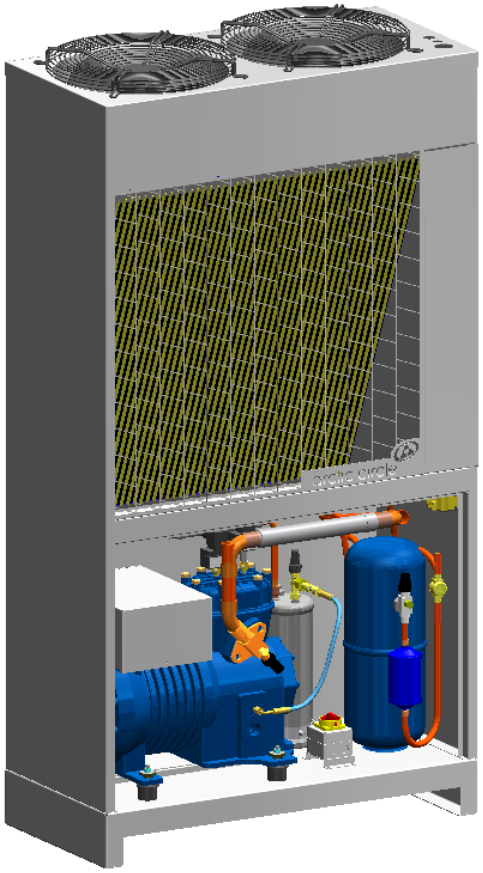
Operating and Maintenance Manual
Simply C

Simply C™ Single Compressor Condensing Unit



ARCTIC CIRCLE LTD

Operating and Maintenance Manual
Simply C

CONTENTS

1.0 Scope.

1.1 This manual covers the specification, application, installation, operation and maintenance of Simply C™ Single Compressor Condensing Units.

1.2 All specification, installation and works performed on Simply C™ Single Compressor Condensing Units, must be carried out in accordance with this manual and specifiers. Installation personnel and service technicians must ensure that they are familiar with the contents of this manual.

1.3 In particular attention is drawn to the section of this manual which relates to Safety, and to the fact that the Operating Instructions from any component suppliers, which form Appendices to this manual, are an integral part of this manual and the instructions therein must be complied with.

1.4 Any queries regarding the Simply C™ Single Compressor Condensing Unit or this manual should be referred to the Engineering department at Arctic Circle Ltd.

2.0 Safety.

This Single Compressor Simply C Unit must not be operated beyond the limits specified in this manual. If there is any doubt over operating parameters then reference must be made to Arctic Circle Ltd.

2.1 This manual contains fundamental information, which must be complied with during specification, installation, operation and maintenance. It must be read and understood by all specifiers, installers and operators.

2.2 All personnel involved in the specification, installation, operation and maintenance of the Simply C™ Single Compressor Condensing Unit must be fully qualified and competent to carry out the work involved.

2.3 Non compliance with these instructions can jeopardize the safety of personnel, the environment, and the Simply C™ Single Compressor Condensing Unit itself. Non compliance with these instructions may invalidate the Simply C™ Single Compressor Condensing Unit warranty.

2.4 In addition to any specific safety measures contained within this manual all relevant national Health & Safety regulations must be observed.

2.5 Guards which are fitted to prevent contact with any moving, hot or cold parts must not be removed whilst the unit can operate, and must be maintained in good condition.

2.6 The unit must be electrically isolated from all supplies before any work is carried out on control panels or wiring. Any such work must only be carried out by suitably competent personnel.

2.7 The unit doors, which are fitted to prevent access to the equipment by unauthorized persons, must be kept locked during normal unit operation.

3.0 Specification.

3.1 Summary of main features and functions

Simply C™ Single compressor condensing units are designed for outdoor use, to deliver low noise levels and high refrigeration performance.

The main component features are incorporated within an aspirated housing, which consists of:-

- A Single reciprocating or scroll (depending on the version)
- Oil management system.
- Condenser and fan assembly. Fans are variable speed or fixed speed (depending on the version)
- Liquid line and receiver assembly.
- Liquid drier assembly.
- Electrical control panel for all equipment.
- Crankcase heater fitted to the compressor.

The aspirated acoustic compressor compartment provides the sound attenuation from the compressor. The compartment is aspirated by the condenser fans, which ventilate the acoustic compartment. The housing also provides a weatherproof shield for the components contained within the unit.

3.2 Application

The Equipment data, details and operating parameters at design conditions are shown on the specification sheet. An additional sheet shows the operating range of the Pack System and its performance within that range. The Equipment must not be operated outside of that range.

Operation outside the conditions specified by the selection criteria may invalidate the warranty.

3.3 Electrical Controls

For a single Quantum compressor with pressure switch control the electrical control panel is contained within the compressor terminal box. A mains isolator is then located remotely within the compressor compartment.

In cases where a scroll compressor and or electronic control has been specified the control panel is located external to the housing on the right hand side. A mains isolator is then located at the bottom left of the panel. **Extreme care is required when entering the control panel, as the control panel may not incorporate a door-interlocked isolator**.

The mains isolator feeds the MCB's to each circuit and overload protection to the motors.

A crankcase heater is fitted to the compressor that will operate when the compressor is not running. An oil separator heater may be fitted to the unit if required. This will also operate when the compressor is not running.

The control circuit is typically 230VAC a step down transformer may be fitted if required reducing the control circuit to 24V.

Pressure switches may be used as the compressors primary control method. The compressor contactor is directly wired to the LP control switch which operates with a dead band to achieve the set suction pressure. Also connected into this circuit are any protective devices such as the HP switch, overload tripped and thermal switches. This prevents the compressor from running outside the units safe limits. If the overload protection has tripped it will require a manual reset.

An electronic controller can be specified or may be required depending on the compressor selection. This will control the compressor based on suction pressure usually measured by a pressure transducer.

The AC condenser fans are typically controlled by a standalone fan speed controller, connected to the high side of the system giving a direct supply to the fans. If EC fans are specified an electronic controller may be used, controlling the discharge pressure read by a pressure transducer. The controller will then give an analogue signal to the fans.

For further details on the fitted controllers reference the components operating manual and the dry run factory data.

In instances where an electronic controller is used the unit may have pressure switch backup installed. Backup control is initiated by the means

of separate pressure switches installed on the low and high side. A high discharge pressure will initiate back up control immediately. A high suction pressure will initiate backup control after a time delay has elapsed. Timers will then control the initial compressor staging. After which the compressors will then control on their pressure switches.

4.0 General

All work carried out on the pack subsequent to manufacture must be done in a manner which is safe and which complies with all relevant legislation. The performance of any unsafe or non-compliant work will obviate any of the above mentioned manufacturers certification and will invalidate any warranty agreements.

5.0 Installation on Site

5.1 When handling the unit, it is important to keep it as low to the ground as possible. The unit should not be tilted more than 20 Degrees to the ground.

5.2 The Pack System must be installed and operated in accordance with the instructions contained in this manual and any relevant legislation and Health and Safety directives.

5.3 The electrical supply installation must comply with the requirements of the IEE Regulations, 17th Edition, and the supply utilized must be correctly rated for the Pack System.

5.4 Installation and commissioning must be carried out by suitably qualified technicians.

5.4.1 Care must be taken to ensure the release of all holding charge before commencing brazing of pipe work.

5.5 All pipe work must be designed to return oil under all foreseeable operating conditions.

5..1 Other adjacent plant that requires a supply of air or dissipates air itself may affect the airflow onto the unit. Make sure that the placement doesn't allow discharge air from some another unit to be drawn into the intake of the condenser. Condenser/pack should be installed away from heat and dust sources.

5.7 The surface on which the unit is mounted and its surrounding area could generate high solar gain, which may increase the ambient air temperature surrounding the unit significantly. An increase of up to 5°C is not unusual.

5.8 If the unit is to be mounted directly on a rooftop, it is recommended that it is mounted on raised mounting steels. Any supporting surface must be rated to support the total operational weight of the unit, including the refrigeration charge and any other equipment that has been added, i.e. pipework etc.

5.9 It is important that there is sufficient free space in front of the unit for airflow across the condenser, and for access to the compressor compartment. This is shown on the drawing 5.18.

5.10 All pipe work must be designed to return oil and low pressure drop under all foreseeable operating conditions.

5.11 Ensure that all refrigeration tubing is clean and dry prior to installation. Use only tubing cutters when trimming tubing to the proper length. The use of saws to cut tubing can contaminate the system with copper chips causing premature system failure.

5.11 Dry inert gas, typically nitrogen, should be passed through the lines, at a low pressure, while brazing joints. This will prevent scaling and oxidation which can clog refrigeration components resulting in system failure.

5.12 Brazing rods (BCuP Alloy), used to join cooper tube and fittings, should contain minimum 5% of Silver.

5.13 Always leak check the unit before insulating so that all joints and connections can be easily seen. Open all service valves and pressurize the system with gas. Make sure to let the unit sit for a period of time to see if any leaks appear. An electronic leak detector and soap bubbles can be used to locate the leaking joint.

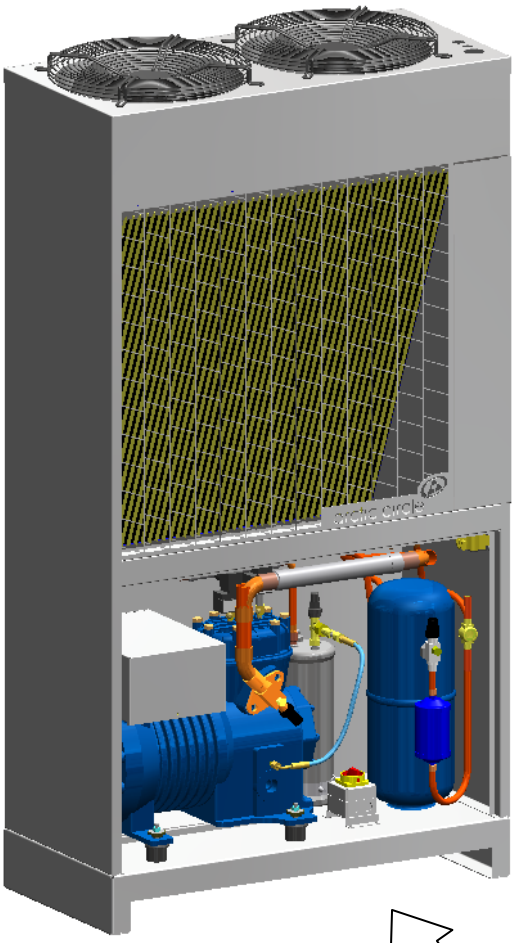
5.14 Pulling a proper vacuum on a system is important to make the system operate efficiently, and to help a long service life. Preferred value of deep vacuum is 500 microns (0.5 Torr).

5.15 Charge the system with the designated refrigerant. Information can be found on the CE Label attached to the pack.

5.16 Inspect and tighten all electrical connections, nuts, bolts, and fasteners that hold major components such as fan motors and blades, compressors.

5.17 The installation should be carried with no negative effect on the environment. All residues and waste shall be secured and managed in the proper manner.

5.18 Diagram Showing Free Space Needed around Unit



1500mm minimum clearance to front of unit.

Notes:

Dimensions shown are in millimetres.
The rear of the unit can be positioned flush with any adjacent surface.
The sides of the unit can be positioned flush with any adjacent surface.

The free area needed at the front of the unit is purely for unrestricted air flow onto the condenser, and access to the compressor compartment.

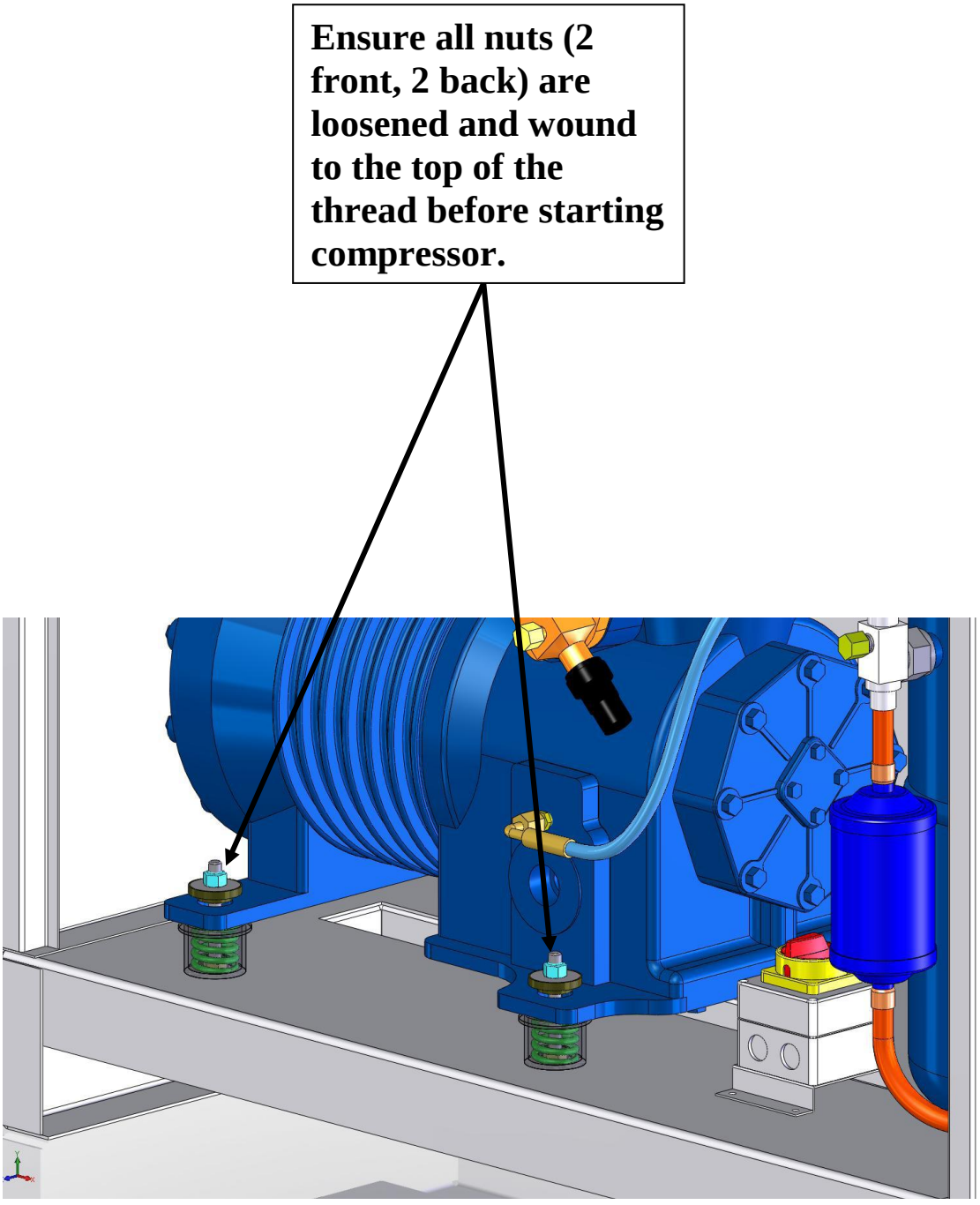
6.0 Commissioning

To ensure the efficient running and reliability of the pack system, it is essential that both the pack and the refrigeration system are set up correctly. Expansion valves and case controllers must be set up to ensure correct operation and prevent liquid return or high superheat of the suction return vapour.

Before starting the pack system, check that: -

- All electrical and mechanical connections and component are tight and have not loosened in transit.
- The compressor oil level is sufficient (1/2 to ¾ level shown on sight glass). The unit comes charged with Solest 31-HE series synthetic oil.
- Incoming mains electrical supply is connected correctly and that the correct voltage, a neutral and an earth are present.
- Compressor service valves, liquid receiver valves and inline shut off valves are open.
- Where system is pre charged with refrigerant, the compressor crankcase heaters have been on for at least six hours.
- All condenser fans turn freely.
- Pressure switches, timers and overloads are correctly set.
- Due to the chemical composition of certain refrigerants they must be charged into the system in liquid form. Under no circumstances is liquid refrigerant to be charged into the suction side of the compressor.
- Check running currents of all compressors and fan motors.
- Test all pressure, and other safety devices.
- See separate sheet for factory settings of pressure switches and timers. Field adjustments may be necessary to suit varying site conditions.
- Ensure all compressor transit nuts are loosened before running the compressor. Once completed, the compressor should “float” freely. If something is preventing it from doing so, do not run the compressor until the issue has been resolved. Please see the following page.

Transit nut position (version with reciprocating compressor).



7.0 Service & Maintenance

The Pack System must be operated, maintained and serviced in accordance with good industry practice and the instructions contained in this manual.

Such work is only to be carried out by qualified service technicians.

7.1 The carrying out of any installation, commissioning, adjustment, maintenance or service work on the Unit by any person other than a trained technician will obviate any of the above mentioned manufacturers certification and will invalidate any warranty agreements.

7.2 The unit should be regularly maintained and serviced to prevent damage, ensure safety and reliability and to ensure longevity.

7.3 A full maintenance should be carried out every 6 months. In particular it is essential that any damage to electrical connections, guards, alarms or any other safety devices are checked.

7.4 At any maintenance the following must be checked: -

- Check condition of, and change if necessary, the oil charge.
- Ensure the condenser is free from any obstructions.
- Check the refrigerant charge and top up as required.
- Check / repair the integrity of all pipework joints.
- Check / tighten the tightness of all electrical connections.
- Check the operation of all safety devices. Repair if required.
- Assess condition and operation of the Pack System.
- Evaluate any damage found. Recommend any further maintenance needed. If damage is sufficient to present a hazard the equipment must be turned off until remedial work is carried out.

8.0 Electrical Operation.

- The electrical supply enters the control panel via connection to an isolator, from which connections are made to the circuit breakers for the various circuits. **The isolator must be switched off before the control panel is opened.**

- The compressor has a crankcase heater, fed by a circuit breaker. This crankcase heater will be switched on automatically via an auxiliary contact on the compressor contactor when the compressor is not running.

- The compressor control circuit features a combined HP and LP safety switch, motor current & thermal overloads, and a klixon cut out relay.

- Compressor operation is controlled by the LP side of the combined pressure switch fitted to the compressor.

- Condenser fans are supplied via a miniature circuit breaker.

- Condenser fan operation is controlled by a fan speed controller fitted via a Schrader valve to the liquid line.

9.0 End-of-life product.

9.1 Any commercial refrigeration equipment containing HFCs in either the refrigeration circuit or the insulation foam that is being disposed of at end-of-life must undergo an HFC recovery process. For central pack systems and condensing units refrigerant must be recovered by a certificated technician before the plant is dismantled. Modern refrigerant recovery machines should be able to remove well over 95% of the refrigerant in an old system. Any insulating foam and material associated with these refrigeration systems (e.g. Polyurethane, rubber etc.) should be sent to a specialist recovery facility.

9.2 All recovered HFC refrigerants can either be:
a) Sent for destruction by incineration at a licensed waste facility
b) Sent to a specialist plant that can re-process the old refrigerant into a gas with properties identical to virgin refrigerant, to create reclaimed refrigerant
c) Given a basic cleaning process, to create recycled refrigerant.

If the old refrigerant is too contaminated it cannot be reclaimed and must be sent for destruction. It is important not to mix different gases in the same recovery cylinder - as this would render them unsuitable for reclamation. Recycled refrigerant must always be used with care as it may be contaminated or of unknown composition. The use of recycled refrigerant with a GWP above 2,500 is restricted to either (a) the organization owning the plant from which the gas was recovered or (b) the organization that carried out the recovery.

9.3 At Electrical and electronic equipment should be treated in accordance with European Directive 2002/96/EC which requires separate collection, treatment and recovery of waste which falls under the categories set out in Annex IA of the Directive.

9.4 At Waste oil is classified as hazardous/special waste and it is covered by the Control of Pollution Regulations 2001. It is not allowed to pour oil into any drains or onto land as this will result in the pollution of rivers and groundwater. Do not burn waste oil on a bonfire as this pollutes the air.

9.5 Used oil shall be secured and delivered to the oil bank for recycling. For the location of your nearest oil bank, contact the Oil Bank Helpline on free phone 0800663366 or visit www.oilbankline.org.uk for information.

9.6 End-of-life decommissioning must be carried out by suitably trained personnel.

9.7 The Contractor is responsible for safety and protection of people, property and environment at the site, including trees, shrubs, lawns, sidewalks, roadways, structures and utilities not designated for removal, relocation or replacement during the course of the work.

10.0 SEPR - Directive 2009/125/EC

Model: SC1SE-12-004-LT-BG			
Refrigerant fluid: R407A			
Item	Symbol	Value	Unit
Evaporating temperature	T	-35	°C
Annual electricity consumption	Q	10903	kWh/a
Seasonal energy performance ratio	SEPR	1.52	-
Parameters at full load and ambient temperature 32 °C (point A)			
Rated cooling capacity	P_A	2.23	kW
Rated power input	D_A	2.59	kW
Rated COP	COP_A	0.86	-
Parameters at part load and ambient temperature 25 °C (point B)			
Declared cooling capacity	P_B	2.46	kW
Declared power input	D_B	2.31	kW
Declared COP	COP_B	1.06	-
Parameters at part load and ambient temperature 15 °C (point C)			
Declared cooling capacity	P_C	2.8	kW
Declared power input	D_C	1.95	kW
Declared COP	COP_C	1.44	-
Parameters at part load and ambient temperature 5 °C (point D)			
Declared cooling capacity	P_D	3.11	kW
Declared power input	D_D	1.63	kW
Declared COP	COP_D	1.90	-
Other items			
Capacity control		fixed	
Degradation coefficient	C_{dc}	0.25	-
Suction superheat BS 13215	T_{sh}	10	K
Subcooling	T_{sb}	0	K

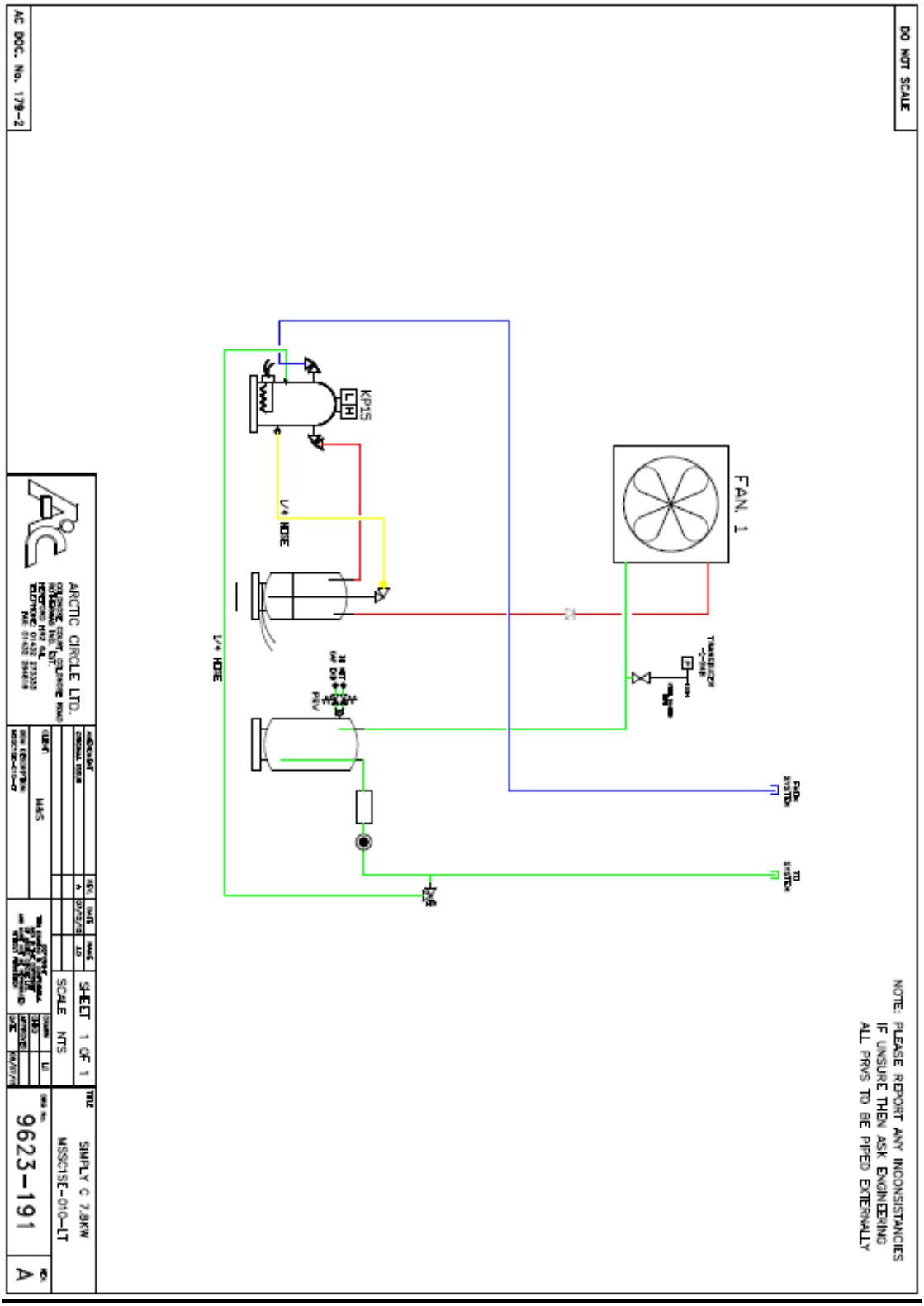
Above values are presented for unit version with one scroll compressor without capacity control and including fan power consumption, according to Regulation EU 2015/1095.

Values of SEPR for particular model/version are available on the website: http://www.acl-online.com/

11.0 Build Specification – Appendix A

12.0 Commissioning and Test Certificates – Appendix B

13.0 Refrigeration Schematic drawing – Appendix C



14.0 Electrical Circuit Drawing – Appendix D

13.0 Technical Data Sheets – Appendix E.

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SAFETY DATA SHEET

C2HF5 30,0313 %;CH2F2 34,6421 %;C2H2F4 35,3266 %

Issue Date:	07.10.2014	Version: 1.0	SDS No.: 000010022564
Last revised date:	20.11.2015		1/15

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name: C2HF5 30,0313 %;CH2F2 34,6421 %;C2H2F4 35,3266 %

Other Name: R407A, HFC-125 40 % (w/w); HFC-134a 40 % (w/w); HFC-32 20 % (w/w)

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Industrial and professional. Perform risk assessment prior to use. Refrigerant.

Uses advised against Consumer use.

1.3 Details of the supplier of the safety data sheet

Supplier

BOC
Priestley Road, Worsley
M28 2UT Manchester

Telephone: 0800 111 333

E-mail: ReachSDS@boc.com

1.4 Emergency telephone number: 0800 111 333

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Directive 67/548/EEC or 1999/45/EC as amended.

Not classified

Classification according to Regulation (EC) No 1272/2008 as amended.

Physical Hazards

Gases under pressure	Liquefied gas	H280: Contains gas under pressure; may explode if heated.

2.2 Label Elements

Signal Words: Warning

Hazard Statement(s): H280: Contains gas under pressure; may explode if heated.

Precautionary Statement

Prevention: None.

Response: None.

Storage: P403: Store in a well-ventilated place.

Disposal: None.

Supplemental label information
EIGA-0783: Contains fluorinated greenhouse gases covered by the Kyoto protocol.
EIGA-As: Asphyxiant in high concentrations.

2.3 Other hazards: Contact with evaporating liquid may cause frostbite or freezing of skin.

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Chemical name	Chemical formula	Concentration	CAS-No.	EC No.	REACH Registration No.	Notes
Pentafluoroethane	C2HF5	30.0313%	354-33-6	206-557-8	01-2119485636-25	
Difluoromethane	CH2F2	34.6421%	75-10-5	200-839-4	01-2119471312-47	
Norflurane	C2H2F4	35.3266%	811-97-2	212-377-0	01-2119459374-33	#

The concentrations of the components in the SDS header, product name on page one and in section 3.2 are in mol due to regulatory requirements.
All concentrations are nominal.
This substance has workplace exposure limit(s).
PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.

Classification

Chemical name	Classification		Notes
Pentafluoroethane	DSD:	none	
	CLP:	Press. Gas Liquef. Gas;H280	
Difluoromethane	DSD:	F+; R12	
	CLP:	Flam. Gas 1;H220, Press. Gas Liquef. Gas;H280	
Norflurane	DSD:	none	
	CLP:	Press. Gas Liquef. Gas;H280	

DSD: Directive 67/548/EEC.
CLP: Regulation No. 1272/2008.

The full text for all R-phrases and H-statements is displayed in section 16.

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SECTION 4: First Aid Measures

General: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact: Rinse the eye with water immediately. Remove contact lenses, if present and easy to do. Continue rinsing. Flush thoroughly with water for at least 15 minutes. Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes.

Skin Contact: Contact with evaporating liquid may cause frostbite or freezing of skin.

Ingestion: Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms and effects, both acute and delayed: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

Treatment: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention.

SECTION 5: Firefighting Measures

General Fire Hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Material will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

Unsuitable extinguishing media: None.

5.2 Special hazards arising from the substance or mixture: Fire or excessive heat may produce hazardous decomposition products.

Hazardous Combustion Products: If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition: Carbon oxides fluorocarbons Hydrogen fluoride ; Carbonyl difluoride

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Last revised date: 20.11.2015 4/15

5.3 Advice for firefighters

Special fire fighting procedures: In case of fire: Stop leak if safe to do so. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out.

Special protective equipment for firefighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Guideline: EN 469 Protective clothing for firefighters. Performance requirements for protective clothing for firefighting. EN 15090 Footwear for firefighters. EN 659 Protective gloves for firefighters. EN 443 Helmets for fire fighting in buildings and other structures. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6: Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures: Evacuate area. Provide adequate ventilation. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

6.2 Environmental Precautions: Prevent further leakage or spillage if safe to do so.

6.3 Methods and material for containment and cleaning up: Provide adequate ventilation.

6.4 Reference to other sections: Refer to sections 8 and 13.

For more specific info about refrigerant, please refer to technical literature available in the manufacturer website.