



BLACK DIAMOND

HYDROBOX 2



USER MANUAL

Designed and manufactured in New Zealand
Black Diamond Technologies

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FEATURES

Hydrobox 2 Features

The Black Diamond Hydrobox 2 has many user friendly intuitive functions and features including:

Starting Features

- Manual Power On/Standby
- Smart Meter Interface
- 7 Day Programmable Timer
- Ripple Feed Power Management Compatible
- Automatic Reheat

Automatic switching to hot water cylinder's electric element under fault conditions

Highly efficient defrost control

Low standby power consumption

Internal power usage meter

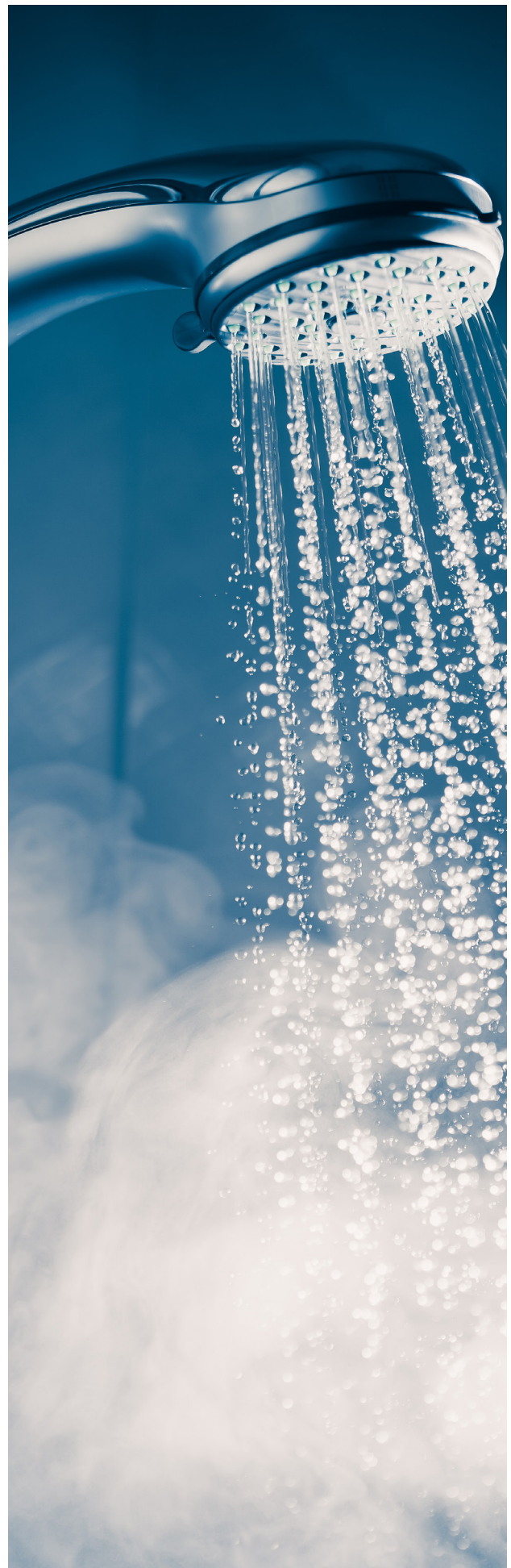
Battery backup internal clock

Audible Alarm in following situations:

- Over current
- Insufficient heating
- Over temperature
- No water
- Water leakage
- Refrigerant leakage
- Requires Service Life Servicing
 - Heat exchanger clean
 - Water pump replacement



Please note the Hydrobox 2 must be installed by persons qualified in the trade (Plumbing, Electrical, Refrigeration and any other qualifications required by regulation, standards or law), and must comply with all applicable standards, codes and regulations in force in the country of installation.



Smart Operation

The Black Diamond Hydrobox 2 has been designed to maximise performance and cost savings, utilising optimised control.

When not heating water, the power is switched off to the outdoor unit, lowering standby power usage and increasing efficiency. The system can be further optimised by choosing the times of the day that it can operate. The higher the ambient temperature, the more efficient the system operates. Colder water at the input side also increases the efficiency.

Mandatory Legionella Control

Each week the Hydrobox 2 will complete a legionella control operation. The Hydrobox 2 will carry out a deep disinfect cycle including activating the electric element of the hot water cylinder as required to ensure tank temperature is above 60°C for a period no less than 1.5hrs.



PLEASE NOTE: Cylinder thermostat must be set to 60°C.

Low Usage Conditions

Where the system has not been activated within 18 hours, a new heating cycle will be completed. This is carried out at 1pm on the second day since last being active. This ensures the tank water is safe even after long periods of not being used.

Modes

The Black Diamond Hydrobox 2 can be set in one of three modes.

Normal [Norm] – 40°C return temperature

When operating in Normal Mode, the Hydrobox 2 unit continues to heat the water in the Water Storage Cylinder until the return water temperature reaches 40°C. This ensures 90% of the user's Water Storage Cylinder is over 60°C.

Economic [Econ] – 40°C return temperature

When operating in Economy Mode the Hydrobox 2 heats the water over a longer period than normal mode, using less energy (ideal for solar connections).

Disinfect [Disin] – 50°C return temperature

Disinfect Mode ensures that the bottom of the tank reaches above 50°C. This mode is recommended for poor quality, non-town supplied water, such as rain water and untreated river water.



PLEASE NOTE: For the Hydrobox 2 timers to function correctly the system cannot be connected to a traditional ripple mains relay plan. If you are connected to such a plan, discuss the best options for your specific location with your electricity retailer.



CONTROLLER

Control Panel

The Hydrobox 2 Controller is an easy to use 4 button control panel with an LED display which automatically lights up when a button is pressed. Once installed the unit should not require adjustment outside use of the 7 Day Timer.

The back light will stay illuminated for 5 minutes from the last button press.



Power Button Features

On/Standby

- Press the power button to turn the system on.

Off – Holiday mode

- Hold down the power button for 4 seconds to turn the system off.

Cylinder Electric Element On/Off

- Holding down the power button for 10 seconds will turn the cylinder's electric element on/off.

Unit Activation

The Hydrobox 2 System is either turned on by the user or it will automatically power on from Standby when:

- The power is initially connected or recovers from a power outage
- The water tank temperature drops by 20°C
- The power turned on by a traditional ripple power relay
- The unit has been turned on by one of the 7 timers
- The system has not been in a heating cycle for 1.5 days (see low usage conditions pg.4)

Unit Standby

The system will automatically switch to Standby (STBY) when:

- The return water temperature reaches 40°C in Normal Mode and ECO Mode or when it reaches 50°C in Disinfect Mode
- The unit has been turned off by one of the 7 timers
- The unit has been manually turned off



PLEASE NOTE: The system will not automatically restart if the Restart Sensor has not dropped by 20°C from the last heating cycle.

OPERATION

Display Screens

The Hydrobox 2 features 20 display screens. The following is a list of the display screens in sequential order:

- Standby Screen
- Temperature Selection / Set Point Adjust
- Set Mode Screen
- IP/MAC Address Screen
- Time/Date Screen
- Summer/Winter Time Set Screen
- A: Primary & Hydronic Electrical Information
- B: R134A Electrical Information
- Timer 1 Screen
- Timer 2 Screen
- Timer 3 Screen
- Timer 4 Screen
- Timer 5 Screen
- Timer 6 Screen
- Timer 7 Screen
- Water Temperature Screen
- Indoor Unit Refrigeration Temperature Screen
- Outdoor Unit Refrigeration Temperature Screen
- External Tank Temperature Probes Screen
- Water Pump Speed Screen
- Water Flow Meter Screen
- Water Usage Meter Screen
- Water Meter Calibration Screen
- R134A LEV Position Screen
- Network Control Screen



To scroll through the above screens simply press the  **Select/Mode** button and then press the  **Up** button to scroll through.

Fig. 1



Power Button



Select/Mode Button

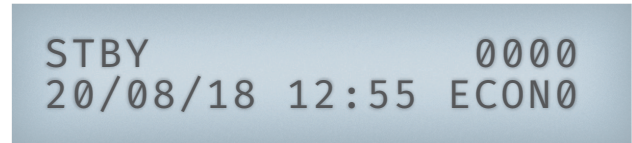


Scroll Down Button



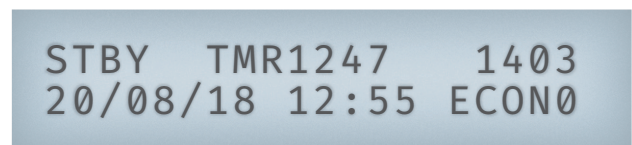
Scroll Up Button


Standby Screen



The screen above indicates that none of the timers are set.

If one of the 7 timers is set, the display will indicate this. In the example below “TMR1247” indicates that timers 1, 2, 4 and 7 are set.



To power on the Hydrobox 2 press the  **Power** button to turn on.

The main LED screen and the green power LED will illuminate (see Fig. 1) to indicate the unit is on. If the green power LED is flashing this indicates one or more of the 7 timers is set.





When powered on, the set temperature, date, time and mode will be displayed, along with the timers which are currently active. Should the unit be operating due to one of the set timers, the timer will flash at 1 second intervals to indicate that it is in timer operation.

Temperature Selection/Set Point Adjust Screen



The Hydrobox 2 System is set to 62°C as factory standard. However the set temperature adjustment range is from 55–63°C.




To change the set temperature, use the following steps:

- Press the  button – the indicated **Set Temp** will flash.
- The temperature can now be adjusted with the  **Down** or  **Up** buttons.
- Once the desired set temp is showing, confirm by pressing  – the **Set Temp** will stop flashing to indicate this has been confirmed.

Set Mode Screen





The mode description in the bottom right corner indicates the heating mode the Hydrobox 2 is set to operate in. As described previously there are three modes the Hydrobox 2 can be set to: Economic (**ECON**), Disinfect (**DISIN**) and Normal (**NORM**).

To change the Hydrobox 2 operating mode, use the following steps:

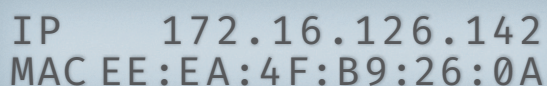
- Press the  button.
- Scroll through to the **Set Mode** Screen by pressing  **Down** or  **Up**.
- The image below depicts the screen which should now be seen. (Version number and date will differ)



```
Mode ECON Ver-4.22
Release Aug 20 2018
```

- Press the  button.
- The mode description (in this case **ECON**) will now flash indicating it is ready to be changed.
- Scroll to the desired mode by pressing the  **Down** or  **Up** buttons.
- Once the desired mode is showing, confirm by pressing . The mode description will stop flashing to indicate this has been confirmed.
- The outdoor model number then flashes.

IP/mac Address Screen




















```
IP 172.16.126.142
MAC EE:EA:4F:B9:26:0A
```

The IP/Mac address contains network information of the Hydrobox 2.

Time/Date Screen

Please use the following steps to set the time and date:

- Press the  button.
- Scroll to the **Time/Date Screen** by pressing the  **Down** or  **Up** buttons.
- Press  – the **'time'** will begin flashing to indicate it is ready to be changed.
- Press  to proceed to setting the **hour** and adjust  **Down** or  **Up** to the correct hour.
- Press  to proceed to setting the **minutes** and adjust  **Down** or  **Up** to the correct minutes.
- Press  to proceed to setting the **month** and adjust  **Down** or  **Up** to the correct month.

- Press  to proceed to setting the **year** and adjust  **Down** or  **Up** to the correct year.
- Press  to proceed to setting the **day** and adjust



















```
Sum LST SUN SEP 0200
Win 1ST SUN APR 0300
```

 **Down** or  **Up** to the correct day.

- Finally press  to finish the **Time/Date** setting.

Summer/Winter Time Set Screen

To set the daylight saving start and stop days, please use the following steps:








- Scroll to the **Summer/Winter Time** Screen by pressing  **Down** or  **Up**.
- Press  – the **'Week'** description indicated will begin flashing to indicate it is ready to be changed. The following key denotes the week association:
 - 1ST = 1st Sunday, 2ND = 2nd Sunday, 3RD = 3rd Sunday, 4TH = 4th Sunday, LST = Last Sunday
- Use  **Down** or  **Up** to adjust.
- Press  to proceed to setting the **day** and adjust  **Down** or  **Up** to the desired day.
- Press  to proceed to setting the **month** and adjust  **Down** or  **Up** to the desired month.
- Press  to proceed to setting the **time** and adjust  **Down** or  **Up** to the desired time.
- Press  to proceed to setting the winter time week, day, month and time using the same steps as above.
- Finally press  to finish the **Summer/Winter Time** setting.

Network Control Screen

The Network Control Screen is used in combination with the Wi-Fi Control app to provide Wi-Fi Control for the Hydrobox 2. Wi-Fi control is on by default.



```
REM ID: 17216126142
ON MAC: EEEA4FB9260A
```

- Press the  button.
- Scroll to the **Network Control Screen** by pressing the  **Down** or  **Up** buttons.
- Press  to adjust settings.
- Use  **Down** or  **Up** to scroll to desired option.
- Press  to confirm change.

Display Screens – continued

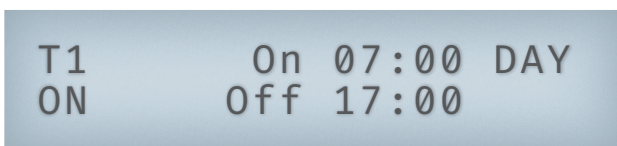
Timer Screens (T1–7)

The Hydrobox 2 System has a total of 7 timers. Each timer can be set in one of four ways:

1. As an **Operational Window Timer**

(The system can only operate during a set period of time. The unit is forced to complete an initial heating cycle, If the unit is running at the off time it will complete the cycle and shut off.)

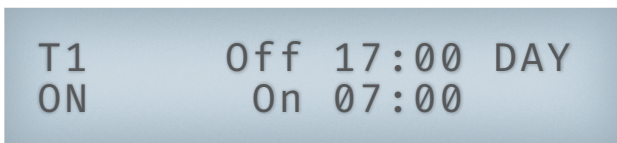
Example shows an operation window timer set to allow the unit to come on from 7am and shut off at 5pm everyday.



2. As a **Non-Operational Window Timer**

(The unit is restricted in operation and cannot run during time specified. If a heating cycle is running at off time, the system will force stop the operation.)

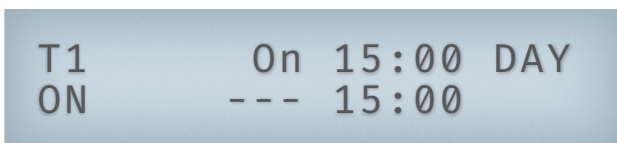
Example shows a non-operation window timer set to prevent the unit from operating between 5pm and 7am daily.



3. As a **Force heat**

(The system turns on at a set time and will force the unit to run at a set time regardless of restart sensor temperature.)

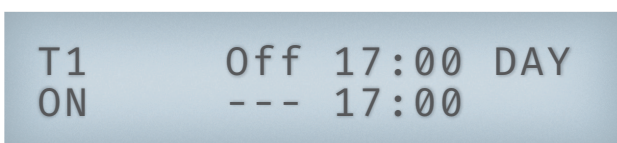
Example shows a Force Heat timer set to 3pm everyday.



4. As a **Force Stop**

(The system turns off at a set time and forces the unit to stop regardless of restart sensor temperature and disallows operation until a "Force Heat" timer occurs or user presses power button.)

Example shows Force Stop set to 5pm everyday.



WARNING: The Force Stop timer is not recommended

Each individual timer can be set to repeat daily, on specific days of the week, on all weekdays, or on weekends only. Each timer can be set individually by using the following steps:

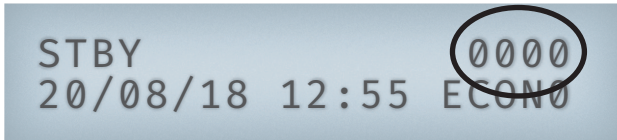
- Scroll through to the desired timer screen. **(T1 – T7)** denote the timers available.
- Initially one of the four timer options must be selected. To do so press <> – the **On/Off** description will begin flashing to indicate it is ready to be changed.
- Use **Down** or **Up** to adjust. If an On/Off or On Timer is required press **Down** or **Up** until **On** is indicated. If an Off/On or Off Timer is required press **Down** or **Up** until **Off** is indicated.
- Press to proceed to setting the hour and adjust **Down** or **Up** to the correct hour.
- Press to proceed to setting the minute and adjust **Down** or **Up** to the correct minute.
- Press to proceed to setting the desired timer occurrence and use **Down** or **Up** to select **MON-SUN** (a specific day), **DAY** (daily), **WKD** (weekend only), or **M2F** (weekdays).
- Press to proceed to setting the timer activation. Should the timer be required use the **Down** or **Up** buttons to adjust until **On** is indicated. To deactivate the timer adjust until **Off** is indicated.
- Press to proceed to setting the second time line. Setting this time will depend on the initial timer option chosen.
 - **On/Off Timer** set the hour and minute to the time you wish the system to turn off.
 - **Off/On Timer** set the hour and minute to the time you wish the system to turn on.
 - **On Timer** set the hour and minute to match the same time chosen previously e.g. both time selections should match.
 - **Off Timer** set the hour and minute to match the same time chosen previously e.g. both time selections should match.
- Press to confirm and end the timer setting process.



NOTE: The following screens display service and diagnostic information. These screens are intended for use by technical and service personal and most cannot be adjusted.

Technical and Service Screens

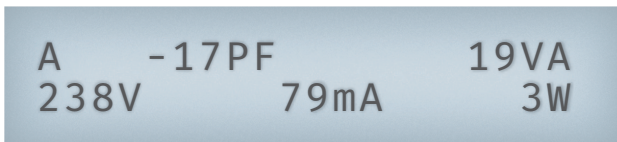
Progress Sequence Indicator



These numbers represent the start up & run sequence of the system.

These numbers will change periodically. These are used for technical purposes only.

A: Primary & Hydronic Electrical Information



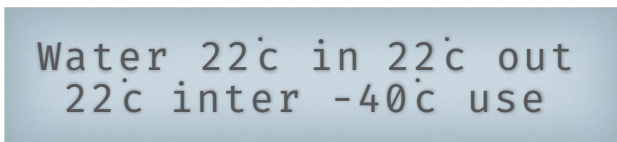
Outdoor unit and indoor PCB power metering.

B: R134A Electrical Information

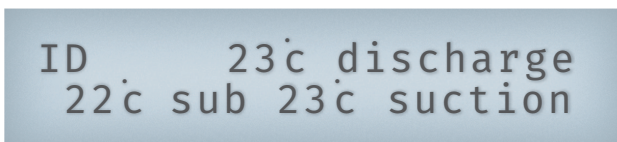


R134A compressor power metering.

Water Temperature Screen

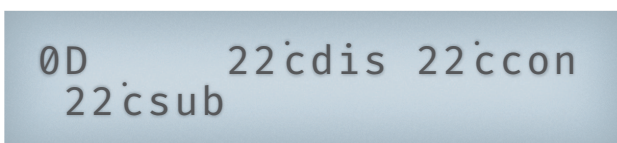


Indoor Unit Refrigeration Temperature Screen



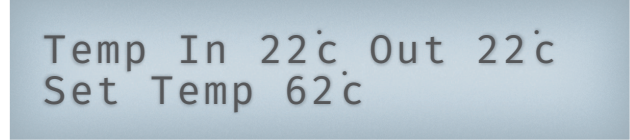
The Indoor (ID) Temperature Screen displays the R134A refrigerant measurements.

Outdoor Unit Refrigeration Temperature Screen

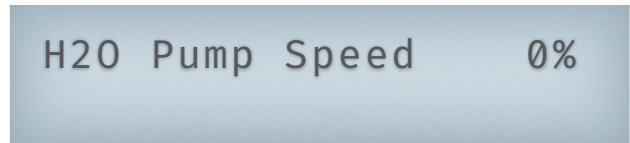


The Outdoor (OD) Temperature Screen displays the R32 refrigerant measurements.

External Tank Temperature Probes Screen



Water Pump Speed Screen



Water Flow Meter Screen

The Water Flow Meter Screen indicates the rate at which water passes through the Hydrobox unit.



Water Usage Meter Screen

The Water Usage Meter Screen, when using an optional water usage meter, indicates the rate at which heated water is flowing from the storage water cylinder.



Water Meter Calibration Screen



WARNING: Do not adjust the water meter calibration screen as this may result in adverse effects on units performance.

R134A LEV Position Screen



The R134A LEV position screen displays information on the liquid refrigerant inside the unit.

TROUBLESHOOTING

Troubleshooting

The Hydrobox 2 System has two levels of fault codes:

Level 1

- Minor faults which are automatically self-corrected. These faults may be displayed but the system will continue to function normally. Please refer to the Fault Codes and Descriptions chart on the opposite page. **Please note that some Level 1 faults may require a service call.**

Level 2

- All Level 2 faults require a qualified service person to address. When these errors are detected the LCD display will display the error number, the blue fault light will illuminate and the alarm buzzer will sound. The system will automatically switch on the power to the external element (if connected) to ensure the storage water cylinder still has hot water.

Water Leaks

In the event a water leak is discovered, immediately turn off the Hydrobox 2 System. Proceed to call your plumber or technical/service agent.



NOTE 1: If there has been a water supply outage or the water turned off for maintenance this will also cause air bubbles in the water supply. The Hydrobox 2 has an internal Automatic Air Bleeder Valve installed which in most cases will automatically remove air around the water pumps. If the system has FLT00 or FLT03 or FLT09 or FLT14 shortly after the system starting, then ensure that the air has been bled out of the Hydrobox System by turning off the water to the Storage Tank Isolation Valve, ensuring that the cold and hot water supply valves to the Hydrobox 2 are open, press the menu button twice to open the motorised ball valve and turn on a hot tap until the flow has no air bursts. Turn off the hot tap and open the Storage Tank Isolation Valve. Manually press the power on button again.



NOTE 2: If the system has an FLT05 alarm ensure that the Sensor placed half way up the tank is plugged into CN46. Also check that the cable between the PTC Sensor and CN46 is not damaged or open circuit. At 25°C the resistance between the two wires is 100k ohms.



WARNING: Should FLT09 or FLT10 be displayed, or in the event of a very loud whistling noise coming from the water tank and bursts of air discharges from the tap, immediately turn the Hydrobox off and if possible the water taps that isolate the Hydrobox from your water cylinder and call your authorised installer/service agent.

As a precaution do not drink the water until the system has been inspected.



WARNING: To avoid running out of hot water, the system is designed to ensure you have a minimum of half a tank of hot water before it starts the heating process. If your household has high demand times during the day, such as everyone showering in the morning, you can set any one of the seven timers to start the heat process 1.5 hours before your high demand period to ensure you have a full tank of hot water.

Fault Codes and Descriptions

Fault Code	Fault Description	Level	Buzzer	External Element Turned On	User Action	Action
FLT00	No water flow at start-up	2	Yes	Yes	Call for service	The system needs bleeding – Refer to note 1
FLT01	Water pump > max. speed. Water too hot	1	No	No	System will retry	Fault will be displayed but system will continue to retry
FLT02	Water pump < min. speed. Water too cold	1	No	No	System will retry	Fault will be displayed but system will continue to retry
FLT03	R134A thermal cut out activated	1	No	No	System will retry	Will shut down for 3 minutes and restart – refer to note 1
FLT04	R134A thermal cut out activated 4 times	2	Yes	Yes	Call for service	Unit has had 3 FLT03 errors in the same run – fault alarm activated and external element turned on
FLT05	Tank Sensor not detected	1	Yes	No	Call for service	The system will still heat the water tank but will not be able to sense when to restart the heating cycle – refer to note 2
FLT06	No OD Startup Data detected	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT07
FLT07	Outdoor unit not responding	2	Yes	Yes	Call for service	Outdoor unit not responding
FLT08	Outdoor current too high > 9A	2	Yes	Yes	Call for service	Outdoor unit using too much power
FLT09	IA too high \geq 3A	2	Yes	Yes	Call for service	Indoor compressor using too much power – refer to note 1
FLT10	Possible refrigerant gas leak	2	Yes	Yes	Call for service	Turn off power and water taps to Hydrobox
FLT11	Defrost WE < 4.0	1	No	No	System will retry	Water too cold to defrost possible water pump fault
FLT12	TC < 2.0	2	Yes	Yes	Call for service	Not enough energy for defrost
FLT13	IA too high	2	Yes	Yes	Call for service	Indoor compressor fault
FLT14	R134A discharge temp too high > 90.0	2	Yes	Yes	Call for service	Indoor compressor over heated – refer to note 1
FLT15	R32 discharge temp too high > 90.0	2	Yes	Yes	Call for service	Outdoor unit discharge too high
FLT17	R134A refrigerant charge low	1	No	No	Call for service	Check for possible R134A refrigerant leaks and recharge as per service manual to 200 grams
FLT18	R134A refrigerant too high	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT09
FLT19	Outdoor unit has errored	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT07
FLT20	Critical outdoor shutdown	2	Yes	Yes	Call for service	Major fault call for service
FLT21	R134A refrigerant charge too low	1	Yes	Yes	Call for service	Check for possible R134A refrigerant leaks and recharge as per service manual to 200 grams
FLT22	Not enough heat energy from outdoor unit after 30 minutes from start-up	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT02
FLT23	R134A discharge too high	1	No	No	System will retry	Will retry every 15 minutes After 4 attempts it will fault FLT14
FLT24	R32 Condensing below 2°C	1	No	No	System will retry	Will retry every 15 minutes After 4 attempts it will fault FLT12
FLT26	R32 discharge temp too high >90.0°C	1	No	No	System will retry	Will retry every 15 minutes after 3 attempts it will fault FLT15
FLT27	Water exit below 50C for 5 minutes	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT10
FLT28	Water exit too hot	1	No	No	System will retry	Will retry every 15 minutes after 4 attempts it will fault FLT01
FLT34	after 3 attempts it will fault FLT15	2	Yes	Yes	Call for service	Refer to FLT00

IMPORTANT INFORMATION

The unit should not be installed, relocated, disassembled, altered, or repaired by the end user.

- Improperly handled units may cause fire, electric shock, injury, water leakage, etc. Consult your supplier for advice before any work is carried out around the unit.
- If the power supply cord is damaged, it must be replaced by the manufacturer or its service representative in order to avoid a hazard.

When installing, relocating, or servicing the unit, make sure that no substance other than the specified refrigerants (R32 in the outdoor unit and R134A in the Hydrobox unit) enters the refrigerant circuit.

- Any presence of foreign substance such as air can cause abnormal pressure rise and may result in explosion or injury.
- The use of any refrigerant other than that specified for the system will cause mechanical failure, system malfunction, or unit breakdown. In the worst case, this could lead to a serious product safety issue.

This appliance is not intended for use 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 concerning use of the appliance by a person responsible for their safety.

- Children should be supervised to ensure that they do not play with the appliance.

During operation the water pipes and refrigerant pipes get hot and should not be touched. Doing so may cause serious injury.

Water Storage Cylinder Requirements

The Hydrobox 2 has been designed for retrofit to an existing water storage cylinder or new installation.

The Water Storage Cylinder must have an effective diffuser on the bottom water feed and be well insulated to ensure the cylinder remains stratified. For mains pressure systems the water pressure must be limited to 500 kPa (5 bar). A water strainer must be used on the water supply to the cylinder. The installation of the Water Storage Cylinder must be carried out by a registered plumber and meet the required government regulations.

Flexible metal enclosed hoses are recommended for connections between the Hydrobox unit and fixed water terminals. This ensures added earthquake protection and vibration noise reduction.

Floor mount of the Hydrobox 2 is preferred as hollow internal walls will act as a drum skin and amplify the compressor vibration into audible sound.

Electrical Requirements

The Hydrobox 2 outdoor unit must be installed in accordance with the installation instructions typical of standard heat pump/air-conditioning units. A 4 core 1.5mm² cable is required between the indoor and outdoor units and a lockable isolation switch by NZ law required beside the outdoor unit. A lockable isolation switch is also recommended for the mains power supply feed to the Hydrobox unit. Power is taken from the normal water tank element source.

For more details please refer to the installation manual.

SPECIFICATIONS

Heating	Capacity		Rated	[kW]	3.4
			Min-Max		[kW]
	Input		Rated	[kW]	0.82
			Min-Max		[kW]
Sound Level		Outdoor (SPL)	[dBA]	49	
Power Supply	(Powered from indoor unit)			240V / Single Phase / 50 Hz	
Controller	In-built 7 Day Timer, External Temperature Probe, Ripple mains feed compatible				
Water Piping	Diameter (Inlet/Outlet)		[inch]		½
	Water Flow		[L/minute]		0.6 – 2.4 (1.2 typical)
	Water Head Height	Min	[m]		5
	Water Pressure	Max	[kPa]		500
	Water Temperature Range	Input	[°C]		5 – 55
Refrigerant Piping	Diameter (Liquid/Gas)		[mm]		6.35 / 9.52
	Max. Length/Height		[m]		20 / 12
	Chargeless Piping Length		[m]		10
Indoor Unit	Dimensions (W x D x H)		[mm]		455 x 240 x 395
	Weight		[kg]		23.1
	Refrigerant	Type		R134A	
		Quantity	[g]		200g (+/- 10g)
Outdoor Unit	Dimensions (W x H x D)		[mm]		800 x 550 x 285
	Weight		[kg]		33
	Refrigerant	Type		R32	
		Quantity	[g]		970
Operation Range Outdoor	Heating		[°C]		-15 / +45
Optional Extras	Ethernet connection (Standard), Optional Water Inlet Temperature Probe, Optional Water Outlet Temperature Probe, Optional Water Usage Meter, Optional Water Flow Meter				

WARNING

Consult your supplier for correct and safe installation of the Black Diamond Hydrobox 2.

- This unit should not be installed by persons other than authorised technicians. An improperly installed unit may cause fire, electric shock, injury, water leakage etc.

Dedicated power supply required.

- A non-dedicated power supply may cause overheating or fire.

Do not install the unit where flammable gas could leak.

- If gas leaks and accumulates around the outdoor unit, it may cause an explosion.

Earth the unit correctly.

- Do not connect the earth wire to a gas pipe, water pipe, lightning rod, or a telephone ground wire. Improper earthing may cause electric shock.

All water pipes between the Hydrobox unit and the storage water cylinder must be insulated.

All refrigerant pipes between the Hydrobox unit and the outdoor unit must be insulated.

SAFETY WARNINGS

WARNING

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

Do not pierce or burn.

Be aware that refrigerants may not contain an odour.

1.0 Ventilation

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

2.0 Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

3.0 Detection of flammable refrigerant

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of , the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

NOTE Examples of leak detection fluids are

- bubble method,
- fluorescent method agents.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to Clause DD.9.

4.0 Removal and Evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:

- remove refrigerant;
- purge the circuit with inert gas (optional for A2L);
- evacuate (optional for A2L);
- purge with inert gas (optional for A2L);
- open the circuit by cutting or brazing.

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing Flammable refrigerant other than A2L Refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for Flammable refrigerant. This process may need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

5.0 Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.



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