

**DULAS Mains Powered
VC225ILR Refrigerator
User's Manual
(WHO PQS E003/072)**



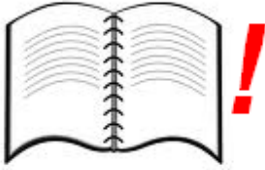
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1. Components Checklist

DESCRIPTION	QUANTITY
REFRIGERATOR	
VC225ILR Refrigerator Cabinet	1
Refrigerator Baskets	6
Refrigerator Key	2
Berlinger Fridge-tag 2 E (Refer to manufacturer's documentation)	1
Other	
Power Supply PS-ILR-002XT attached to: - AC cable (2 m, with pre-terminated mains plug) - DC cable (3 m, with pre-terminated connectors)	1
Screws (5 x 40 mm) – for wall mount	5
Wall Plugs (Brown) – for wall mount	5
Cable Ties	10
Cable Tie Bases	10
Screws – for cable tie bases	10
Wall Plugs (Red) – for cable tie bases	10
MC Connection Tool	1

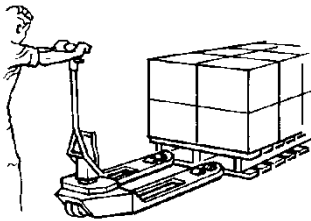
2. Safety Instructions



Read the Manual - please read all instructions completely before installing. Installation and system servicing should only be carried out by a qualified and competent engineer. Work performed by persons with insufficient technical knowledge may adversely affect the performance of the unit or cause physical injury or damage to the equipment.



The refrigerator is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction. Children must be supervised not to play with the appliance. This refrigerator is for professional use only. It is not designed for household use.



Refrigerator and power system are heavy - please observe good manual handling procedures when moving the refrigerator and solar power system. Only use suitable transport equipment.

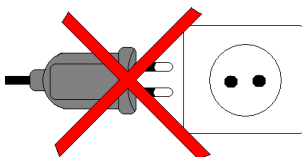


Live electrical components - The refrigerator operates from low voltage DC. There are high voltage live circuits within the accompanying power supply which should only be accessed by qualified technicians.

Always keep the front hinged panel of the PS-ILR-002XT locked shut and store the plastic key handle in a safe place. Only allow qualified technicians to open the cabinet.



Electrical danger - under fault conditions high electrical currents can occur. Never bypass a circuit breaker and always replace with the same type and rating.



DC power only - this refrigerator is designed for operation with the supplied power system only. Do not connect the refrigerator to other power supplies.

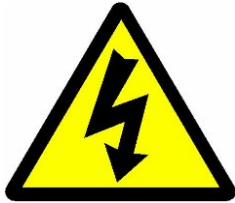


Dangerous substances - this refrigerator contains substances that are not biodegradable and can cause harm, please ensure that all components of the refrigerator are disposed of correctly, see Section 6 for more information. Do not damage the internal side panels of the compartment.



Keep Dry - This refrigerator is for indoor use only. Do not expose it to rain.

WARNING: This unit's cooling system contains flammable refrigerant. Due to this fact, the following information is particularly important:



Warning: Do not damage the refrigeration circuit. Ensure that sharp or pointed objects do not come into contact with the refrigeration circuit.

Warning: Do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer.



Warning: Keep ventilation openings, in the appliance enclosure or in the built-in structure, clear of obstruction.

Warning: Do not use electrical equipment inside the appliance.

Warning: Do not store explosive substances such as aerosol cans with a flammable propellant inside this appliance.

3. Your Dulas Mains Powered Refrigerator

Congratulations on choosing the Dulas VC225ILR vaccine refrigerator. With over 40 years of engineering experience in the production of vaccine refrigerators, Dulas is considered one of the market leaders in this field.

The VC225ILR is Dulas' latest innovation in vaccine refrigeration. Using technology adapted from our groundbreaking Solar Direct Drive refrigerators we have created a mains powered refrigerator that is ideally designed for intermittent electricity supplies. With advanced insulation and a robust phase change lining, our ILR delivers an exceptionally long holdover while also providing 100 % freeze free protection for your vaccines. This new technology offers the same renowned Dulas quality and reliability that have always kept your vaccines safe, but in a simpler and more efficient package.

How does the Dulas ILR work?

When mains power is available the refrigerator runs, cooling the vaccine compartment and its contents. In many situations electricity is intermittent, causing problems for traditional mains powered refrigerators. To maintain the temperature when the power is off the Dulas ILR has a phase change lining. This lining acts as a "cold store" and stores energy that keeps the temperature inside the refrigerator stable when electricity is not available. The temperature of the cold store in the Dulas ILR is naturally between +4 °C to +5 °C which is the perfect temperature required for safe vaccine storage and means that the product is 100 % freeze free.

In order to store sufficient energy to deliver the specified holdovers, the refrigerator must be allowed time to charge its cold store. Refer to the table in Section 17 *User Training* to see how long it will take for the Dulas ILR to be ready to store vaccines.

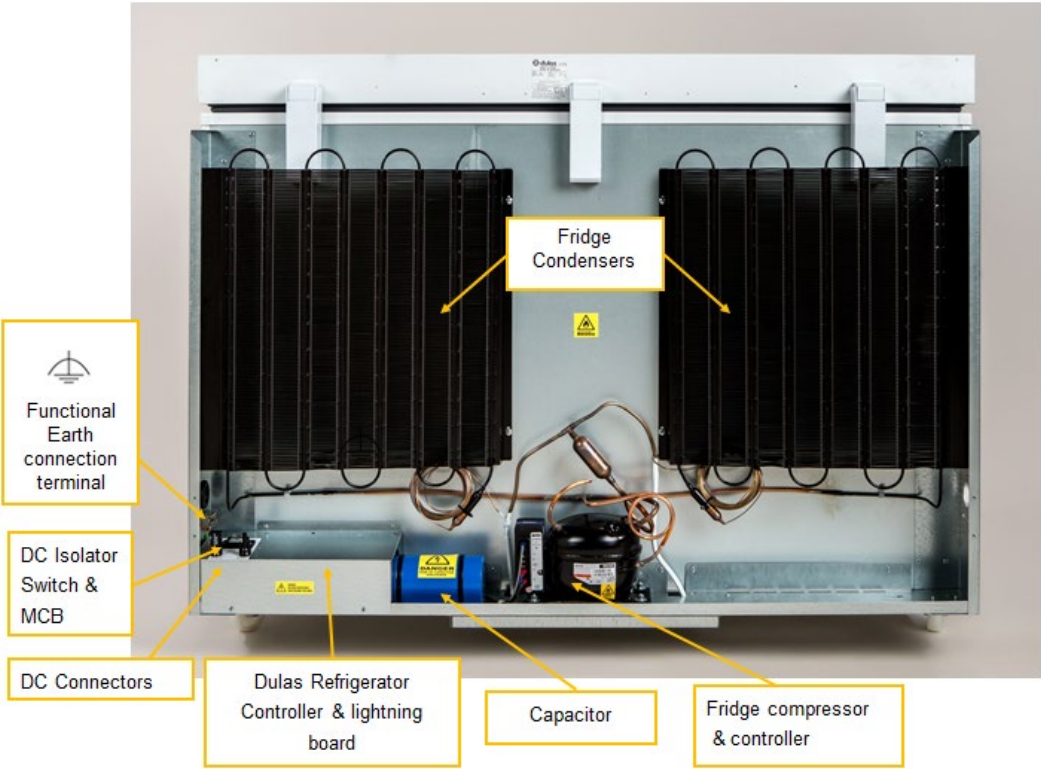
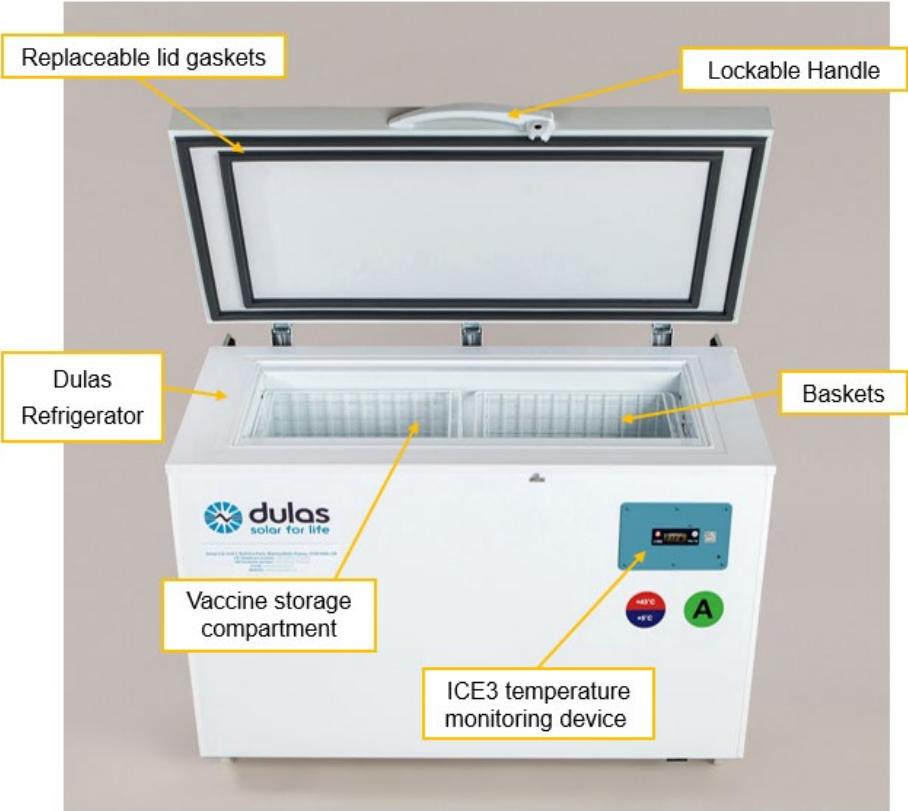
Recommended Power Supply

The Dulas ILR must be connected to the supplied Dulas AC power supply (PS-ILR-002XT). This power supply delivers the DC electricity required by the refrigerator.

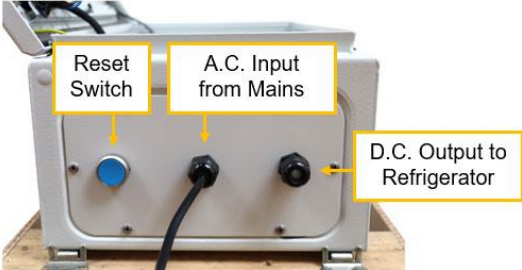
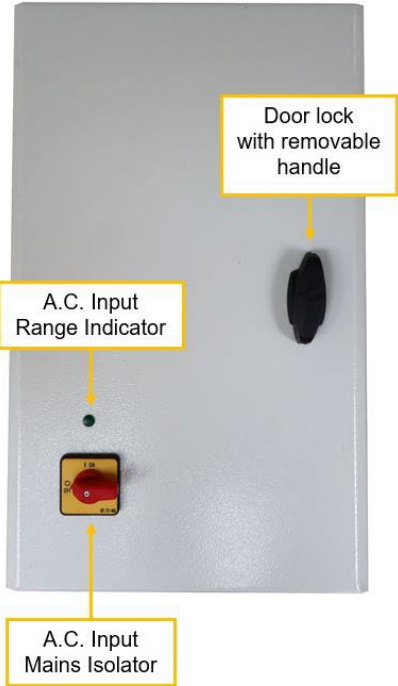
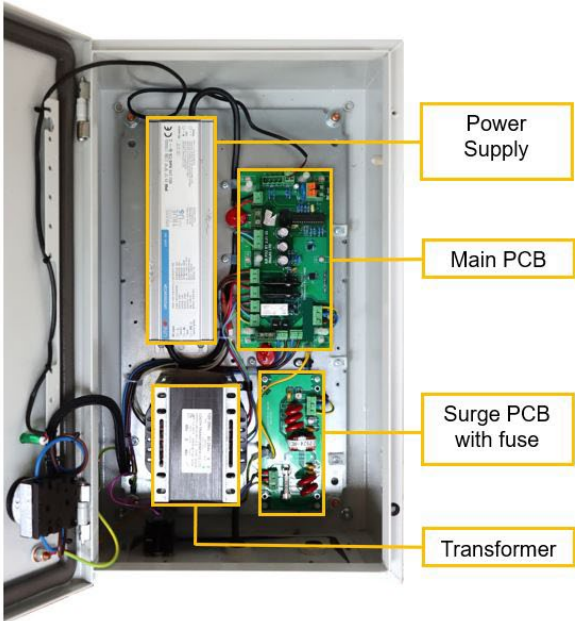
Connect the power supply to a suitable AC mains input of the following specifications. There are two versions of the power supply: 'H' = high voltage, and; 'L' = low voltage. **Only use the power supply version that matches the mains power specification for the install location.**

	PS-ILR-002XT-H	PS-ILR-002XT-L
Nominal Rated Voltage	230 V AC	120 V AC
Rated Voltage Range	110 to 280 V AC	82 to 159 V AC
Nominal Rated Frequency	50 Hz / 60 Hz	
Rated Frequency Range	45 to 65 Hz	
Mains supply	Single-phase, rated to at least 5 A	

4. Refrigerator Components



PS-ILR-002XT



5. Material Safety Information

THE REFRIGERATOR

The Dulas VC2225ILR conforms to the European Directive 2002/95/EC on hazardous substances and does not contain the following elements: lead, cadmium, mercury, hexavalent chrome, PBB or PBDE.

The absence of ozone destroying materials is in accordance with EC 1005/2009 (CFC-free).

It is compliant with European Standards (CE) EN60335-1:2010 & EN60335-2-24:2010.

R600a refrigerant - Isobutane, is highly flammable when mixed with air. Do not inhale, ingest, and avoid contact to skin. Ensure that any work carried out on the refrigeration circuit is done by a competent refrigeration engineer.

THE PHASE CHANGE MATERIAL (PCM)

The refrigerator contains an organic phase change material (PCM) that provides the energy store for the refrigerator. This PCM material is a paraffin wax that is liquid at room temperature and is stored in large tanks secured inside the walls of the refrigerator. In normal use the user will never be aware of its presence. This PCM is classified under regulation (EC) No 1272/2008 as a category 1 aspiration hazard and is classified under regulation 67/548/EWG, 1999/45/EG as having the potential to cause physical harm (R65 & R66). At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. At high temperature aerosol/mist can cause an irritation of the respiratory tract.



H304 May be fatal if swallowed and enters airways.

P301 + P310 IF SWALLOWED: Immediately call a POISON CENTRE or physician.



P331 DO NOT induce vomiting.

R65: Harmful: may cause lung damage if swallowed.

R65: Repeated exposure may cause skin dryness or cracking.

In the event of a PCM spillage:

- Wear suitable protective clothing, gloves and safety glasses when clearing up spillages.
- Use an absorbent substance such as sand to contain any escaping material.
- If the PCM contaminates rivers and lakes or sewers inform authorities. Avoid water ingress underground. Do not flush into surface water or sanitary sewer system.

6. End of Life & Product Recycling

PACKAGING

The packaging is made from recyclable / reusable materials and should be brought to an official recycling centre. The materials used are:

- Heat treated (HT) timber, certified by UK Forestry Commission (ISPM No. 15 Mark)
- Corrugated cardboard / Cardboard
- Polyethylene plastic
- Moulded polystyrene parts
- Steel reinforcing straps

WARNING – Keep packaging away from children - danger of suffocation from plastic!

WORN OUT REFRIGERATOR

The refrigerator still contains valuable materials and is not to be disposed of in the normal household waste.

- Ensure that the cooling circuit of the worn out device is not damaged when being transported.
- Information on the coolant used is on the type plate on the back of the refrigerator.
- The walls of the refrigerator contain an organic phase change material that can be harmful and must be disposed of safely. Please contact Dulas for advice.
- Worn out devices must be professionally disposed of in accordance with local regulations and legislation.

Potentially hazardous components / materials are:

- Refrigerant gas (R600a)
- Phase change material (PCM) - paraffins, normal C5-20
- Electrolytic capacitor
- Electronic components:
 - SDD controller
 - Compressor controller
 - ICE3 temperature monitoring device
 - PS-ILR-002XT (main PCB, surge PCB, internal power supply)
- Battery: The ICE3 contains a LiFePO4 (Lithium Iron Phosphate) battery. Please pay strict attention to the following points:
 - Never dispose of batteries or devices in a fire. Follow all local regulations when disposing of used batteries or devices.
 - Never place batteries or devices on or in heating devices, such as microwave ovens, stoves, or radiators. Batteries may explode when overheated.
 - Never crush or puncture the battery. Avoid exposing the battery to high external pressure, which can lead to an internal short circuit and overheating
 - Dispose of or recycle the ICE3 in accordance with the WEEE 2012/19/EU guidelines or your local regulations. The device may also be returned to the manufacturer for proper recycling.

Disposal of Phase Change Material (PCM)

The PCM used in the Dulas refrigerator has a very long life and does not degrade through use. At the end of the refrigerator's useful life the PCM should be either recycled or disposed of in accordance with applicable regional, national and local laws and regulations. Contact your local waste disposal authority for advice. The product can be incinerated in accordance with local regulations. In the EU it has a Waste Disposal Code (EWC): *13 08 99 oil waste not otherwise specified*.

REFRIGERATOR POWER SUPPLY

Do not dispose of this equipment with normal domestic waste!

To comply with the European Directive 2002/96/EC on Waste Electrical and Electronic Equipment and its implementation as national law, electrical equipment that has reached the end of its life must be collected separately and returned to an approved recycling facility. Any device that you no longer require must be returned to our agent, or find out about the approved collection and recycling facilities in your area.

Ignoring this European Directive may have potentially adverse effects on the environment and your health!

7. Refrigerator Transportation

To reduce the risk of bodily injury, or damage to the refrigerator, the following precautions **must** be observed:

- Properly secure the refrigerator when in transit to prevent it moving or falling within the vehicle.
- Plan any lifting or moving of the refrigerator in advance, paying particular attention to steps, gradients and doorways.
- Ensure suitable moving and lifting equipment is used as required.
- Make sure there is sufficient assistance to safely carry out any lifting and moving of the refrigerator.
- Keep the refrigerator in its original packaging for as long as is practical to prevent damage during transit and unloading.
- Do not drop the refrigerator or allow it to topple over.

8. Refrigerator Installation

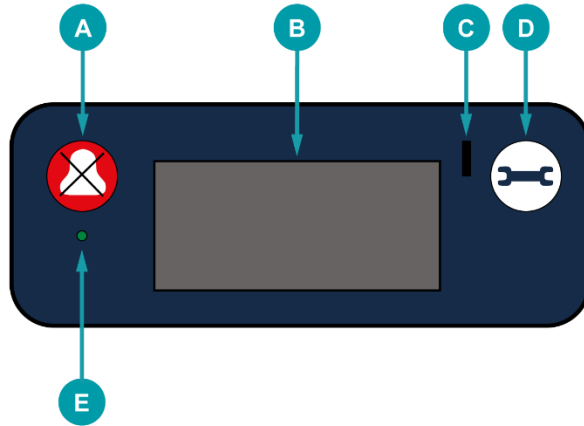
DO NOT position the refrigerator in direct sunlight or next to any heat sources. Make sure the refrigerator is positioned to provide good ventilation and ease of access for maintenance. Ventilation is particularly important for the condensers and compressors.

- 1) Position the refrigerator on a level surface; wipe all internal and external surfaces with a clean cloth.
- 2) Check the DC isolator at the back of the cabinet is in the "0" position.
- 3) Connect the refrigerator to the Dulas PS-ILR-002XT power supply. Check that there is sufficient slack in the cable to allow access to the back of the refrigerator.
- 4) Plug the Dulas PS-ILR-002XT into a suitable AC outlet and turn it on. Then switch the DC isolator to the "1" position. Within 1 minute the compressor will start if there is AC power. You will be able to hear the compressor operating and feel the condensers getting warm.
- 5) Activate the ICE3 temperature monitoring device: Press and hold both buttons for 10 seconds. Please refer to Section 9 for further information.
- 6) Ensure that the lid is firmly closed.
- 7) Check that all cables are securely supported so that they will not be pulled loose if the refrigerator is moved for cleaning.
- 8) Roll the refrigerator into its final position and apply the brakes on the castors to secure it.



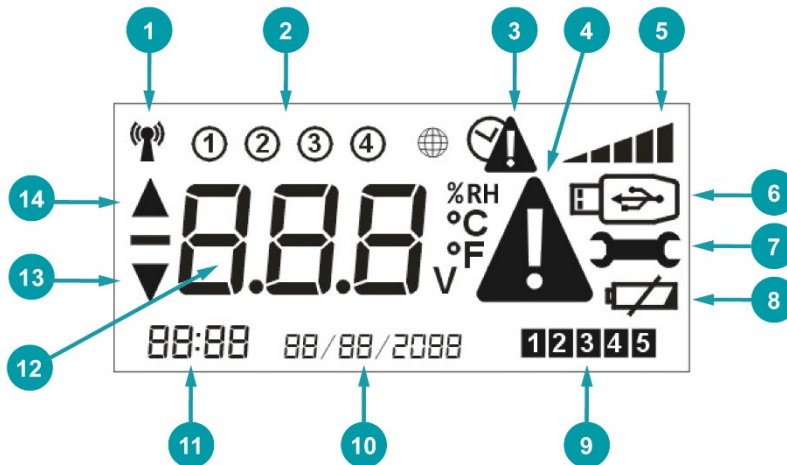
9. ICE3 Temperature Monitoring Device

This refrigerator is fitted with a Beyond Wireless ICE3 temperature monitoring device. The ICE3 is prequalified as a 'Remote Temperature Monitoring Device' (RTMD) in the World Health Organisation's Performance Quality Safety catalogue, WHO PQS ref E006/036.



Key to Front Panel

- A. 'Mute' Button
- B. LCD Display
- C. Data Connection Point, USB 2.0 Type-B Mini
- D. 'Test Mode / Force Connect' Button
- E. LED Indicator

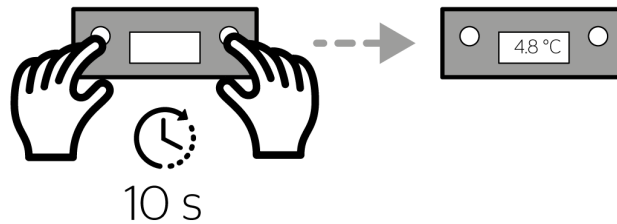


Key To LCD Display

- | | |
|--|----------------------------------|
| 1. 'GSM Modem On' Indicator | 8. 'Battery Low' Indicator |
| 2. 'Channel' Indicator(s) | 9. 'Connection Status' Indicator |
| 3. 'Historic Alarm' Indicator | 10. Date |
| 4. 'Active Alarm' Indicator | 11. Time |
| 5. 'Signal Strength' Indicator | 12. Temperature/Humidity Reading |
| 6. 'USB' Indicator | 13. 'Low Alarm' Indicator |
| 7. 'Test Mode / Force Connect' Indicator | 14. 'High Alarm' Indicator |

COMMISSIONING

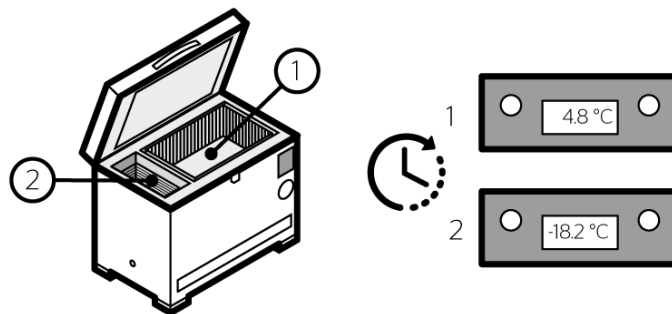
The ICE3 is not active during shipping. Once the refrigerator has been installed, the ICE3 device must be activated by pressing and holding both buttons on the front panel for 10 seconds. The display will turn on and the device will begin recording.



USE

Once activated, the ICE3 will measure the temperature of the refrigerator's compartment(s) using the inbuilt temperature probe(s), and will show this on its display.

The ICE3 display alternates between the temperature of the vaccine compartment ('Channel' 1) and the temperature of the freezer compartment ('Channel' 2). If there is no second compartment, only one temperature will show.



ALARMS

Alarm Thresholds

The upper and lower alarm settings are factory set into the device as follows:

'Low Alarm' setting: Exposure to a single temperature event of $-0.5\text{ }^{\circ}\text{C}$ or below for 60 minutes.

'High Alarm' setting: Exposure to a single temperature event of $+8\text{ }^{\circ}\text{C}$ or above for 10 hours.

Active Alarms

When there is an active alarm:

- The 'Active Alarm' symbol displays.
- An up or down arrow displays to show if its a 'High Alarm' or 'Low Alarm'.
- The LED flashes.
- The buzzer sounds with short beeps when *warning* of an alarm event.
- The buzzer sounds with fast beeps during an alarm event.

The ICE3 will signal a *warning* that an alarm event is pending by sounding short beeps when it detects that either of the alarm temperature thresholds have been breached. Once a temperature threshold has been breached for a given duration (see 'Alarm Thresholds' section above), the buzzer will sound with fast beeps to indicate an alarm event. The buzzer can be silenced temporarily by pressing the 'Mute' button on the front of the device, and will stop permanently once the compartment temperature has returned to within threshold.

Historical Alarms

Historical alarms are indicated by the 'Historical Alarm' indicator. When displayed, this indicates that there has been an alarm which resolved, but that the user did not "acknowledge" by pushing one of the buttons. The indicator can be cleared by pushing the 'Mute' button, signalling that the alarm has been acknowledged.

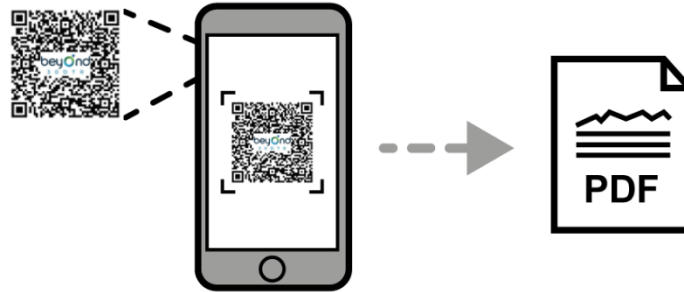
The 'Historical Alarm' is designed to act as a prompt for the user to download or access the temperature data via any of the methods described below. The temperature excursion can then be properly investigated, and corrective action taken.

DATA STORAGE

Local Data Storage

The ICE3 has the capacity to store up to 120 days of data in its on-board memory. Once this is full, the oldest data will be overwritten. The 120-day record can be accessed via the USB port on the device (using a USB 2.0 Type-B Mini connector cable) connected to a PC laptop.

Alternatively, a unique sharable pdf report of the last 30 days of temperature data can be generated online by scanning the QR code on the front of the ICE3 with a mobile phone (apple or android). Please refer to your mobile phone user manual for information on scanning QR codes.



Remote Data Collection - Optional

The integrated ICE3 supplied with this refrigerator has the option of enabling Beyond Wireless's industry leading remote temperature monitoring services (RTMS). The RTMS can either be configured to activate alongside the device when it is first turned on, or alternatively they can be activated remotely at any point once the ICE3 is in service.

Once the RTMS are activated the ICE3 is then visible as part of Beyond Wireless's Connected Cloud platform. This offers the full range of PQS accredited functionality of the standalone ICE3 product (WHO PQS/E006/036).

If your refrigerator does not have RTMS enabled and you would like to learn more about this option, please get in touch with Dulas for more information and pricing.

MAINTENANCE

Wipe with a dry cloth. Avoid contact with water.

The ICE3 is powered by a rechargeable lithium battery. The battery has a design life in excess of 10 years and should last for the lifetime of the refrigerator. Should replacement be required, please contact Dulas directly for a spare and technical support.

10. Refrigerator Loading

IN ORDER TO KEEP INTERNAL TEMPERATURES STABLE AND MINIMISE ENERGY CONSUMPTION, ONLY OPEN THE LID WHEN STRICTLY NECESSARY.

The VC225ILR refrigerator has a single compartment specifically for the storage of vaccines, see Section 4. This compartment is designed to maintain a stable temperature between +2 °C and +8 °C across an ambient temperature range from +5 °C to +43 °C. There are no points within the vaccine compartment that drop below freezing and thus no danger of freezing vaccines.

The refrigerator contains stacking baskets designed to make stock management easier and encourage air circulation within the compartment.

Do not remove these baskets and do not store vaccines outside of these baskets.

The wire baskets encourage the circulation of air by maintaining a small gap between the basket and the cabinet wall. Good air circulation will help the refrigerator to maintain an even temperature throughout the compartment. In order to save energy, try to keep the lid open for as short a time as possible.

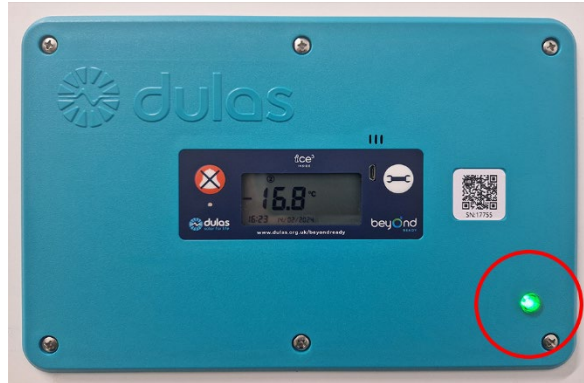
Stock management

- Allocate a certain space for each different type of vaccine, so that they may be located rapidly.
- Check the vaccine labels and adhere to any special requirements.
- Always use before the expiry date (store older vaccines on top).
- Store the most frequently used vaccines in the top baskets for easy access.

WARNING: ALWAYS FOLLOW THESE VACCINE STORAGE GUIDELINES

11. Green Compressor Status LED Light

The green LED light on the front of the refrigerator illuminates to indicate that the compressor is operating. The compressor will run if the refrigerator temperature is above about 4 °C and there is DC power from the PS-ILR-002XT.



Normal operation

When the refrigerator is first turned on the compressor will run continuously for a few hours to cool the phase change lining. After this time the compressor will begin cycling on and off to maintain the correct internal temperature.

12. User Training

The end user of the VC225ILR refrigerator should be instructed in the simple processes outlined below and also those in Section 13 *Maintenance Tasks*. It should be stressed that these tasks are essential to ensure correct and reliable operation of the refrigerator.

Caution: failure to follow these instructions may lead to system failure and vaccine wastage.

If you have a problem, please contact your appointed engineer.

Operation of the Refrigerator

Turning on

When turning on for the first time, or when the refrigerator has been turned off for more than 3 days:

- Turn the power on and allow the refrigerator to run in accordance with the table below:

Total No. of hours the power is off each day	Running time required before full holdover is achieved (at +43 °C ambient)	Continuous operation possible once cool down has been achieved
0 hours	2 days	Yes
12 hours	4.5 days	Yes
16 hours	7 days	Yes
20 hours	14 days	Yes

- Before loading with vaccines, ensure that the temperature display on the front of the refrigerator reads +4.5 °C or less.

Daily Routine

- Keep the lid closed, open only when required and lock after use.
- Store the most frequently used vaccines in the top baskets for easy access.
- Do not keep food or drink in the refrigerator.

Vaccine Storage

- Only store vaccines in the refrigerator.
- Use the baskets provided: Do not store vaccines outside the baskets.
- Always store vaccines in their original packaging.
- Always keep the same type of vaccine together and store vaccines neatly.
- Always use old vaccines before new ones; before use make sure vaccines have not expired.

13. Maintenance Tasks

Every morning and afternoon:

- Check the vaccine compartment temperature (the correct temperature is +2 °C to +8 °C).
- Fill in the daily record sheet.

On the first day of every week:

- Wipe away any moisture build up inside the refrigerator (and inside cabinet lid).
- Drain any water from the bottom of the refrigerator (using the inbuilt drain).

On the first day of every month:

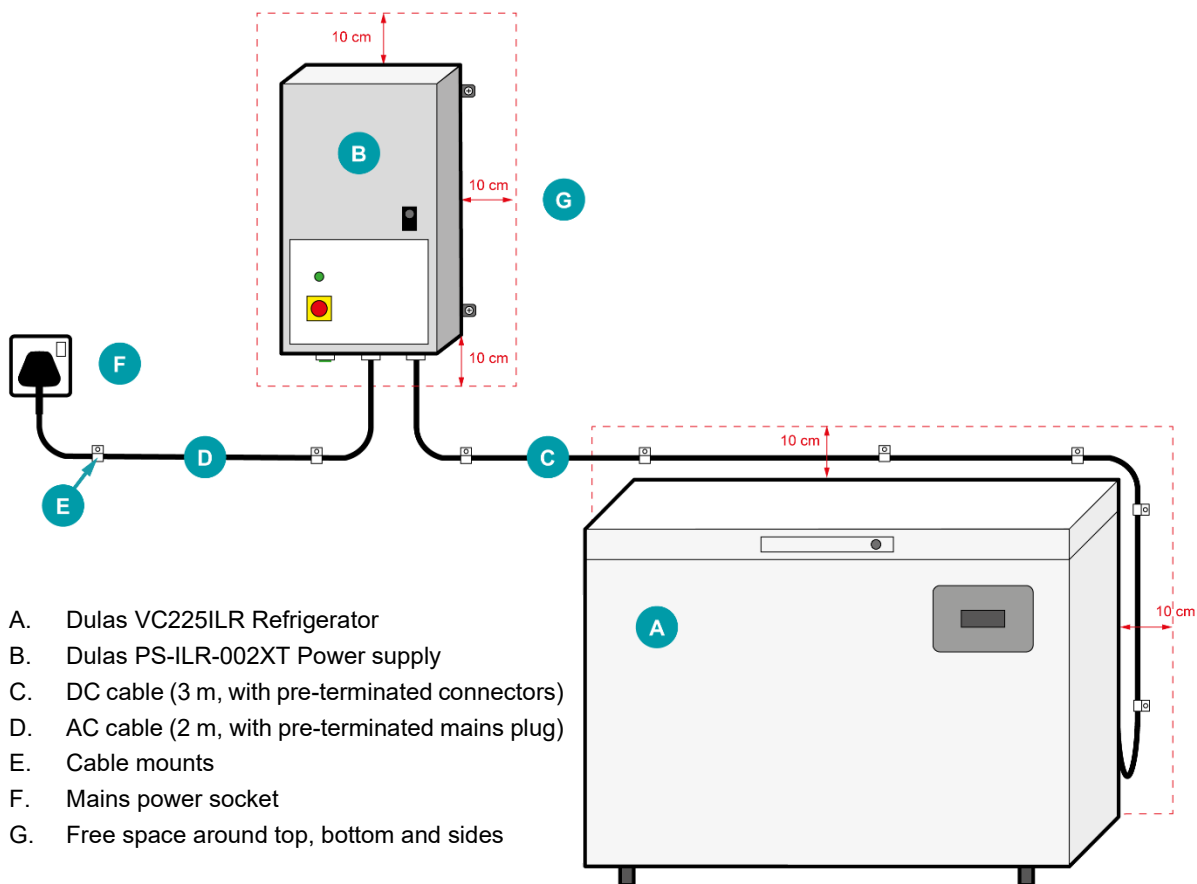
- Clean the refrigerator with a soft damp cloth (avoid using water to the rear of the fridge).
- Clean the lid gasket and inspect for damage or gaps.

Every 6 months (technician only):

- Check all mechanical fixings and electrical connections.
- Check for visual damage to refrigerator, power supply and power cables.

14. VC225ILR System Layout

Power Supply and Cable Mounting





About Dulas

For over 40 years, Dulas has been a pioneer in renewable energy. Our mission is to develop and implement renewable energy solutions that improve lives, help to combat climate change, and support communities in the most rural parts of the world.

Our approach is summed up in three words: **People. Purpose. Planet.**

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