



RDK7-24

24 Volt Air Conditioning Compressor

Service Manual

Suits: Australia & South Africa Systems

Application

- * Anti Idle
- * Primary
- * Secondary
- * Dual Compressor with OEM



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Manufacturer Information

Rencool Pty Ltd is an Australian owned and operated company, manufacturing durable high quality DC voltage Air Conditioning systems for distribution into the world's marketplace.

Rencool Pty Ltd can design and manufacture systems to suit a wide range of applications and specialize in full DC voltage systems that operate without the need for an engine driven compressor.

Our products can be found within the Trucking and Transport industry, Mining, Construction, Military sector and Heavy lift, Rail (both locomotive and static installations), Marine, Civil Aviation, Telecommunications and Solar power plants.

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Green Business Australia

QC Sign Off

Build date.....

Build No.....

QC Technician.....

Hour Meter.....

S/N.....

Series Model.....

Client.....

Country.....

Packing Fumigated.....

(Important) Terminology Understanding

The RDK7 Series 24 volt Air Conditioning drive compressor unit is powered from a Brushless electric motor powered and controlled by the BLDC 200 amp Smart Controller. The controller is an important component within the unit's power operations. It controls torque, speed, amp draw, high low voltage, high temp cut-out and regulated power needed to maintain the set RPM from our factory pre-programmed settings.

The RDK7 unit is designed to be used as Primary, Secondary or Anti Idle and can be linked to the OEM A/C original components and also the engine drive compressor as a dual compressor circuit. System is able to provide cooling up to 6.2kw and can be up to 12 meters away from the main components. Unit is designed to tolerate extreme conditions which includes, water, dust, sulphur, coal, salt and other such abrasive substances for Mining, Military, Marine and Heavy Construction.

IP Ratings

Brushless Motor: IP-66

BLDC Smart Controller: IP-66

Brushless Fan: IP-68

Compressor: IP-68

Wiring Connectors: IP-66

The RDK7 unit comes in (two) cooling capacities, (RDK7-L) 4.0 kw lower cooling & current consumption and (RDK7-H) 6.2kw with higher cooling and current consumption. Both units are identical; the lower capacity cooling unit (RDK7-L) has 5 less compressor pistons.

The RDK7 unit has been designed to operate in three different modes. Which mode application chosen determines the variation of the installation hook-up configuration.

In this manual it shows the different modes for the RDK7 application and its example hose hook-up circuit. Care must be taken in the hose run circuits when marrying the RDK7 unit to run also from the OEM compressor. Oil separation must be used on the OEM compressor. The RDK7 unit has its own oil separation tank within the unit.

Refrigerant Information

- 1) Gas charge is solely dependent on many factors, it is crucial that the correct gas charge is carried out. Failing to input the correct weight of 134a will result in poor cooling and damage to the HVAC system. Below are benchmarks to work from depending on your hose length, evaporator assembly, and accumulator or NON-accumulator system configuration.

Example only

- CAT 793 Haul Truck (Accumulator System) : 2.2kg – 134a
- Atlas Copco MT-6020 Underground Truck (Standard TX valve System) : 1.4kg – 134a

- 2) The RDK7 unit is pre charged with 300ml of Unidap7 refrigerant oil, 150ml in the compressor and 150ml in the **built-in** oil separator.

Additional oil may be required and should be applied at a rate of 20% of the total R134a charge. We use and only recommend Unidap7 grade. (PAG)

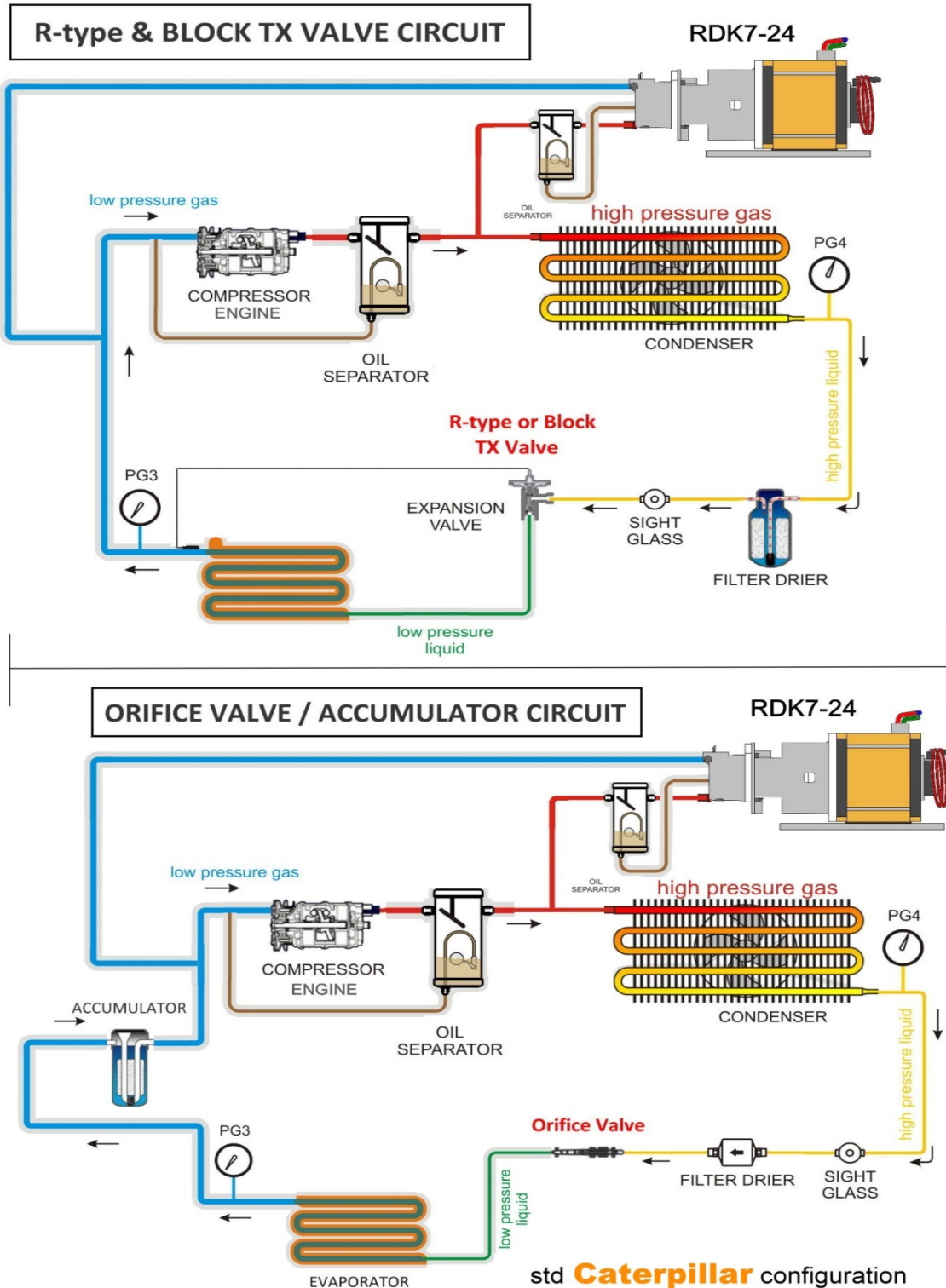
Oil return to the a/c compressor must be taken into consideration with all installations.

- 3) (Dual Comp) 150ml of Unidap7 oil is supplied for the OEM compressor oil separator.
- 4) The use off 90° bend fittings in the suction return and discharge refrigerant lines should be kept to a minimum for optimal system performance.
- 5) The unit is designed for use with R134a refrigerant only and the use of other refrigerants or blends will void the warranty.
- 6) The evacuation procedure **must be** from the low & high-side!
- 7) Evaporator and any existing hosing **MUST BE FLUSHED!**

Caution

- 1) Condenser restriction impacts significantly on the cooling performance and the input power requirements of the drive unit.
- 2) Total suction hose length should be restricted to 12 meters.
- 3) To provide optimal system performance it is preferable to have the RDK7 unit away from heat source and wheel guards.
- 4) It is the responsibility of the installer to ensure the RDK7 is suitable for use in the intended application.
- 5) Any attempt to access or modify the BLDC Controller software via the serial data connector will void all warranty.

System configurations with Dual Compressor (OEM)

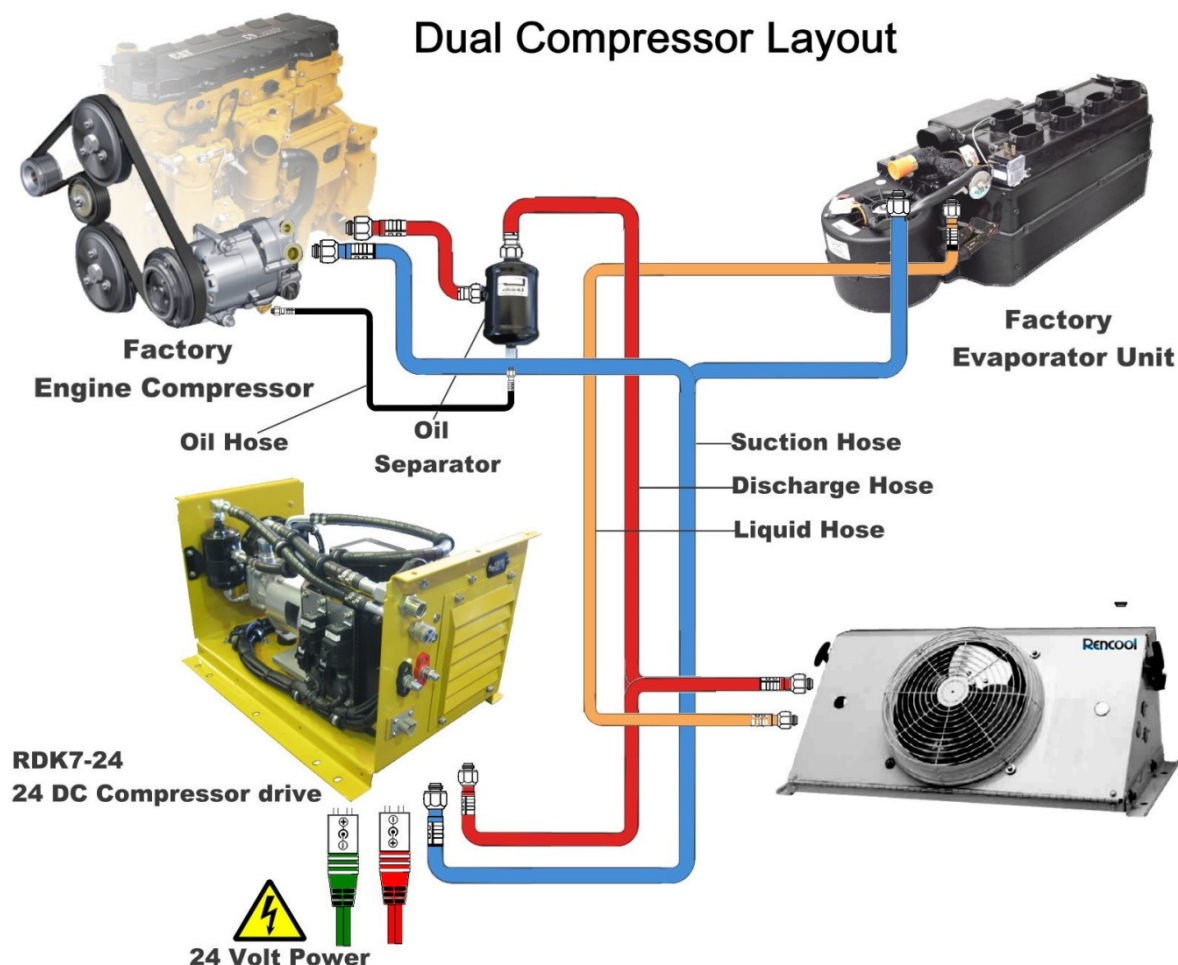


Example (1)..... (Dual Compressor) Anti Idle Operation

The below air conditioning circuit diagram shows the RDK7 unit is designed to run with the OEM factory evaporator or after market and the OEM compressor with the RDK7 compressor drive system. The OEM Condenser **must have remote thermo fans**. Machines such as Caterpillar that have (Accumulators) must be replaced with the receiver drier & Orifice.

Oil separator **must be installed** at the (Off engine drive) compressor with the oil separator kit provided in the (Subkit) Oil separator cannot be mounted near extreme heat.

IMPORTANT: 150 ml of oil must be added to the oil separator on installation, inject the entire oil provided into the inlet of the oil separator. The system OEM compressor works as normal operation feeding into the OEM condenser & evaporator pumping from the OEM compressor. When the engine drive compressor is shut down on idle mode the RDK7 compressor takes over the cooling duty.



Anti-Idle & Primary Application

Examples (1) continue..... (Dual Compressor) Anti Idle Operation

The RDK7 unit is designed to function as Primary and Anti Idle air conditioner. When the engine is running the **engine pulley drive OEM compressor** is performing the cooling duty as per normal operation. When the Machine Engine is shut down the RDK7 unit takes over the cooling duty until the Machine Engine is re-started.

Anti-Idle Basic Operation example

- Engine running the air conditioner performs as normal operation
- Engine shut down with key in off position RDK7 unit - switch to DC electric compressor operation
- (A/C) switch (on) speed 1,2,3,or 4 with A/C switch (on), A/C will be operative
- (A/C) switch (on) speed 1,2,3,or 4 with A/C switch (off), A/C will not operate
- (A/C) switch (off) and A/C switch on A/C system will not operate
- With Engine running and fan speed and A/C switch on the off engine drive compressor will operate
- Once engine is switched (**off**) with all A/C functions untouched set the RDK7 unit to automatically turn on (with no time delay)
- To turn off A/C system the main A/C switch or fan speed switch must be in **off** position. Main Isolation switch also shuts down the A/C system (not recommended)
- **NOTE:** Condenser fans must run with engine compressor on or DC compressor on, condenser fans needs to operate when either compressor is engaged.

Example (RUN TIMER OPTION)

A timer delay relay can be installed so if the operator shuts down the machine and the timer starts the DC cooling operation

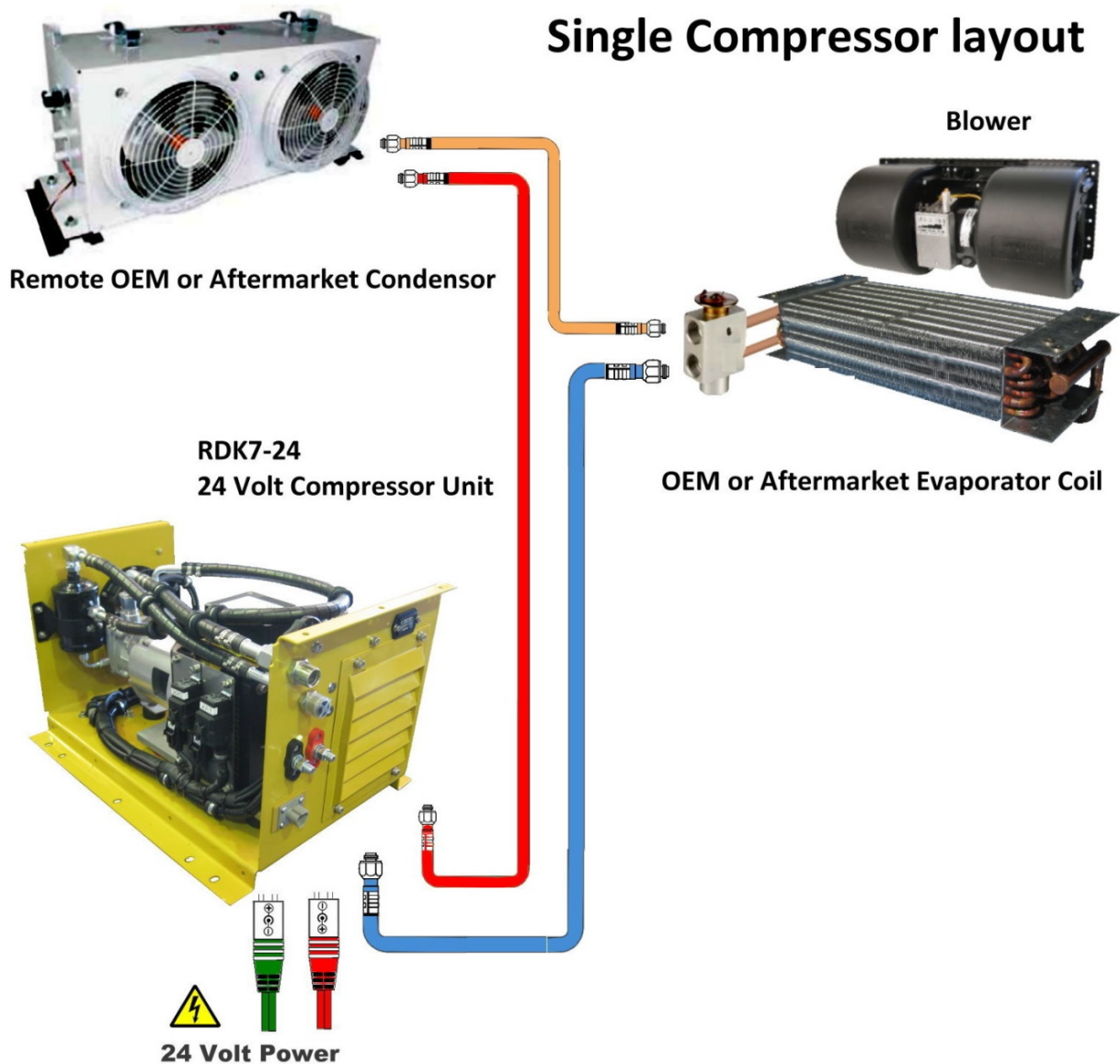
i.e for 30 mins and if the operator is still waiting in the machine after the 30 min period the operator can simply turn ignition on and back off and this will restart the timer for another 30 mins of 24 VDC cooling. This safe guards unintentional use and waste of energy.

Anti-Idle & Primary Application

Example (2)..... (Single DC Powered Compressor) Primary & Anti-Idle Operation

The RDK7 is designed to be used as a primary function compressor system and also for when the engine is shut down. Suction and discharge hose lengths are recommended to be kept below 12 meters. Cannot exceed 7kw capacity coil system for primary or Anti-Idle and condenser pressures best under 200 PSI / 1378 kpa @ +40 deg C.

NOTE: RDK7 unit must have clean ambient air supply to the in-built cooling fan



Prior to Installation RDK7

The RENCOOL RDK7 has been designed to be integrated into existing and new air conditioning systems with a minimal use of resources.

However the following points of note and procedures must be followed during the installation of the RDK7 unit to ensure maximum performance and durability and will also minimise the possibility of damage to the unit from incorrect installation.

Mechanical key points

- 1) **Clean ambient air flow is critical**, to the unit's performance and reliable operation depends on ambient air flow as like any standard air conditioner.
- 2) Location of the RDK7 unit must be thought out correctly for available real estate and also making it a suitable location.
- 3) Must be kept away from strong heat source such as engines, exhaust systems, above gear boxes and or drive train components and wheel guards where debris is consistent.
- 4) Do not mount RDK7 unit where air flow is restricting air flow **in** or **out** of the louver Flutes.
- 5) The unit must be mounted on a horizontal plane with a max of 10% variation off the axis.
- 6) Active cooling of the controller unit and drive motor must be used during operation. This is provided by the integrated aux brushless cooling fan.
- 7) Applications and installations with extreme levels of vibration and harmonic transmission may impact the unit's MTBF and consideration must be given to the use of supplementary isolation mounts in these instances.
- 8) The installed RDK7 unit must not be subject to immersion.
- 9) The RDK7 unit must be mounted with a min (6) in 10 supplied mounting holes. We recommend the use of high tensile M10 fasteners.



Prior to Installation

Electrical and Voltage Requirement Information

Note: It is crucial to the operation of the RDK7 unit the correct voltage is supplied at all times to the unit, either on Anti Idle mode or Primary function.

- 1) Correction cable size must be utilised between the power source and the RDK7 (B+ and B-) connection terminals. Use the supplied 100A fuse should be used and cable size needs to be a minimum of **(OB&S)** 20mm
- 2) The RDK7 is a 24v DC system, Operational voltage range is 18.5Vdc to 29.9Vdc.
- 3) The B- connection between the power source and the RDK7 must be secured before the B+ connection is made. This is to avoid damage to the controller and motor by capacitor charge or discharge.
- 4) All electrical main cable connections to the RDK7 system must be crimped and soldered. Extreme cable lengths from the power source must be calculated for voltage drop. If the cable length is more than 12 meters 20mm diameter cabling must be used.
- 5) Alternator output must be above 100 amp @ 24 volt for standard machine component usage to be manageable to maintain performance of the RDK7 unit.
- 6) Machine power usage must be considered such as lighting and electrical devices.
- 7) The controller is programmable for over and under voltage. Low voltage cut-out 18vdc and over voltage 30vdc, this can be reprogramed to suit the application from manufacture only.
- 8) The higher the Voltage level lessons the Amp current draw and faster the motor will run @ 24 volt ONLY system. As the voltage drops the motor will reduce in RPM. Effects are not dramatic but the amp draw is a noticeable in RPM.
- 9) If RDK7 unit is being used for Anti Idle application, the correct Auxiliary batteries must be used. We recommend (AGM) deep cycle batteries only. What total amp hour you require will be dependent on the run time needed with main engine off.

Prior to Installation

DC amps to Watts Calculation

RDK7 consumption @ 24 volt = 28 to 60 amps max load @ +40 Deg C

The power P in watts (W) is equal to the current I in amps (A), times the voltage V in volts (V):

$$P = I \times V$$

$$1680\text{watt} = 70\text{amp} \times 24\text{volts}$$

Calculate Power Consumption & Time of Use

$$1680\text{w for 1 hours}$$

$$1680 \times 1 = 1680\text{Wh}$$

30% Safety Net Power Consumption (Wh)

$$1680 \times 1.3 = 2184\text{WH}$$

Convert power consumption to Battery Ah (80% of discharge)

Capacity (Ah)

$$2184 / (24 \times 0.8) = 113.75$$

You will need at least a battery with 113.75 AH to have the RDK7 running for 1.5 hours none stop **(worst case)** depending on ambient temp(Higher head pressure = Higher amp draw)

If using Auxiliary batteries - You must use an (AGM) type battery, we recommend min of 2 x 165 AGM deep cycle (Depending on run time needed) with a 200 amp smart charger feeding from the (R) terminal of the Alternator to charge the batteries. The evaporator will have to be wired to the aux batteries, so when the DC system is on with the machine engine off it won't draw current off the OEM batteries.

The RDK7 controller has a low voltage cut out (18v dc) but that only drops the RDK7 out , the evaporator and condenser fans will continue to run. If you want the whole Aux A/C system to shut down on low voltage you will need to run a low voltage relay to shut the full system down or a timer relay. Depending on work place operation needs.

Prior to Installation

RDK7 Air Flow

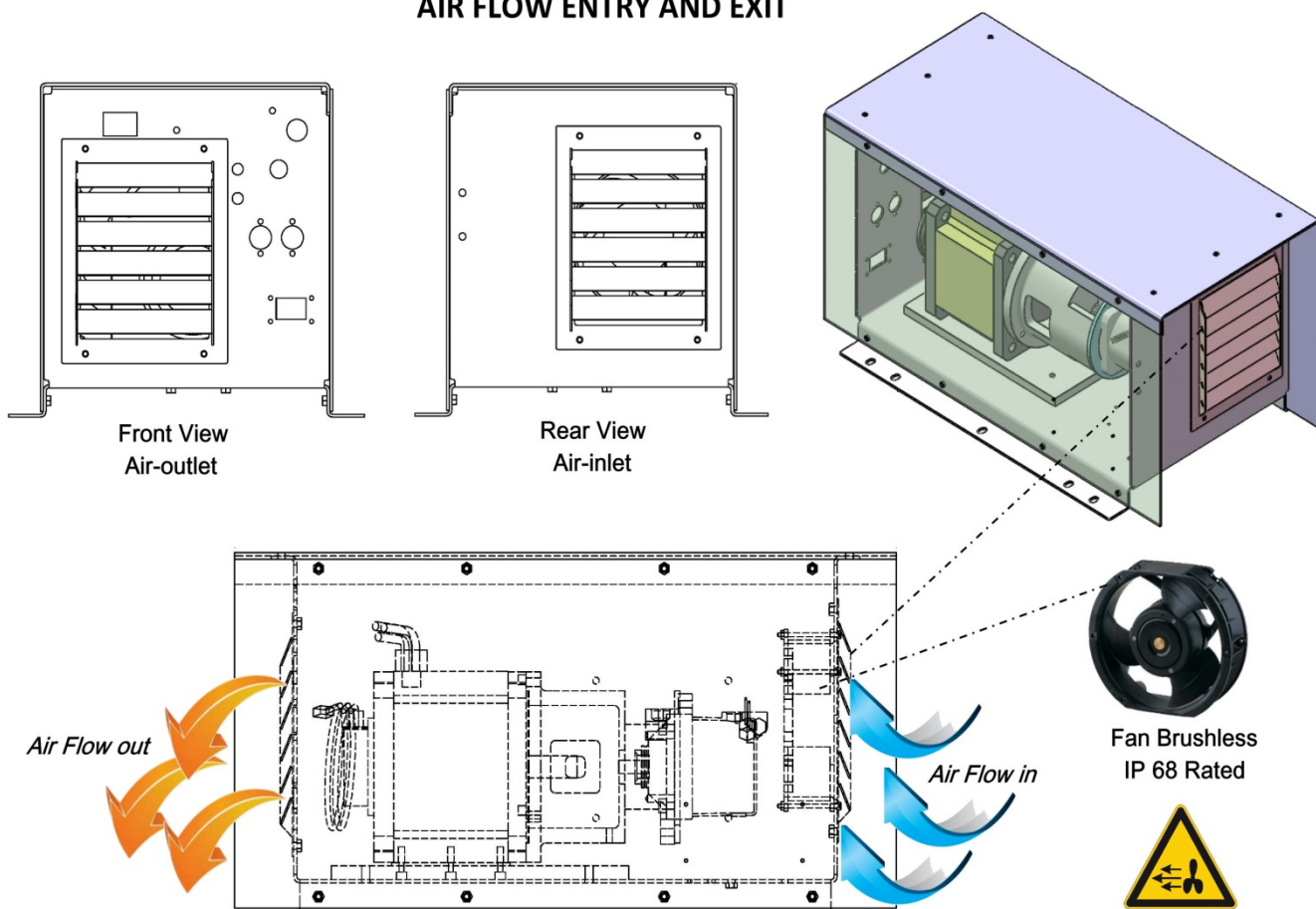
Be sure there is enough room to mount the RDK7 away from unnecessary heat and ample ambient air flow through the Air Flutes on each end of the unit.

Suppling clean ambient air to the RDK7 is important for many factors.

- Lower amp draw
- More efficient BLDC motor
- More efficient BLDC Controller
- More cooling performance
- Longer life for the drive

The air flow is a very important factor to keeping the DC motor and BLDC controller cool. Cutout temp for the controller and DC motor is +110 deg C. Controller will send a fault light code if it goes out on thermo-overload.

AIR FLOW ENTRY AND EXIT



Prior to Installation

(Q) Will you be running Single or Dual compressors (ENG / RDK7) ?

- Locate a position for the oil separator to be installed on the engine comp (oil return fitting)
- Always mount the oil separator (above the engine comp)
- O-ring hose fittings (#8 - 3/4" 16UNF) for easy connection in the discharge line, and a male flare (7/16" 20UNF) for the oil return line. This unit is ideal for use with all compressors up to 200cc capacity.
- RDK7 compressor is pre-oiled and also the oil separator in the RDK7 unit.
- **The oil separator on the engine needs to be added (150ml of UNI-7 supplied with the RDK7 Kit) - Dual comp option only <**
- **Note:** The correct amount of oil must be maintained in the compressor and system. Long hose runs and dual comp systems must have additional oil added to the system. Severe oil may result in compressor failure from insufficient oil.
- **Note:** Over oiling a HVAC system will result in poor cooling capacity.
- (Q) What hoses will you need to make or mod?
- (Q) How will the RDK7 hook up to the OEM evaporator and engine comp?
- (Q) Where will the hoses be running?
- (Q) What is the Alternator AMP output?
- Once you have worked out the total machine current draw add 65 amps on top of that (worst case with the RDK7 with high head pressure) this will give you an idea of what size alt you need to upgrade to or if your current alt is large enough.
- (Q) How much off engine run time will you need if using aux batts? Choosing the right size batteries.

NOTE: *The RDK7 unit is designed to function as Primary and Anti Idle air conditioner. When the engine is running the engine pulley drive OEM compressor is performing the cooling duty as per normal operation. When the Machine Engine is shut down the RDK7 unit takes over the cooling duty until the Machine Engine is re-started.*

Component Scheduled Change Outs

The expected operational life (MTBF) of key parts and components can be defined as per below:
Component is dependent on environmental condition. e.g. Under and above surface Mining are dependent on type (Particle).



✱ Internal Cooling Fan

10,000 hr (subject to fine particle ingress)



✱ BLDC Motor

25,000 hr (subject to environmental condition)



✱ Compressor

15,000 hr (subject to environmental condition)



✱ Vibration Mounts

8,000 hr Steel Track – 15,000 hr Rubber Wheel



✱ Oil Separator

5,000 hr – Per annual or system down



✱ BLDC Controller

25,000 hr (subject to active cooling)



✱ Drive Coupling

8,000 hr (subject to fine particle ingress)



✱ Dis-Suct Hoses

15,000 hr (subject to environmental condition)

RDK7 SERVICE INFORMATION

To ensure optimal performance of the air conditioning system, Rencool recommends the following maintenance and service procedure be followed.

The interval of inspections & service has been calculated on unit hours of operation for above & underground Mining situations.

500 hour inspection or 6 months

- 1) Condenser cooling fan free of debris and operational.
- 2) Check hoses and fittings for signs of leaks.
- 3) Return air inlet clear of debris.
- 4) Check compressor mounts x 5.
- 5) Check drive coupling alignment and red spider for fatigue.
- 6) Check BLDC controller for debris build-up
- 7) Check power cables for burning and/or deterioration.
- 8) Check for BLDC motor and compressor noise / vibration.
- 9) Check for loose bolts and fasteners broken.
- 10) Check discharge and suction pressures.
- 11) Check amp draw of compressor and condenser fans (see spec sheet).
- 12) Check fault codes lights are green at BLDC controller

RDK7 SERVICE INFORMATION

Service 3000 hours and/or Annually

1. Remove and replace oil separator > warning > (re-fill 150 ml oil into oil separator)
2. Remove and replace oil separator at OEM compressor (if fitted) > (re-fill 150 ml oil into oil separator)
3. Remove and replace accumulator tank (if fitted) OEM > (Oil replacement) 50ml +/- 10
4. Condenser cooling fan free of debris and operational.
5. Check hoses and fittings for signs of leaks.
6. Return air inlet clear of debris.
7. Check compressor mounts x 5.
8. Check drive coupling alignment and red spider for fatigue.
9. Check BLDC controller for debris build-up
10. Check power cables for burning and/or deterioration.
11. Check for BLDC motor and compressor noise / vibration.
12. Check for loose bolts and fasteners broken.
13. Check discharge and suction pressures.
14. Check amp draw of compressor and condenser fans (see spec sheet).
15. Check electrical control box for burnt relays and build-up of dust on components.
16. Check fault codes lights are green at BLDC controller

BLDC Controller Fault Codes



The RED LED flashes once at initial power on and then stays off for correct controller operation.
If fault is present the RED LED will flash a two digit code.

If no fault is present and the correct controller initialisation procedure has been attained, the GREEN LED will illuminate constantly.

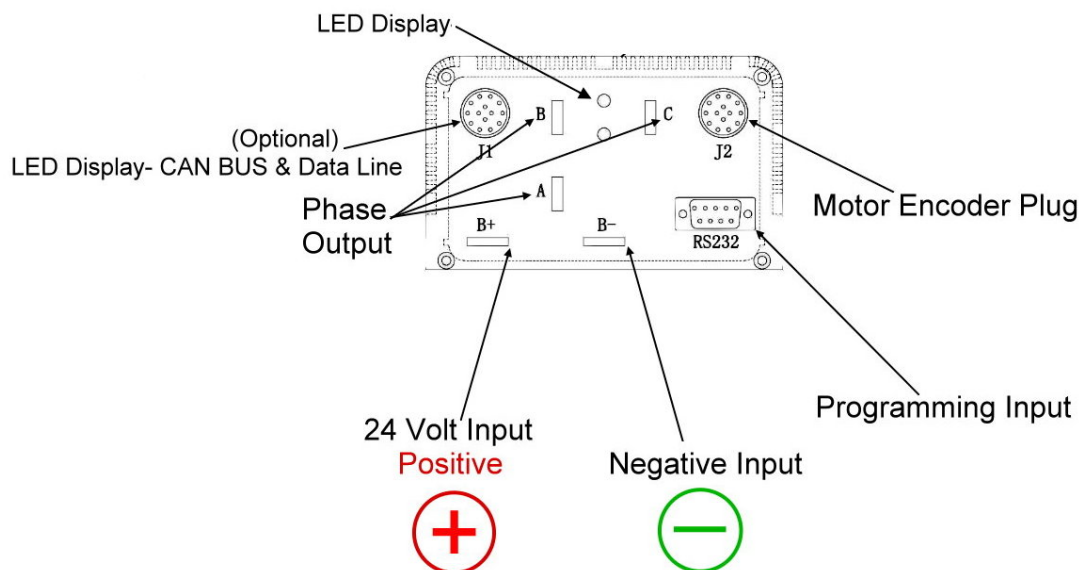
After 1 second from power on (if fault present) the first digit will flash then after a delay of 0.5 second the second digit will flash.

The number of flashes will indicate the numeric value of each digit.

ie: Power ON – 1 sec - xx - 0.5 sec - xx this indicates fault code 2.3

If more than one fault is present there will be a delay of 2 seconds between each separate fault code.
If only one fault is present the code will continue in a loop with a 2 second delay between each display.

NOTE: No attempt must be made to interface with or modify the controller software GUI via the RS232 interface. The specification is preset for each individual drive unit. If the values are changed damage may occur to the controller and or the motor and void the warranty.



Fault Codes

FAULT CODE (RED LED)		ERROR	DESCRIPTION OF FAULT
1.2	▣ ▣▣	OVER VOLTAGE ERROR	BATTERY VOLTAGE IS HIGHER THAN MAX OPERATIONAL VOLTAGE OF THE CONTROLLER. OVER VOLTAGE AT REGENERATION. ALLOW A 2% TOLERANCE WITH OVERVOLTAGE SETTING.
1.3	▣ ▣▣▣	LOW VOLTAGE ERROR	LOW VOLTAGE AT STARTUP. THE CONTROLLER WILL ATTEMPT TO CLEAR FAULT CODE AFTER 5 sec IF VOLTAGE RETURNS TO SPECIFICATION.
1.4	▣ ▣▣▣▣	OVER TEMPERATURE WARNING	THE CONTROLLER INTERNAL TEMPERATURE IS OVER 90°C. THE CONTROLLER WILL REDUCE OUTPUT POWER.
2.1	▣▣▣ ▣	MOTOR FAILS TO START	MOTOR HAS NOT REACHED 25RPM AFTER 2 sec FROM START. POSSIBLE ENCODER OR CABLE FAULT.
2.2	▣▣ ▣▣	INTERNAL VOLTAGE FAULT	CHECK B+ and B- PWR VOLTAGE ARE CORRECT. CHECK LOAD ON 5V SUPPLY CIRCUIT. CONTROLLER DAMAGED.
2.3	▣▣ ▣▣▣	OVER TEMPERATURE	THE CONTROLLER INTERNAL TEMPERATURE IS OVER 100°C. THE CONTROLLER WILL SHUTDOWN. THE CONTROLLER WILL RESTART IF TEMPERATURE DROPS BELOW 80°C.
2.4	▣▣ ▣▣▣▣	THROTTLE ERROR AT START	THE THROTTLE SIGNAL IS HIGHER THAN DEAD ZONE AT POWER UP. THE FAULT WILL CLEAR IF THROTTLE RESTART OR RELEASE.
3.1	▣▣▣ ▣	FREQUENT AUTO RESET	NO FAULT. RANDOM RESET OF CONTROLLER.
3.2	▣▣▣ ▣▣	INTERNAL RESET	RESET REQUIRED DUE TO OVER CURRENT – HIGH BATTERY VOLTAGE – LOW SUPPLY VOLTAGE.
3.3	▣▣▣ ▣▣▣	THROTTLE SHORT OR OPEN CIRCUIT WHEN USING 1-5V HALL SENSOR FOR THROTTLE.	CHECK THROTTLE FOR SHORT OR OPEN CIRCUIT. WHEN THROTTLE IS OKAY RESTART WILL CLEAR FAULT ERROR.
3.4	▣▣▣ ▣▣▣▣	THROTTLE IS NOT ZERO ON DIRECTION CHANGE	THE CONTROLLER WILL NOT OUTPUT MOTOR DIRECTION CHANGE IF THROTTLE IS NOT 0 OR AT SPEED. THE CONTROLLER WILL WAIT FOR CORRECT SIGNAL.

Fault Codes

FAULT CODE (RED LED)		ERROR	DESCRIPTION OF FAULT
4.1	■■■■■ ■	OVER VOLTAGE AT START UP OR REGENERATION	THE CONTROLLER WILL NOT OUTPUT TO MOTOR IF DETECTS OVERVOLTAGE AT POWER UP. WILL CUTBACK REGENERATION CURRENT OR STOP REGENERATION.
4.2	■■■■■ ■■	ENCODER SIGNAL ERROR	INCORRECT TERMINAL DESIGNATION OR DAMAGE WIRING OR FAULTY CONNECTION TO ENCODER. DAMAGED OR INTERMITTENT FAULT WITH ENCODER. INCORRECT ENCODER ANGLE SETTING.
4.3	■■■■■ ■■■	MOTOR OVER TEMPERATURE	THE MOTOR TEMPERATURE IS HIGHER THAN CONFIGURED SPECIFICATION (IF THE FUNCTION IS ENABLED). CONTROLLER WILL SHUTDOWN AND WAIT FOR TEMPERATURE TO DECREASE.
4.4	■■■■■ ■■■■	MOTOR LOCKED ROTOR	WHEN IN LOCKED CONDITION THE MAX OUTPUT FROM CONTROLLER WILL BE LIMITED TO 90% OF LAST POWER SETTING. ONCE LOCKED ROTOR CONDITION CLEARS THE FAULT ERROR WILL CEASE AND MAX OUTPUT WILL BE ENABLED.
FAULT CODE (GREEN LED)		ERROR	DESCRIPTION OF FAULT
GREEN OFF		NO POWER OR NO OPERATION	CHECK WIRING TO J2 CONNECTOR. CHECK POWER INITIALISATION CIRCUIT.
GREEN ON		CORRECT OPERATION	NO FAULT. CONTROLLER FUNCTION WITHIN SPECIFICATION.
GREEN AND RED LED ON		NO OPERATION	SOFTWARE IS UPDATING. SUPPLY VOLTAGE TOO LOW OR BATTERY VOLTAGE TOO HIGH. CONTROLLER IS DAMAGED.

Trouble Shooting

The RDK7 unit is not powering up.

The battery supply at the main studs (24v pos red and 24v neg black) on the side of the RDK7 unit should 24vdc or whatever your aux battery voltage is.

If you don't have battery voltage, please check the RDK7 internal fuse and all cabling from the RDK7 back to the aux batteries or power source, Check for broken cables loose and dirty terminals or voltage drops in the circuit.

If you do have power at the main studs (24v pos red and 24v neg black) the red or green light will be on the RDK7 Controller.

No red or green led lights on the controller.

Check to see if you have power to the B+ and B- (24vdc or whatever your aux battery voltage is) if you have voltage to the controller at the main connector has it blown any of the 2 internal fuses?

If there is voltage at the J1 but not at the led lights when plugged in. **Possible Faulty Controller.**

If there is no continuity, check all plugs from circuit breaker to the J2 plug. Once open circuit is fixed system should operate.

Controller is working and flashing a fault code. refer to controller fault code sheet.

Still no compressor on both systems. There may be fault on the thermostat switching signal.

For further technical support and installation procedures please contact the manufacturer directly. Any warranty claims must be made through the distributor or selling agent.

Line Drawing - Full Compressor Drive View

