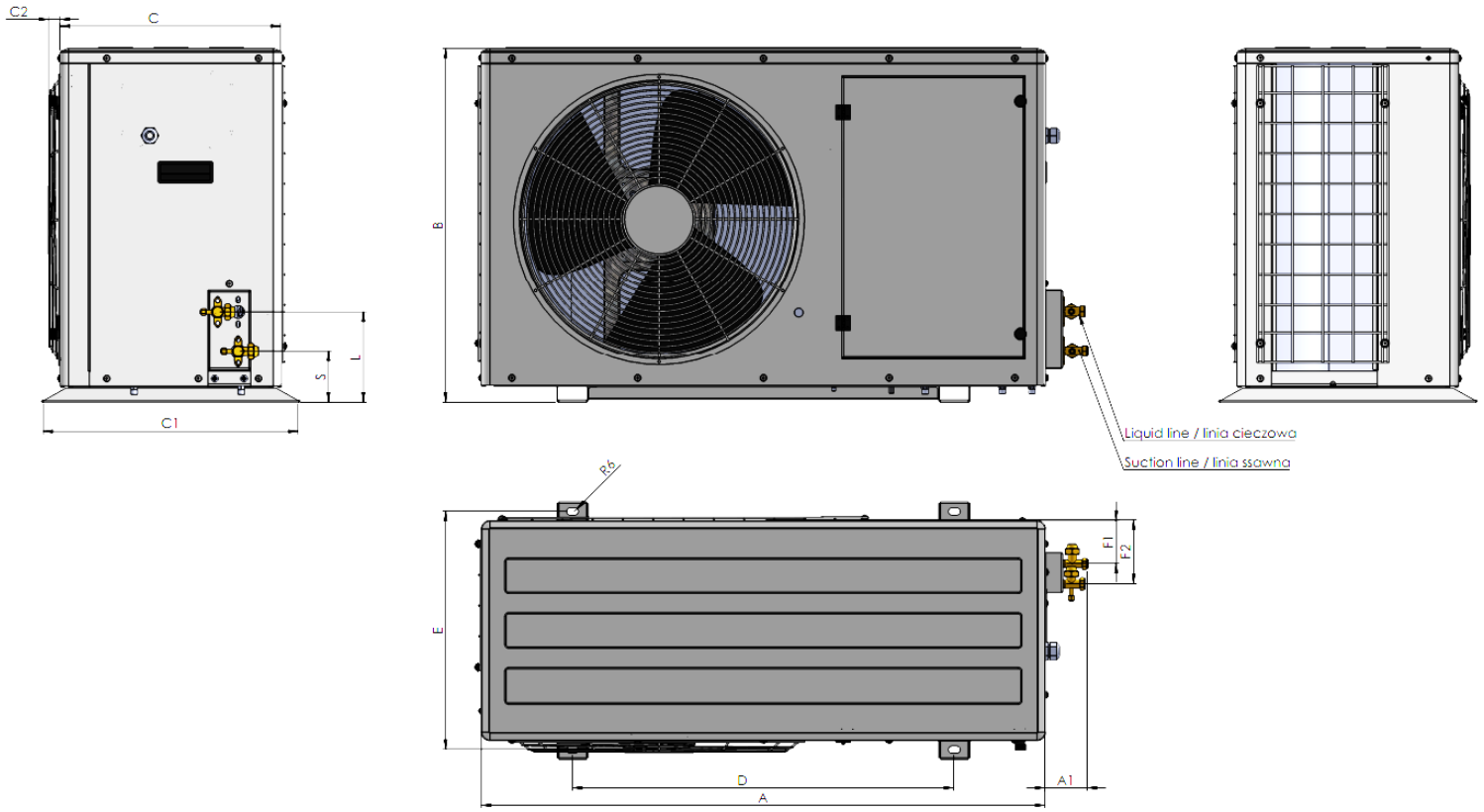
6. Units drawings

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



A	970	mm
A1	72,5	mm
B	610	mm
C	380	mm
C1	445	mm
C2	20	mm
D	656	mm
E	410	mm
F1	75	mm
F2	110	mm
S	88	mm
L	156	mm

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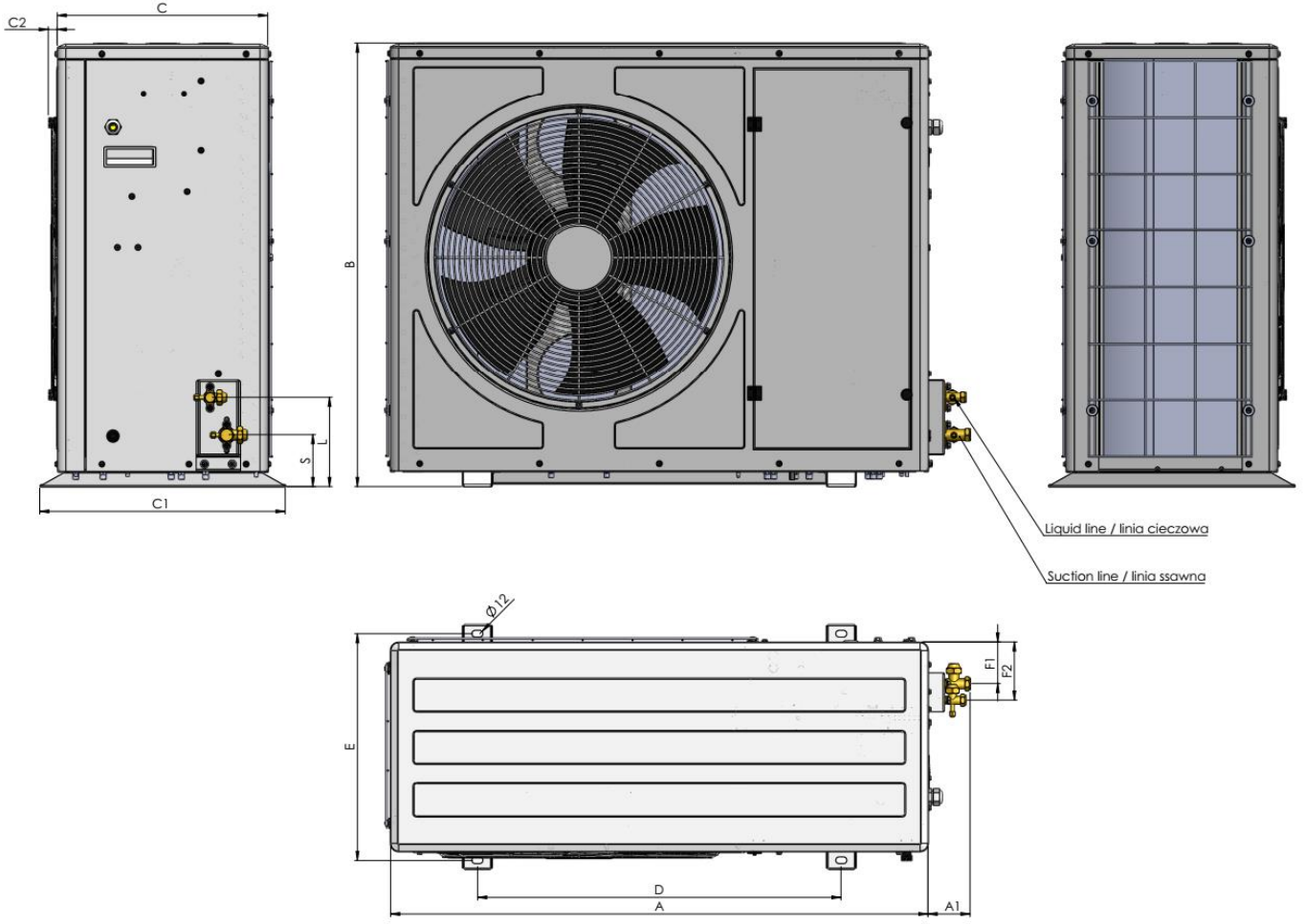
6.2. iCOOL SE 6,5 MT (E1)



A	975	mm
A1	101	mm
B	802	mm
C	385	mm
C1	445	mm
C2	16	mm
D	656	mm
E	410	mm
F1	75	mm
F2	105	mm
S	94	mm
L	161	mm

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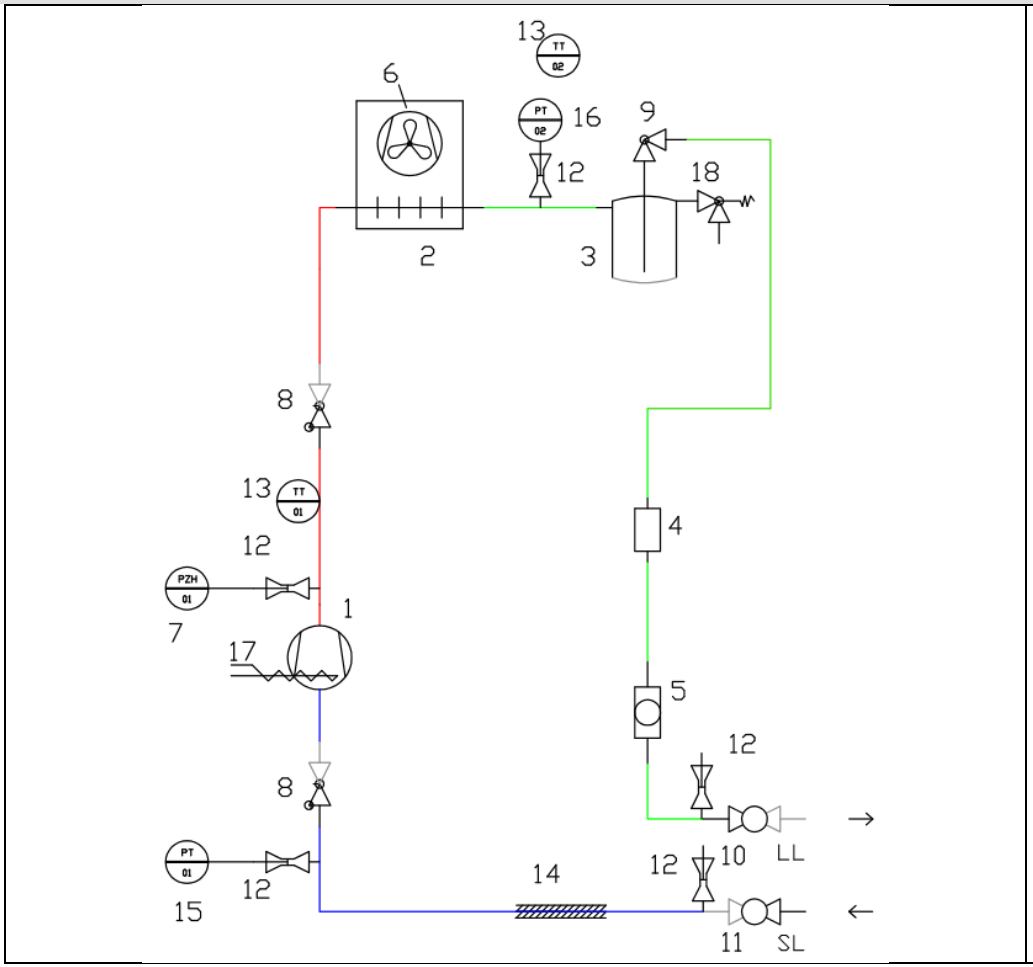
7. Schematic diagrams

7.1. iCOOL SE MT series



1	Rotary inverter compressor
2	Condenser coil
3	Liquid receiver
4	Filter dryer
5	Sight glass
6	Fan
7	HP pressure switch
8	Check vavle
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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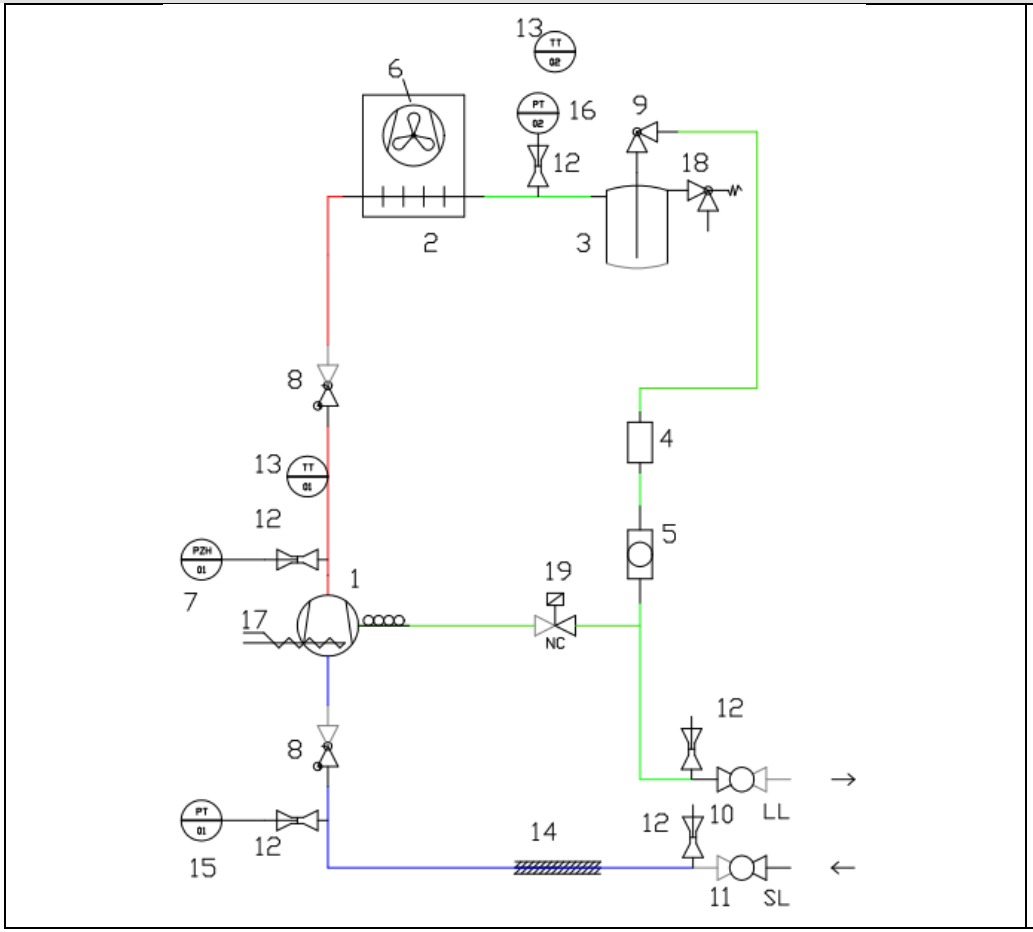
7.2. iCOOL SE LT series



1	Rotary inverter compressor
2	Condenser coil
3	Liquid receiver
4	Filter dryer
5	Sight glass
6	Fan
7	HP pressure switch
8	Check vavle
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	Liquid injection solenoid valve

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8. 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.

Selection of a condensing unit should be done with tables in the technical brochure or with the local supplier of an AREA iCOOL SE condensing unit.

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 (full load) capacity of the condensing unit at that condition.

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

8.2. Condensing unit selection with technical brochure examples

Example 1. In a low temperature system, two evaporators are planned with capacities Q1=800W and Q2=1400W. 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=Q1+Q2= 2200W. 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 Q1=700 W, Q2=700W, Q3=1400W and Q4=1400W. 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=Q1+Q2+Q3+Q4= 4200W. 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 Q1 and Q2. These units should be for example connected together with a common solenoid valve or make pairs Q1+Q3 and Q2+Q4, 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).

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9. Transport and storage

Warning: Danger of injury!

Block stacking is not allowed.

During transport and storage, unit should be transported exclusively on a palette.
Lifting by means of sling belts attached to palette is permissible.

Lifting and moving the device should be performed using devices designed for this (forklift, crane, etc.)
Machines used for lifting the unit must meet the requirements of Directive 2006/42/EC, have adequate load capacity and be approved for use.

Never go under a suspended unit.

Unless the unit is transported manually, maintain safe distance from the transported unit of at least 1.5 m.

Tilting the device is not allowed.
The unit must stand levelled.

Store the device in shaded area in temperatures between -25°C and +55°C with relative humidity 10-90%.

The device with package shall not be subjected to rain, corrosion environment or direct sunlight.

After unpacking, make a judgement whether the unit is undamaged and complete. Noticed discrepancies should be reported to supplier.

During transport and storage, the unit should be protected against humidity and dust (e.g. foil, carton)

Use of pipes, condenser collecting pipes or fittings to lift the unit is forbidden.

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10. Verification of the technical condition

Upon receiving the unit, check:

- if it was not damaged during transport (every unit is packaged),

- its leak-tightness (each unit is pre-filled with dry nitrogen at the pressure of 3-5 bar)

- its components for damage (pipes, pressure switch etc.),

- if the accessories are according to the order.

11. Installation

11.1. General remarks

Incorporation of the unit into any refrigeration system should be preceded by technical consultation or drawing up a project with selection of other components of the system (evaporators, automation) and determination of the appropriate location for the unit and pipes.

Unit should be installed by qualified personnel familiar with cooling equipment.

11.2. Location of the unit

The ambient temperature in which the unit is operated should be within -20°C to 43°C.

To reduce the risk of exceeding this temperature is recommended to put unit under a canopy or inside a room where free air flow can be ensure.

Condensing unit should be installed according to guidelines presented in the appendix B.

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11.3. Requirements on the refrigeration system

Condensing units are dried and pre-filled with oil and dry nitrogen gas at the factory. The unit's connections are tight. Pay attention not to introduce dirt and moisture into the system. The refrigeration system must be made of dry and clean components, according to the plan, technical rules and relevant standards and regulations.

The unit is pre-filled with pressurised nitrogen. To release it, loosen the nuts at valve service connections both at the suction and the liquid side.

In addition the refrigeration system should:

- protect the compressor against ingress of the liquid refrigerant both during operation and shutdown. To do so, appropriately route the suction lines, use appropriate automation components, evaporators etc.

- ensure the oil return to the compressor by properly arranging the refrigerant lines

- provide protection against excess energy losses by insulating both the suction and the liquid refrigerant sides

- all connections must be tight – it is recommended to use soldered connections.

Refrigeration system containing F-gases should be marked accordingly.

Low temperature and freezing installation

In a low temperature system with evaporation temperature below -15°C only LT series condensing units can be used. LT condensing unit are equipped with a liquid injection solenoid valve, regulated by discharge temperature. Liquid injection is necessary to avoid discharge temperature overheating in a system with high pressure difference between suction and discharge.

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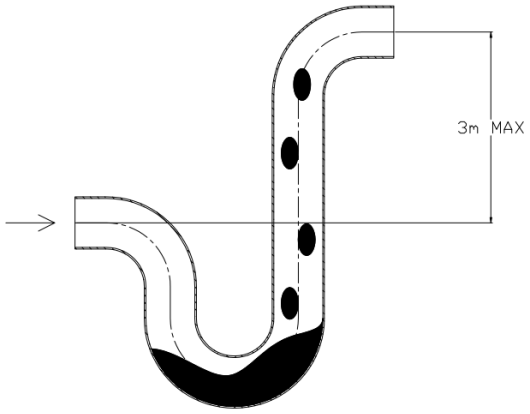
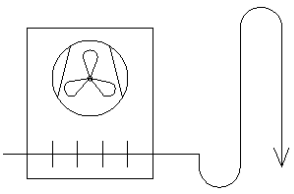
Oil traps

To enable an oil return with a refrigerant on a suction line, P-shaped oil traps should be done, which make oil transport possible. These traps should be made before each vertical suction line section with an upstream flow and at the evaporator outside after the temperature sensor. A single oil trap on the suction pipeline allows oil to flow upwards to the maximum height of three meters. In case of a higher vertical section, there should be additional oil trap made in the middle.

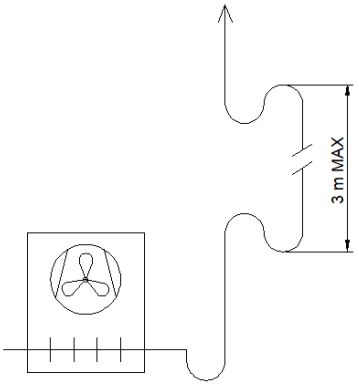


The suction line must be routed appropriately to the relative position of the evaporator and the unit and the height difference between them. This is particularly important to ensure correct oil return from the evaporator, improve refrigerant evaporation, and reduce the risk of flooding the compressor with a liquid refrigerant.

If the evaporator is situated higher than the condensing unit, it is recommended to pump down the refrigerant before stopping the compressor. Suction pipeline should be, at least with U-shaped trap be routed above an evaporator. On vertical section with a flow upstream, oil trap should be made.



Evaporator over condensing unit



Evaporator below condensing unit

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Piping diameter requirements

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).

Diameters of condensing unit suction and liquid line connections are optimal diameters of pipes for a typical installation at 30-100% of unit's capacity range in nominal conditions. Each time diameter of a piping should be optimized with used components, to ensure oil return. Use appropriate pipe reduction when necessary.

Piping length

Due to refrigerant velocity and pressure drop, the recommended maximum absolute length of pipes integrated with the iCOOL SE should not exceed 15m for a liquid line and 15m for a suction line. Effective length (straight pipes and equivalent length for connectors and components) should not exceed 20m. It would be an equivalent of e.g. 10 elbows for a 15m installation with 5/8" pipe. Estimated equivalent lengths for different connectors are shown in the table below.

The maximum allowable suction line distance from a condensing unit to the furthest evaporator is 30m (40 m effective length) for iCOOL SE MT series and 20m (30 m effective length) 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.

	Elbow short 90°	Elbow long 90°	Elbow 45°	U-turn	Tee straight flow	Tee branch flow	Reduce 50%	Reduce 25%
1/4"	0,2	0,2	0,1	0,5	0,2	0,5	0,2	0,2
3/8"	0,3	0,2	0,2	0,7	0,2	0,7	0,3	0,3
1/2"	0,4	0,3	0,2	1	0,3	0,9	0,4	0,4
5/8"	0,5	0,4	0,3	1,2	0,4	1,1	0,5	0,5
3/4"	0,6	0,4	0,3	1,4	0,4	1,3	0,6	0,6
7/8"	0,7	0,5	0,4	1,7	0,5	1,5	0,7	0,7
1 1/8"	0,9	0,6	0,5	2,1	0,6	2	0,9	0,9

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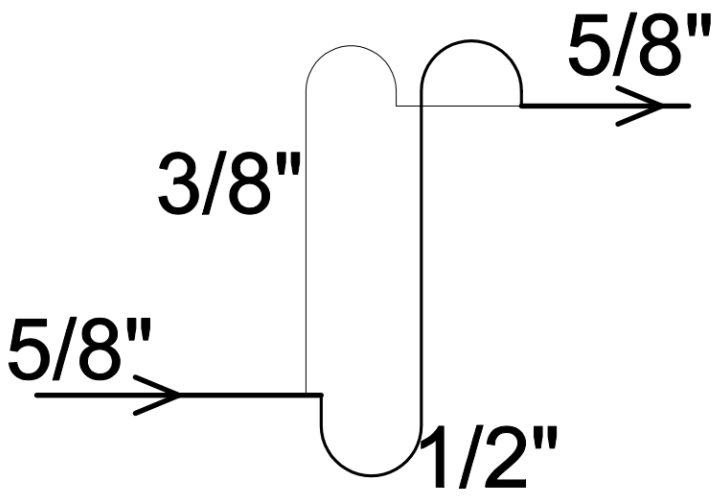
Double risers

To ensure minimal refrigerant velocity in a system with the inverter compressor, suction line reduction or double riser should be used, when necessary.

A double riser gives the effect of a downsized riser at minimum load, while providing about the same pressure drop as a full sized line at full load. The smaller riser is sized to insure oil return at the minimum capacity step; the larger riser is sized so that the combined "flow areas" of both of these risers are approximately equal to the main suction or discharge line.



Full load capacity			Minimum capacity			
d_z	area, mm^2		Riser#1		Riser#2	area , mm^2
3/8"	44,4	→	8 mm	&	6 mm	40,8
1/2"	89,9	→	3/8"	&	8 mm	72,7
5/8"	151,3	→	1/2"	&	3/8"	134,3
3/4"	228,3	→	5/8"	&	1/2"	241,2
7/8"	321,1	→	3/4"	&	1/2"	318,2
1 1/8"	554,9	→	7/8"	&	3/4"	549,4
1 3/8"	841,4	→	1 1/8"	&	7/8"	876,0
1 5/8"	1187,3	→	1 3/8"	&	7/8"	1162,5

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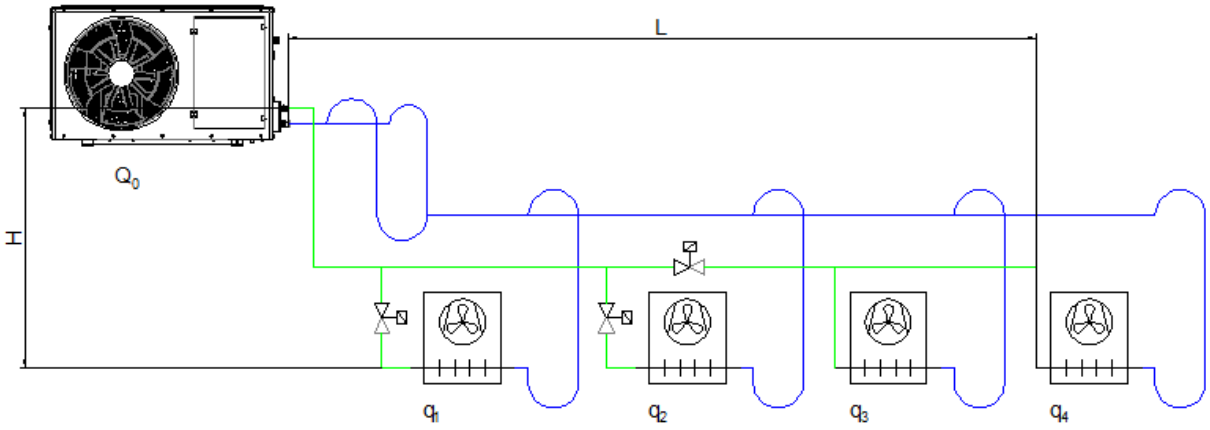
The system should be designed to have optimized piping length and diameter. In long piping installation or with too small suction diameter, due to piping resistance, suction pressure read from transducer mounted in condensing unit may have much lower value than the evaporator's pressure read. The largest differences will be observed when unit would be working with a high compressor frequency, which can result in non optimal performance. During the unit's first start-up pressure level must be checked on unit and on evaporator. Adjust condensing unit setpoint if necessary.



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

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12. Preparation for starting the unit

12.1. Leak tightness test and drying

After the installation is complete, carry out a leak test of the system using nitrogen. The tightness of the unit is tested at the factory.

The leak tightness test should be carried out according to EN-378-2.

Pressure of the nitrogen should be increased gradually according to safety rules.

Do not exceed maximal allowable pressure of unit, specified on the units nameplate.

Do not carry out leak tightness tests by introducing chemical agents into the system. Doing so will void the warranty.

To dry the system, generate a vacuum inside and fill the system with nitrogen. Generate vacuum twice: first when the condensing unit's valves are shut and then:

- create a vacuum 1000 microns (1 Tr, 1,3 mbar)

- fill the system with nitrogen to a pressure of at least 10 bar,

- empty the system via service connection on the suction valve,

- generate vacuum when the unit's cut-off valves are opened until the pressure of 1000 microns (1 Tr, 1,3 mbar),

- check the vacuum quality for 3 hours after disconnecting a vacuum pump,

- if the pressure in the system quickly increases, it means there is a leak in the system. The leakage point should be found and repaired, and a vacuum need to be created again.

- if the pressure in the system slowly increases, it means that in the system there may be residual moisture. Filling the system with dry nitrogen and creating vacuum should be repeated.

- if no leak is detected, fill the system with refrigerant.

Do not start the compressor or power the contacts of the electric motor while there is underpressure in the system. It may cause electric arc or irreversible damage to the motor of the compressor.

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12.2. Refrigerant charging

Before charging the refrigerant turn on the crankcase heater.

Zeotropic, blends should be charged only in a liquid form.

Liquid refrigerant should be charged into the liquid receiver.

After commissioning it may be necessary to add refrigerant. Adding liquid refrigerant on suction side should be done with special caution, far from condensing unit with throttling a flow.

During first commissioning of an iCOOL SE, for each 1 kg of refrigerant above 2,5 kg there should be add 50ml of oil, which is compliant with technical specifications.

12.3. Power connection

The electrical connection should be made by a specialist with the legally required qualifications to connect electrical devices.

The electrical system must meet the requirements of relevant safety regulations and standards.

Connect the main power cord to the screw terminals marked -Xz (L1, L2, L3, N, PE) on the electrical board of the unit.

The electrical connection of the unit should be made taking into account the recommendations for the minimum cable cross-sections of specified unit included in the table in point **No. 5**.

Warning: The use of wires with too small cross-section may result in voltage drops, increased current consumption and incorrect operation of short-circuit and overload protection. This can lead to the destruction of the compressor, condenser fans and health or life threat.

WARNING: The device has capacitors which remain live after disconnecting the power supply (they are slowly discharged). Wait 15 minutes after disconnecting the power supply before carrying out repair or service work!

Before starting the unit for the first time or after a longer standstill, make sure that the power supply wires of the unit are not damaged and that the screw connections of the electrical components have not been loosened! (The loosening of the joints could have been caused by vibration during transport or prolonged work).

Additional information not included in this document is given in Appendix A "Electrical documentation and quick start guide "

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12.4. Unit protection class (electric shock protection)

The unit is made in protection **class I**.

ICOOL SE units are fully wired and factory tested.

The user only needs to properly connect the electric power supply.

The user only needs to properly connect the electric power supply.

IMPORTANT:
Due to the fact that the unit's inverter has a leakage current exceeding 3.5mA, it is necessary to provide (according to IEC 61800-5-1) PE (yellow-green) wire with cross section of minimum 10mm^2 or additional protective connection in the form of a separate PE wire with a cross-section, not smaller than the cross-section of the power supply wires, connected to a separate terminal (or the housing, if such a connection is provided) .

Residual current circuit breaker (RCD)
If a residual current device (RCD) must be used as an additional protection against electric shock (requirement for the place where the unit is installed) only a **type B** (delayed) RCD may be used on the power supply side of the generator.

If a type A residual current device is present in the supply circuit, but is not used to protect the unit, it may be necessary to use an RCD with a higher operating current (100mA or 300mA).

12.5. Electromagnetic Compatibility (EMC)

iCOOL SE units must be installed by trained personnel and in a manner suitable for ensuring the required electromagnetic compatibility for the respective operating environment (industrial/ commercial/residential).

Units are designed for installation in an commercial environment (class C2 according to IEC 61800-3: 2018).

Adapting the unit to residential (C1) environment requires the use of an additional RFI filter, which reduces radio interference (in order to select the solutions, please contact witch out technical department).

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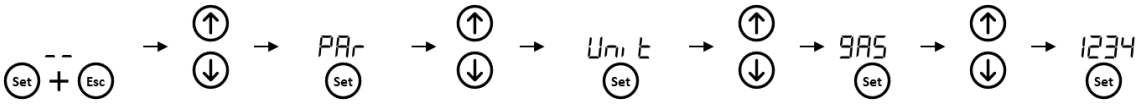
13. Starting the unit

Start the procedure after charging the refrigerant, inspection of: connections, refrigerant charging, leakage, electrical connections and power supply (phase control relay - if present).

A. Make sure that the unit is **turned off**.
B. Check whether all cut-off valves are open.
C. **Turn on** the power supply.
D. Wait for controller start up. Controller is ready for work when FrEE text on display disappears.
E. In case of **different** refrigerant than R449A usage there is a need to change its mode by setting parameter 9A5 according to table below and instruction:



No.	Parameter. 9A5	Description
1.	0	404A
2.	1	134A
5.	4	507A
6.	5	448A
7.	6	449A
8.	7	513A

F. After choosing type of unit the initialization process will start. Controller display will show information LOAd and type of chosen refrigerant. After finishing the procedure controller will change to default display information view.
G. Set desired **evaporation temperature** (default **-10.0°C**) with parameter tES according to instruction below:

H. Set desired **compressor shut off temperature** (default **-20.0°C**) with parameter tEPd according to instruction below:

I. **Turn on** external start permission signal.
J. **Turn on unit** by pushing and **holding F1 button** (arrow up) for **3 seconds** (while being out of menu options).
K. Unit start-up will be confirmed by appearance of turn on symbol on controller display:

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L. **ATTENTION!** When all starting conditions are met the unit will **automatically turn on**.

Additional information not included in this document is given in Appendix A "Electrical documentation and quick start guide "

13.1. Unit start switch

iCOOL SE units in standard option do not have physical starting up switch. There is a dedicated controller parameter to start the unit additionally activated by holding arrow buttons for 3 seconds:

• **Turning on the unit**: Press and hold F1 button (arrow up) for 3 second outside of menu,

- **Turning off the unit**: Press and hold F3 button (arrow down) for 3 seconds outside of menu

13.2. Checking the correct operation of the unit

After start-up the unit should operate without generating excessive vibrations, knocks and heat. The evaporators should be covered with frost evenly.

Check the pressure on the test pressure gauges. The difference between the condensing temperature indicated by the pressure gauge and the ambient temperature should be within 0–15 K.

The indicator should indicate a colour corresponding to dry refrigerant. The flow should be smooth and non-turbulent. If the flow is turbulent and bubbles are visible, too low amount of refrigerant is used.

The thermostatic valve must be adjusted correctly. Vapor from the evaporator should be superheated by 4–8ºC. The thermostatic valve should be adjusted according to valve instruction manual. Adjust the valve when the refrigeration system is operating.

Gas temperature at the compressor's discharge side must not exceed 110ºC

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14. *Operation and maintenance* of the unit

14.1. Requirements concerning operation of the unit

According to F-gas regulations refrigerant systems may be subjected to obligatory tightness tests and keeping records depending on the type of the refrigerant and its charge.

To ensure appropriate compressor working conditions, its number of start/stop cycles must be limited. For this reason the unit's capacity should be selected accordingly to the capacity requirements. Use controllers to limit the number of compressor's working cycles.

To ensure the correct work of the unit during operation:

a) The condensing unit should be powered up at least 4 hours before the first startup to heat the crankcase. Check if crankcase heater is powered up
b) If knocking noise is heard or in case of improper operation, overheating or lack of cooling effect - disconnect the unit from the power supply, locate the faults and address them,
c) When there is a risk of ice formation on the evaporators, effective defrosting must be ensured.
d) In the case of planned stoppages longer than 3 days, there should be made a pomp-down procedure and the unit must be turned off on the controller. For stops longer than 1 week, it is recommended to disconnect the power supply.
e) If a compressor have a sight-glass, after the first 40 hours of operation check the oil quantity and refill it if necessary,
f) Check if the refrigerant is dry; if necessary replace the filter drier.

14.2. Oil level control

Any change in a factory oil quantity should noted in the start-up protocol and service protocols of the condensing unit.

The minimum and maximum oil levels are reached when the oil amount is 20% less/more than the nominal oil level respectively.

Using excessive amount of oil can damage the compressor.

Using oil type other than the original one and replenishing the original oil with other oil type can damage the compressor and void the warranty.

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14.3. Crankcase heater

The heater can reach the temperature of 80^{0}C. Touching the heater can cause burns. The oil temperature should be maintained at approximately +10 to 15^{0}C above ambient temperature.

Lack of heater or its damage must be immediately reported to the supplier.

Failure to connect the electric heater to the power supply can damage the compressor. This will void the warranty.

Oil crankcase heater must be connected to the power supply at least 4 hours before starting the compressor after longer period of non-operation, as well as during normal operation of the system, even if the compressor does not operate.

14.4. Safety valve service

Safety valve service on the purpose of legalization (which should be done according to law regulations which are mandatory in the country of installation) or replacement has to be done according to the procedure below :

1) Disconnect condensing unit power supply
2) Cut-off section(close the valves) where safety valve is mounted
3) Refrigerant in the section where the safety valve is mounted should be pumped out and its mass should be measured. Make sure there is not refrigerant in this section.
4) Change the safety valve
5) Create a vacuum 1000 microns (1 Tr, 1,3 mbar) in the serviced section
6) Open valves on the serviced section
7) Refill the systems with the same amount of refrigerant as You pumped out
8) Condensing unit is ready to plug in power supply and start it

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15. Servicing

15.1. Servicing actions

The condensing unit must be regularly checked by authorized and qualified personnel.

Any modifications of the system introduced by third parties are the sole responsibility of the user and will void the warranty.

1) Before attempting to carry out maintenance work, make sure that the equipment is not operating and is disconnected from the power supply. Exercise caution when carrying out maintenance of electrical connections.
2) Visually check if there is no visible damage which would render the system non-operational.
3) If the system was dried or is filled with nitrogen, dry and fill the system. Carry out these operations according to the general rules.
4) Check if the pipes and connections are not broken and if there are no visible cracks and other signs of mechanical damage. Make sure that transport or long period of non-operation did not cause components to move in relation to each other which could damage them.
5) Switch on the heaters 4 hours before the start-up. This is required before the first start-up and after each prolonged period of non-operation if the voltage was disconnected from the terminals. Failure to do so may cause oil to foam and lead to compressor damage.
6) Before the start-up, particularly after installation or maintenance, make sure the compressor cut-off valves at the suction and discharge sides are opened. Close the valves only when necessary.
7) When emptying the system and compressors follow the general rules.
8) Do not leave air in the compressor before filling it with refrigerant. Dry the compressor thoroughly.
9) The oil level in the compressor and the oil separator circuit must be correct. If significant oil loss is noticed, replenish the oil by using the same oil type which was used originally or its alternative.
10) Set the pressure switches and pressure limits according to the refrigerant compatible with the compressor. Settings of controller and pressure switches must not cause the compressor's operating range to be exceeded.

> In case of iCOOL SE G3i units pressure switches are not adjustable, but during commissioning correct refrigerant has to be selected in the unit controller!

11) Before starting the entire system check if the compressors are connected correctly. To do so, measure the current drawn by the compressor during start-up. Measure the current when the suction and discharge side valves are opened. The current at the start-up should quickly increase to the maximum value and drop after reaching it. If this does not happen, check for the cause of this problem and address it.
12) The refrigerant temperature at the discharge side should not exceed 110^{0}C.

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13) The vapor at the suction side should be superheated by 10–20 K. If these values are exceeded, adjust the expansion valves or controllers.
14) Check the pressure readings in the controller are consistent with the manometer readings (suction / liquid). The fan speed should be adjusted on the regulator (if the regulator is present)

15.2. Regular inspections of the installation

Once a month User	-Check the cleanliness of the condenser -Check the moisture level in the system (sight glass colour)
Once in 6 months User	-Checking the condition of evaporators' drip trays -Checking the condition of pipelines of a condensate
Once in 12 months Service	-Clean the condenser -Check the operation of check and solenoid valves -Checking tightening of threaded connections -Check the condition of flexible couplings -Check if there are any refrigerant and oil leaks -Check alarm history -Check the pressure at the discharge side -Check the pressure at the suction side -Check the temperature of the suction vapor -Check the temperature of vapor at the discharge side -Check the crankcase temperature -Check the vapor superheating

In case any irregularities are noticed, take appropriate steps to address them. It is recommended to prepare a form to be filled in during the periodic inspections, repairs, adjustments and maintenance.

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16. Typical problems

Condensing units iCOOL SE are equipped with a controller, which displays the current error. List of errors registered by a controller with potential solutions are in appendix A.

17. Decommissioning

In case of decommissioning the unit or its components exercise caution with electrical and pressurized components

Before decommissioning disconnect the supply voltage and extract the refrigerant according to rules concerning handling refrigerants.

In case of changing a single element close shut-off valves before and after it and extract the refrigerant from that section.

Refrigerant recovered from the installation should be recycled, reclaimed, or utilized.

The temperature of the oil extracted from the compressor and oil separator can be above 60°C. Exercise caution.

Oil is polluting waste and should be utilized.

18. Attachments

- Appendix A – Electrical documentation and quick start guide;
- Appendix B – Instruction for installation of air cooled condensing units;
- Appendix C – EU Declaration of conformity;
- Appendix D – The commissioning report;
- Appendix E – Fault history reading instructions for iCOOL SE generation units

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