

OPERATORS MANUAL

Alu-Cab



KHAYA

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Review all instructions information carefully before installation.

Any damages, direct or incidental to the installer and/or property due to incorrect installation of any parts are the responsibility of the installer. Due to the various applications and fitment options available, the responsibility lies with the user to ensure all mounting points are secure and tight before every trip. If unsure, consult with your Distributor regarding the operations of our products.

Users are advised to be mindful of the load they are carrying and drive in accordance with road conditions.

DISCLAIMER

Alu-Cab

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1. Introduction

Admittedly, the joke's a bit stale these days, but love it or hate it, the humour does highlight the rigors of rental life. Imagine a vehicle that spends 80% of its life off-road, in remote regions, driven by people with very little mechanical sympathy, and very often, limited overland and/or 4x4-driving experience.

Well, that's exactly what our campers endure every year – more than 5 million combined kilometers of remote African travel within the rental market. Needless to say, these journeys serve as the perfect trial and error field test – each of which shapes the development, durability, reliability, and of course, the user-friendliness of our campers.

Ultimately, this 20 year evolution has brought us to the 2-sleeper and 4-sleeper Khaya Campers. These drive-off units are designed to maintain your vehicle's versatility, without compromising on creature comforts and functionality.

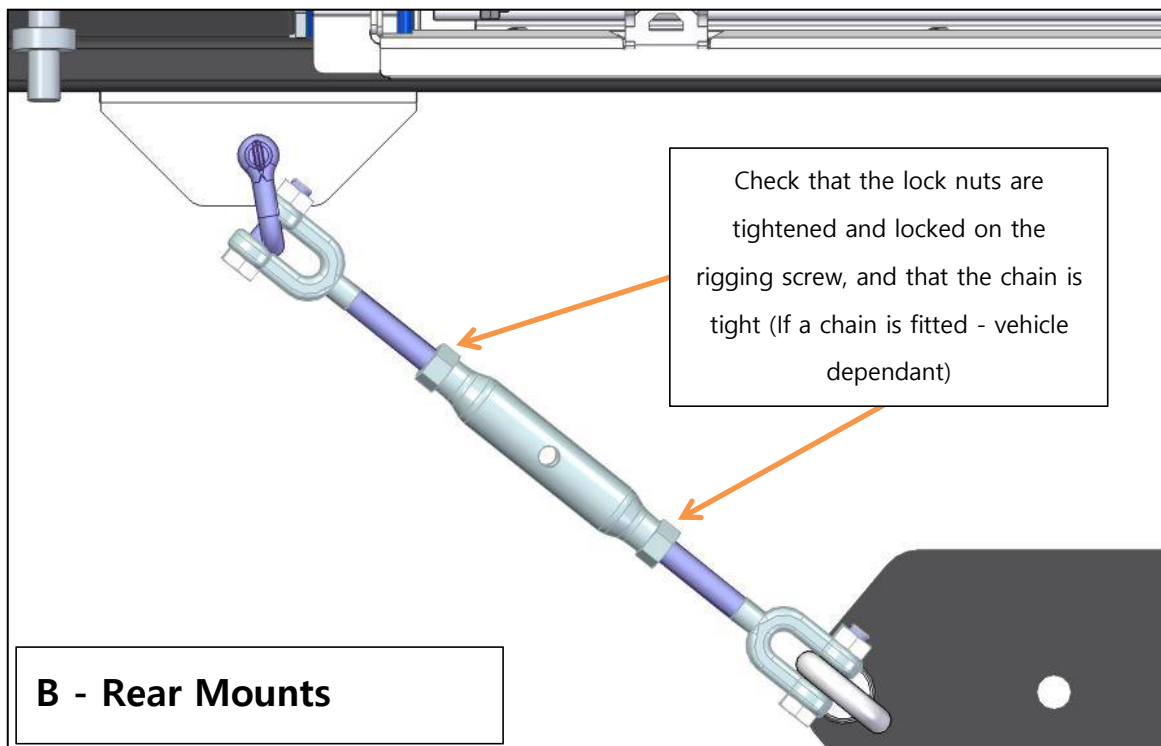
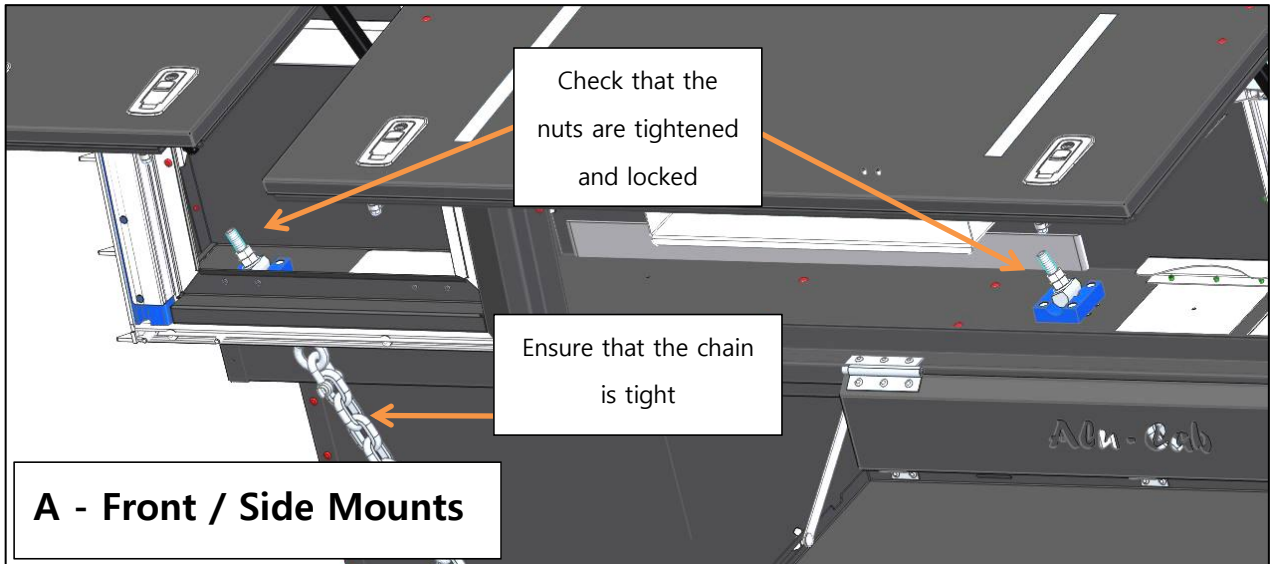
Boasting a starting dry weight of approximately 400 kg, the 2-sleeper Khaya does a great job of balancing functional cabin space with a compact exterior design that doesn't prohibit access to remote campsites. Much of this is made possible thanks to the Khaya's tried and trusted aluminium construction.

But the real gem is being able to park the Khaya, off your vehicle (at home or at your office) so that it's ready to rock and roll for any adventure. With the Khaya, there are no boundaries to your freedom, no routes to worry about, and no trailers to hitch, just load up and hit the road!



2. Pre-Trip Safety Check

In conjunction with the usual vehicle pre-trip safety inspections, it is important to always perform the below safety checks, on your Khaya, before embarking on an adventure.

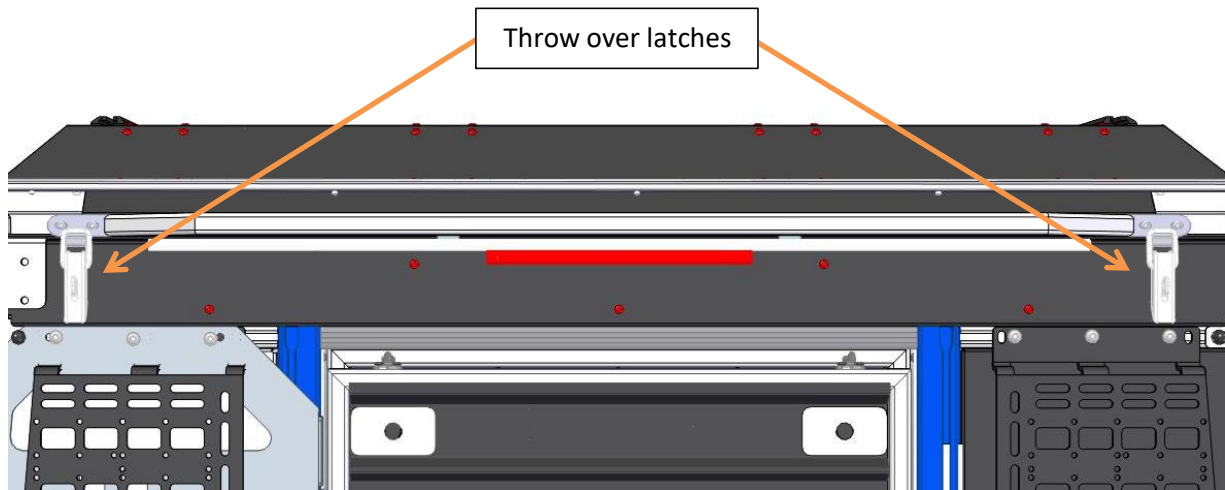


C - Ensure all latches and external accessories are locked and/or secured properly before departing.

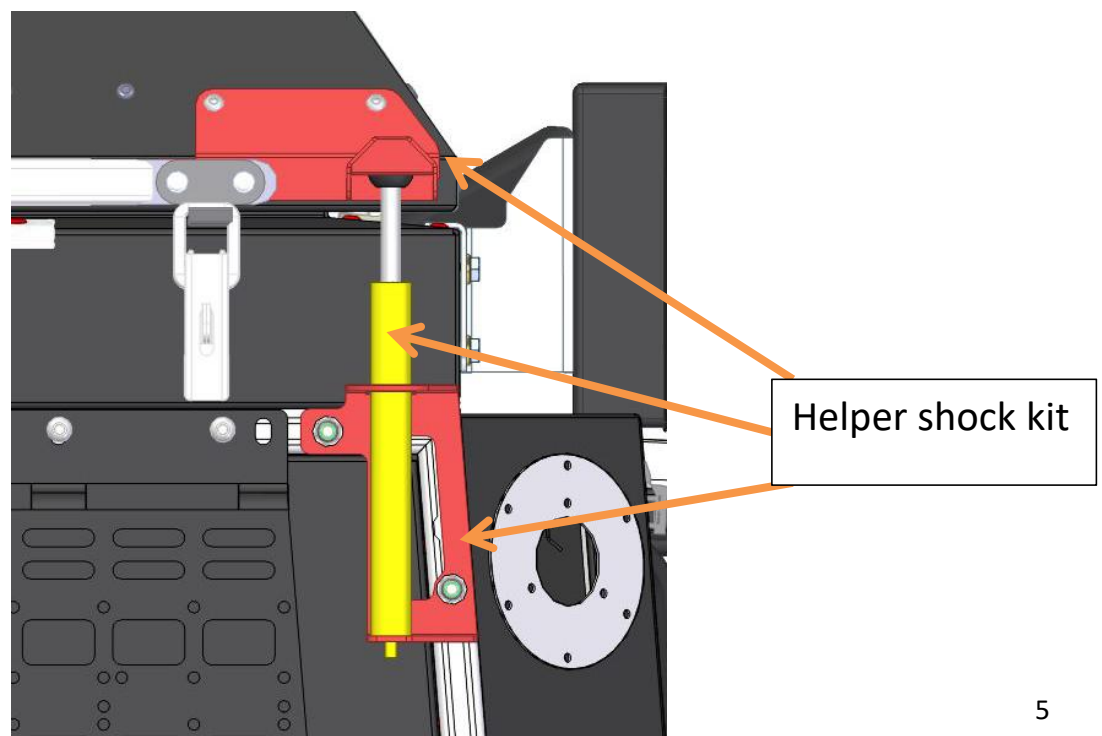
3. Component Identification & Operation

a) Roof Top Tent - Manual Opening

There are throw over latches that lock the roof top tent in its closed position, R-clips are used to secure the latches. Remove these R-clips, flip the catch open and simply push the roof of the tent up, using the handle, until the gas shocks takes over .

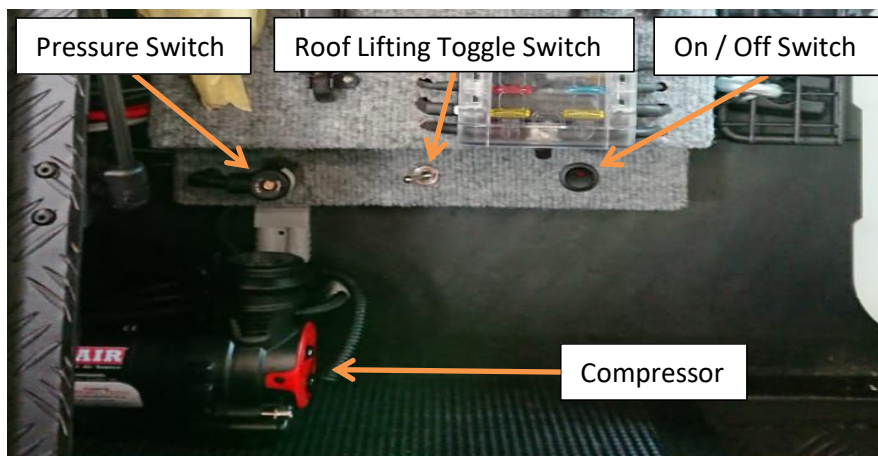


There is an option to have additional Helper Shocks fitted onto the rear, next to the throw over latches. These helper shocks reduce the amount of input force required, from the user, when opening the tent.



b) Roof Top Tent - Air Assisted Opening

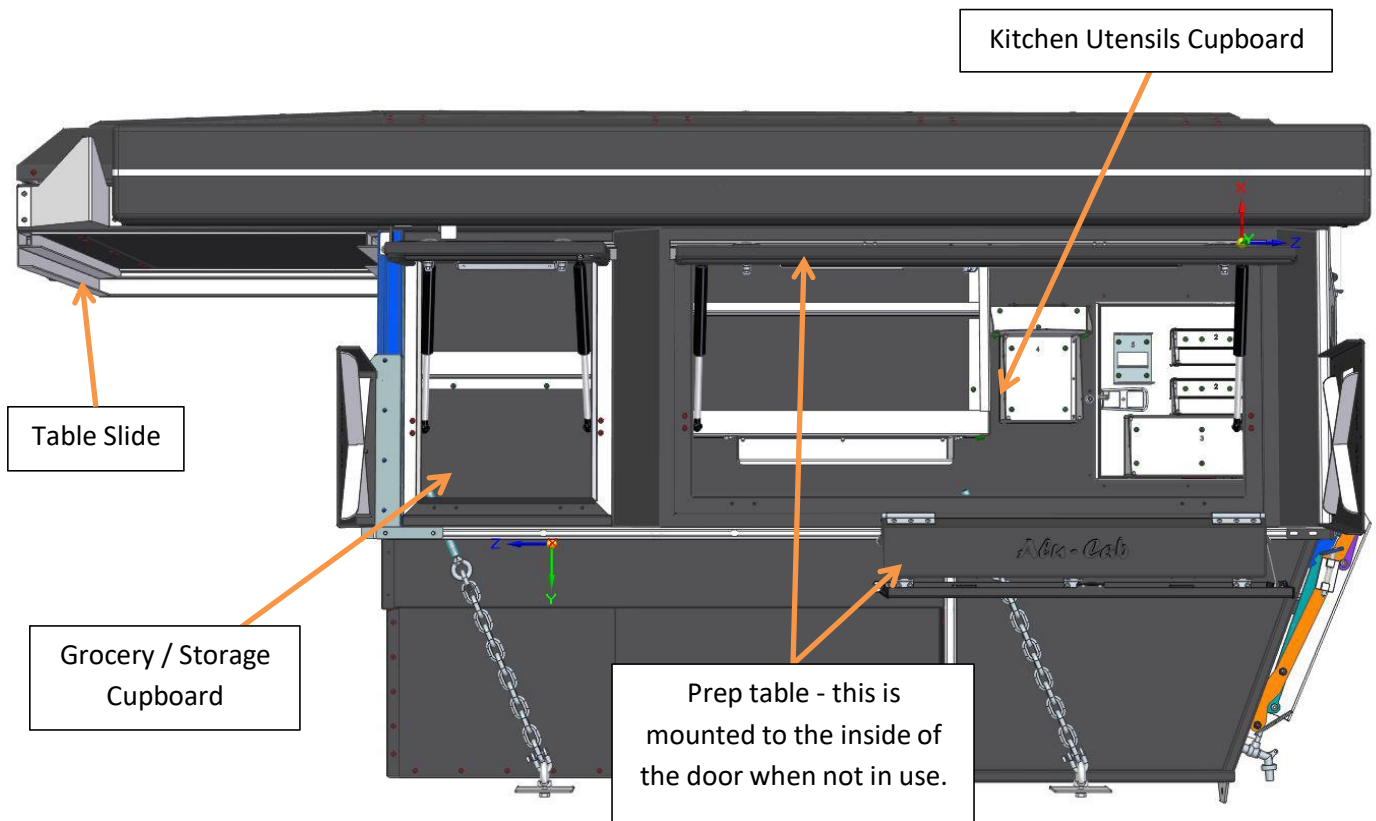
In the recovery cupboard, under the breaker panel, you will find the Air Assist Kit controls and compressor. The electrical power switch on the right, is to switch the air compressor on and off. On the left of that switch, in the centre, is the roof lifting toggle switch and on the far left is the pressure switch currently set to cut power to the compressor at a pressure of 4.5 - 5 bar.



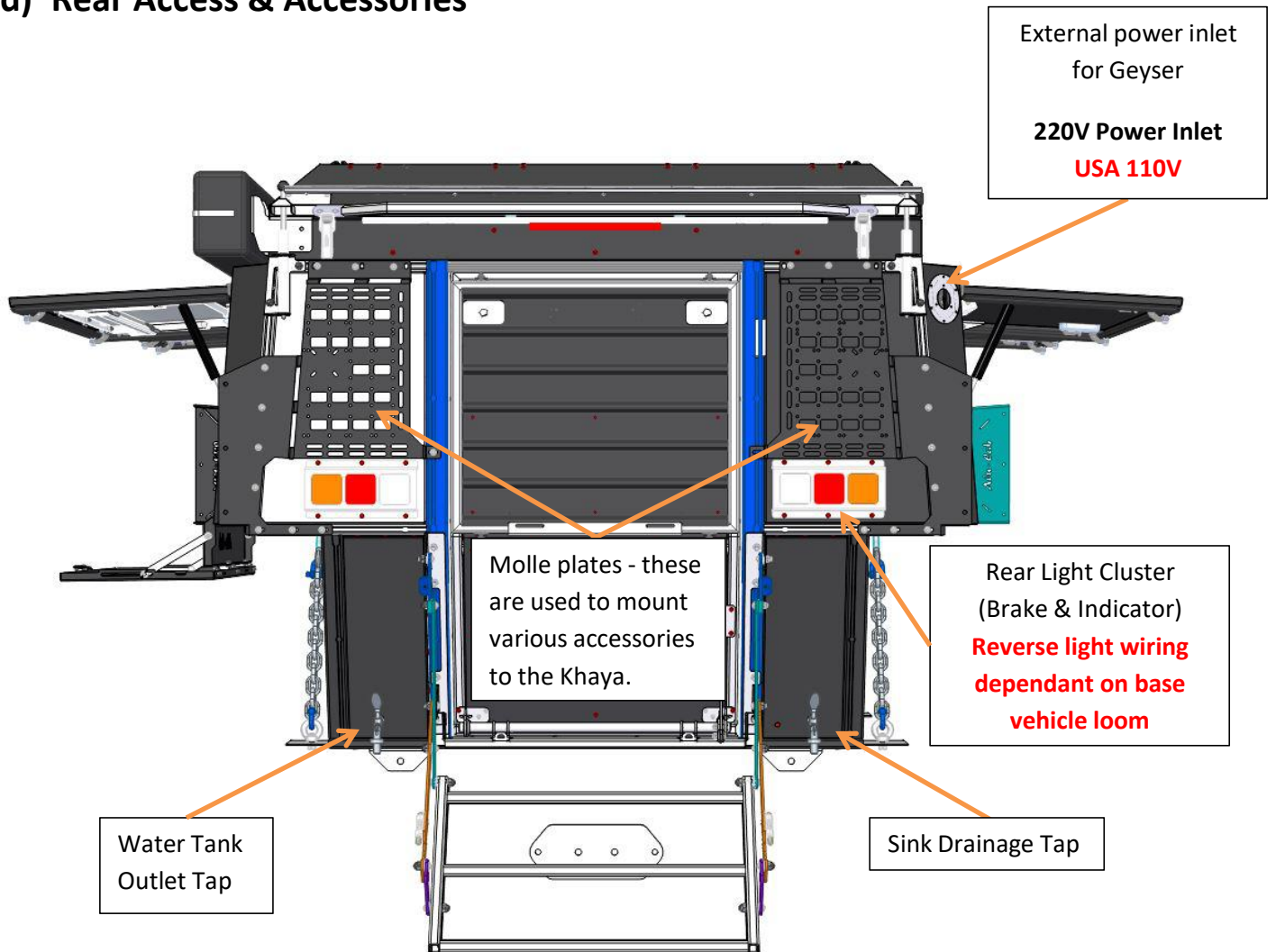
To lift the roof, follow the same procedure described in the Manual Opening sequence, but instead of manually lifting the roof, switch on the compressor with the On / Off Switch, while the Roof Lifting Toggle Switch is in the working position. Air will be supplied to the pneumatic actuators at the rear, and the roof will lift, to open position. Switch off the On / Off Switch, once the roof is fully open.

To drop the roof, flip the roof lifting switch to release the air in the struts and then pull the roof down manually.

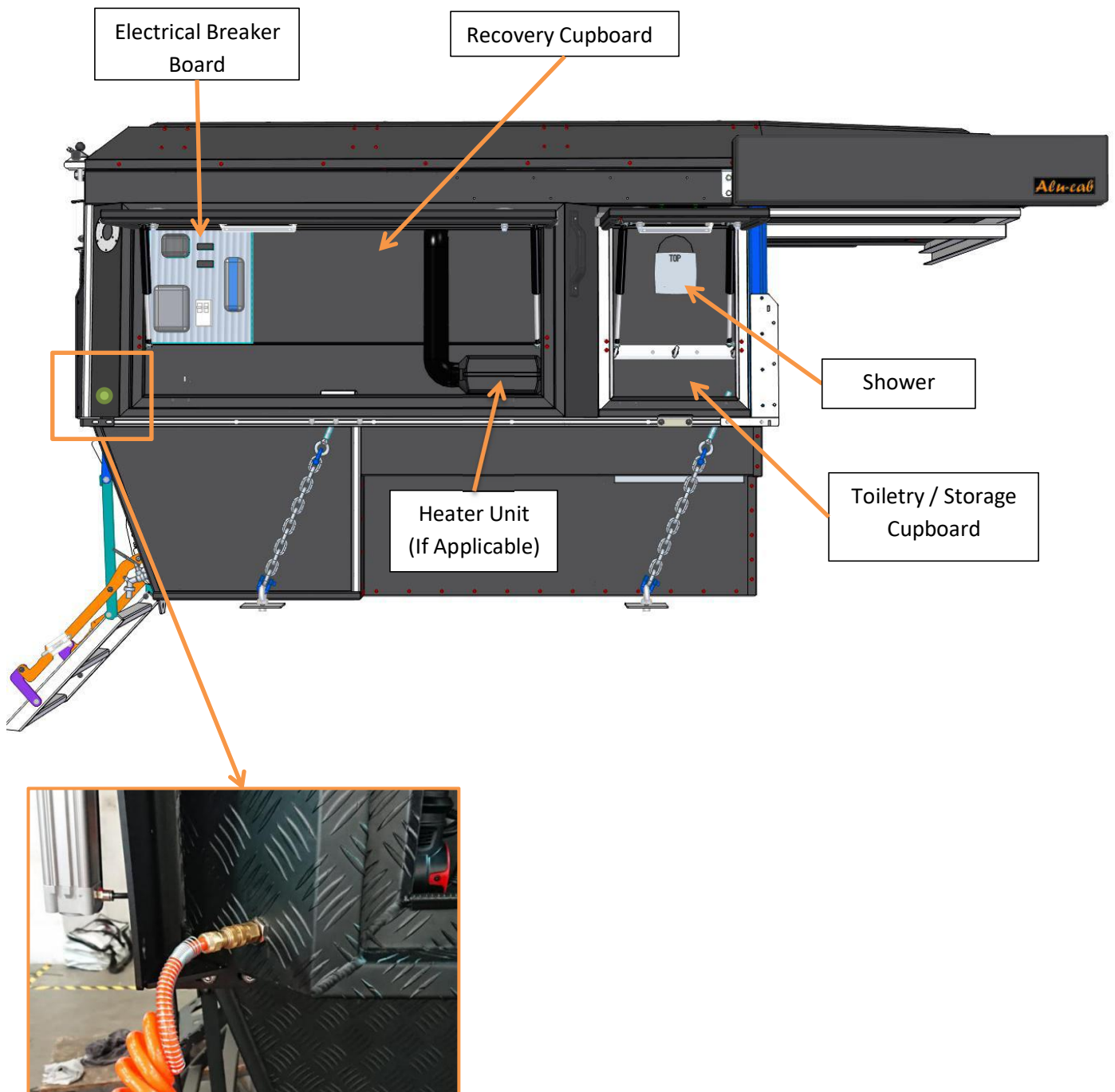
c) Cupboards / Storage Compartments - Left Hand Side



d) Rear Access & Accessories



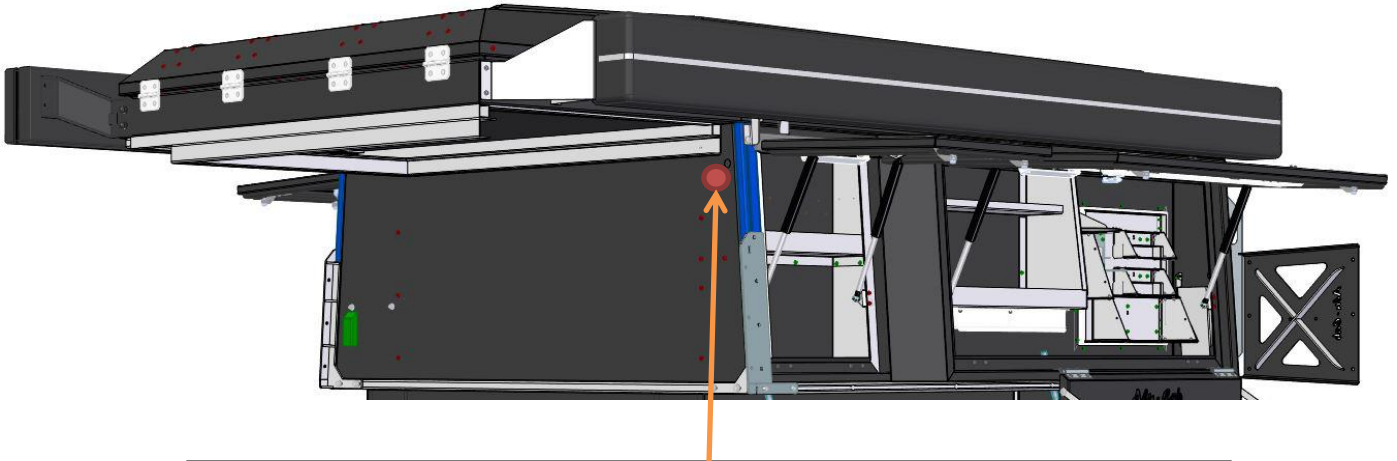
e) Cupboards / Storage Compartments - Right Hand Side



The auxiliary air outlet point can be used to inflate tyres, mattresses or other similar items.

To operate this point, simply plug in the quick-connect spiral air hose, and switch on the compressor with the On / Off Switch. Ensure that the Roof Lifting Toggle Switch is in the non-working position.

f) Water Tank



The Khaya has a 75 litre water tank which is BPA free and meets FDA food safety regulations and made of food grade polyethylene. The tank would be refilled at the point shown above.

g) Geyser Power

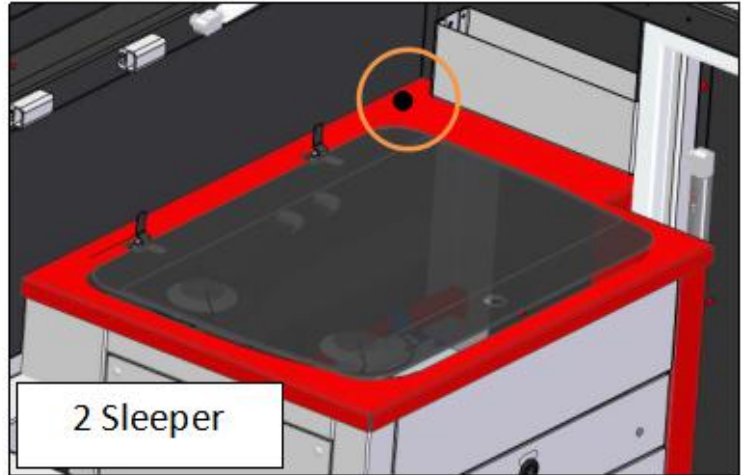
The Khaya geyser can be switched over to run off mains power, while stationary. This can be done quite simply, by plugging in the mains lead (110 / 220 V) and flipping the switch, located on the breaker board:



If you are using on-board battery power to heat the geyser, remember to leave the vehicle running.

h) Shower / Geyser / Water Heater

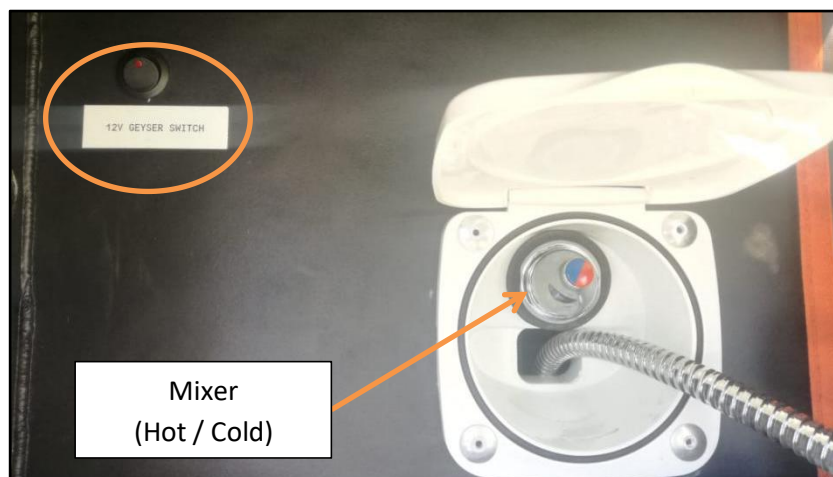
To turn on the water pump, feeding the shower, you will need to turn on the power switch, as follows:



The 4 Sleeper power switch is located adjacent to the rear entry door, on the inside.

The 2 Sleeper power switch is located on the sink unit.

To turn on the Geyser / Water Heater, the power switch must be turned on. It is located in the shower cupboard, as shown below:



The temperature of the shower water can be regulated by adjusting the regulator knob, also shown above.

i) Air Heater



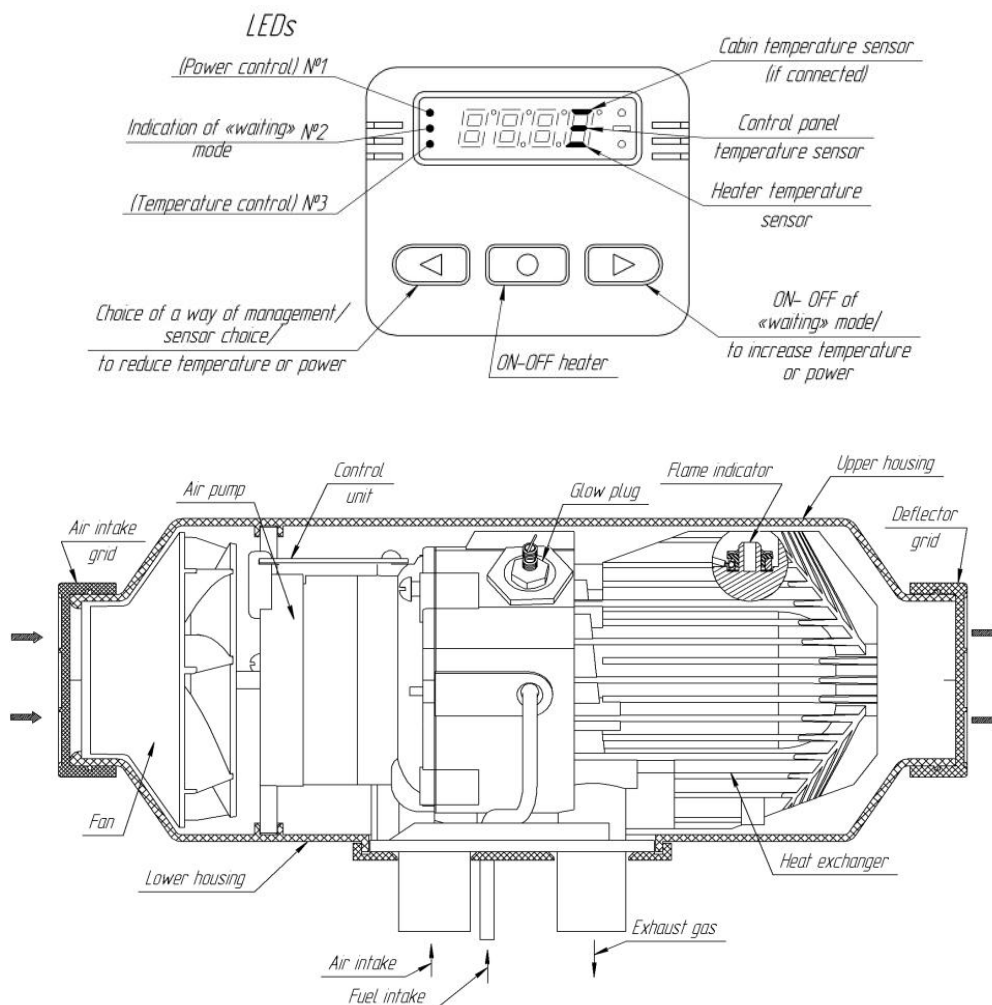
When filling the Air Heaters diesel tank, always use a funnel, and avoid spillage.

Always clean up any spilled diesel!

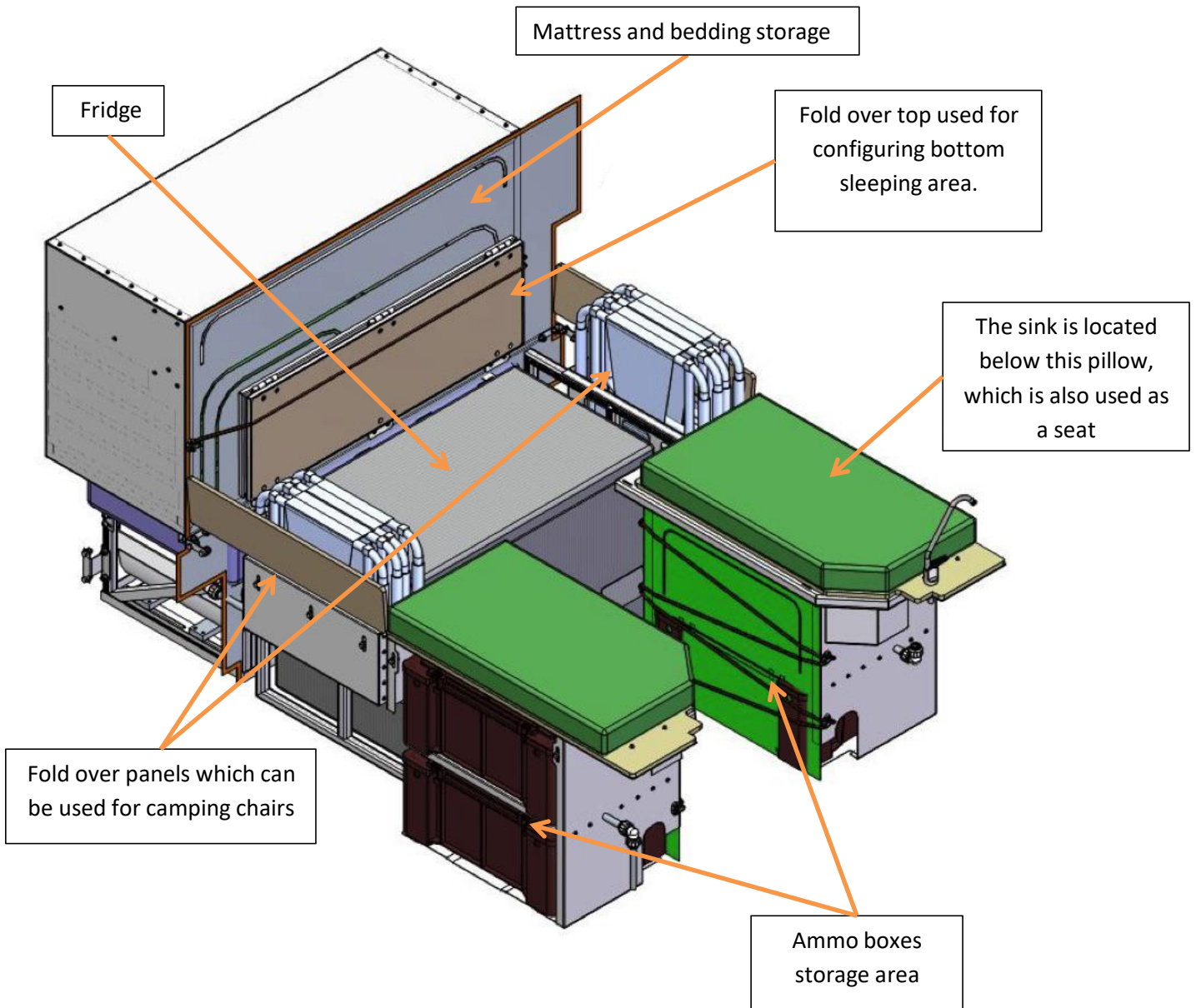


Before operating the Air Heater, read the full operators manual, included in the appendices of this document.

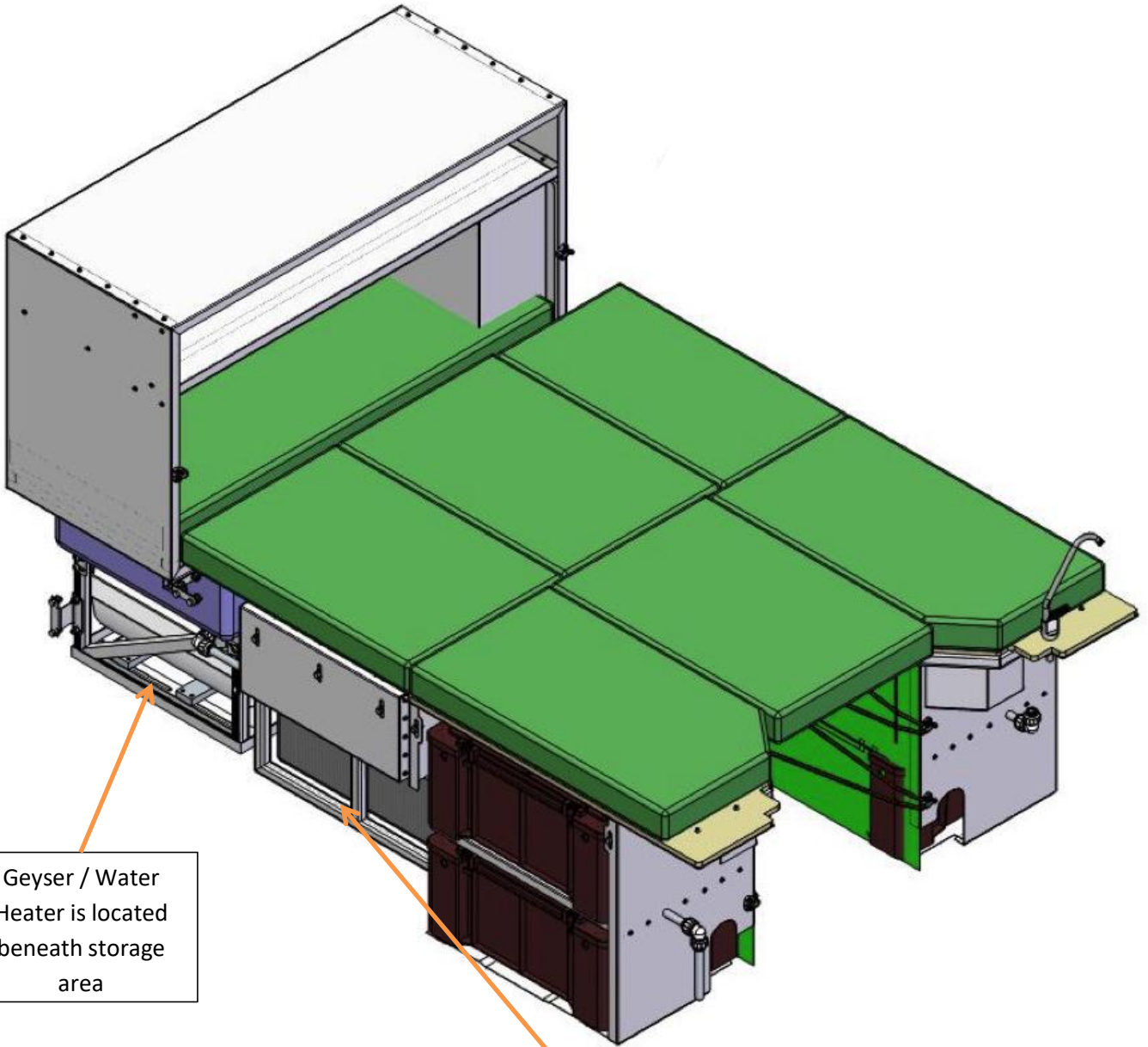
The control panel, and the heater assembly are shown below for reference only:



j) Interior - 4 Sleeper (Day Time Setup)

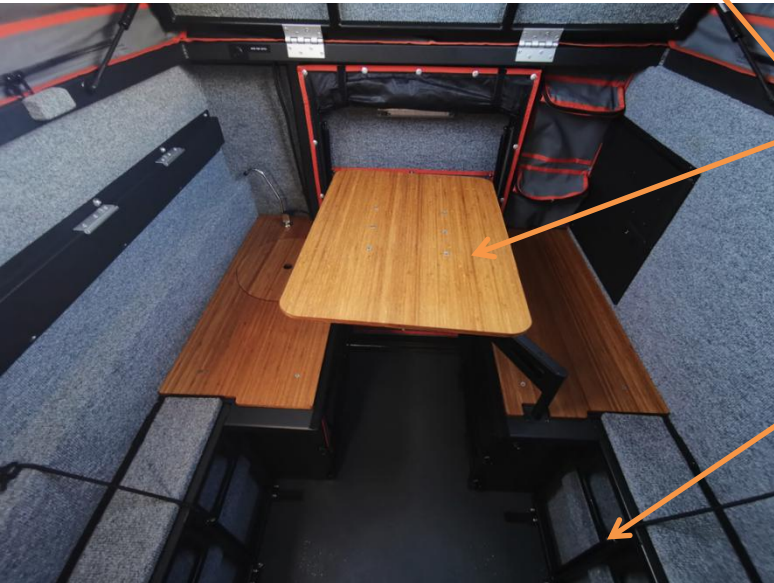


k) Interior - 4 Sleeper (Night Time Setup)

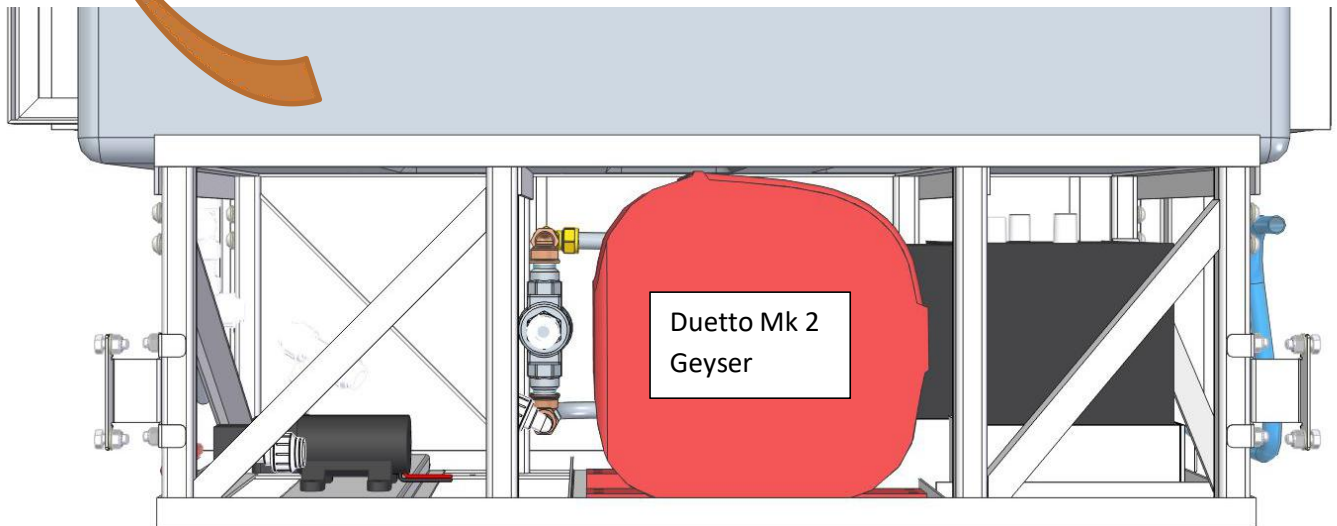
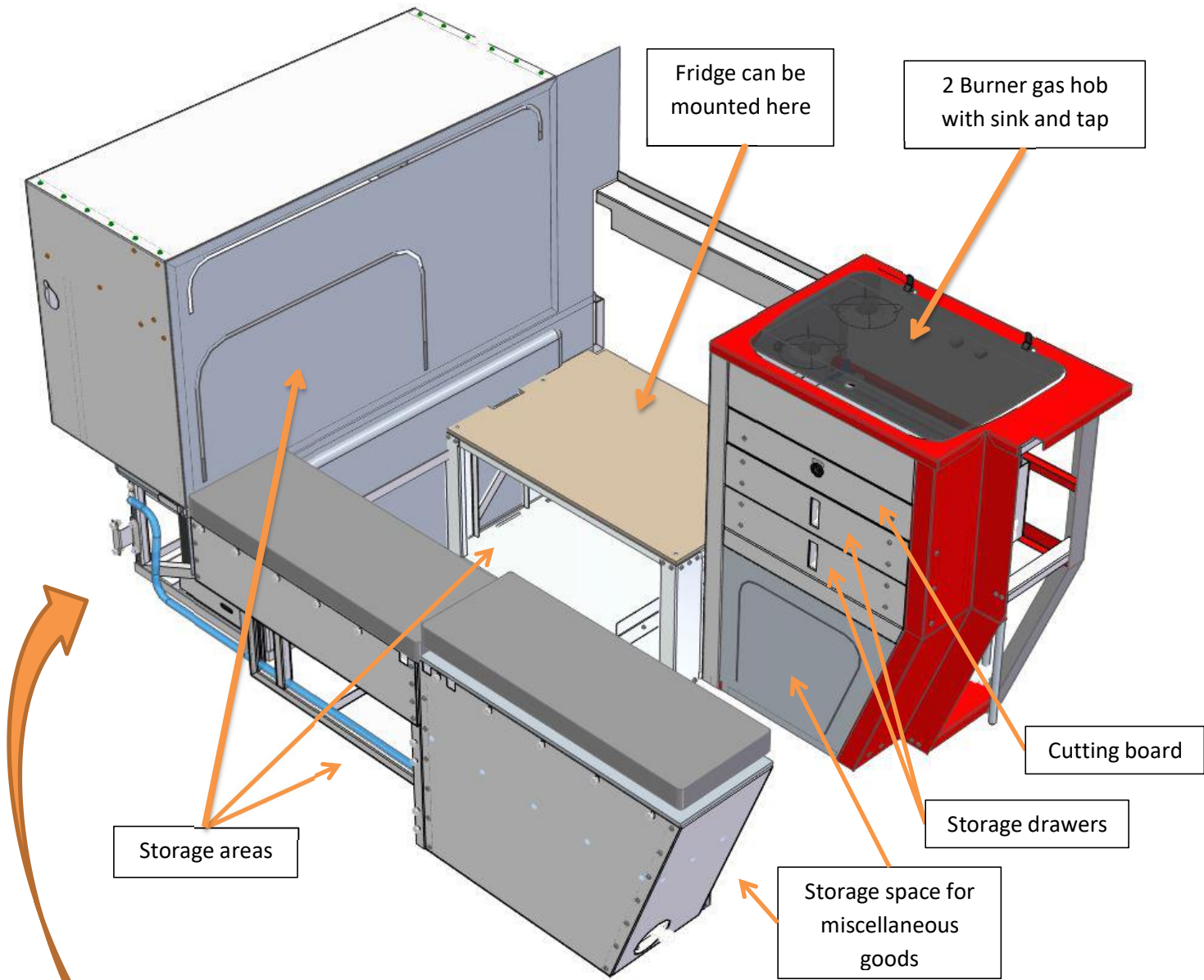


Geyser / Water Heater is located beneath storage area

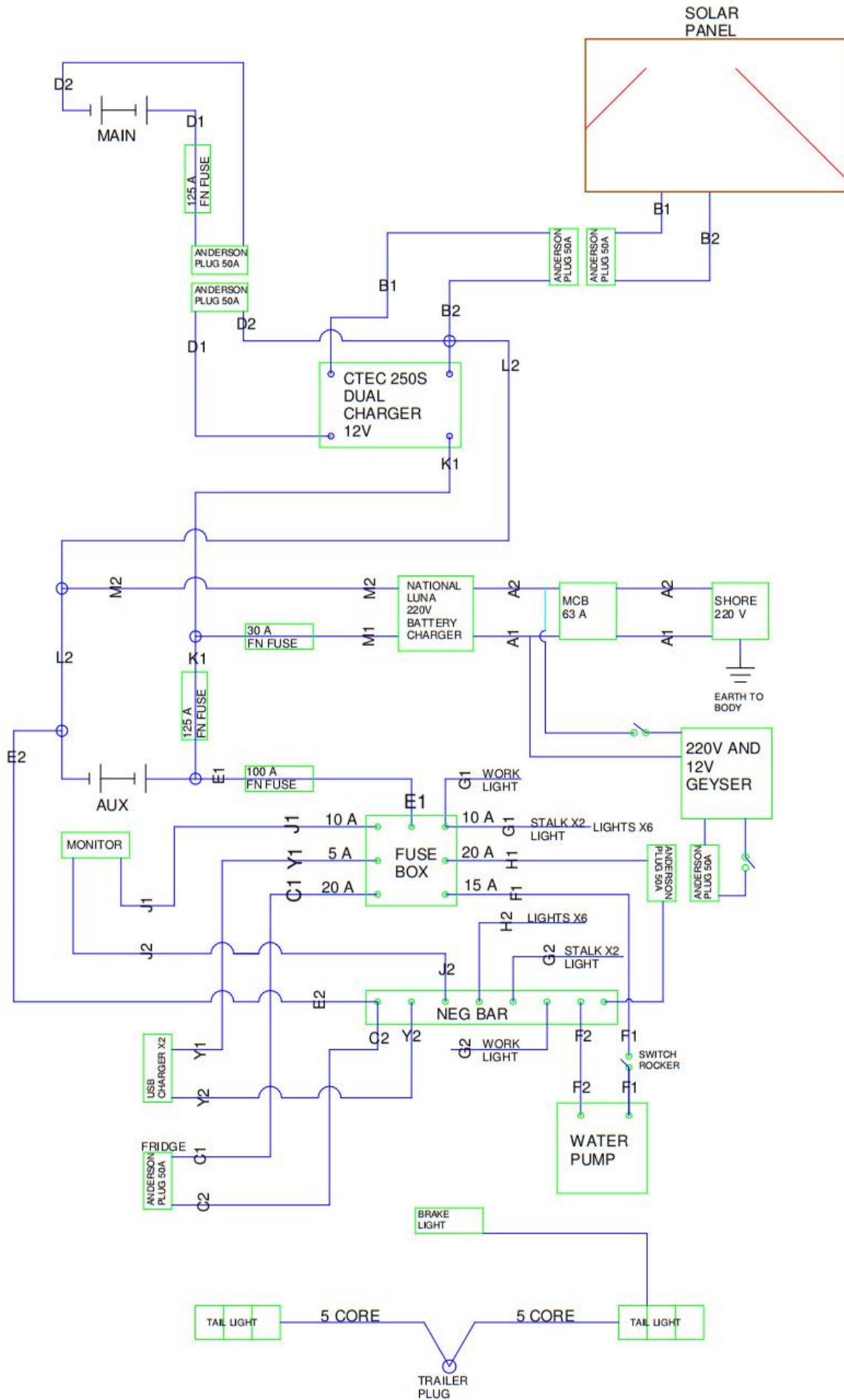
This table is removable and swings into desired position. When the table is not being used it should be packed away next to the pop up panels.



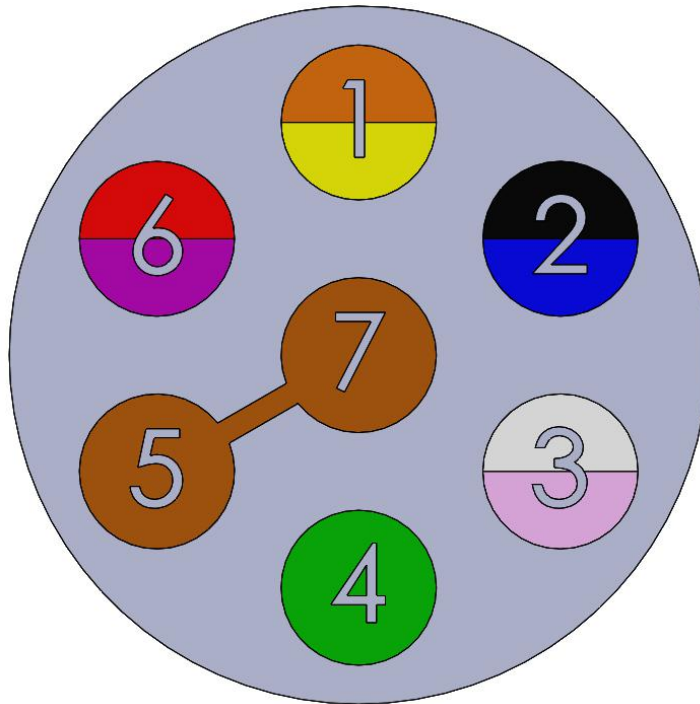
I) Interior - 2 Sleeper



m) Wiring Diagram & Identification



TRAILER PLUG - REAR LIGHT CLUSTER WIRING IDENTIFICATION



1 - ORANGE or YELLOW

2 - BLACK or BLUE

3 - WHITE or PINK

4 - GREEN

5 - BROWN*

6 - RED or PURPLE

7 - BROWN*

LEFT INDICATOR

SPARE CONNECTOR (CAN BE USED FOR REVERSE LIGHT)

NEGATIVE (-)

RIGHT INDICATOR

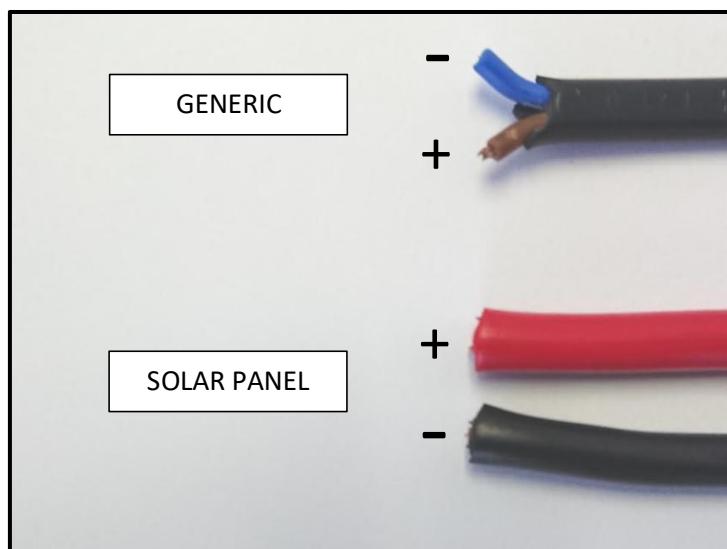
PARK LIGHTS

BRAKE LIGHT

PARK LIGHTS

*** 5 & 7 ARE USUALLY BRIDGED ON THE BASE VEHICLE'S LOOM**

INTERNAL WIRING IDENTIFICATION



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1. Introduction

This Operation Manual is intended to familiarize the User with salient features, operation, assembly and operating procedures for air heater PLANAR–2D–24 and PLANAR–2D–12 (hereinafter called «the heater») intended for heating a vehicle driver workplace and various compartments of a motorized vehicle at atmospheric temperatures as low as -45°C (-113°F).

PLANAR-2D-24/12 heater has two types of configuration:

- 1) standard (see paragraph 7);
- 2) increased (Optional accessory):
 - Modem (heater control via SMS-messages);
 - Cabin temperature sensor;
 - Electromagnetic locking valve;
 - Fuel tank (with installation kit).

Minor changes performed on the heater structure by the Manufacturer may not be documented in this Operation Manual.

2. Basic Parameters & Specifications

The basic heater specifications are quoted in Table 1.

The basic parameters are quoted to a margin of $\pm 10\%$ tolerance at a temperature of 20°C (68°F) at a nominal voltage (table 1).

Table 1

Parameter Code	Version	
	PLANAR–2D–12	PLANAR–2D–24
Nominal Supply Voltage, V	12	24
Fuel Type	Diesel Oil in compliance with GOST 305, atmospheric temperature-dependent	
Heating Efficiency: max, kW, min, kW,	1,8 0,8	
Heated Air Volume: Max , m ³ /h Min, m ³ /h	75 34	
Fuel Consumption at: Max power, l/h (gal/h) Min power, l/h (gal/h)	0.24 (0.06) 0.1 (0.03)	
Heater power consumption, W Doesn't exceed while heating mode		
Max, W	29	29
Min, W	10	10
Start/Stop Mode	Manual	
Maximum Weight, kg (lb)	10 (22)	

3. Safety Measures

3.1 The installation of the heater and its fittings shall be performed by authorized organizations only.

3.2 The heater may only be used for the purposes specified herein.

3.3 The fuel supply line shall not be installed inside the passenger compartment or cabin of a motor vehicle.

3.4 A vehicle that uses the heater shall be equipped with a fire extinguisher.

3.5 The environment where the heater is to be used shall be free of highly inflammable vapors and a large quantity of dust.

3.6 To prevent the possibility of exhaust gas poisoning, the heater shall not be used when the vehicle is in an enclosed area (garage, workshop, etc).

3.7 When refueling the vehicle, the heater shall be switched off.

3.8 When performing welding operations on the vehicle or repairs on the heater, disconnect the heater from the vehicle battery.

3.9 When assembling or dismantling the heater, observe the safety measures specified by electric work regulations for the fuel supply system and the vehicle's wiring system.

3.10 The heater shall not be connected to the vehicle electric circuit while the engine is running or the battery is switched off.

3.11 The heater's electric power supply must not be disconnected before the end of the purge cycle.

3.12 The heater's connectors must not be connected or disconnected while the heater's electric power supply is turned on.

3.13 Heater food by the electric power has to is carried out from **the storage battery** irrespective of the **mass** of the vehicle.

3.14 It is forbidden to step on a heater and to put on it subjects.

3.15 It is forbidden to cover a heater with articles of clothing, pieces of fabric, etc. and as to place them before its entrance or an exit of heated air.

3.16 Wait 5 to 10 seconds before switching the heater back on.

3.17 In the event of two subsequent ignition failures, contact the maintenance department to report a malfunction.

3.18 In the event of a failure in heater operation, contact a designated repair organization authorized by the Manufacturer.

3.19 Manufacturer warranty shall not apply if the above requirements are not adequately met.

4. Description of Heater Structure and Operation

The heater operates independently from the vehicle engine.

The fuel and electric power supply is provided by the vehicle. See Figure 4.1 for the heater wiring diagram.

The heater is a self-contained heating device comprising the following:

- Heating device (See Figure 4.2 for basic components thereof);
- Fuel supply pump providing fuel for the combustion chamber;
- Ignition and indicator device (control panel);
- Wiring harness connecting heater fittings to the vehicle battery.

The heater's operating principle is based on heating air driven through the heater's heat exchange system.

The heat sources are fuel combustion gases from the combustion chamber. The resulting heat warms the walls of the heat exchanger, which is air-blown from the outside. Air passes through the ribbing of the heat exchanger and enters the passenger compartment or other compartments of the vehicle.

Upon ignition, control unit of heater checks the heater to ascertain whether fittings such as the flame indicator (the indicator of a flame combines in itself functions of the sensor of temperature of the heat exchanger and the overheat sensor), air pump motor, plugs, fuel supply pump and the electric circuits thereof are working properly.

If no problem is detected, the ignition process starts.

In accordance with the preset sequence, the combustion chamber is fore-purged and the heating plug warms up to the required temperature. Air and fuel starts to enter the combustion chamber under the same procedure, whereupon the ignition process is initiated. Once stable combustion is achieved, the heating plug switches off. Flame control is provided by the flame indicator. All processes involved in heater operation are monitored by the control unit.

The control unit controls heat exchanger temperature and halts the combustion process as soon as the temperature exceeds the specified limit. The heater may be switched off at any time.

Pressing the heater deactivation command stops the fuel entering and the combustion chamber is purged with air.

During automated operation control of the heater in emergency situations, bear in mind the following:

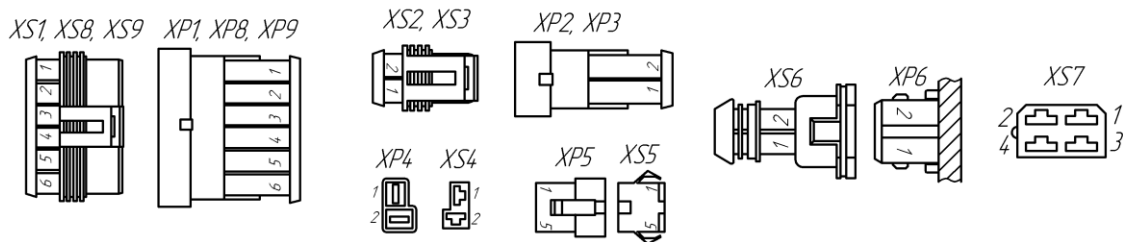
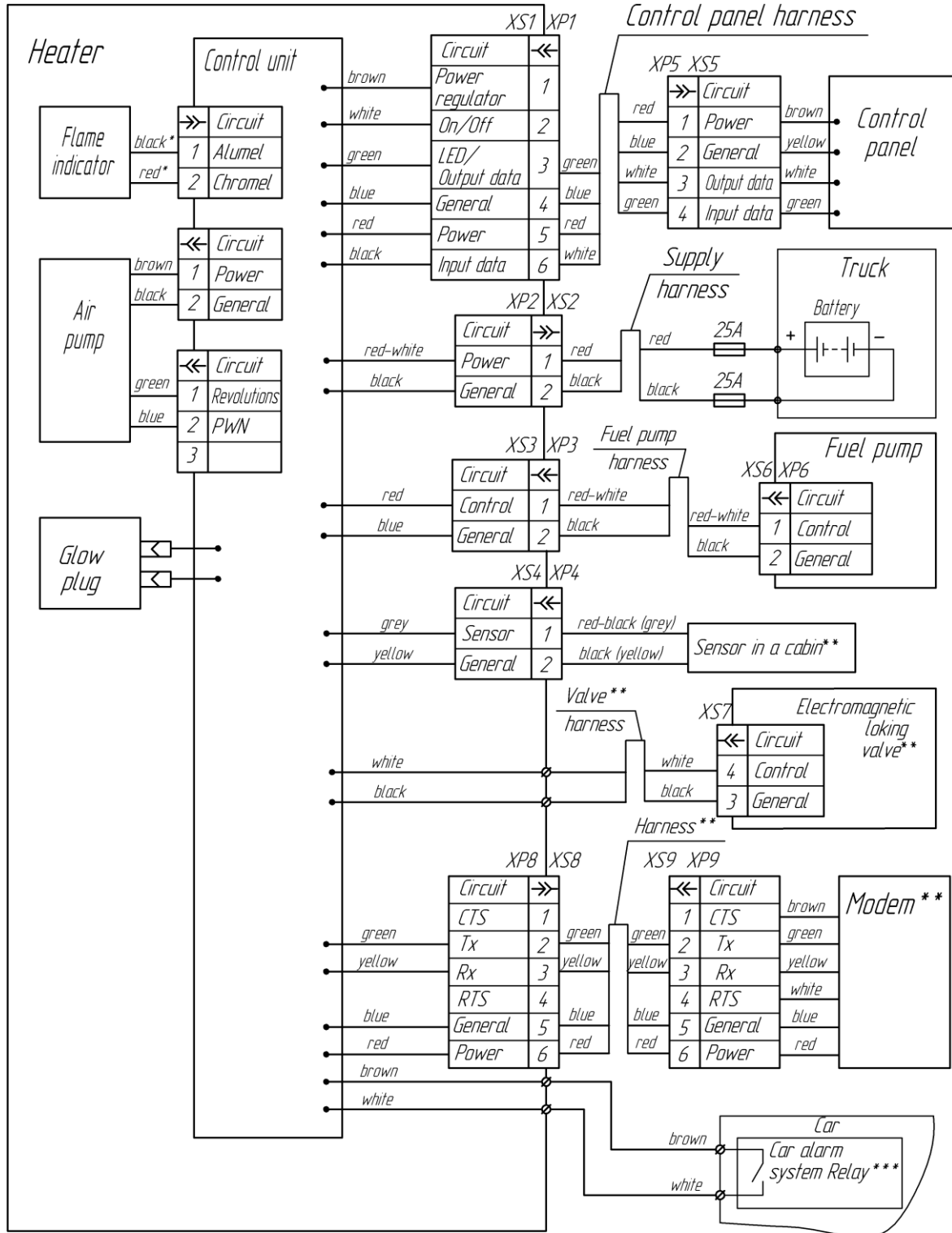
1) In the event of ignition failure, the process will be repeated. The heater will switch off following two consecutive ignition failures;

2) If a combustion failure occurs while the heater is in operation, the heater will start repeated ignition. The maximum number of starts for this reason – no more than 3 times;

3) If the heat exchanger is overheated (maybe as a result of closure of the heater inlet/outlet vents), the heater will switch off automatically;

4) If voltage drops below 10V (20V) or exceeds 16V (30V) the heater will switch off.

5) In the event of emergency shutdown, the indicator will show the information according to the code of malfunction see table 6.1;



1. View of connector show from contact side;
2. * - Color of tags on wires;
3. ** - At the additional order.
4. *** - Example of connection of a heater to the car

Figure 4.1- Wiring Diagram

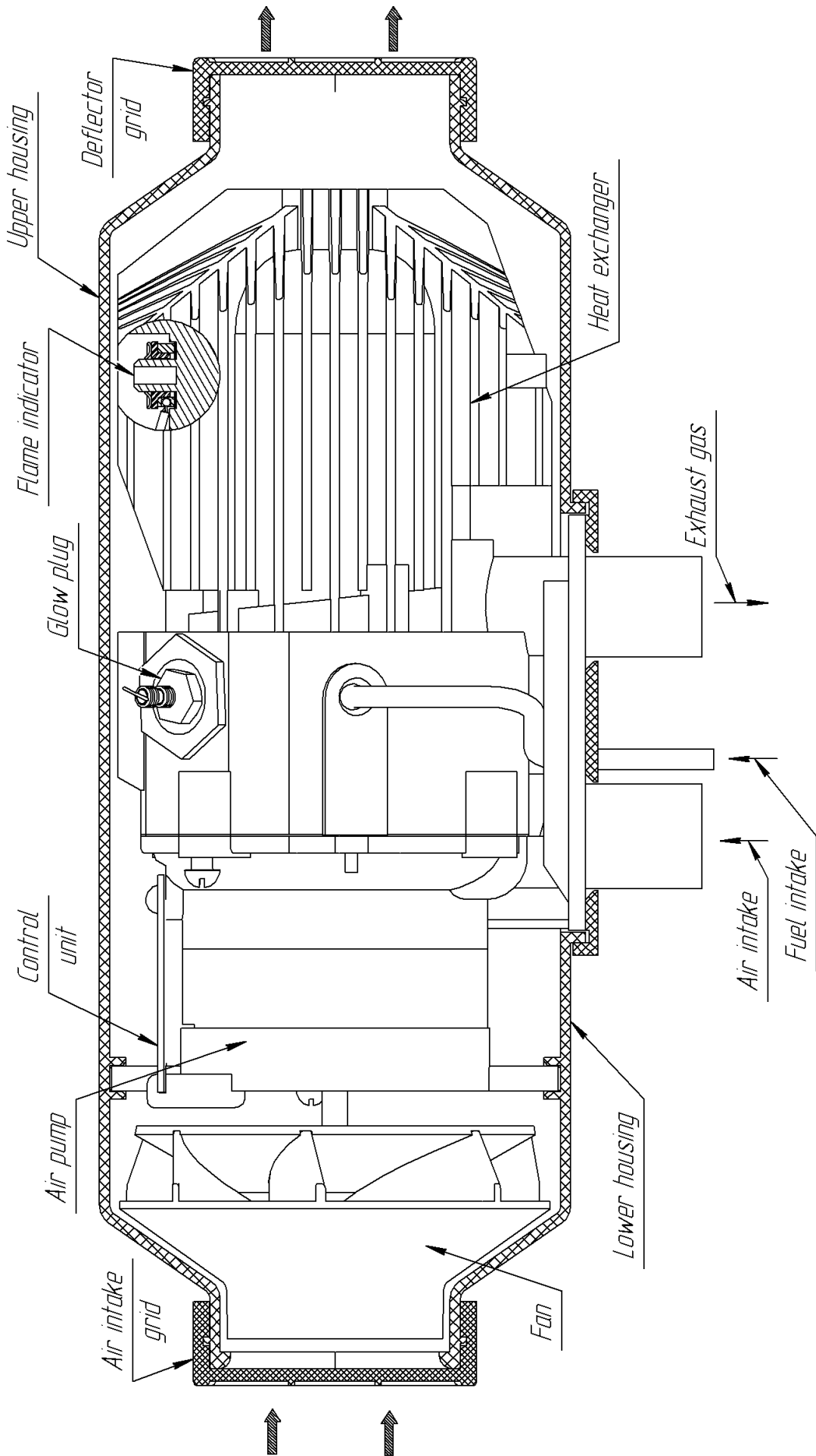


Figure 4.2 – Basic Heater Components

5. Control Unit

The control unit and the control panel control the heater.

The control unit performs the following functions:

- a) initial diagnostics (serviceability check) of heater fittings during ignition,
- b) diagnostic of heater elements throughout operation,
- c) heater activation/deactivation by command from control panel;
- d) combustion process control;
- e) automated switching of ventilation after the combustion process stopped;
- f) automated deactivation of the heater occurs:
 - in the event of failure of one of the controlled elements,
 - when any parameter exceeds the specified limit (heat exchanger temperature, supply voltage, combustion chamber flame failure)
 - at flame failure in the combustion chamber

6. Control Panel Functions

6.1 Control panel «ПY-10M».

The ПY-10M control panel is delivered under the additional order, it is intended for management of heater work.

The panel is intended for:

- a) start and stop a heater in a manual mode;
- b) changes in a manual operating mode of a heating capacity (heating temperature);
- c) indications of a condition of a heater on a light-emitting diode.

On the front panel of the control panel are located (see fig. 6.1):

- 1) keyboard switch (pos.1);
- 2) potentiometer (pos.2);
- 3) light-emitting diode (pos.3).

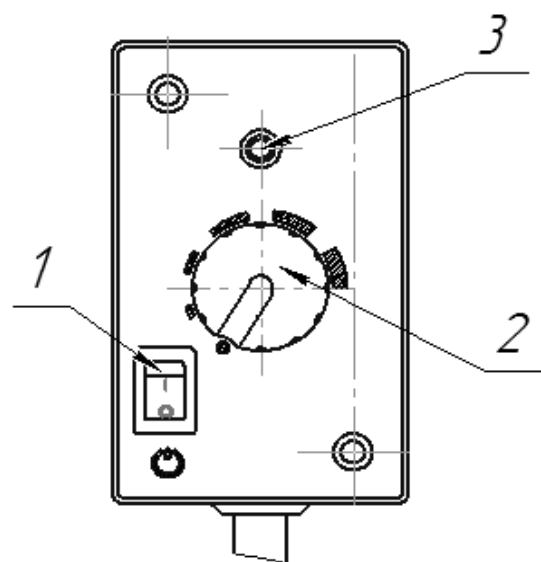


Fig. 6.1 - ПY-10M Control panel

The keyboard switch is intended for switching on/off the heater.

The potentiometer at turn changes heating capacity from 0,8 to 1,8 kW, and at established remote cabine temperature sensor changes temperature from 15°C to 30°C.

Light-emitting diode of pos. 3 shows a mode of a heater:

- shines red color – a mode of heating or a ventilation mode at the beginning and at the end of heater work;
- blinks red color - at malfunction (faulty). The quantity of blinkings after a pause corresponds to a type of malfunction (see table 6.1);
- doesn't shine - at an idle heater.

6.2 The control panel «IIY-16M» is intended for:

- heater activation and deactivation in manual mode;
- choice of a way of management «on power» or «on temperature»;
- activation of "waiting" mode
- indication of the established temperature or power;
- indications of temperature of one of 3x sensors (built in the heater, built in the control panel or remote – cabin temperature sensor, if it is connected);
- failure code indication in case of heater failure while operation.

6.2.1 The front board of the panel contains: four-digit light emitting diode (LED) indicator, three LEDs and three knobs. Functionality of the knobs and LEDs. (fig.6.2)

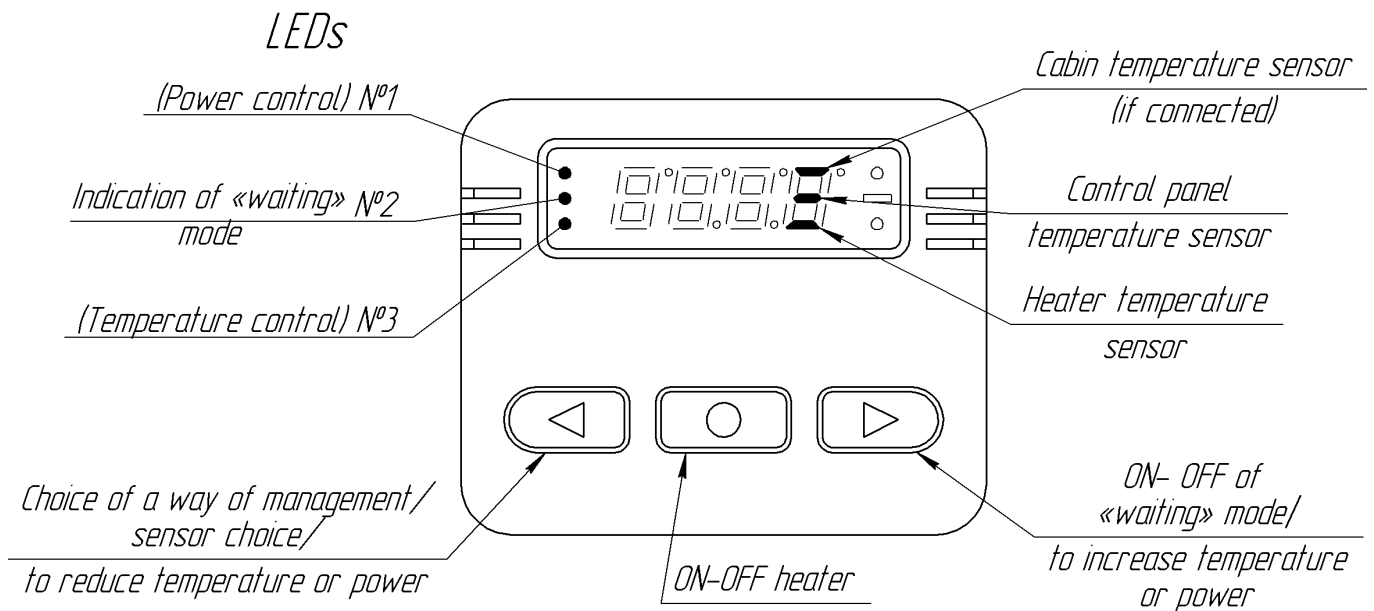


Fig. 6.2- Control panel «IIY-16M»

The way of management "on power" is intended for the fastest heating of the room. If to establish "max" power, the heater will constantly work with the maximum heating capacity. In operating time of a heater it is possible to set it's power (8 steps of power).

The way of management "on temperature" is intended for maintenance in necessary temperature. If the measured temperature is less established, the heater will work at "max" power. When indoors temperature will come nearer to the established value, heating capacity of a heater will start decreasing. And, the less difference of temperatures, the is less heater heating capacity.

Waiting mode is a mode on which process of burning stops and air ventilation indoors begins. Ventilation is necessary for maintenance of identical temperature in all room. During ventilation temperature in the room is constantly measured and if it becomes lower than established, the heater will be started again.

Features of work of a heater:

1) "Waiting" mode is compatible to way of management "on temperature" and isn't compatible to way of management "on power". The heater won't stop burning during the work "on power" irrespective of light-emitting diode No. 2 indication.

2) After each switching off of a heater there is a dumping of activation of "waiting" mode.

3) At a choice of a way of management "on power" the heater constantly works at the chosen thermal power. At achievement of comfortable temperature we recommend to reduce power or to make air ventilation of the room.

4) On the mode "on temperature" the heater will work for maintenance of the established temperature, thus its thermal power will change from max to min depending on air temperature. The air temperature is higher, the less heat makes a heater.

At achievement of the established temperature:

- if the waiting mode isn't activated, the heater will pass a mode to "min". Further work of a heater depends on temperature indoors:

1) if temperature continues to increase, the heater will continue to work at power "min". It is possible to switch off a heater manually;

2) if temperature starts going down, the heater will smoothly increase the developed thermal power, trying to maintain indoors established temperature. It is possible to switch off a heater manually.

- if the waiting mode is activated, on reaching the set temperature the heater will pass into waiting mode. On the waiting mode burning stops and air ventilation indoors begins. When temperature indoors will fall on 5°C below the established there will be the next ignition of a heater. It is possible to switch off a heater manually.

6.2.2 Control Panel installation and connection

Control Panel is installed in cabin or passengers compartment on the dashboard or any other comfortable for the driver place.

The control Panel is fixed with double-faced adhesive tape, which is stuck to the back side of the Control Panel. You can take out wires of the unit from its back or side cover. It is necessary to degrease the surface used for Control panel installation. Take off protective film from the tape and install the Control Panel on the prepared surface.

If installation of the control panel is made by means of a holder, it is necessary to fix two self-tapping screws a holder on the dashboard, and then to latch in it the control panel.

The connection of the Control panel to the heater is performed according wiring diagram (fig. 4.1)

6.2.3 Complex checkup of the Control Panel after installation

After installation and connection of the Control panel to the heater the checkup is performed in following way:

-set up the necessary operation mode on the Control panel;

-check activation and deactivation of the heater;

-check deactivation of the heater while artificial failure (take off the connector from the fuel pump during operation mode of the heater), while this the malfunction code appears on the indicator.

6.2.4 Succession of work with the control panel

While first time the heater is connected to electric circuit of the car or after breaks of power supply, according to environmental temperature there will be following information on the panel (for example)- the temperature in the area of the sensor installed in the heater is -12°C , if the temperature in the area of the sensor is above zero, there will be no "mines" before the figure. Movement according to the main menu is carried out by the button « \leftarrow » (fig.6.2)

I	Way of management – on power; Temperature of the sensor which has been built in control panel is equal -12°C ; «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
II	Way of management – on temperature; Temperature of the sensor which has been built in control panel is equal -12°C ; Control of work of a heater is exercised according to indications of the sensor of temperature installed in the control panel. «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
III	Way of management – on temperature; Temperature of the sensor which has been built in the heater -13°C ; Control of work of a heater is exercised according to indications of the sensor of temperature installed in the heater. «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
IV	Way of management – on temperature; Temperature of the sensor which has been built in control panel is equal -12°C ; Control of work of a heater is exercised according to indications of the sensor of temperature installed in the control panel. «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
V	If the remote cabin sensor is connected. Way of management – on temperature; Temperature of the remote cabin sensor is equal -10°C ; Control of work of a heater is exercised according to indications of the remote cabin sensor of temperature. «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
VI	Way of management – on power; Temperature of the remote cabin sensor is equal -10°C ; «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;
VII	Way of management – on temperature; Control of work of a heater is exercised according to indications of the remote cabin sensor of temperature. «O» - heater start; « \leftarrow » - transition to the following menu; « \leftrightarrow » - activation/deactivation of "waiting" mode;

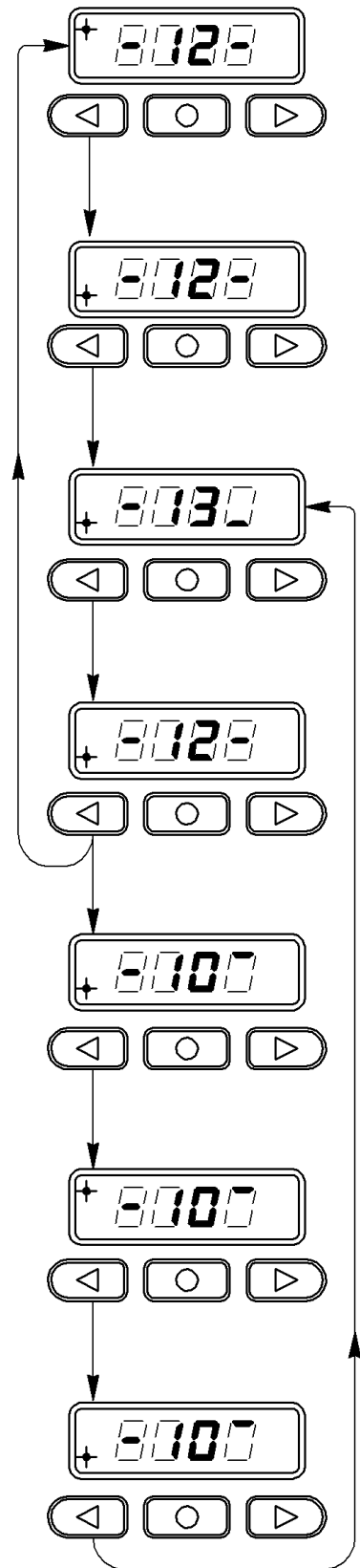


Fig.6.3.- The menus switched by the left button

Activation - deactivation of "waiting" mode is carried out by the button «⇌» (fig.6.4).

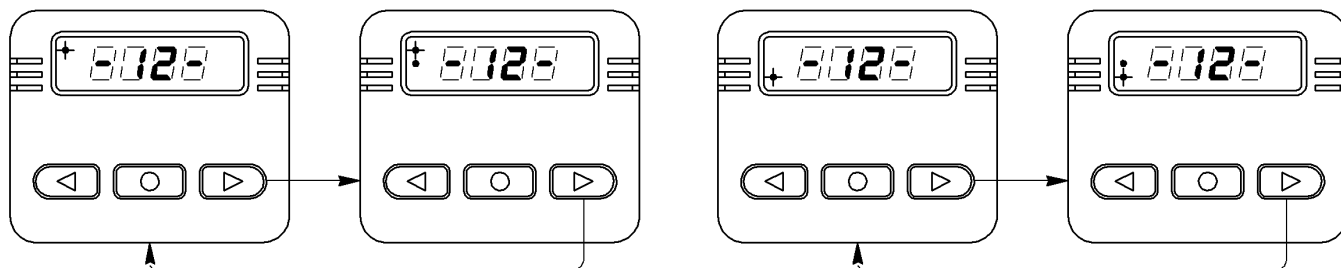


Fig.6.4 - The menus switched by the right button

После запуска отопителя, в зависимости от выбранного способа управления необходимо установить величину мощности или температуры.

If power control is selected, pressing knobs with arrows «⇌» (decreasing), « ⇌ » (increasing) – you can set up the necessary power. The indicator shows the scale according which the power is set up (fig. 6.5).

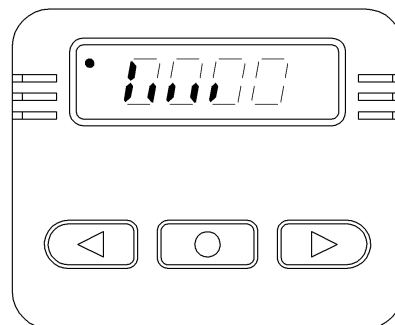


Fig.6.5 – Management on power

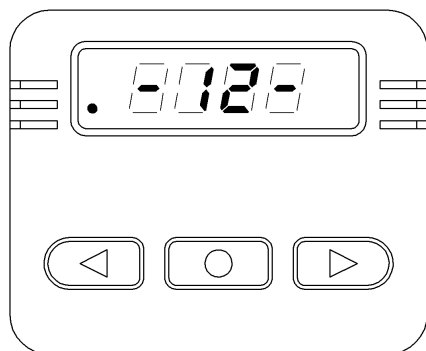


Fig.6.5.a – Management on temperature

If temperature control is selected, pressing knobs with arrows «⇌» (decreasing), « ⇌ » (increasing) – you can set up the necessary temperature (fig. 6.5a). The temperature is set within 1°C (33.8°F) to 30°C (86°F) in a zone of the installed sensor.

With the view to energy saving, the indicator stops glowing 20 seconds after last pressing of any knob, while this LED№1 or LED№3 is:

- lightning constantly if the heater is activated;
- blinking rarely (1 time per 1,5 second) if the heater is not activated; (+).
- blinking while fault (1 time per second);
- blinking frequently (5 times per second) while deactivation of the heater (while purging) (*).

To restart the indication there's need to press any knob.

Attention!

1. If cabin temperature sensor circuits are disconnected heater will go working on middle power Operation mode.

2. While heater activation without setting operation modes it is necessary to press the knob «O» one time if the indicator is lightning, and 2 times if the indicator is not lightning.

6.2.5 Heater deactivation.

For switching off of a heater it is necessary to press the O button. Thus supply of fuel stops, the combustion chamber purge within 3-5 minutes is made, the light-emitting diode No. 1 or No. 3 will often blink until the termination of a purge (fig 6.6)

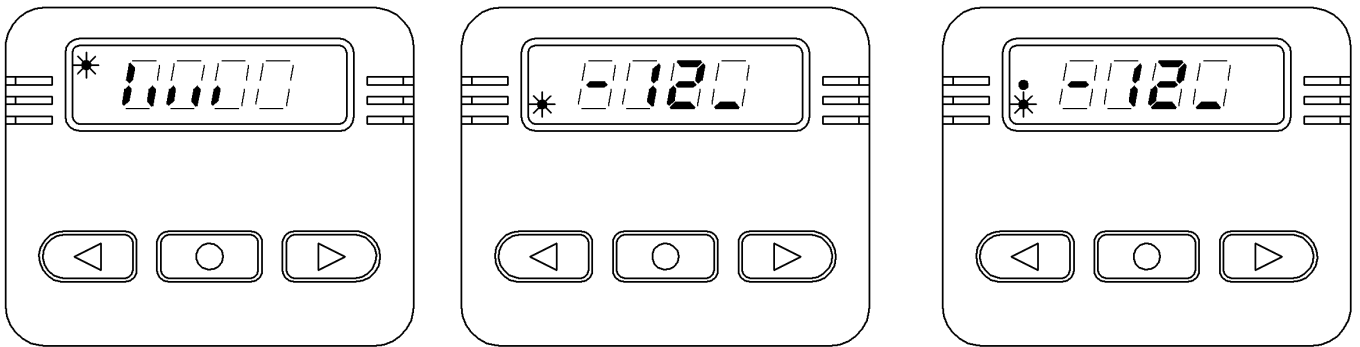


Fig 6.6-Purge

Attention!

It is forbidden to switch off electric power supply before purge cycle is finished.

6.2.6 Indication of malfunction code while failures in heater operation

While heater activation and operation there can be malfunctions. In case of malfunction the control unit deactivates the heater automatically. Every malfunction is coded and automatically appears on the indicator (Fig 6.7). While this, malfunction's code and the LED showing the operation mode of the heater will blink rarely. The heater's malfunction codes are described in table 6.1. Pressing of any knob of the control panel will switch off indication of the malfunction code and bring the control panel in initial state.

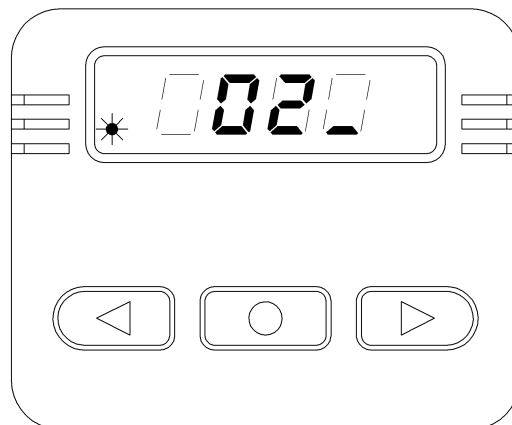


Fig 6.7 The panel the indicator at heater malfunction

6.2.7 Possible malfunctions

If after pressing any knob of the Control Panel the indicator is not lighting, there should be checked:

- fuses-25A;
- connectors and wires.

The Control Panel is not subjected to repair, it should be replaced for a new one.

Table 6.1- Malfunction codes

Quantity of blinkings	Malfunction code	Problem description	Commentary Problem solution
1	1	Overheat on the upper bound of temperature. Overheat on the growth rate of temperature of the case.	Check the inlet/outlet pipe of the heater for unpumped heated air flow. Check the flame indicator (overheating sensor) on the heat exchanger, replace if necessary.
12	2	Overheat in a control unit zone.	Check the inlet/outlet pipe of the heater for unpumped heated air flow.
5	5	Break of the flame indicator (overheating sensor of the housing)	Check the flame indicator (overheating sensor) on the heat exchanger, replace if necessary.
6	6	Built-in temperature sensor on control unit failure.	Replace the control unit
4	9	Heating plug failure	Check the plug and replace if necessary
11	10	Air pump motor malfunction	Check the electric wiring of the air pump motor, replace the air pump, if necessary.
9	12	Shutdown, voltage boost	Check the battery, regulator and power supply wiring. The voltage between 1 contact and 2 contact of connector XS2 (see connection layout fig. 4.1) should not exceed 16V (30V)
2	13	No further activation attempt is possible	If possible quantity of activation attempts is used, check the heating plug, fuel level and fuel supply system. Check combustion air system and exhaust pipe line
9	15	Shutdown, low voltage	Check the battery, regulator and power supply wiring. The voltage between 1 contact and 2 contact of connector XS2 (see fig. 4.1) should be not less 10V (20V)
10	16	During a purge, the flame indicator (overheating sensor of the housing) didn't cool down	Check the inlet/outlet pipe of the heater for unpumped heated air flow. Check the flame indicator (overheating sensor) on the heat exchanger, replace if necessary.

7	17	Fuel pump failure	Check fuel pump wiring for short-circuit fault or disconnection fault. Replace the pump if necessary.
8	20	No connection between Control panel and the heater	Check wiring, connectors.
11	27	Air pump failure. Motor won't rotate	Check the wiring of the air pump, control unit, replace if necessary.
11	28	Air pump failure. The motor rotates without control	
3	29	The admissible number of breakdowns of a flame in operating time is exceeded	Check the fuel level and fuel supply system. Check combustion air system and the exhaust pipe line. If the heater can be started, check fuel pump and replace if necessary.
---	78	Fixed the flame failure when the time of pre-heater work.	It is shown for your information. Check Check tightness of clamp on the fuel line, fuel line leaks, tightness of the fitting on the fuel pump.

6.3 Use and connection to the vehicle remote alarm system for activation and switching off the heater with the help of transmitter.

You can use vehicle remote alarm system to control the heater operation if there is an additional channel.

The relay having normally opened contacts is connected to an exit of this channel (the relay isn't included in the delivery package). Contacts of the relay should be connected to wires of the modem harness before XP8 connector (see fig. 4.1).

The ends of wires are closed by a thermoshrinkable tube. For connection of a heater it is necessary to strip out the ends of wires and to connect them (to solder) to the car relay (if necessary to extend wires).

Control of the heater can be done in two ways: short-circuit contacts of relay (time of the closed state 0.5 to 3 seconds), and long-circuit closure (more than 3 seconds). Short first impulse will starts the heater, next short impulse stops the heater.

With long impulse of the contacts of relay a command "Start" will be formed. When contacts will be open - the command "Stop" will be formed.

After start the heater will start working at "max" mode on power.

It is possible to stop the operation of the pre-heater with the help of the transmitter of vehicle remote alarm system and from the control panel.

Type of the transmitter has no significant meaning, the only requirement is that the relay current consumption must not exceed current capacity of the remote alarm system channel.

The harness of XP8 connector to which vehicle remote alarm system is connected, is used also for connection of the modem. Thus work of a heater can be operated from all connected devices (the control panel, the modem, an vehicle remote alarm system).


6.4 The use and installation of the modem to run the heater.

Operation of the heater can be controlled over the phone using a modem and a special application. For remote control operation of the heater is possible to connect the control unit to the GSM modem, which is designed for use in harsh conditions (cold, vibration, etc.). In modem as in your phone, the SIM card can be installed. On account of this SIM card should be a small amount to make the modem work correctly.

Just do not forget to replenish the account. For simplicity of control of balance and payment (provided that the SIM card of the modem and your cell phone are served at one mobile operator) the SIM card of the modem can be transferred to personal account of your cell phone, having written the corresponding application in salon of mobile operator.

Set the modem at any convenient, clean place. Connect the antenna to the modem and bring antenna to the open space (for example, on the windshield) . Connect the modem to the heater (according to fig. 4.1 and fig. 7.1) and test it .

Heater control is carried out using an application installed on the mobile phone (refer to the modem).

From the main desktop, or from the application menu, run the application «TeplostarSMS" logo  .

If it is the first application launch on this device, it is necessary to enter phone number of the SIM card inserted into the modem (further this input isn't required).

If it is the first application launch on this device, it is necessary to enter phone number of the SIM card inserted into the modem (further this input isn't required).

For start of a heater it is necessary to press "START", for a stop - "STOP".

For change of application controls it is necessary to use the side menu: to press the button in the right top corner or make "slide to the left".

The following settings are available:

SMS delivery notification – the notice of receiving the SMS by the modem.

Faults notification – the notice of malfunctions in product work.

For obtaining information on a status of a heater it is necessary to press "CHECK STATUS", in reply information on product operating time will come (if it works), a malfunction code (if it is), the air temperature and value of supply voltage.

For obtaining information on the product it is necessary to press "About device", the SMS with a serial number of a heater and the version of the software established on a heater in reply will come..

You can see the detailed instruction on work in «The instruction of the user for the TeplostarSMS appendix» (in a modem set).

* Appearance of the appendix can differ from presented in fig. 6.8.

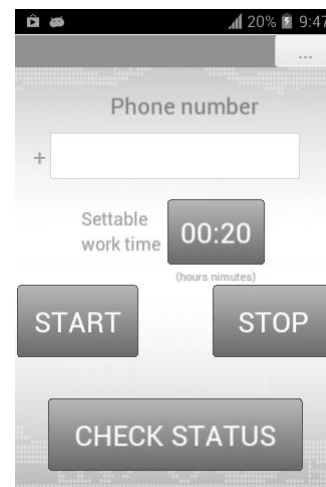


Fig.6.8 – appendix screen*

7. Scope of Supply

See Figure 7.1 for scope of supply and connection diagram of basic heater components. For list of basic heater components, see Table 7.1.

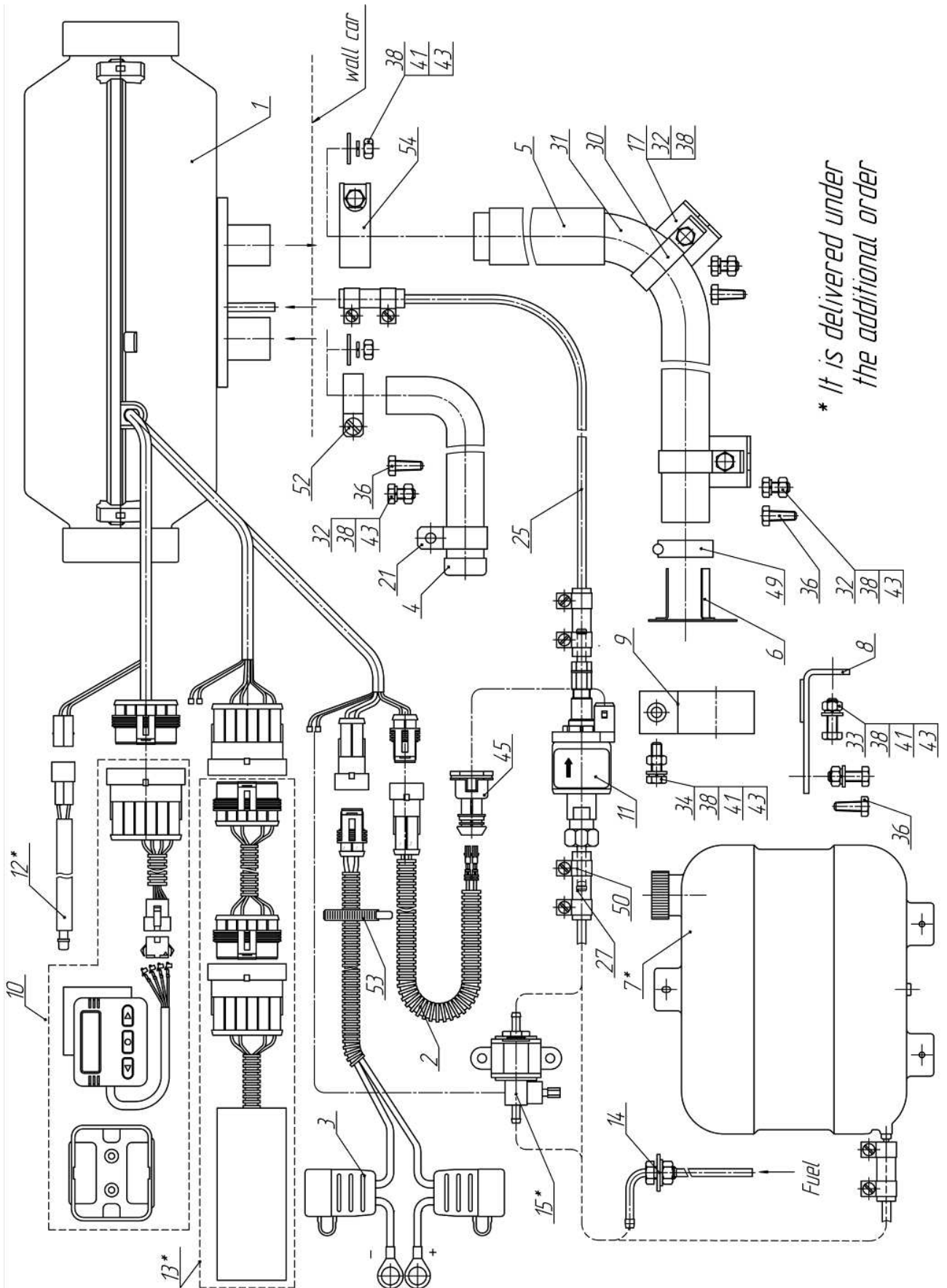


Figure 7.1 – Connection Diagram of Basic Heater Components

Table 7.1

No.	Designation	Pieces Per Set
1	Heater (12V or 24V)	1
2	Fuel Supply Pump Harness	1
3	Power Supply Harness	1
4	Air Intake	1
5	Heat insulation	1
6	Screen	1
7*	Fuel tank	1
8*	Holder with gasket	3
9	Clamp	1
10	Control panel «ПГУ-16М» with harness or «ПГУ-10М»	1
11	Fuel pump 24V or 12V	1
12*	The sensor in a cabin	1
13*	Modem	1
14	Fuel supply intake	1
15*	Electromagnetic locking valve	1
17	Holder	2
21	Air Inlet Clamp	1
25	Connecting Tube (polyamide) L = 5500 mm	1
27	Sleeve L= at least 70 mm (or one hose L= 4 x 70 = 280 mm)	4
30	Clamp	2
31**	Exhaust Pipe L=1000mm	1
32	Bolt M6x16	5
33*	Bolt M6x20	6
34	Bolt M6x25	1
36*	Screw 6.4x14	6
38	Nut M6	16*
41	Enlarged Flat Washer Ø6	11*
43	Split Washer Ø6	14*
45	Cap connector AMP 282762-1	1
49	Clamp Mikalor 20x32/9 W1	1
50	Clamp ABA min 10/9	8
52	Clamp Mikalor 25x40/9 W1	1
53	Plastic Clamp 200x3.6	15
54	Exhaust Pipe Clamp 26-28 Vaper	1

* It is delivered under the additional order.

**Delivery of an exhaust pipe 31 with not established screen 6 is possible.
Screen installation to make according to fig. 7.1.

8. Installation Requirements

8.1 Heater Installation

Installed the heater indoors while bearing in mind the permissible operating positions shown in Figure 8.1. The figure 8.1 shows the two maximum assembly positions of the heater. Positioned the heater's inlet vent in such a way to prevent absorption of vehicle/heater exhaust gas in normal operating conditions. The gap between the walls/partitions and the edge of the inlet vent shall be at least 50 mm (see Figure 8.1). The distance between the walls/partitions and the edge of the outlet vent shall be at least 150mm. When assembling or operating the heater, ensure that no foreign objects enter the inlet/outlet vents. Prior to assembly, ensure availability of spare heating plug and bear in mind dismantlement requirements, as this will permit easier maintenance in future. At installation of the heater check that its case had no contact both with a floor and with other parts of a cabin or a manned compartment. See Figure 8.2 for how to position mounting holes to install the heater into the motor vehicle casing.

At installation to the heater of air ducts, they shouldn't have the deformations reducing the section through passage of an air duct. The maximum length of an output air duct shouldn't exceed 5 meters of total length.

ATTENTION ! To ensure reliable performance, follow the above recommendations carefully. Install the heater horizontally as shown in Figure 8.1.

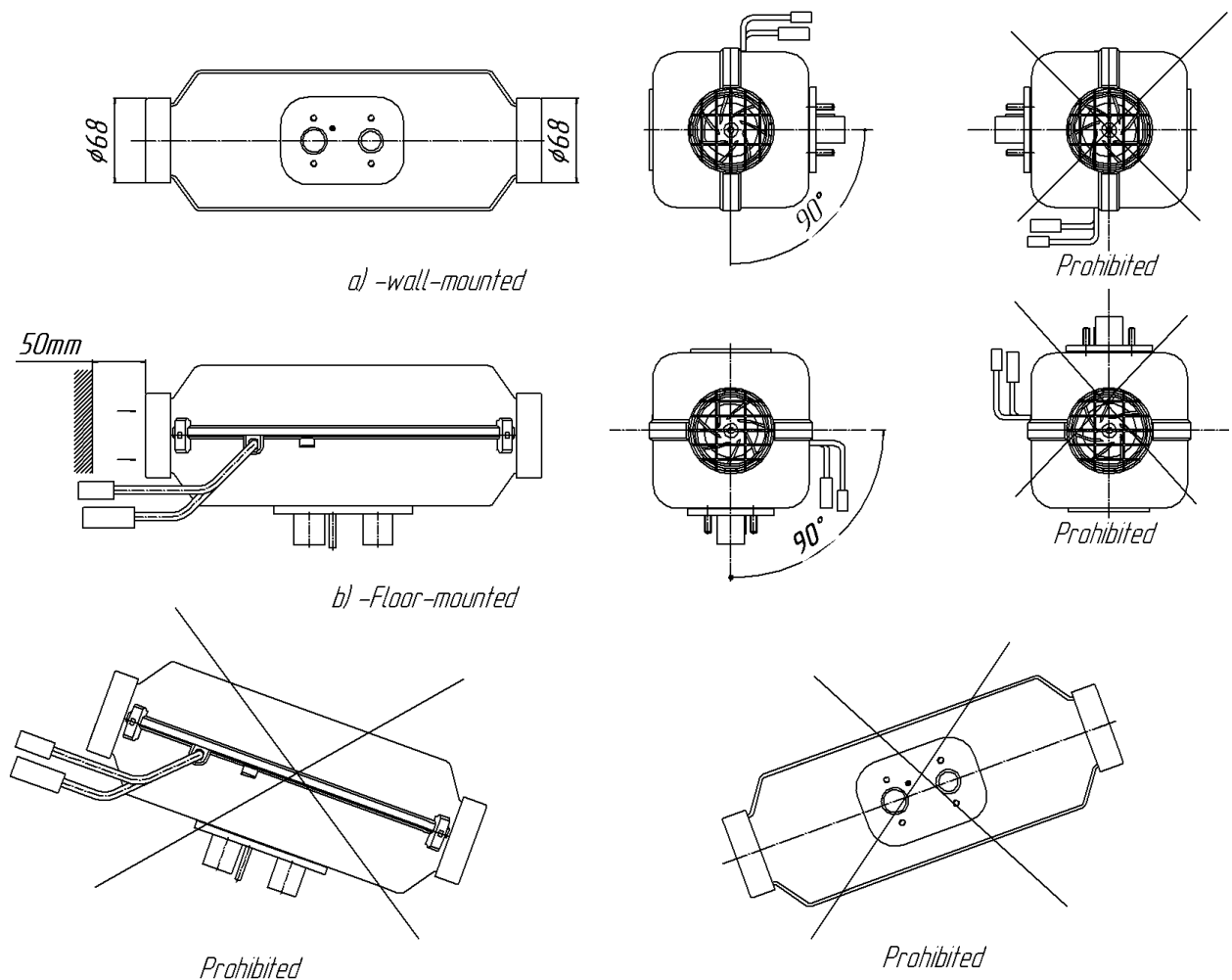


Figure 8.1 – Variants of installation of a heater.

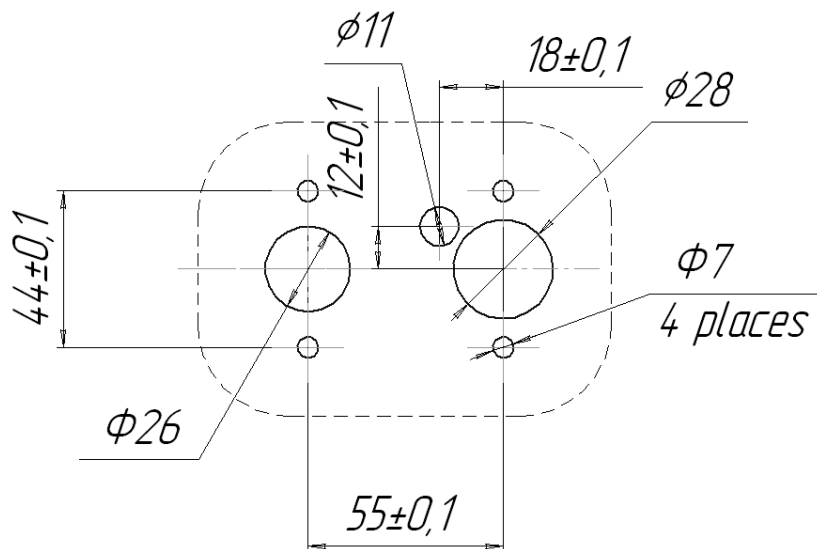


Figure 8.2– Mounting Holes Used for Heater Installation

8.2 Air Inlet Installation

Air necessary for burning, should not be soaked up from salon or a cabin and a car luggage space. Position the pipe's air inlet vent to prevent snow entering or choking the pipe and to allow incoming water to run off. **The entrance aperture of an air inlet is forbidden to have against a running air stream at car movement.**

8.3 Exhaust Pipe Installation

When installing the exhaust pipe, be mindful of its high operating temperature. Cut the exhaust pipe (a flexible corrugated metal hose) to size. Fix the exhaust pipe in place using clamps and position it at a slight angle following the trajectory of gas flow. To protect some parts of the vehicle (electric wiring and other harness) from high temperatures, there must be heat insulation installed.(pos.3, fig.7.1)

To achieve a tight fit, prior to connecting the exhaust pipe to the heater pipe, make a saw-cut of about 15mm along the length of the exhaust pipe without going beyond the gripped part of the pipe. Ensure that the end of the exhaust pipe does not come into contact with the rubber seal of the heater. Direct exhaust gas outside. Position the gas outlet vent and the air inlet vent in such a way as to prevent exhaust gas from entering the combustion chamber. Ensure that exhaust gas does not enter the passenger compartment of the vehicle and that it does not get sucked in through the vehicle fan.

Do not allow exhaust gas to affect the performance of vehicle components. Position the exhaust pipe outlet vent so as to prevent snow entering or choking the pipe and to allow incoming water to run off. At the vent of the exhaust pipe the screen is installed, this necessary for stable operation of the heater while working low idle. If this screen is not installed, install it according fig.7.1

The exhaust outlet of an exhaust pipe is forbidden to have against a running air stream at car movement.

8.4 Installation of a fuel tank on the car

The fuel tank is established according to figure 8.3. A fuel tank it is necessary to have so that the exit of fuel which can flow out from its bulk mouth, on the earth was provided.

The bulk mouth of a fuel tank should not be in salon, a luggage carrier, in a motor compartment. If the bulk mouth is located on a vehicle lateral face the filler cap in the closed position should not support car's body dimensions. Fuel which can spill at filling of a fuel tank, should not get on exhaust systems and electro wires. It should be taken away on a ground.

For the purpose of an exception of leak of fuel from a fuel tank by gravity at infringement of tightness of the fuel pump, a fuel tank it is preferable to have so that the fuel maximum level was below a cut of a fuel tube of a heater.

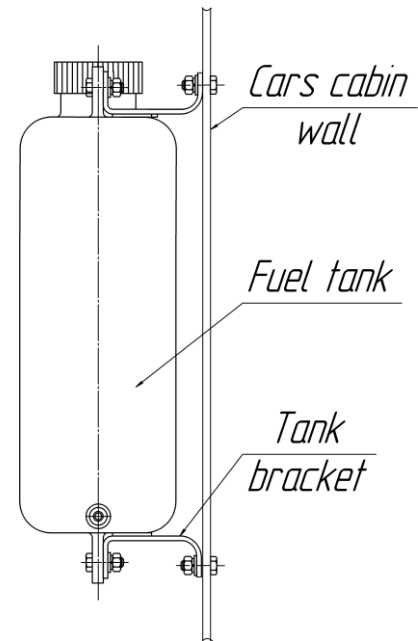


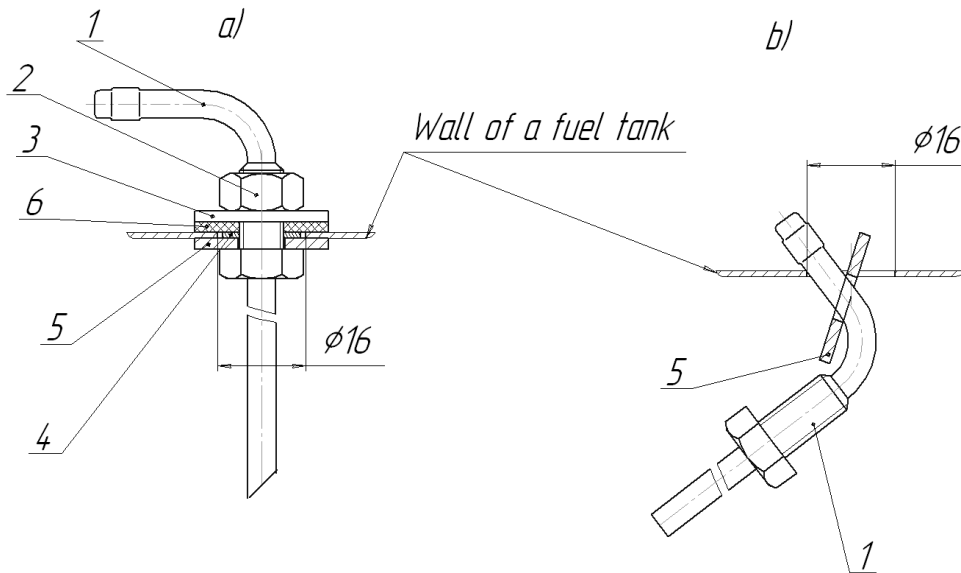
Figure 8.3 - Installation of a fuel tank on the car

ATTENTION!

Before a heating season it is necessary to check a fuel tank. If the fuel was stored long time in a tank (for example from last heating season), it needs to be removed! To wash out a tank with gasoline or kerosene and to fill in new diesel fuel. This procedure is intended for removal of a deposit in fuel at long storage. Not performance of this procedure can lead to a contamination or failure of the fuel pump and the raised sooting in the combustion chamber.

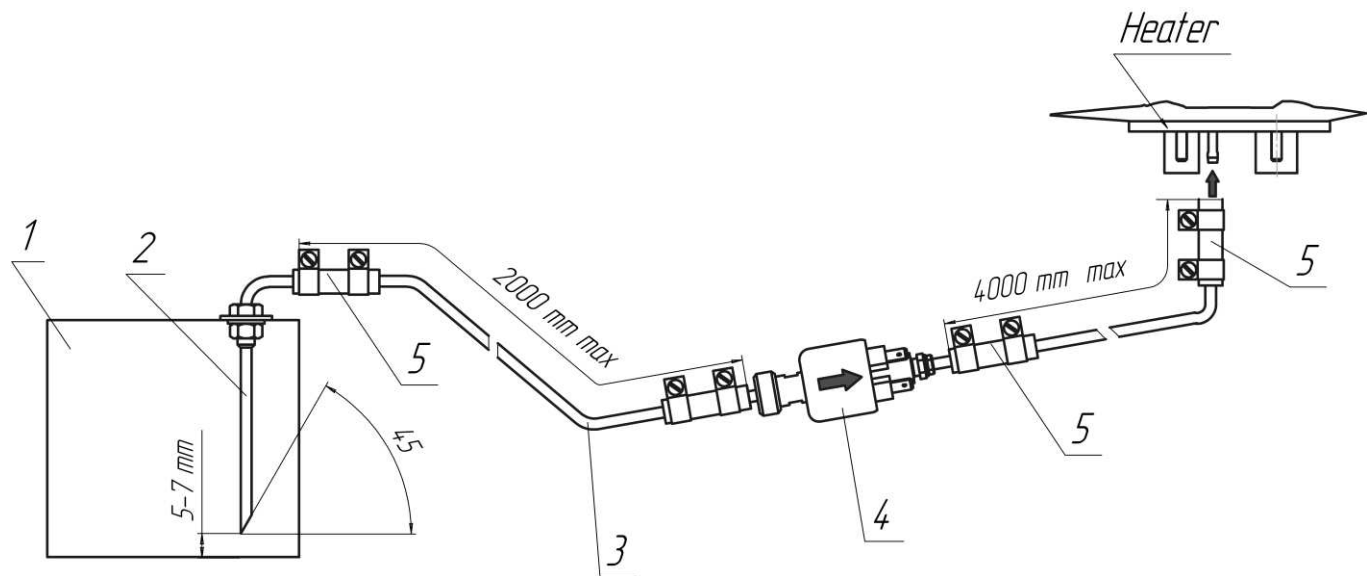
8.5 Installation a fuel supply intake in a regular tank of the car

Fuel can enter the heater through a fuel supply intake from the regular fuel tank of the car. Fuel supply intake must be installed into regular fuel tank of the car according to fig. 8.4,a). Perform installation of special washer with fuel supply intake to the tank inlet according to fig.8.4,b) Perform installation of the fuel supply line from fuel supply intake to the heater according to fig.8.5.



- 1 - fuel supply intake
- 2 - nut M8
- 3 - washer 8
- 4 - washer 8
- 5 - special washer
- 6 - gasket

Fig 8.4 – Fuel supply intake installation in a regular tank of the car



- 1 – regular fuel tank of car
- 2 – fuel supply intake
- 3 – fuel supply line d=2 mm
- 4 – fuel pump
- 5 – sleeve

Figure 8.5 – Installation Diagram for Heater Fuel Supply System Using a fuel supply intake

8.6 Installation of Heater Fuel Supply System

8.6.1 Installation of Heater fuel pump

The fuel supply pump should be mounted as close to the fuel tank as possible and positioned below the tank's lower fuel level.

The scope of supply heaters enters fuel pump manufacturing ADVERS company. The spatial position of the fuel supply pump must comply with figure 8.6 (preferably in a vertical position).

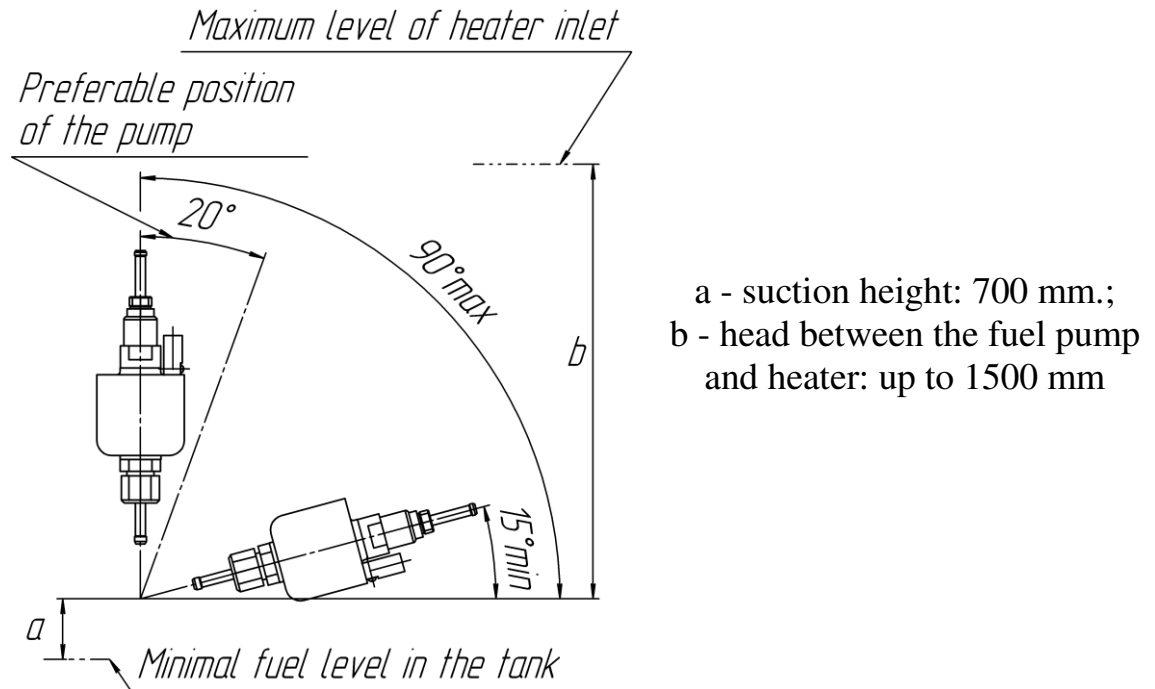


Figure 8.6- Permissible mounting position of fuel pump

8.6.2 When installing the fuel supply line, do not allow connecting sleeves to bend. Use a sharp knife to cut the fuel tube as in Figure 8.7. The cutting location shall be free of indentations, hairs and must not restrict flow through the tube.

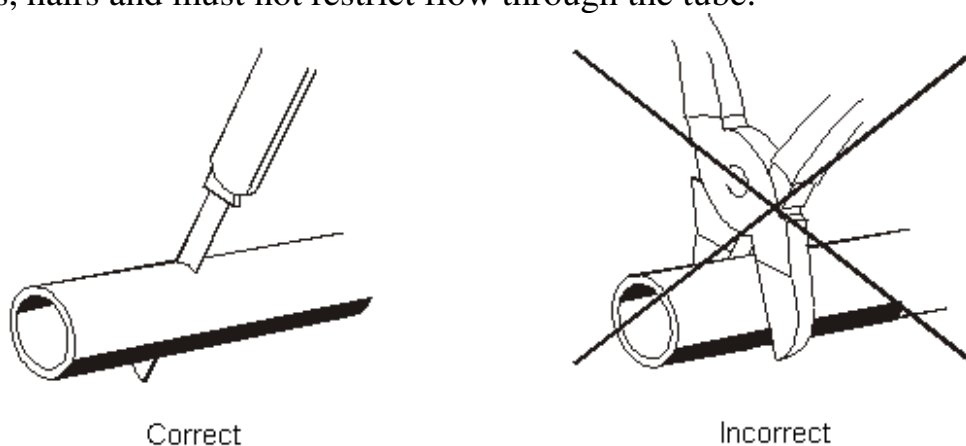


Figure 8.7 – Tube Cutting Prior to Installation

ATTENTION 1. Do not allow the fuel supply line or fuel supply pump to overheat. Do not install the fuel supply line and fuel supply pump near the exhaust pipe or on top of the engine.

2 The fuel supply line connecting the fuel supply pump to the heater should be installed at the same lifting angle.

8.7 Installation of Heater Electric Circuit

Heater wire harnesses shall be installed in compliance with the heater wiring system as shown in Figure 4.1. When installing, do not allow the wire harnesses to become overheated, deformed or dislodged during vehicle use. Attach the harnesses to the vehicle fittings using plastic clamps.

Attention! Remove the fuse prior to installation.

8.8 Installation the sensor in a cabin.

The sensor in a cabin (fig. 8.8) is intended for air temperature measurement in a zone of its installation and allows to work in a mode of maintenance of the set temperature within $15 \div 30^{\circ}\text{C}$.

The sensor is installed in a cabin (or the manned volume of vehicle) in a place convenient for the driver (personnel). The maximum length of a cable of the sensor is 5000mm. After installation the of the sensor it must be connected to the XS4 socket of the heater.

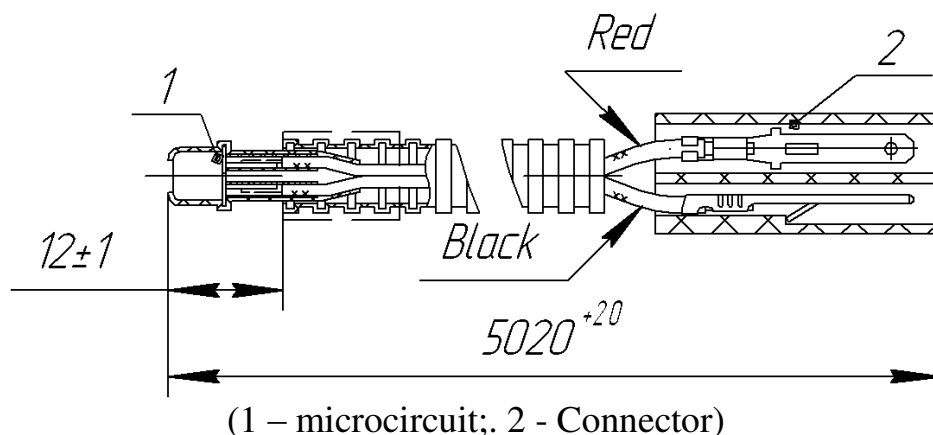


Figure 8.8 – The sensor in a cabin.

8.9 Installation the electromagnetic locking valve.

The electromagnetic locking valve serves for giving or overlapping of supply of fuel in a heater. The valve is installed in front of the fuel pump and prevents supply of fuel in idle at present a heater. Normally the valve — is closed. When giving on valve the supply voltage the coil of an electromagnet takes away a rod with a locking element from a saddle of the valve and opens the pass for a fuel. At removal of supply voltage from the valve the returnable spring presses a rod with a locking element to a saddle of the valve blocks the pass for a fuel.

9. Post-installation Testing

9.1 When installing, ensure that:

- the fuel supply lines of the fuel supply system are leak-proof and all clamps are securely tightened,

- the electric contacts of the harnesses and heater elements are securely installed,

9.2 Install fuse 25A .

9.3 Fill the fuel pipe system with fuel with the help of fuel pumping device (fuel pumping device YIT-1 can be ordered at manufacturer) or repeated inclusion of a heater. After filling the system check that the fuel pump system is not leaking.

9.4 Check that the heater is working on min and max modes:

The process of activation begins with purging of the combustion chamber. After purging the process of combustion begins and the heater goes on working in operation mode.

9.5 Deactivate the heater. While switching off the heater the fuel stops entering and the process of ventilation of the combustion chamber and heat exchanger starts.

9.6 Activate the heater while the vehicle engine is running and ensure that the heater is operational.

ATTENTION! 1 When performing initial ignition following installation, the fuel supply line should be filled with fuel using a fuel pumping device until the fuel level reaches the inlet plug of the heater. If there is no pumping device, restart the heater as many times as necessary to fill the fuel supply line.

2 Remember that each time the heater fails to start at the first attempt, the heater will be restarted automatically by the control unit. If the heater is not activated after 2 attempts, there will be malfunction code on the Control panel.

10. Recommendations

10.1 To ensure consistent performance, the heater should be switched on for up to 5 minutes each month throughout the year (warm seasons included). This will prevent the moving parts of the fuel supply pump from sticking, (which may be caused by leaving the heater movable fittings in low-quality fuel for a long period of time).

10.2 Reliable performance depends on the type of fuel used depending on the atmospheric temperature.

10.3 Check **the battery charge level** on a regular basis.

10.4 Reliable operation of heater depends on the type of fuel used. Type of fuel should be in accordance with GOST 305-82, depending on the ambient temperature (see Table 10.1). May be used and the mixture of fuel according to Figure 10.

10.5 While long storage of the vehicle it is recommended to switch off the heater from the vehicle battery to avoid its discharging (current consumption in non operation mode 30-40 mA).

Table 10.1

Ambient temperature, °C	Fuel type or blend
0°C and above 0°C	Diesel JI-0, 2-40 Or JI-02-62 ГOCT 305-82
0°C – -5°C (32°F – 23°F)	Diesel 3-0,2 mines 35 ГOCT 305-82
-5°C - - 20°C (23°F - -4°F)	Diesel 3-0,2 mines 35 ГOCT305-82 or Diesel 3-0,2 mines 45 ГOCT305-82
Lower then -20°C (-4°F)	Diesel A-0.4 ГOCT 305-82

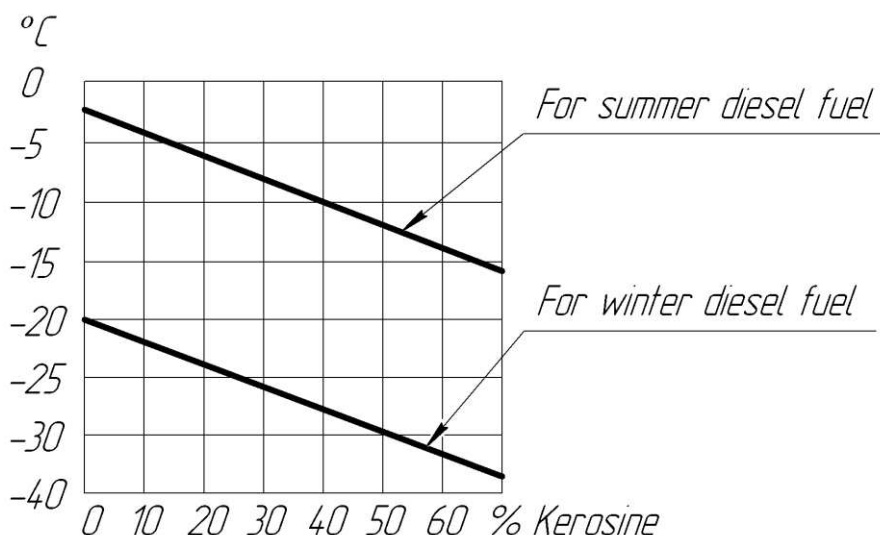


Figure 10 - Amount of kerosene mixed with diesel fuel, depending on the ambient temperature.

11. Remedial Procedure for Heater Ignition Problems

11.1 Certain problems may be solved without contacting a maintenance station. If the heater does not operate when switched on, proceed to the following steps:

- 1) Check the fuel level in the tank and in the fuel supply line beyond the fuel supply pump;
- 2) Check fuse 25A;
- 3) Check to see that all the contacts of the connectors and the fuse block are securely joined (contact corrosion is possible);
- 4) disconnect blocks XP2 and XS2 of the power supply harness connector (fig 4.1) for 1-2 min and then connect them.

11.2 All other types of heater malfunction will be indicated automatically on the control panel according to the malfunction code.

11.3 If there are malfunctions except those specified in 11.1 does not remedy any of the problems that you may be having, please contact an authorized maintenance station.

ATTENTION! The heaters completed with glow plug with a glow pin of production of Japan. This glow plug need to be checked for working capacity giving on it voltage 9V (for heaters with voltage 12V) or 18V (for heaters with voltage 24V).

12. Transportation & Storage

12.1 The heaters are safe to transport and may be transported by any means of transport, including air and rail transport providing the packed products are protected from atmospheric precipitations and climatic factors as per requirements specified in Section 5 of GOST 15150-69 and mechanical effects as per requirements specified in Category C of GOST 23216-78.

12.2 As far as climatic factors are concerned, transportation and storage conditions shall comply with storage requirements set out in Section 2 of GOST 15150-69.

12.3 Heater period of storage in packing of the enterprise of the manufacturer - 24 months

13. Warranty

13.1 The warranty term of exploitation of heater outflows under reaching one of next terms:

- the term of exploitation attained 18 months after the sale of good;
- good worked a warranty resource - 1000 hours;
- mileage with established heater exceeds 50,000 km.

13.2 Appointed tenure of employment of heater - 3000 hours.

13.3 In default of stamp of organization with naming the date of sale a warranty term is calculated from the date of making of heater.

13.4 A manufacturer does not accept claim on incompleteness and mechanical damages after sale of heater.

13.5 A producer guarantees normal work of the heater on condition of observance by the consumer of all rules of exploitation, transportage and storage, indicated in this guidance. If a malfunction was found out during a warranty term, then she will be set free of charge. Installation of heater the organizations authorized by a producer must conduct. In this case, the warranty card is filled column «Information on installation.»

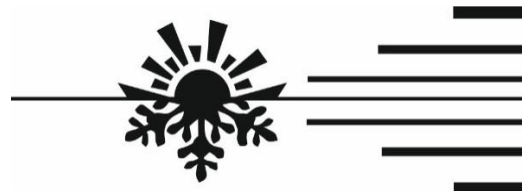
Warranty obligations do not spread to the defects arising up as a result :

- force-majeure circumstances: shots of lightning, fire, flood, impermissible violations of supply voltage,
- road a transport incident;
- failures to observe of rules of exploitation, storage and transporting;
- repair or adjusting, if they are conducted by the organizations, not authorized by a producer on installation of the heater and warranty repairing;
- refuse of work of heater by reason of contamination of combustion chamber;
- violations of work of electrical equipment of car;
- independent repair of heater or the use of unoriginal spare parts.

You can watch the list of the enterprises which are carrying out guarantee repair of products on a site www.autoterm.ru

Concerning maintenance, contact LLC Service Company Samara (t. +7(846)207-05-20) or on a site www.autoterm.ru in a forum.

Заметки / Notes



Operating Manual
PU-27
Control Panel



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Introduction

This Operating Manual is part of the documentation for hydronic pre-heaters and air heaters (hereinafter referred as the product). The Manual contains information for the user on safe maintenance of the product.

This control panel is compatible with the following products:

pre-heaters:

- 14TC-10
- 14TC-mini
- BINAR-5S

air heaters:

- Planar 2D
- Planar 4D
- Planar 44D
- Planar 8D

For detailed information on product models supported, please visit www.autoterm.ru

In case of any problems, we strongly recommend that you contact authorized service centers, the addresses and phone numbers of which you can obtain from the seller or on the www.autoterm.ru website.



Before operating the pre-heater, read this operating manual and the pre-heater (heater) operating manual.

Warranty and liability

The manufacturer will not be liable for defects and damage caused by failure to follow the product installation and maintenance instructions.

- The control panel can only be used to control products from the list of compatible products.
- Do not connect and disconnect the control panel connector while the product is operating.
- After the product is switched off, it should not be switched on again for at least 5–10 seconds.
- For safe product operation, after two unsuccessful attempts to start the product in a row, contact the service department for troubleshooting information.
- The warranty operating period of the control panel is 18 months from the date of sale, provided the operation, transportation and storage rules are followed by the consumer.
- The warranty storage period is 24 months from the product packing date.
- In the absence of a company stamp indicating the sale date, the warranty period is calculated from the date of manufacture.

This warranty does not cover defects appearing as a result of:

- force majeure circumstances, including lightning strike, fire, flood, impermissible voltage surges or traffic accidents;

- failure to follow the rules for installation, operation, storage, and transportation specified in the Operating Manual;
- use of the control panel for purposes other than intended.

Safety

Do not switch on and operate the product in locations where combustible vapors or gases or large amounts of dust can form and accumulate (for example, filling stations or petroleum, fuel, coal, timber or grain storage facilities). Explosion hazard.

Do not switch on and operate the product in enclosed or non-ventilated premises. Hazard of poisoning and asphyxiation by exhaust gases.

Do not switch on and operate the product if combustible materials or fluids are present in the exhaust gas. Fire hazard.

Do not use a faulty product. Injury hazard due to use of faulty device.

Purpose

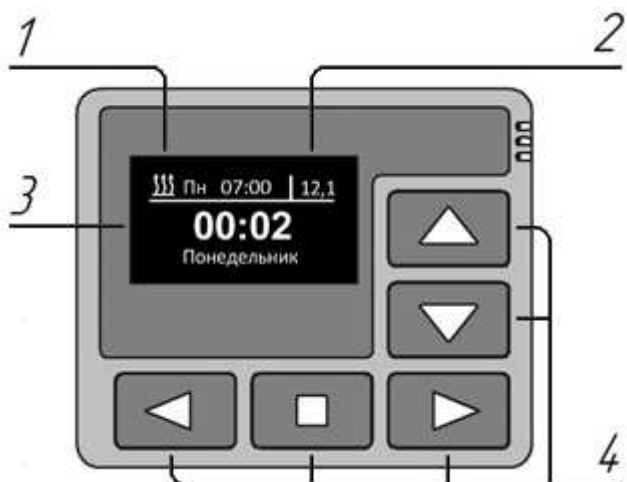
The control panel is designed for:

- manual start and shutoff of the product;
- manual start and shutoff of the pump (for the pre-heater);
- manual start and shutoff of ventilation (for the heater);
- fluid temperature display (for the pre-heater)
- power supply voltage display;
- current time and operating time display;
- activation of the product startup timer;
- economy mode activation (for the pre-heater);
- additional heater operation mode selection (for the pre-heater);
- display of malfunction code in case of product malfunctions;
- display of control panel and control unit software version.



The control panel interface depends on the product it is connected to.

Control panel external view



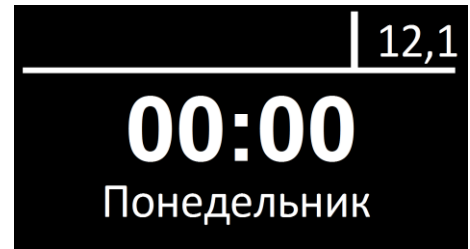
- 1 – activated startup timer.
- 2 - power supply voltage.
- 3 – LED indicator.
- 4 – control keys.

Starting control panel operation




After connecting the control panel to the product, the control panel software version and the process of establishing connection with the product will be displayed.

After the connection is established, the main screen (current time, day of week and power supply voltage) will be displayed.



Main screen













Action of keys in the main screen:

Keys	Action
	Navigation between the main screen and temperature sensors screen.
	Enter the main menu.
	Start product.

Main menu

Switch to the main menu from the main screen by clicking the  or  key.

Menu icon	Description
	Startup timers menu.
	Product operating parameters setting menu. <i>(*this menu cannot be used for products without settings).</i>
	Control panel settings menu.
	Current time and day settings menu.
	Language settings menu.
	Software version display menu.
	Pre-heater operating time setting menu. <i>(*this menu cannot be used for air heaters).</i>

Action of main menu keys:	
Keys	Action
	Navigation through the main menu
	Activation of selected menu item
	Exit from the main menu to the main screen

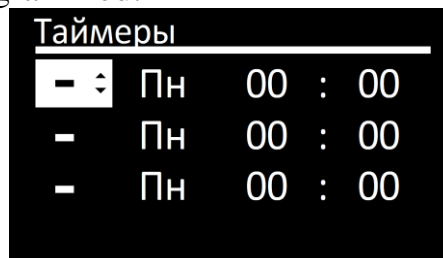


Timers settings menu

The control panel allows the startup timers to be programmed.

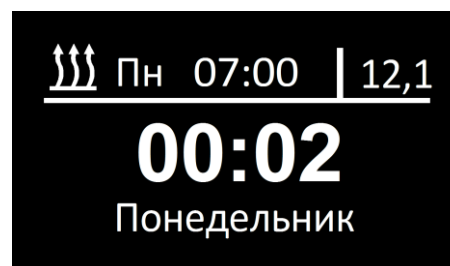
For startup timer setting, the following data must be indicated:

- startup time in 24-hour format;
- day of week (Mon. - Sun.) or select daily startup (Daily);
- activated timer:
 - activated -
 - non-activated -



Only a single timer can be activated. After editing of the timers is completed, press the key to switch to the main screen.

When the timer is activated, the activated timer icon, day of week and startup time will appear in the upper left corner of the main screen.




In case of product power loss, timer settings are saved and timer activation is reset.

Action of the Timers menu keys:

Keys	Action
	Navigation through the menu items
	Change menu item value
	Exit from this menu to the main screen






Fast access to startup timers activation menu

For fast access to the timer activation menu from the control panel main screen, press and hold the  key.



This menu is only intended for timer activation.
Timers cannot be edited in this menu.

Action of timers activation menu keys:

Keys	Action
 , 	Navigation between timers.
	Timer activation / deactivation.
 , 	Exit from this menu to the main screen



Hydronic pre-heaters settings menu

BINAR-5S heater settings menu:


Binar-5S	
Тжд. подогр.	89
Догреватель	-
Тжд. догреват.	85

“Settings” menu items:

<p>Pre-heater fluid T</p>	<p>Fluid temperature at which the pre-heater switches to standby mode (heater shuts off and pump continues to operate). When the fluid temperature drops, the pre-heater exits standby mode (the heater starts again). The default value for the switch to standby mode is +88 °C. The temperature for the switch to standby mode can be set in the +20 to +95 °C range.</p>
<p>Additional heater</p>	<p>In the additional heater mode, the pre-heater operates with the engine and maintains the set fluid temperature.</p> <ul style="list-style-type: none"> - Additional heater mode is OFF. <p>Additional heater automatic operation. If the pre-heater is off, after the vehicle engine starts, the pre-heater will start automatically. After the engine stops, the pre-heater will shut off automatically.</p> <p>If the pre-heater is on, after the vehicle engine starts it will switch to additional heater mode automatically.</p> <p>Additional heater manual operation. If the pre-heater is off, after the vehicle engine starts, the pre-heater will not start automatically (manual start is required). If the pre-heater is on, after the vehicle engine starts it will switch to additional heater mode automatically.</p>
<p>Additional heater fluid T</p>	<p>Additional heater temperature setting. The required temperature value can be set in the +75 to +95 °C range. The default temperature is +85 °C.</p>

Additional heater pump standby	<p>Setting pump operation in standby mode. In the additional heater mode, after the heater switches to standby mode, the pre-heater shuts off and the pump continues to operate. Depending on this setting:</p> <ul style="list-style-type: none"> - The pump operates continuously (from the moment of start to the moment of pre-heater shutoff). ✓ The pump operates simultaneously with the pre-heater and does not operate in standby mode.
Heater	<p>Setting of interior heater activation (provided the relay harness is connected to the heater).</p> <ul style="list-style-type: none"> - The interior heater is not activated while the pre-heater is on. ✓ While the pre-heater is on, the interior heater starts automatically, depending on the fluid temperature.
Heater T	<p>Setting of interior heater activation temperature. The required temperature value can be set in the +30 to + 60 °C range. The default temperature of relay activation is + 40 °C.</p>
Pump with engine	<p>Setting of pump activation when the engine starts. The pump, operating together with the heater, can be used for additional circulation of coolant during vehicle engine operation. The pump will activate automatically after the engine starts and will switch off after engine shutoff.</p> <ul style="list-style-type: none"> - The pump will not start. ✓ The pump will start when the engine starts.
Pump selection	<p>Pump selection depending on configuration, pre-heater</p> <ul style="list-style-type: none"> - Bosch pump ✓ ADVERS pump
Alarm channel	<p>Setting of pre-heater control with the alarm channel. <i>(provided the pre-heater is connected to the alarm system and a free channel is available).</i></p> <ul style="list-style-type: none"> - Pre-heater control OFF ✓ Control ON.
Reset settings	<p>Reset pre-heater settings to default values.</p>

Action of Settings menu keys:

Keys	Action
	Navigation through the menu items



Exit from menu to the main screen



Change menu item value



Air heaters settings menu

Отопитель

По Т отопителя

По Т пульта




По Т внешнего

Settings menu items:

Heater T based	In the “heater T based” mode, the “Set temperature” of the temperature sensor located in the heater is used for operation.
Control panel T based	In the “control panel T based” mode, the “Set temperature” of the temperature sensor located in the control panel is used for operation.
Exterior T based	In the “exterior T based” mode, the “Set temperature” of the exterior temperature sensor is used for operation.
Power based	In the “Power based” mode, the “Set power” is used for operation.
Set power	Heater power value in the 0 to 9 range, where 0 is minimum and 9 is maximum power.
Set temperature	The value at which the heater will switch to standby mode. The heater will switch from standby mode when the temperature of the sensor used to control heater operation drops 5 °C below the “Set temperature” value.
Ventilation	Ventilation mode ON setting - Ventilation mode OFF. When the heater switches to standby mode, the air pump will shut off. ✓ Ventilation mode ON. When the heater switches to standby mode, the air pump will continue to operate in ventilation mode.

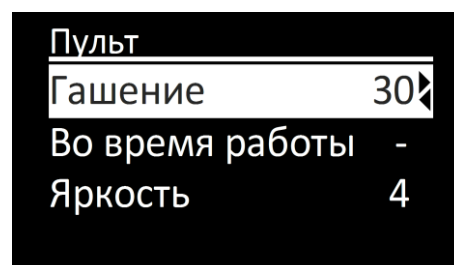
Action of Settings menu keys:

Keys	Action
------	--------

	Navigation through the menu items
	Exit from this menu to the main screen
	Change menu item value

Parameters settings menu




This menu is intended for setting control panel parameters.



Parameters menu items:	
Dimming	Setting of indicator lighting time. By default, the control panel indicator lighting time is 30 seconds. The light duration can be set in the 10 to 120 sec. range with a 1 sec. step, or to set continuous lighting; in the latter case, the “-“ sign will appear on the display.
During operation	Setting of indicator lighting during operation. - the indicator is dimmed while the pre-heater is on. ✓ the indicator is constantly lit while the pre-heater is on.
Brightness	Setting of indicator light brightness. Indicator light brightness is set in the 0 to 4 range. The brightness default value is 4.
Click start	Setting of start by clicking key for pre-heater/heater start. - Click – pump/ventilation start. Press and hold – pre-heater start. ✓ Click – pre-heater start. Press and hold – pump/ventilation start.
Clock adjustment	Setting clock adjustment. The clock accuracy may vary slightly due to low temperatures. The required adjustment can be set in the -59 to +59 seconds per day range. The correction default time is 0.

Keys lighting	Keys lighting setting. ✓ - keys lighting ON. - keys lighting OFF.
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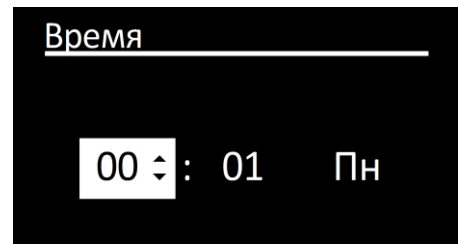
Action of Parameters menu keys:

Keys	Action
	Navigation through the menu items
	Change menu item value
	Exit from this menu to the main screen




Time settings menu



Current time is set and displayed in a 24-hour format. When the control panel power is shut off, the current time is set to zero and the day is reset to Monday.



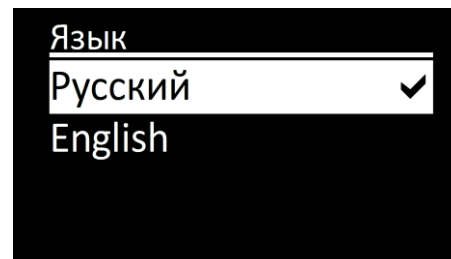
Action of Time menu keys:

Keys	Action
	Navigation through the menu items
	Change menu item value
	Save changes and exit from this menu to the main screen





Language settings menu

This menu is intended for interface language selection.



Action of Language menu keys:

Keys	Action
	Navigation through the menu items
	Confirmation of language selection and exit from this menu to the main screen

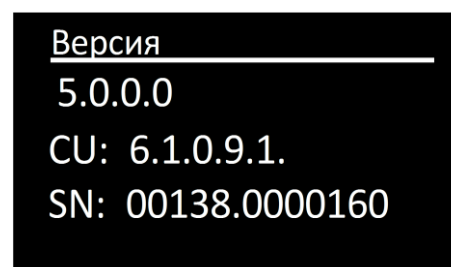


Software version display menu

In this menu, the information on software versions is displayed.

- control panel software version;
- product control unit software version;
- Product serial number.

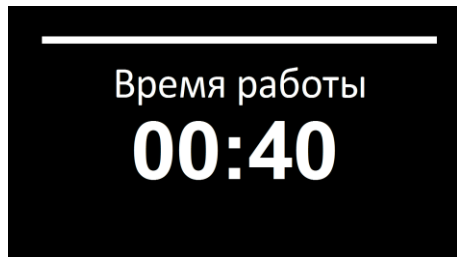
Press any key to exit.



Operating Time settings menu



This menu is intended for setting pre-heater operating time with a 5 minute step. The operating time setting range depends on the product the control panel is connected to.

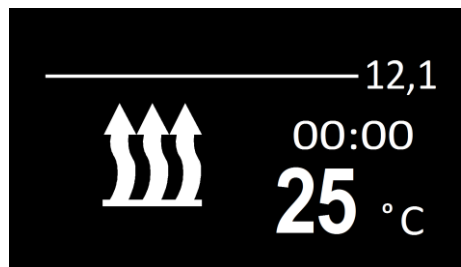


Action of Operating Time menu keys:	
Keys	Action
	Value editing.
	Confirmation of set value and exit from this menu to the main screen

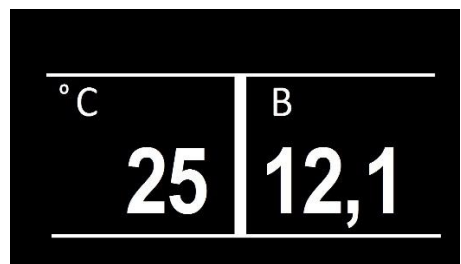
Hydronic pre-heater start



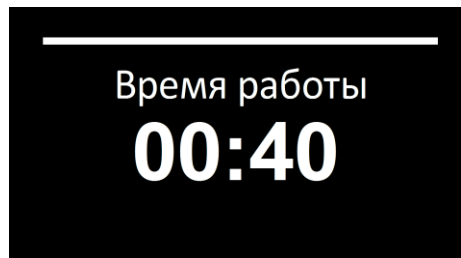
Start of pre-heater from the main screen or from the temperature sensors screen. The indicator will appear as follows. The pre-heater operating time count will be started.



Full-screen display of current coolant temperature and power supply voltage.



When the pre-heater is operating, enter the pre-heater operating time editing menu.



Pre-heater shutoff.



Air heater start



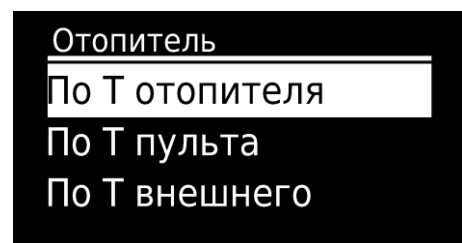
Start of heater from the main screen or from the temperature sensors screen. The indicator will appear as follows.



Temperature sensors display.



When the pre-heater is operating, enter the pre-heater operating time editing menu.



Heater shutoff.



Economy mode ON / OFF.
(for 14TC-mini and 14TC-10)



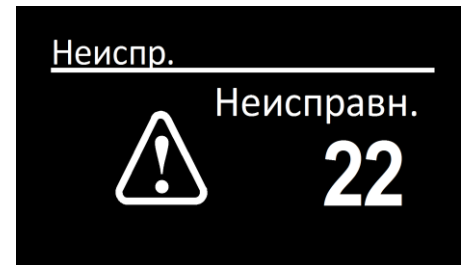
Pre-heater shutoff.



Malfunctions



Malfunctions occurring during pre-heater operation are coded and automatically displayed on the control panel display. For malfunction reset, press any key. The malfunction codes depend on the product the control panel is connected to. See malfunction code descriptions in the product operating manual.



ATTENTION!

Maintenance and repair should only be performed by trained, qualified personnel!

Acceptance and packing certificate

PU-27 control panel, serial number _____

Is manufactured and accepted in accordance with the applicable technical documentation and found suitable for operation.

Packing performed

_____ *Surname*

_____ *signature*

Production date _____

Department _____

Stamp Here QC

Notes

MANUAL

CONGRATULATIONS

on the purchase of your new CTEK charger providing professional battery care. This charger is included in a series of professional chargers from CTEK SWEDEN AB and represents the latest technology in battery charging. With the CTEK D250SA and SMARTPASS 120 you can be sure of getting maximum performance from your dual battery system.

SAFETY

CALIFORNIA PROPOSITION 65

WARNING: This product contains chemical known to the state of California to cause cancer or reproductive toxicity.

- The D250SA and SMARTPASS 120 have been developed for 12V lead-acid batteries. Do not use the unit for any other type of battery.
- Wear protective goggles when connecting and disconnecting batteries.
- Battery acid is corrosive. Rinse with plenty of water immediately if you get acid on your skin or in your eyes. Get medical assistance.
- Never use a charger with damaged electric cables. Check that the cables have not been damaged by hot surfaces, sharp edges or in any other way.
- Explosive gases are generated while lead-acid batteries are being charged. Avoid any sparking near the battery. Use in a well-ventilated location.
- Never place the charger above the battery, and avoid covering the charger during charging.
- Disconnect the battery terminal posts before installing.
- The D250SA and SMARTPASS 120 are not spark-free.
- The installation must include a fuse in accordance with the recommendations in the table "CABLE AND FUSE RECOMMENDATIONS".



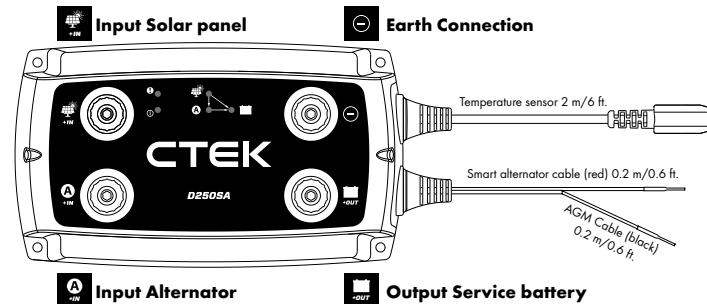
WARNING!

The D250SA and SMARTPASS 120 are not protected against reversed polarity.

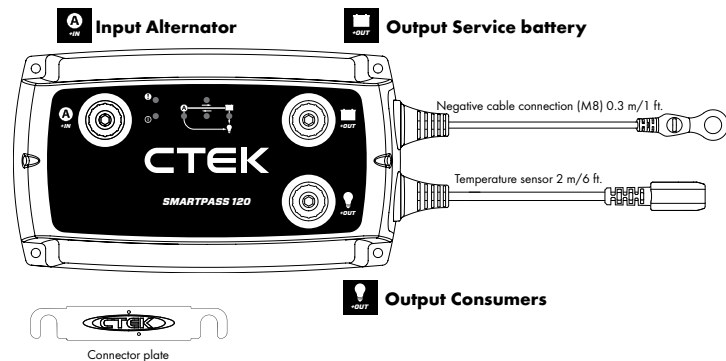
Remember that all installations in boats must comply with ISO 10133!

1. The cabling from the batteries must have fuses near the batteries.
2. The batteries must be securely fastened in a ventilated space.
3. The cabling must be run through pipe ducting, separately from 230V/110V wiring (mains power), or secured by clips at every 30 cm/1 ft.
4. Cabling in the engine compartment must be temperature rated at 70°C/ 158°F.

D250SA



SMARTPASS 120



D250SA

- The D250SA is a DC to DC battery charger for a dual battery system with a starter battery and a service battery.
- The D250SA charges the service battery either from an alternator or from a solar panel, or from a combination of both.
- The D250SA separates the batteries in a dual battery system and thereby replaces, for example, a separation relay, VSR (Voltage Sensitive Relay), diode isolator or a mechanical battery selector.
- The D250SA can be used on its own or in combination with SMARTPASS 120. In combination, the D250SA and SMARTPASS 120 can charge at up to 140A.

FUNCTIONS:

- **Charging service battery from a conventional alternator (constant charging voltage)**
The D250SA charges a service battery at up to 20A from the start battery when a conventional alternator is running. This function is switched off when the engine is not running to prevent discharge of the starter battery.
- **Charging of a service battery from a smart alternator (with variable charging voltage)**
The D250SA can charge a service battery at up to 20A from the starter battery when a smart alternator is running. This function is switched off when the engine is not running, so as not to discharge the starter battery. The Installation section describes how the D250SA needs to be connected in order to activate the smart alternator functions.
- **Charging a service battery from a solar panel**
The D250SA can charge and trickle charge a service battery from a solar panel at up to 20A. The D250SA uses MPPT (Maximum Power Point Tracker) to maximise the power from the solar panel.
- **Separation of the starter battery and the service battery**
The D250SA separates the starter battery from the service battery when the engine is not running.
- **Temperature compensated charge voltage**
The D250SA optimises the charge voltage by increasing the charge voltage at temperatures below 25°C/77°F and reducing it at temperatures higher than 25°C/77°F. The functions is always active.
- **Trickle charging of the starter battery from a solar panel**
The D250SA trickle charges the starter battery from a solar panel at intervals of 3 seconds if the service battery is fully charged.
- **Optimised charging of AGM batteries**
The D250SA can provide a suitable charging voltage for optimal charging of AGM (Absorbent Glass Mat) batteries, which require a higher charge voltage than other types of lead-acid battery. The installation section describes how the D250SA needs to be connected in order to activate the AGM battery function.

SMARTPASS 120

- SMARTPASS 120 is a solution for supplying current to charge and manage consumers in a dual battery system consisting of a starter battery and a service battery.
- SMARTPASS 120 separates the batteries in a dual battery system and thereby replaces, for example, a separation relay, VSR (Voltage Sensitive Relay), diode isolator or a mechanical battery selector.
- SMARTPASS 120 connects the starter and service batteries together in order to charge them both from the alternator.
- SMARTPASS 120 protects the service battery from deep discharge which would damage the battery.
- SMARTPASS 120 supplies consumers from the alternator instead of from the service battery while the service battery is charging, which permits faster charging.
- SMARTPASS 120 can be used on its own or in combination with D250SA. In combination, the D250SA and SMARTPASS 120 can charge at up to 140A.

FUNCTIONS:

- **Charging a service battery**
SMARTPASS 120 charges the service battery from the starter battery or another current source that is connected when the alternator is running or when the starter battery voltage is high enough.
- **Battery guard**
SMARTPASS 120 disconnects consumers when the service battery voltage is low in order to avoid deep discharge, which would damage the battery. The consumers are reconnected after the service battery voltage has increased. Connect critical consumers directly to the service battery so they will not be disconnected if the voltage falls to lower than 11.5V.
- **Start assistance**
SMARTPASS 120 automatically connects the service battery to the starter battery for 10 sec to assist, if the starter battery on its own is unable to start the engine. After the start assistance function has been activated, SMARTPASS 120 will display a fault indication until starting has been achieved without using the start assistance function.
- **Separation of the starter battery and the service battery**
SMARTPASS 120 separates the starter battery from the service battery when the engine is not running.
- **Assigning current source priority**
SMARTPASS 120 can sense when the alternator is running and in that case supplies consumers with current from the starter battery to work with the D250SA and maximise charging efficiency. Otherwise the consumers are supplied with current from the service battery.
- **Dynamic overcurrent protection**
SMARTPASS 120 has overcurrent protection to shield the product. Overcurrent protection permits maximum current to be sent from the alternator temporarily so that charging will be accelerated.
- **Battery temperature protection**
SMARTPASS 120 protects the battery by switching off charging if the service battery temperature rises too high.
- **Starter battery trickle charging**
The service battery trickle charges the starter battery without assistance from the solar panel or alternator to compensate for the self-discharge of the starter battery. The service battery charges in 3-second pulses when its voltage is higher than that of the starter battery and the voltage of the starter battery is low.

FUNCTION INDICATIONS

D250SA		Explanation
1		The service battery is being charged by the alternator.
2		The service battery is being charged by the solar panel.
3		The service battery is being charged by both the alternator and solar panel.
4		The service battery is fully charged. The service battery is being trickle charged by the solar panel.
5		Current saving mode, no charging in progress.

SMARTPASS 120		Explanation
1		Current from alternator to service battery and consumers. Current from service battery to consumers.
2		Current from alternator to service battery and consumers.
3		Current from alternator to consumers. The service battery is charged by the D250SA.
4		Trickle charging of the starter battery from the service battery.

CABLE AND FUSE RECOMMENDATIONS

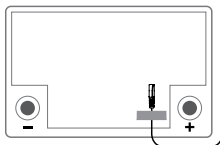
		MIN. CABLE SIZE					FUSE
UNIT	CABLE	0.5 m 2 ft.	1 m 3 ft.	2 m 6 ft.	5 m 15 ft.	10 m 30 ft.	
D250SA		4 mm ² / AWG12	4 mm ² / AWG12	4 mm ² / AWG12	6 mm ² / AWG10	10 mm ² / AWG8	30A
		4 mm ² / AWG12	6 mm ² / AWG10	10 mm ² / AWG8			30A
SMARTPASS 120		4 mm ² / AWG12	4 mm ² / AWG12	4 mm ² / AWG12	4 mm ² / AWG12	4 mm ² / AWG12	
	Connector plate*	4 mm ² / AWG12	6 mm ² / AWG10	10 mm ² / AWG8	10 mm ² / AWG8	10 mm ² / AWG8	
SMARTPASS 120		35 mm ² / AWG2	35 mm ² / AWG2	35 mm ² / AWG2	50 mm ² / AWG1	50 mm ² / AWG1	300A
		35 mm ² / AWG2	35 mm ² / AWG2	35 mm ² / AWG2			300A

*If the D250SA and SMARTPASS 120 are installed in different locations and the accompanying connector plate is not used, please follow the recommendations in the table.

INSTALLATION

1. Install the apparatus on a smooth surface where it can be firmly secured and where it is not exposed to fuel, oil or dirt. To obtain the correct distance, start by fitting the two units together with the accompanying connector plate (see Figure 3) before they are finally fastened to the smooth surface.
2. Secure the apparatus with, for example, M4 or ST4.2 screws at each corner (see Figure 1).
3. Before connecting the cables, ensure that the negative terminal post on the battery is not connected.
4. Connect the cables to the apparatus connections by securing screws (M8) (see Figure 2). Use an Allen key - tightening by hand without a tool is not enough.
5. Use tape (see Figure 4) to secure the temperature sensor to a clean flat surface above the service battery. Position the sensor as close to the positive terminal post as possible.
6. Connect the battery negative terminal post.

Figure 4



WARNING!

The D250SA and SMARTPASS 120 are not protected against reversed polarity. Disconnect the battery terminal posts before installation.



WARNING!

The D250SA and SMARTPASS 120 are not spark-free. Ensure good ventilation.

RECOMMENDED TIGHTENING TORQUES

Figure 1

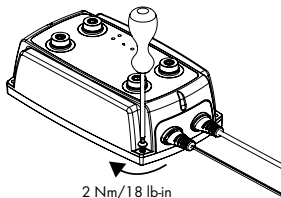
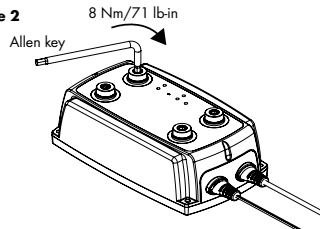
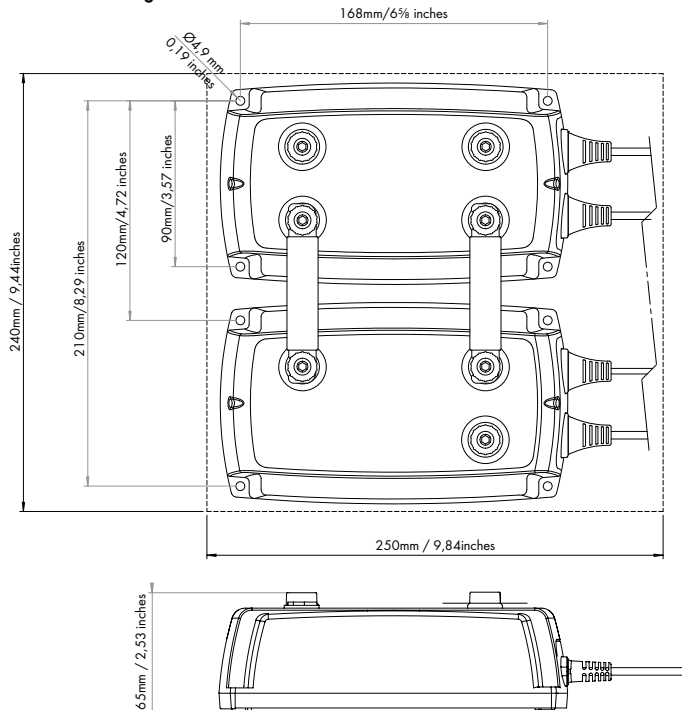


Figure 2



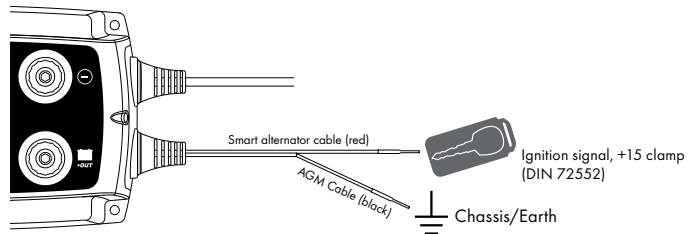
DIMENSIONS

Figure 3



SETTINGS D250SA

Smart alternator cable (red)	Type of alternator	AGM cable (black)	Charging voltage
Not connected	Conventional alternator	Not connected	14.4V
Connected	Smart alternator	Earth	14.7V



SYMBOLS

Fuse		See "CABLE AND FUSE RECOMMENDATIONS"	
Flashing lamp		Continuously lit lamp	
Solar panel		Non critical consumer	
Alternator		Critical consumer	

Connection

Connected to

D250SA		
Input Solar panel		<ul style="list-style-type: none"> Solar panel (* see technical specification) Wind generator * Other DC source *
Input Alternator		<ul style="list-style-type: none"> Starter battery Input Alternator SMARTPASS 120 via connector plate or cable
Output Service battery		<ul style="list-style-type: none"> Service battery Output Service battery SMARTPASS 120
Earth Connection		<ul style="list-style-type: none"> Chassis/Earth Solar panel (-) SMARTPASS 120 (-)
Smart alternator cable (red)		Ignition signal, +15 clamp (DIN 72552)
AGM Cable (black)		Chassis/Earth
SMARTPASS 120		
Input Alternator		<ul style="list-style-type: none"> Starter battery Input Alternator D250SA via connector plate or cable
Output Service battery		Output Service battery D250SA
Output Consumers		Non-critical consumers

INSTALLATION EXAMPLES

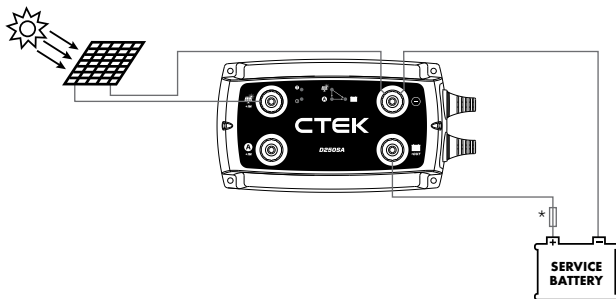
1. Solar panel

PREREQUISITES

Solar panel capable of charging a 40–300Ah service battery. The D250SA uses MPPT (Maximum Power Point Tracker) to maximise the power from a solar panel.

TIP 1

Do not connect two solar panels in series. Max. input voltage 23V.



*See "CABLE AND FUSE RECOMMENDATIONS"

2. Small service battery

PREREQUISITES

A dual battery system where the D250SA charges a 40–300Ah service battery from a generator which also charges a starter battery.

It is advantageous to use this installation when:

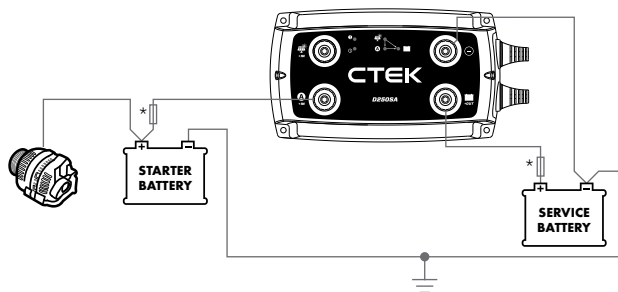
- The alternator is unable to deliver the desired charging voltage.

TIP 2

If the alternator has external voltage detection for the service battery, the voltage detection wiring must be connected to the starter battery.

TIP 3

Complement the D250SA with a SMARTPASS 120 if the service battery capacity is greater than 100Ah or has parallel consumption while charging is in progress. This reduces the charging time.



*See "CABLE AND FUSE RECOMMENDATIONS"

3. Small service battery and solar panel

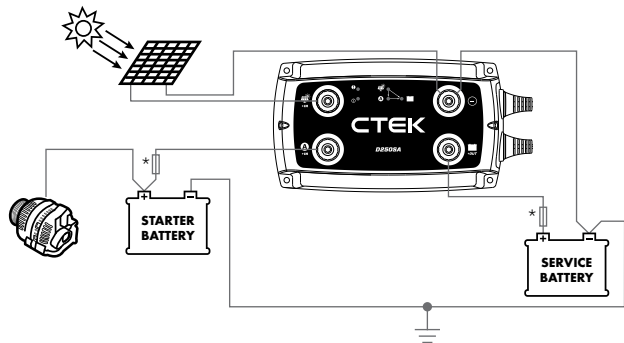
PREREQUISITES

A dual battery system where the D250SA charges a 40-300Ah service battery from a solar panel, an alternator, or both which also charge a starter battery.

It is advantageous to use this installation when:

- The alternator is not able to deliver the desired charge voltage.
- Charging from a solar panel.

See also tips 1, 2 and 3.



*See "CABLE AND FUSE RECOMMENDATIONS"

4. Service battery with parallel consumers

PREREQUISITES

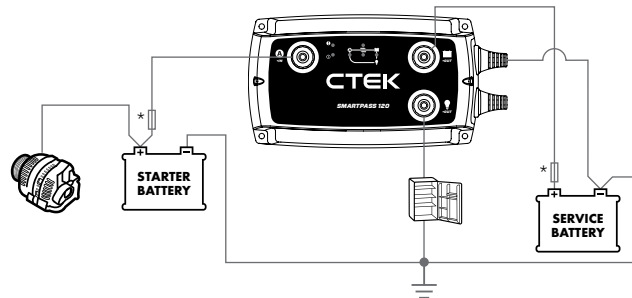
A dual battery system where the SMARTPASS 120 charges a 28-800Ah service battery from an alternator which also charges a starter battery.

It is advantageous to use this installation when:

- The alternator is able to deliver the desired charging voltage.
- The service battery capacity is greater than 100 Ah.

- The consumers are supplied directly from the alternator at the same time as the service battery is being charged.

See also tips 2 and 3.



*See "CABLE AND FUSE RECOMMENDATIONS"

5. Large service battery with parallel consumers

PREREQUISITES

A dual battery system where a D250SA together with a SMARTPASS 120 charges a 100–800Ah service battery. Current is supplied from a solar panel and/or an alternator. The starter battery is charged from an alternator.

It is advantageous to use this installation when:

- The alternator is not able to deliver the desired charging voltage.
- The service battery capacity is greater than 100Ah.
- Parallel consumption takes place during charging. By connecting the consumers to the Output Consumers on the SMARTPASS 120, the service battery will be able to charge without parallel consumption and the consumers

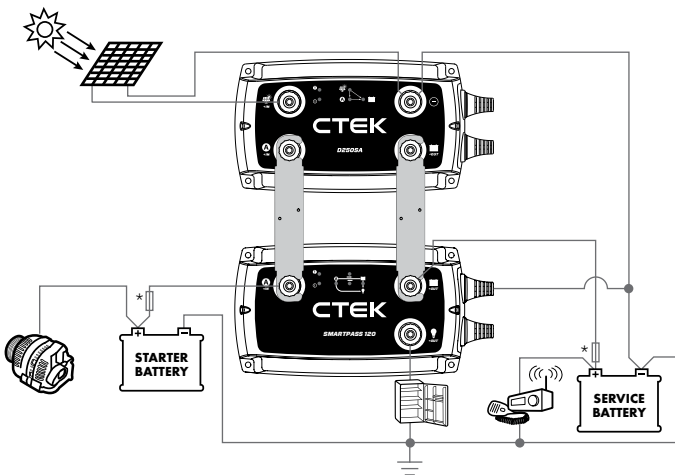
will instead be supplied with current from the alternator.

- The service battery shall be protected against deep discharge. Connect non-critical consumers to the Output Consumers on the SMARTPASS 120. Connect critical consumers directly to the service battery. SMARTPASS 120 does not in that case switch off the critical consumers when the service battery is completely discharged.

TIP 4

Connect the cabling from the starter and service batteries respectively to the SMARTPASS 120 and not to the D250SA.

See also tips 1, 2 and 3.



*See "CABLE AND FUSE RECOMMENDATIONS"

6. Connect an AC/DC charger

PREREQUISITES

A dual battery system where there is a 230/110V charger and a D250SA that, together with a SMARTPASS 120, charge a service battery with a capacity of 150–800Ah. Current is supplied from a solar panel and/or an alternator to the service battery. The starter battery is charged from an alternator.

It is advantageous to use this installation when:

- The charge from the alternator while it is charging (engine running) is not enough, so it has to be supplemented by a 230/110V charger.
- The alternator is not able to deliver the desired charge voltage.
- The service battery capacity is greater than 150Ah.

- Parallel consumption while charging is taking place. By connecting the consumers to the Output Consumers on the SMARTPASS 120, the service battery will be able to charge without parallel consumption and the consumers will instead be supplied with current from the alternator.

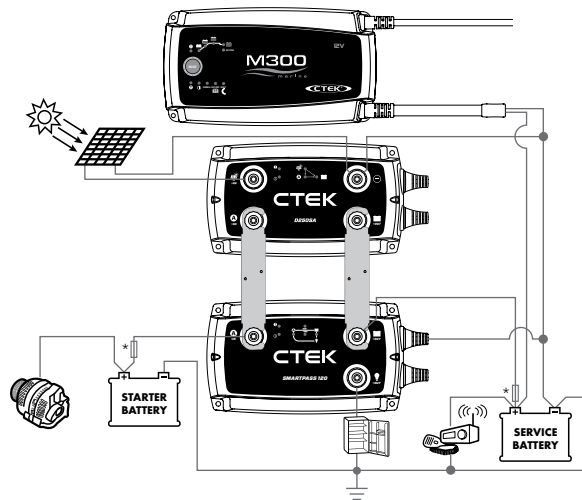
TIP 5

Connect a 230/110V charger to the starter battery if it needs charging. In that case both the starter and service batteries will be optimally charged from the 230/110V charger.

TIP 6

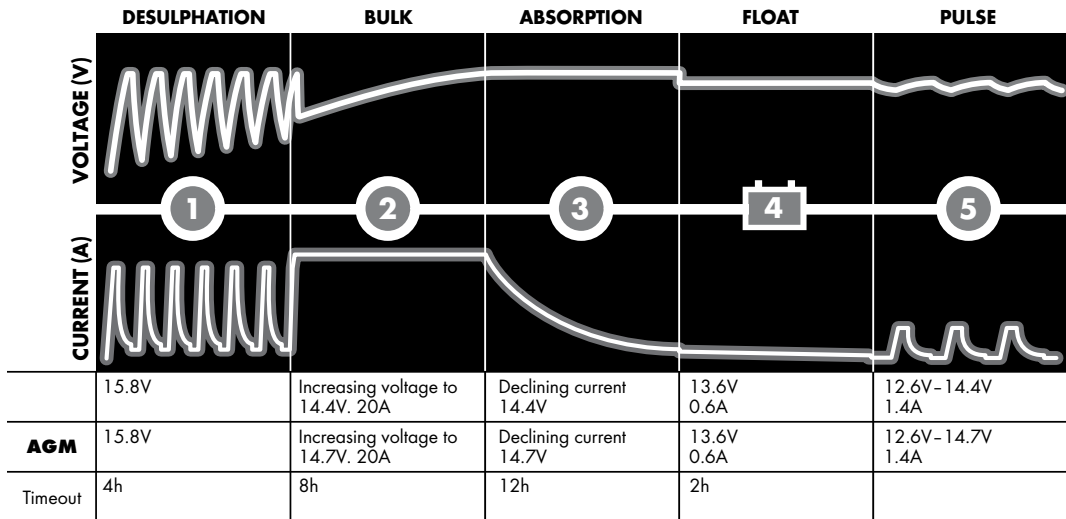
Heavy current consumers (more than 80A) must be connected directly to the service or starter battery.

See also tips 1, 2, 3 and 4.



*See "CABLE AND FUSE RECOMMENDATIONS"

D250SA CHARGING PROGRAM



STEP 1 DESULPHATION

Detects sulphated batteries. Pulsing current and voltage, removes sulphate from the lead plates of the battery restoring the battery capacity.

STEP 2 BULK

Charging with maximum current until approximately 80% battery capacity.

STEP 3 ABSORPTION

Charging with declining current to maximize up to 100% battery capacity.





STEP 4 FLOAT

Maintaining the battery voltage at maximum level by providing a constant voltage charge.

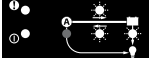
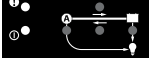



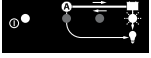

STEP 5 PULSE

Maintaining the battery at 95-100% capacity. The charger monitors the battery voltage and gives a pulse when necessary to keep the battery fully charged.

D250SA FAULT INDICATIONS

	<p>Reason: The apparatus and/or the service battery has a temperature that is too high. Recommendation: Consider moving the apparatus and/or the service battery to a cooler location.</p>
	<p>Reason: The service battery has a connection problem. Recommendation: Check the connections of the service battery and its fuse.</p>
	<p>Reason: The service battery has a connection problem. Recommendation: Check the connections of the service battery and its fuse.</p>
	<p>Reason: The service battery has a connection problem. Recommendation: Check the connections of the service battery and its fuse.</p>

SMARTPASS 120 FAULT INDICATIONS

	<p>Reason: Service battery is overheating. Recommendation: Check the service battery with a battery tester and/or check the installation.</p>
	<p>Reason: Excessive current or internal temperature too high. Charging current too high to the service battery. Recommendation: Check the service battery with a battery tester. Reduce the alternator size or connect another D250SA in parallel. The service battery is too deeply discharged.</p>
	<p>Reason: Excessive current or internal temperature too high. Too many consumers connected simultaneously. Recommendation: Consider moving the apparatus to a cooler location or reduce the use of consumers.</p>
	<p>Reason: Excessive current or internal temperature too high. Current to the starter battery too high. Recommendation: Check the starter battery with a battery tester. Replace the starter battery if the warning repeats.</p>
	<p>Reason: Excessive current or internal temperature too high. Too many consumers connected. Recommendation: Consider moving the apparatus to a cooler location or reduce the use of consumers.</p>
	<p>Reason: Battery guard activated. Service battery not charged enough. Recommendation: Charge the service battery.</p>
	<p>Reason: Start assistance activated. Recommendation: Charge the starter battery. Replace the starter battery if the warning repeats.</p>

TECHNICAL SPECIFICATION

PRODUCT	D2505A	SMARTPASS 120
Model number	1044	1058
Input	11.5–23V, 25A	11.5–23V, Max 120A (350A temporarily for 10 seconds.)
Output	Max 14.4V (14.7V in AGM), 20A	Max. 23V, 120A
Back current drain	Less than 1Ah/month	Less than 7Ah/month
Ripple*	Less than 4%	Not applicable
Ambient temperature	-20°C to +50°C (-4°F to +122°F)	
Power reduction	30°C 16A, 50°C 13A	
Temperature-compensated charging voltage	23 mV/°C from 25°C/77°F	
Battery types	All types of 12V lead-acid batteries (WET, EFB, Ca/Ca, MF, AGM and GEL)	
Battery capacity	40–300Ah	28–800Ah
Dimensions	192 x 110 x 65mm (L x W x H)	
Enclosure class	IP65 (splash and dust proof)	
Weight	0.7 kg (1.5 lbs)	
Recommended solar panel size	50–300 W	
MPPT**	Yes	No
Conventional alternator cut-in	>13.1V, for 5 sec. (engine running, alternator charging)	
Conventional alternator cut-out	<12.8V, for 10 sec. (engine running, alternator not charging) or service battery voltage > starter battery voltage	
Smart alternator cut-in	>11.8V, for 5 sec. (engine running, alternator charging)	
Smart alternator cut-out	<11.4V, for 10 sec. (engine running, alternator not charging) or service battery voltage > starter battery voltage	
Battery guard cut-in	<11.5V	
Battery guard cut-out	>12.0V	
Temperature protection cut-in	>60°C (140°F)	
Start assistance activation	Starter battery <6V	
Trickle charge starter battery	Starter battery 11.5V–12.6V.	

*) The quality of the charge voltage and charge current is very important. A high current ripple heats up the battery which has an aging effect on the positive electrode. High voltage ripple could harm other equipment that is connected to the battery. CTEK battery chargers produce very clean voltage and current with low ripple.

***) MPPT (Maximum Power Point Tracker) finds the best combination of current and voltage so that the output power is maximised.

LIMITED WARRANTY

CTEK issues this limited warranty to the original purchaser of this product. This limited warranty is not transferable. The warranty applies to manufacturing faults and material defects. The customer must return the product together with the receipt of purchase to the point of purchase. This warranty is void if the product has been opened, handled carelessly or repaired by anyone other than CTEK or its authorised representatives. One of the screw holes in the bottom of the product may be sealed. Removing or damaging the seal will void the warranty. CTEK makes no warranty other than this limited warranty and is not liable for any other costs other than those mentioned above, i.e. no consequential damages. Moreover, CTEK is not obligated to any warranty other than this warranty.

SUPPORT

Visit: www.ctek.com for support, FAQ, the most recent version of the user instructions and further information concerning CTEK products.

Technical Data

Type of Charger	8 Step, fully automatic, switch mode with maintenance charging		
Type of Batteries	12V Lead acid rechargeable batteries (WET, MF, VRLA, AGM, GEL & Calcium)		
Input Voltage AC	220V-240VAC, 50/60Hz		
Output Voltage	Nominal : 12V		
Input Current	0.65A RMS Max.		
Minimum Battery Voltage	2.0V		
Output Power	60W		
Charging Voltage	🏍️ 14.4V ± 0.25V	🚗 14.7V ± 0.25V	BOOST 16.0V
Efficiency	80%		
Charging Current	🏍️ 0.8A	🚗 5A Max.	
Ambient Temperature	-30°C to 50°C, reduced output power at higher temperatures		
Battery Capacity	1.2-120Ah (charging) up to 160 Ah for maintenance		
Housing Protection	IP65 (dust and splash proof) outdoor		
Ripple Voltage	< 2%		
Back Current Drain*	5mA		
Noise Level	< 50dB (Tested from a distance of 50cm)		
Dimensions (LxWxH)	187x63x48mm		
Weight	0.75kg		

* Back current drain is the amount of current drawn by the charger from the battery, when the charger is connected to the battery without the AC power cord connected.

Bulk Charging Times

Battery Size (Ah)	MODE	For ± 80% charge (hours)
6	🏍️ 0.8A	7
8		9
12		14

Batteries below 12Ah should not be charged with 5Amp current

20	🚗 5.0A	4
60		12
80		16
120		24

Type of Batteries

- WET - Lead Acid Flooded Battery, (can be serviced).
- MF - Maintenance Free (Sealed, cannot be serviced).
- VRLA - Valve regulated Lead Acid (Sealed).
- AGM - Absorption Glass Matt
- GEL - Gel Cell (Sealed).
- Calcium - Lead Calcium, maintenance free.

Declaration of Compliance

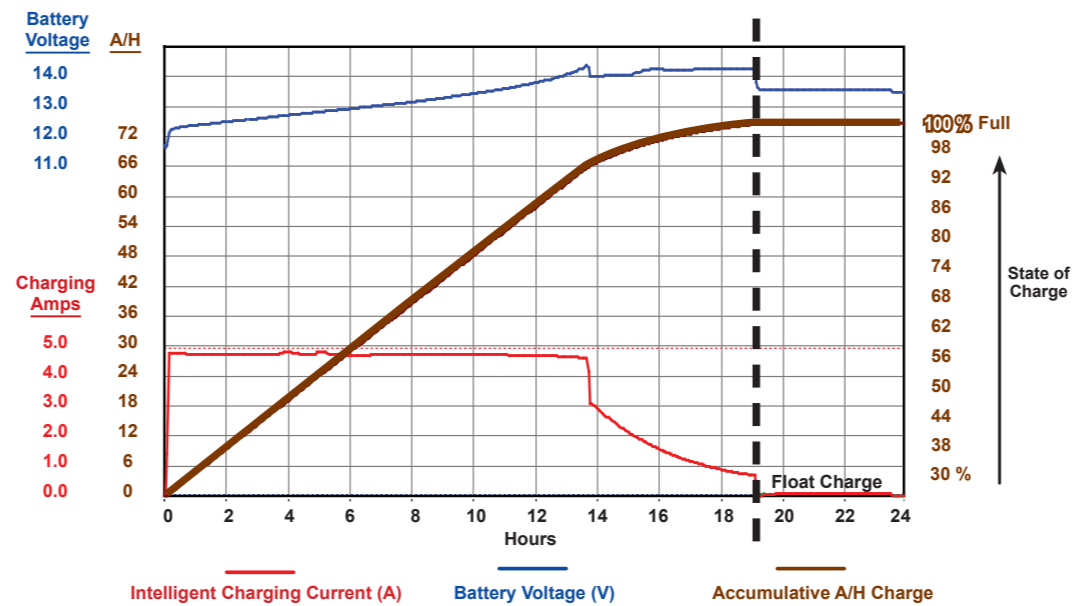
Tested and approved by and conforms to:

- EN 60335-1
- EN 60335-2-29
- EN 55014-1
- EN 55014-2
- EN 61000-3-2
- EN 61000-3-3
- EN 62233

CONTACT | +27 (0)11 452-5438 (tel) | +27 (0)11 452-5263 (fax) | info@nationalluna.com | www.nationalluna.com
 STREET ADDRESS | 34 Plantation Road | Eastleigh, Edenvale | 1609 Johannesburg | South Africa
 POSTAL ADDRESS | PO Box 8899 | Edenglen 1613 | Johannesburg | South Africa

NL - Bat Charger - B - R - Feb 2017

Data Log Graph illustrating the recharge characteristics of the National Luna 5Amp Intelligent Charger applied to a 105 A/H deep cycle battery after it was subjected to a 70% depth of discharge. (i.e. 73.5 A/H was removed from the battery and then recharged over a 24hr period).

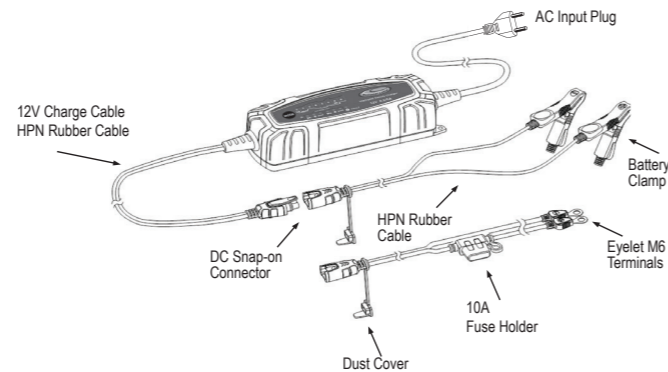


Full Charge

In the above example it can be seen that the battery took approximately 19 hours to reach maximum charge. Thereafter the charger reverts to an automatic float / maintenance state to keep the battery in peak condition.

Kit Includes / Contents of Package

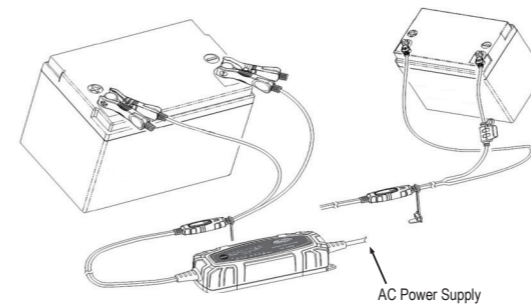
- NL 5Amp 8 Step Intelligent Battery Charger
- Quick contact battery leads with clamps
- Quick contact battery leads with eyelet terminals (Ø 6.5mm) with in-line battery protection fuse (10A) for permanent attachment to the battery posts to allow quick connection/disconnection using a snap-connector.



Charging Set-Up

Charging using battery clamps

Charging using M6 eyelets



Panel Mount Housing
 (Available as an optional extra)

A special housing has been designed to clip over the existing snap-on connector supplied with the battery charger. Simply drill the mounting holes on the panel where required.

- Ø - 27mm (Large hole)
- Ø - 3.5mm (M3 Screw)



Charges & Maintains

Flooded (WET), MF, VRLA, AGM, GEL & Calcium Batteries

A compact Dual Function 12Volt Battery Charger suitable for motorcycle, motor vehicle and Deep Cycle batteries



UNIQUE FEATURES - ONE CHARGER DOES IT ALL !

- Automatically Diagnoses, Recovers & Charges Flooded (WET), MF, VRLA, AGM, GEL & Calcium Batteries
- Unique charging and maintenance feature enhances battery life (Can be permanently connected)
- 8 Step fully automatic smart charge & maintenance program
- 1.2Ah - 120Ah (charging) up to 160Ah battery capacity
- Rescues drained batteries over 2 Volt
- Includes Quick Connect battery clamps
- Includes Quick Connect ring terminals



12V 5A



SET PDF Min Line Width .25 !!!!!

GOOD REASONS FOR BUYING A BATTERY CHARGER

To get an understanding of good battery maintenance, this document will assist the user regarding the correct charging procedures in order to prolong the life of a battery.

As a general rule, a battery should never be allowed to be left in a discharged state. (This causes unnecessary damage and greatly reduces the life of the battery).

There is a popular misconception that a battery can rapidly re-charge itself in a short space of time. (This is simply not true for most batteries). If not properly re-charged after use, irreparable damage to the battery will occur if not maintained with a full charge.

- **Motorcycle** - Typically a motorcycle is rarely used and the battery goes flat over time.
- **Boating** - When a boat is in storage the battery will naturally discharge over time.
- **Motor Vehicle** - Many motor vehicles are driven short distances on a daily basis, and the battery is never able to reach full charge.
Most vehicles are fitted with an electronic alarm system that requires power from the battery. In the event of the vehicle being left in storage and not used (i.e. being on holiday) the battery could be completely discharged, causing irreparable damage. Connecting a maintenance charger will keep the battery in peak condition.
- **Auxiliary** - When camping, an additional auxiliary battery can be used to provide power for 12Volt lighting & refrigeration. (It can take up to 24Hrs to recharge the battery back to full capacity after use).
- When a Dual Battery System is installed in a vehicle the main battery remains fully charged and only the auxiliary battery is being used (discharged). Even though the car is driven for, say 6Hrs, and the main battery is fully charged, the auxiliary battery has not had sufficient time to recharge completely.
- **Household** - Should there be a power failure at home, back-up batteries used for motorised gates, computer UPS and alarm systems would need to be re-charged.

Choosing the correct Battery Charger

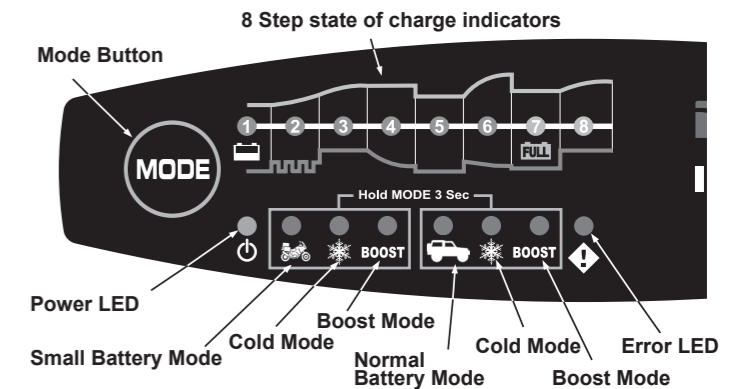
Previously the older type batteries could be serviced and the electrolyte (distilled water) added. Most common battery chargers were developed to charge these older type batteries.

Most modern batteries are of a sealed maintenance free design, and require specialised charging. The battery charger must not subject the battery to over charging (gassing) as this will deplete the electrolyte and cause damage to the battery.

Newer batteries such as Dry Cell, AGM and Gel batteries should never be charged with the older type battery chargers.

The National Luna Battery Charger is suitable for all battery types

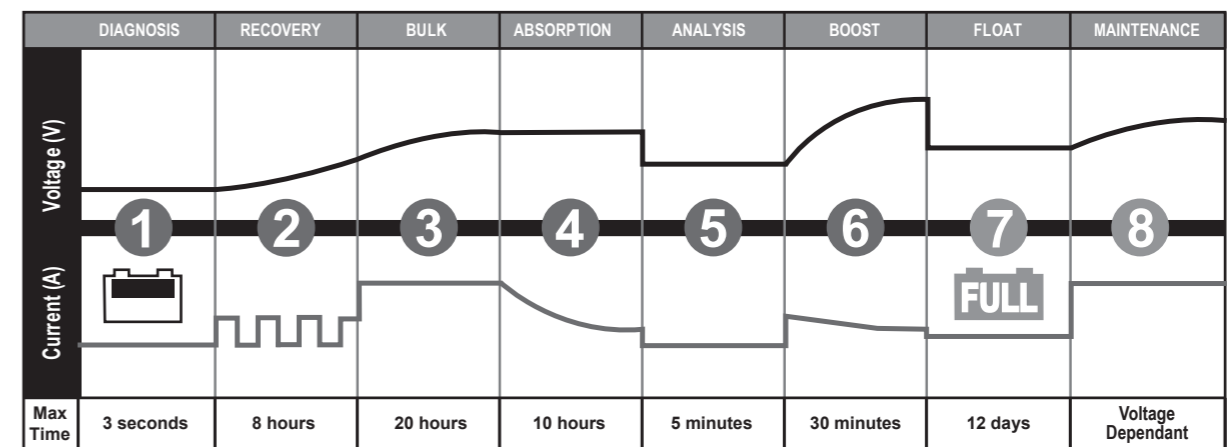
How The National Luna 5Amp Battery Charger Works



CHARGING MODES

For Batteries less than 12Ah		For Batteries greater than 12Ah	
	Mode 14.4V/0.8A This mode is suitable for batteries less than 12Ah.		Mode 14.4V/5.0A This mode is used for Flooded (WET), MF, VRLA, AGM, GEL, Deep Cycle and Calcium batteries.
	Mode 14.7V/0.8A This mode is recommended for AGM batteries less than 12Ah. This mode is also suitable for charging batteries in sub-zero temperatures.		Mode 14.7V/5.0A This mode is recommended for AGM batteries. This mode is also suitable for charging batteries in sub-zero temperatures.
	Mode 14.4V/0.8A + 16.0V/0.3A This mode is suitable to recover severely discharged batteries smaller than 12Ah. <i>(Recommended to boost at least once a year).</i>		Mode 14.4V/5.0A + 16.0V/1.5A This mode is suitable to recover severely discharged batteries. <i>(Recommended to boost at least once a year).</i>
	Mode 14.7V/0.8A + 16.0V/0.3A This mode is suitable to recover severely discharged AGM batteries smaller than 12Ah or charging in sub-zero temperatures.		Mode 14.7V/5.0A + 16.0V/1.5A This mode is suitable to recover severely discharged AGM batteries or charging in sub-zero temperatures.

THE NATIONAL LUNA NL 5Amp CHARGER PERFORMS AN 8-STEP FULLY AUTOMATIC CHARGING CYCLE



- 1) Diagnosis** : This unique diagnostic function checks the status of a battery and ascertains if the battery can accept charging.
- 2) Recovery** : A deeply discharged battery of over 2.0V can be recovered and charged with pulse charging of a small current.
- 3) Bulk** : 80% of energy is returned in this phase with maximum charging current.
- 4) Absorption** : With use of declining current technology charging up to almost 100% is achieved.

- 5) Analysis** : Checks status of charge. If battery does not retain energy, it must be replaced.
- 6) Boost** : Recovers severely discharged batteries under high voltage charge.
- 7) Float** : Battery is fully charged and ready to use.
The battery is maintained at maximum level by applying low current charge.
- 8) Maintenance Charge** : The charger continuously monitors the terminal voltage in order to determine if a maintenance charging should be initiated to keep battery fully charged. (i.e. When the charger is permanently connected).



85P PORTABLE COMPRESSOR SPORT COMPACT SERIES

PART NO. 00085



IMPORTANT:

It is essential that you and any other operator of this product read and understand the contents of this manual before installing and using this product.

SAVE THIS MANUAL FOR FUTURE REFERENCE

USER MANUAL



85P PORTABLE COMPRESSOR

Please read this instruction manual carefully prior to operating this product. Pay particular attention to the **CAUTION** and **WARNING** statements in this manual. Failure to comply with these instructions could result in personal injury or property damage. Retain these instructions for future reference.

DESCRIPTION:

This portable oil-less air compressor is designed to operate on 12 volts DC and must be plugged into a cigarette lighter power port to operate. The unit comes equipped with a pressure gauge and a 3 pc. set of inflation tips. It can be used for inflating tires, sports balls, or topping off pressure for single person tube rafts, air mats, and other uses.

85P AMP DRAW WARNING:

Most automotive cigarette lighter/power ports handle up to 15 amps. Some vehicles' power ports may have even lower amp ratings. Before purchasing and using this unit, inspect the amp draw limitations of your vehicle's power port. The 85P Portable Air Compressor requires a power port rated for 15 amps. Never replace fuses of higher amp rating beyond the original rating of the circuit. Consult your vehicle's manual for further details.

IMPORTANT SAFETY INSTRUCTIONS:

CAUTION: The compressor has been designed to provide long-term, trouble-free operation. To reduce risk of electrical shock or electrocution and to prevent damage to your compressor, follow these simple guidelines:

1. Do not disassemble. Do not attempt to repair or modify this unit.
2. Never allow children to operate this compressor. Close supervision is necessary when this compressor is being used near children.
3. This compressor will become very hot during and immediately after use.
4. Do not touch any part of this compressor with bare hands, other than the ON/OFF switch and carry handle, during or immediately after use.
5. Provide sufficient cooling time before storing the unit.
6. Never operate the compressor near fire, flammable gas or liquid.
7. There are no user-serviceable parts in this unit, no lubrication is required.
8. Do not pump anything other than atmospheric air.
9. Never use this product while sleepy or drowsy.
10. Be sure the unit's power switch is in the OFF position when not in use.
11. Use only in well ventilated areas.
12. The unit should be used only in dry environment. Protect the unit from rain, snow or other sources of moisture.
13. Never carry the air compressor by the hose or power cord.
14. Never point air nozzle towards another person or any part of the body.
15. Inflate items only to their manufacturer's recommended pressure.
16. Do not leave air compressor running unattended. It could burst tires or other items.

85P PORTABLE COMPRESSOR

FEATURES:

1. Built-In 120 PSI Pressure Gauge
2. LED Work Light/Power Indicator
3. Accessory Power Plug
4. Deluxe Carry Bag with Bright Orange Lining for Enhanced Visibility
5. 3-Pc. Inflation Tips Kit
6. Oil-Less Design
7. Gearless Direct-Drive Motor
8. Permanently Lubricated Bearings
9. Compact Size for Easy Carrying and Storage
10. Solid Brass Twist-On Tire Chuck
11. Power cord: 10 ft. / Air Hose: 3 ft.

OPERATING INSTRUCTIONS:

IMPORTANT: Engine MUST be running while using this compressor.

Before attaching air compressor's power cord to power source, check to make sure that the ON/OFF switch of your compressor is in the **OFF** position.

CAUTION: Your Portable Air Compressor is Moisture and Dust Resistant, but **NOT WATER OR DUST PROOF**. Never place compressor in soft sand while running the compressor. Vibration from the compressor will cause the compressor to settle into soft sand, resulting in compressor drawing in foreign particles. Never expose compressor to water while running the compressor.

TIRE INFLATION:

1. This compressor is designed to operate on 12 volts DC.
2. To obtain power, plug into a vehicle accessory power port.
3. Turn your vehicle engine on.
4. Attach the twist-on air chuck to the tire's valve stem.
5. Turn the compressor power switch to ON and begin to inflate tire.
6. When the pressure gauge indicates the desired pressure, switch the unit OFF and remove the air hose from the tire's valve stem.
7. To check and verify the actual tire pressure, the compressor must be in the OFF position.

Please Note: During inflation, due to air velocity, pressure gauge cannot provide accurate pressure readings, to check and verify the actual tire pressure the compressor must be in OFF position.

CAUTION: To avoid over inflation, never exceed recommended pressure. Doing so may cause articles to burst and can cause serious bodily injury. Always make sure the Portable Compressor's power cord is uncoiled and fully extended when using your air compressor to avoid overheating the power cord.

FOR ALL OTHER INFLATABLE OBJECTS, INCLUDING BICYCLE TIRES, TOYS, AND SPORTS BALLS:

IMPORTANT: Engine MUST be running while using this compressor.

1. A selection of inflation tips is provided to fit some inflatable objects.
Simply screw the appropriate nozzle into the tip of the air hose.
2. Attach the appropriate nozzle to article to be inflated and turn the power switch to the ON position.
3. When article is inflated to desired firmness, turn the compressor off. Do not over inflate.

85P PORTABLE COMPRESSOR

MAINTENANCE INSTRUCTIONS:

Turn **OFF** and unplug Air Compressor. Your air compressor is equipped with permanently lubricated, maintenance-free motor. Never try to lubricate the compressor. Use only mild soap and a cloth dampened with hot water to clean plastic parts. Avoid any type of detergents or solvents, which might contain chemicals that could damage plastic portions or painted surfaces of the compressor. All other services should be performed by a qualified technician.

MODEL 85P SPECIFICATIONS:

Part Number:	00085 / 85P
Weight:	4.30 lbs. / 1.95 kg.
Voltage:	12V DC
Max. Amp Draw:	15 amps
Max. Working Pressure:	60 PSI
Max. Duty Cycle (@ 72°F):	20 Min. @ 30 PSI
Flow Rate @ 0 PSI (13.8 Volts):	1.26 CFM
Dimensions:	9.1" (L) x 3.1" (W) x 5.6" (H)
Ambient Temperature:	-4°F ~ 158°F

LIMITED WARRANTY:

VIAIR Corporation warrants this product, when properly installed and under normal conditions of use, to be free from defects in workmanship and materials for a period of one year from its original date of purchase. To receive warranty service or repair, please contact VIAIR Corporation.

Returns should be made within one year of the date of purchase, after a Return Goods Authorization (RGA) number has been assigned by VIAIR Corporation. To obtain RGA, fax a copy of your receipt to (949) 585-0188. For complete warranty details, please visit: www.viaircorp.com/warranty

PLEASE NOTE:

THIS WARRANTY COVERS PRODUCT DEFECTS ONLY; IT DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL DAMAGES AS RESULT OF MISUSE OR ABUSE.

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TEL: (949) 585-0011 • FAX: (949) 585-0188
www.viaircorp.com

Mercury RV Water Heaters

Duoetto MK2

Aqueous MK2

DUO-10/AQU-10

*****WARNING ! *****

DO NOT power on device without water, ever. (Permanent Damage will result)

www.ausj.com.au

sales@ausj.com.au

The most up-to-date version of the manual is available at www.ausj.com.au.

QUICK INSTALLATION GUIDE: (Aqu-10)

- 1 – Mount Heater
- 2 – Connect Pressure Valve to cold, connect cold water hose.
- 3 - Connect HOT Water hose

- 4 -FILL with water check for leaks
- 5– PLUG IN Power (Standard Household Power Point 240v)
- 6– Switch on , heat up, check all hose connections for leaks.

QUICK INSTALLATION GUIDE: (DUO)

- 1 – Mount Heater
- 2 – Connect Pressure Valve to cold, connect cold water hose.
- 3 - Connect HOT Water hose

- 4 -FILL with water check for leaks
- 5 – PLUG IN Power (Standard Household Power Point 240v)
- 5a – Connect LARGE RED wire to (+) 12V Power sources. BLACK wire to negative (-)

- 5b – Connect Small RED wire to (+) 12V Power sources. BLACK wire to negative (-)
- 6 – Switch on , heat up, check all hose connections for leaks.

Thank you for your purchase of the DuoettoMK2 Dual Voltage Water Heater! This device is approved to European Quality Standards, CE, AS/NZS 60335.2.21: 2002 A1-3 and has obtained WaterMark certification. This unit is a simple system with high quality parts designed to meet your needs. Please read the instruction manual for maintenance and correct installation and operation of your heater.

Should any fittings be required for your installation, we have a range which can be viewed on our website.

1. Product Features

Intelligent

The DuoettoMK2 and Aqueous MK2 units have an advanced thermostat. This thermostat allows the water temperature to be set between 30°C and 75°C on 240VAC or 30°C and 70°C on 12VDC.

Durable and Elegant

The exterior shell is made of high quality robust material , The tank inside is made of SPCC steel & enamel.

Environment Friendly and Efficient

The polyurethane insulation provides excellent heat preservation, saving electricity by maintaining the temperature.

Multi-Functional Protection

Over-temperature cutout. Run Dry Protection. Over pressure protections all work in sync to make this a reliable and safe water heating option.

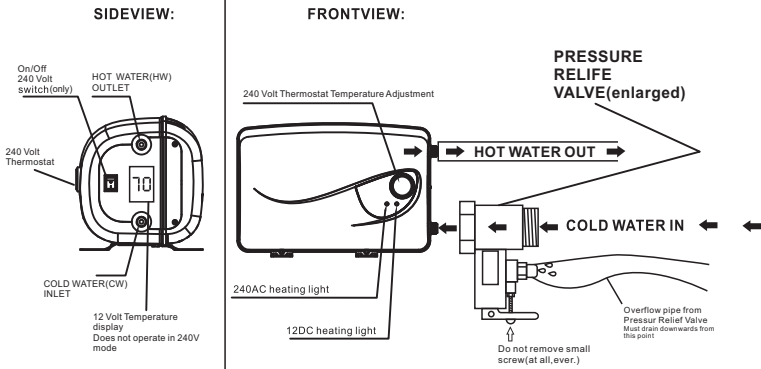
MODEL: DUO-10, AQU-10

Electric Storage Water Heater

2. Accessories and Data

The following accessories are included with your unit.

No.	Item	Quantity
1	Duoetto/Aqueous MK2water heater	1
2	Mounting brackets	2
3	Bracket bolts and washers	4
4	Self-tapping screws	8
5	Combined pressure relief valve	1
6	Owner's manual	1



3. List of Technical Parameters

	DUO-10		AQU-10
	240V AC	12VDC	240V AC
Rated Volume (L)	10L		10L
Rated Temperature (C)	30°C to 75°C	30°C to 70°C	30°C to 75°C
Rated Voltage (V)	240V AC	12VDC	240V AC
Rated Power(W)	1000W	300W	1000W
Rated Current(A)	4.2A	25A	4.2A
Rated Frequency (Hz)	50Hz		
Rated Tank Pressure(MPa)	0.85MPa / 117 psi		0.85MPa
Weight(Kg)	7.4kg		7.4kg
Dimensions(mm)	409x267x269mm		409x267x269mm
Mounting Mode	Horizontal		Horizontal

4. Safety Cautions

Electrical safety requires that this unit be earthed according to the working rules of installations of electrical goods.

The location this water heater is installed in should be able to support four times the weight of the watersystem when it is full of water (Approx. 40kg).

The water heater must be filled with water before being given power during the first use. The water heater is not allowed to heater without water (run dry).

The power socket must be earthed.

Don't handle the plug with a wet hand.

Do not operate this device if the cord, feed or plug is damaged in any fashion.

Don't replace the safety valve with any unauthorized products.

5. Installation

1 - Mounting the Heater (must be horizontal)

- Fit the brackets to the unit using the bolts and washers
- Using the supplied screws, fix the brackets to the floor/wall (you may have to predrill holes)

Warning: The wall or floor must be strong enough to support four times the weight of the heater filled with water (Approx. 40kg).

2 - Pipe Connection

- Screw the combined pressure relief /non return valve (1 part) onto the cold water inlet. (Standard ½" BSP Connection) It is recommended that you use either a liquid thread sealer or plumbers thread tape.
- **If the water pressure exceeds 85MPa = 850 kilo-pascal = 123PSI or water flows constantly from the pressure relief valve hose a pressure reducing valve must be used on the cold water inlet. (Available from plumbing stores or ausj website)**

1. 2 Connect the cold water pipe to pressure relief valve

3 – Connect hot water pipe to outlet on the unit (½" Thread BSP).

4 – Connect the overflow hose to pressure relief valve outlet and route to adequate drainage . Hose must be in continuous downward direction lower than the heater to avoid water leaks.

5 - You are now ready to turn on cold water supply and FILL the tank to check all connections for leaks. Do so.

if LEAKS = Fix them

NO LEAKS = You are ready to power on and HEAT water

6 – Plug in to 240v power outlet , switch on, adjust temperature dial to desired output temperature

7 – For 12Volt operation, connect 5mm LARGE RED wire to + (positive) and LARGE BLACK to Negative (-) to battery.

(If your battery is further away than the length of cable supplied with heater, refer to chart for suitable 12V Extension cable size. Please note a 12V 50amp fuse should be fitted at battery connection) Refer to section 9 for appropriate cable sizing.

-

8 – Connect the small black wire to earth / negative (-)

9 – Connect small red wire to switched power source. (LED display will light up)

This is crucial for 12v operation of the heater.

- Important: To avoid draining the engine crank battery, the red small positive wire must be connected to a switch or an ignition source. (Applicable for the DUO-10/12V type only).

-

6. Methods of Usage

On/Off Switch: Controls 240VAC heating. When it switches on, the 12VDC heating will not work. The water heater will be heating on 240VAC power.

DC LED: A blue light indicates 12VDC heating. It will turn off when the heater is being powered by 240VAC.

Button Function:

+/"-"button = Set the heating temperature, 1°C increments .

Display:

88

Digital display show the setting temperature and actual temperature .

Shows the setting temperature (Digital display flashes), After 5S it will show actual temperature in the tank.

Error tips

Temperature sensor open/short circuit: display shows "E1";

Thermostat: The thermostat controls 240VAC heating.

Over Temperature Protection: This protects the water heater from overheating. It disconnects a heating element at temperatures in excess of 85°C (12VDC) or 90°C (240VAC). Safety systems cannot automatically reset.

Over Pressure Protection: When the internal pressure is higher than the rated tank pressure the safety valve will automatically release pressure. It is normal that water is blown down from the pressure relief outlet.

7. Guarantee / Warranty

The guarantee on this water heater is 24 months within Australia (from the date of sale).

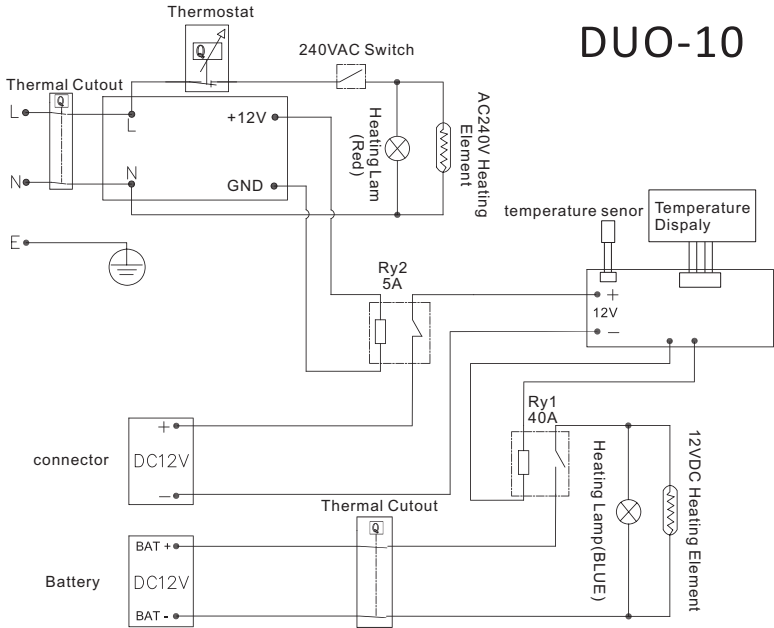
Supply of spare parts is carried out free of charge within the warranty period.

Note: Infringement of the instruction manual procedures cancels the warranty period and any complaints will not be accepted.

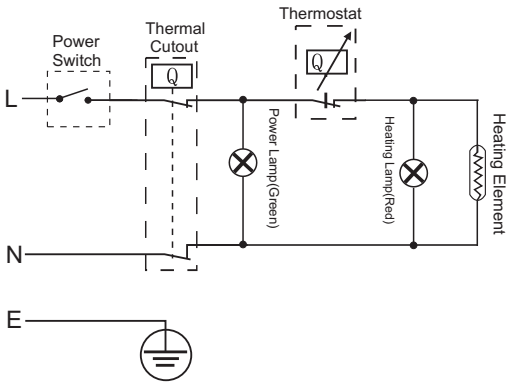
8. Circuit Diagram

Only install your appliance in accordance with any state or territory regulations with a qualified installer.

ELECTRICITY DIAGRAM



No notice to any change of the diagram



AQU-10

9. 12V DC Cable Length and Current Capacity Guide

Current, Length (Twin) to area (sq mm)

12.6VDC, current carrying capacity(CCC)(top) then follows 5% volt drop to 70 sq mm.

**Current, length (twin) to area (sq mm)
12.6V DC, current carrying capacity (CCC) (top)
then follows 5% volt drop to 70 sqmm**

		Current in amps										
		12	16	20	25	32	50	63	80	106	125	155
length, red & black metres	1	1	1.5	2.5	4	6	10	16	25	35	50	70
	2	2.5	2.5	4	4	6	10	16	25	35	50	70
	3	4	4	6	6	10	16	16	25	35	50	70
	4	4	6	6	10	10	16	25	25	35	50	70
	5	6	6	10	10	16	25	25	35	50	50	70
	6	6	10	10	16	16	25	25	35	50	70	70
	7	10	10	16	16	16	25	35	50	70	70	over
	8	10	10	16	16	25	35	50	50	70	over	
	9	10	16	16	25	25	35	50	70	over		
	10	10	16	16	25	25	50	50	70			
	11	10	16	16	25	25	50	70	70			
	12	16	16	25	25	25	50	70	over			
	13	16	16	25	25	35	50	70				
	14	16	16	25	25	35	70	70				
	15	16	25	25	25	35	70	over				
	16	16	25	25	35	50	70					
	17	16	25	25	35	50	70					
	18	16	25	25	35	50	70					
	19	25	25	25	35	50	over					
	20	25	25	35	50	50						
30	35	35	50	70	over							
40	35	50	70	over								
50	70	70	over									
60	70	over										
70	over											

LED Lighting Solutions

Dual Power Lights

Standard Range

Size (mm) LxWxH	Description	Current (mA)* Dim / Bright	Lumens	Lumens/Watt
200x30x16	9 LED Clear (10Vdc-15Vdc)	61 / 190	62 / 176	85
200x30x16	15 LED Clear (10Vdc-30Vdc)	54 / 297	67 / 353	103
300x35x16	21 LED Clear (10Vdc-30Vdc)	54 / 407	69 / 464	106
300x35x16	27 LED Clear (10Vdc-30Vdc)	83 / 530	104 / 593	104

*Current measurement performed at 12.0Vdc.

Clip-on Range (Tent-pole clip-on and 8 metre Cable)

- 9 LED Clear Lens with Battery Clamps only
- 9 LED Yellow Lens with Battery Clamps only
- 27 LED Clear Lens, Combi Plug & Battery Clamp Adapter
- 27 LED Yellow Lens, Combi Plug & Battery Clamp Adapter



Weatherproof Touch Lights

Standard Range (10Vdc-30Vdc)

IP66 Rated

Size (mm)	Description	Current (mA)* Low / Med / High	Lumens	Lumens/Watt
250x33x12	18 LED Clear	52 / 197 / 389	75 / 284 / 547	121
250x33x12	18 LED Yellow	52 / 197 / 389	61 / 235 / 456	100

Dual Colour Range

250x33x12	18+12 LED Clear/Yellow	37 / 106 / 210	17 / 58 / 90*	45
250x33x12	18+12 LED Clear/Red	36 / 103 / 205	15 / 54 / 99*	43

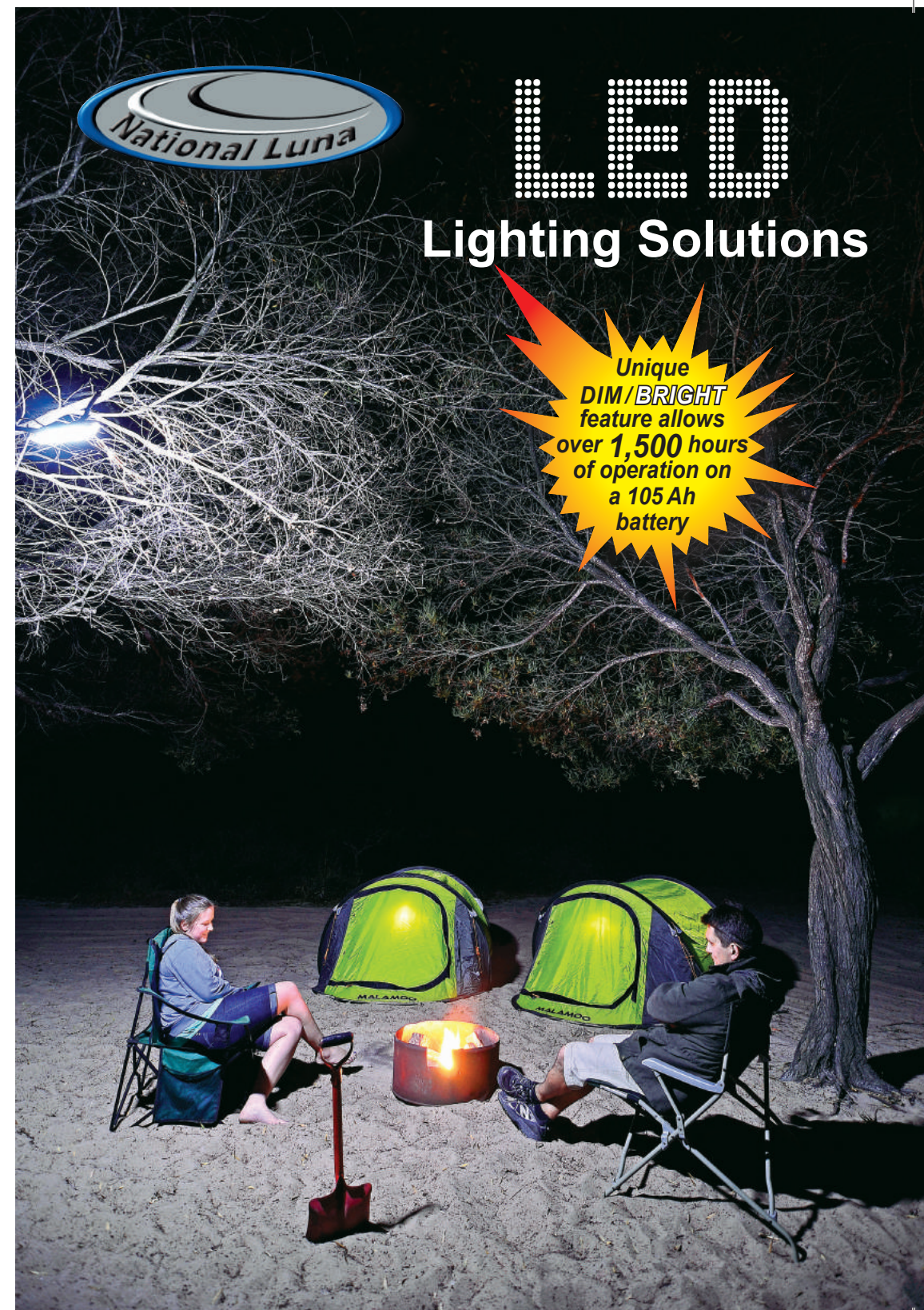
*Lumen values are based on the yellow & red colours respectively.



info@nationalluna.com
www.nationalluna.com

Manufactured

in South Africa



LED Lighting Solutions

Unique
DIM/BRIGHT
feature allows
over **1,500 hours**
of operation on
a **105 Ah**
battery



Lighting Solutions

Safe, Natural Light

These lights provide a natural white light similar to daylight without any ultra-violet or infra-red emission, making them safe and pleasant to use.

Ultimate Energy Saving

- The combination of high quality LED's and a high efficiency regulator circuit provides the best light output at the lowest power consumption.
- When other lights start to fade, these lights keep going for longer.

Anti-Glare

- A specially designed anti-glare texture combined with high-clarity polycarbonate reduces glare.
- Also eliminates UV emission and improves light distribution.
- The increase in light spread prevents eye fatigue.

Wide Operating Conditions

Efficient power regulation ensures constant light output throughout the full voltage range, resulting in cool operation and extended product life.

Quality Construction

- All models use high-quality LED's and electronic components as well as metal circuit boards for durable, trouble-free operation.
- Ultra-power models are assembled with an aluminium base for low temperature, long-term operation.

Electrical Protection

This light is protected against abnormal electrical conditions such as reverse polarity, short-circuits and surges common in electrical circuits. (Correct polarity is required for operation.)

Weatherproof Touch Lights



IP66 Rated

The new Weatherproof Touch Lights are compact, versatile LED lights that combine exceptionally high efficiency with intense brightness for any interior or exterior 12Vdc or 24Vdc application.

3-in-1 Touch Light with 'Strobe' function

The advanced touch control provides 3 brightness levels as well as a unique strobe function.

Advanced Power Management

- Power management ensures constant power and brightness over changing voltage conditions.
- Protection against unstable and varying power sources is also included.
- The automatic economy and shut-down functions further reduce power consumption in battery applications.
- The light will automatically switch to the low power function to conserve energy - eventually switching off at 10Vdc. (This prevents excessive discharge and permanent damage to a battery).

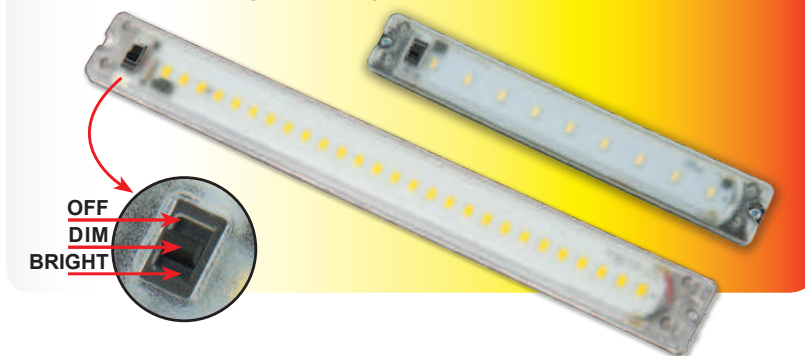
Standby Light (Find in the Dark)



The touch button is illuminated by a soft backlight when turned OFF. This standby light is useful for locating the button in complete darkness.

Dual Power Lights

Unique "Dim" - "Bright" Setting



Dual-Power 2-in-1 Function

- Select between a low and high power mode.
- "Dim" mode is perfect for ambient lighting and is the ultimate energy saver.
- "Bright" mode provides full light output, useful for wide-area lighting.

Clip-on Lead Light Option

- Clip-on versions are available for quickly attaching to poles for a non-permanent setup.
- 8 metre cables supplied with all clip-on models.

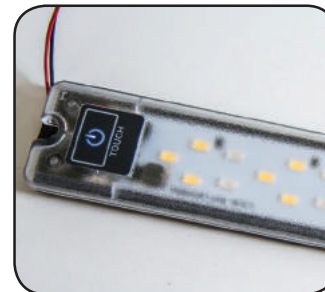
Colour Lens Option

Optional red and yellow lenses are available.



Dual Colour LED Touch Lights

In addition to the unique features of the Weatherproof Touch Light, the Dual Colour Touch Lights now offer two colour modes. (i.e. operating 18 x white LEDs or 12 x colour LEDs.)





PORTABLE REFRIGERATION



LEGACY Single Compartment Models: NL40/52/55/65/80/125

LEGACY Dual Control Models: NL50/60/72/90/110

Owner's Manual



PORTABLE REFRIGERATION

The National Luna Range of products has been designed and manufactured in South Africa since 1989.

Every product sold is of the highest possible quality, manufactured with world-class technology, marketed and serviced by a knowledgeable and dedicated team both Locally and Internationally.

National Luna Portable Refrigeration Models:

National Luna Single Compartment Models: NL40/52/55/65/80/125

National Luna Dual Control Models: NL50/60/72/90/110

This Manual is a combined publication, for National Luna **LEGACY** models manufactured from June 2019 & contains relevant information, common to all Models.

Please complete the tear-out return card to register your warranty or register online:
www.nationalluna.com

Introduction

Congratulations on the purchase of your National Luna LEGACY Portable Fridge / Freezer.

The National Luna range of portable fridges and freezers are high-performance, high efficiency refrigerators ideal for harsh conditions and applications that are limited to battery power such as off-road vehicles, caravans and solar installations.

The versatility of each of the National Luna models allows the use of a wide range of AC supply voltage (85V DC - 265V AC) as well as 12-volt or 24-volt battery power (9.6V AC - 31.5V DC).

The use of a custom-designed digital thermostat and smart control circuitry ensures temperature stability and low power consumption.

All refrigerator models are built using high quality materials, unique assembly techniques and strict testing procedures to ensure the highest level of quality and performance.

Precautions

When the refrigerator is used in an automotive application, ensure that it is secured to prevent accidental movement. The carry handles can be used with straps or tie-downs if necessary.

- A base mounting plate is optional and recommended for most applications.
- Ensure the correct type of cable and connectors are used for installation.
- Ensure that any power leads connected to the refrigerator will not be pulled or damaged by any movement of the fridge - especially where slides or drawers are used.
- Do not use a power lead that is damaged.
- Do not connect the refrigerator to a power source that does not comply with the input power specifications. (Displayed on the fridge's rear panel)
- When storing the fridge, ensure that the lid is propped open to allow for breathing. Disconnect the appliance from an electrical source. (Note: When the fridge is switched off, the interior light will still function if the unit is connected to a power source).
- Do not block or cover the ventilation holes. (During off-road conditions items may become lodged around the cooling area).

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Operating your Single Compartment Fridge

(Models: NL40/52/55/65/80/125)

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(Models: NL50/60/72/90/110)

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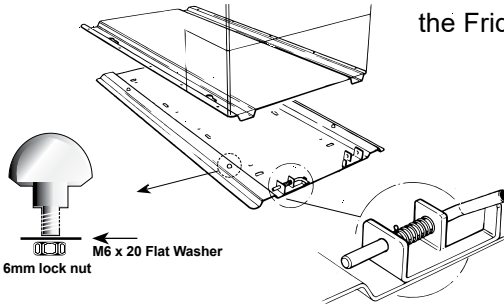
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Getting to know your portable Fridge

Securing your Fridge in a vehicle using a Base Mounting Plate

A low-profile design with locking pin, this base offers a fixed mounting position with an easy to remove mechanism. The optional base mounting plate allows the refrigerator to be securely fastened to the floor or body of the vehicle.

The unique locking design ensures that the Fridge remains fixed in position.



Securing your Fridge in a vehicle using Tie-Down Straps



The sturdy and functional carry handle has a slot into which a hold down strap can be fitted as indicated.

(Care must be taken not to over-tighten the hold-down strap when using a ratchet device.)

Air Flow

Allow a 100-200 mm gap around the refrigerator compressor area for ventilation (Airflow). The higher the ambient temperature, the more ventilation space is required for efficient airflow and cooling. (In the case of restricted airflow, the compressor will automatically shut down - see page 21 for Trouble Shooting).

Do not block or cover the ventilation holes. (During off-road conditions items may become lodged around the cooling area).

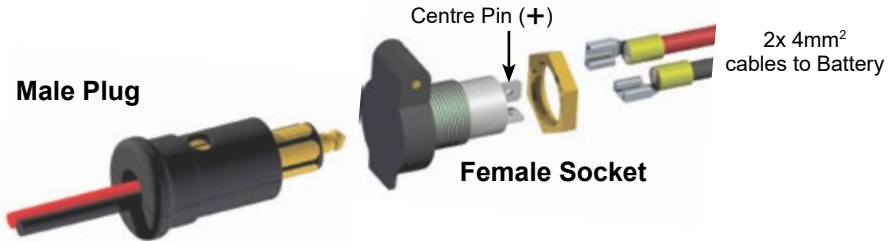


Installation Guidelines

Electrical Connections

When installing the refrigerator into a vehicle for the first time, ensure that the electrical connections to the vehicle's battery are secure and the specified wiring is used. (See wiring guidelines on page 8)

The fridge is supplied with a power lead for use with a 12 Volt DC supply. This power lead is terminated with a high-quality male plug for connection into your vehicle.



1. Install the supplied female socket into your vehicle in a convenient location.
2. Use suitable cables to connect the female socket to the vehicle's battery. (Cable thicknesses of 4mm² or greater is recommended.)

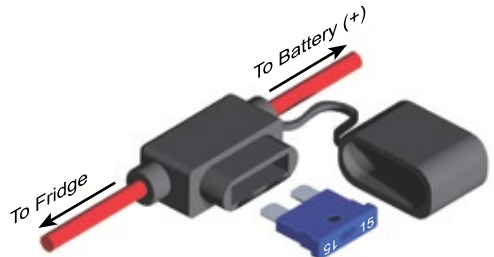


When installing electrical outlets in your vehicle, do not rely on the vehicle's body for an electrical earth path.

- If you choose to change the male plug on the DC cable supplied for a different type of plug, first ensure that all power has been disconnected.
- Split and strip the wires as required for the new plug. Take care to ensure that the correct polarity is used on the new plug and crimp the connections where possible.

Fitting an in-line fuse

Although the fridge has a built-in fuse, it is recommended to install an additional fuse on the positive wire as close to the battery as possible. This will protect against short-circuits that may occur along the length of the cable. Ensure that all connections are properly crimped and insulated.



An automotive fuse with a rating of 15A is recommended

Installation Guidelines

Connecting Power



This Fridge can accept a DC voltage ranging from 9.6V to 31.5V, as well as an AC voltage range from 85V to 265V.

The 12Vdc power input is protected with a 15A automotive blade fuse.

An AC and DC source can be connected to the refrigerator simultaneously. Under these conditions, the AC supply will be chosen as the primary power source.

If the AC supply is interrupted, the DC supply will be automatically selected and operation will continue normally. (After a 1 minute delay)

Suggested Wiring Specifications / Guidelines

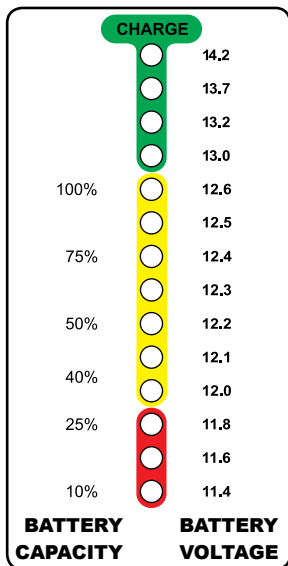
One of the most problematic issues with installing a 12 Volt refrigeration system is incorrect wiring. Most users do not understand the importance of maintaining battery voltage over the distance from the battery to the installed Fridge. While most car cigarette lighter sockets appear to be adequate, in practise a large voltage drop occurs between the socket and the car battery. This may result in the fridge shutting down as a result of a low-voltage condition.

It is recommended the following table be used as a guide to establish what cable thickness is to be used depending on the distance from the car battery to the fridge. As a rule of thumb one should use a 1.0 mm² multi-strand copper wire per meter of distance from the battery. (minimum 4mm²)

Cable Size		Max Length between battery & fridge
AWG Approximate	Cross Section mm ²	12 Volt Operation Meters
11	4	4
9	6	6
7	10	10
5	16	16

Note: Two wires (positive & negative) must be connected from the battery to the Fridge / plug point.

Battery Voltage vs Capacity



- Voltage of a battery can be an indication of its “state-of-charge”.
- The voltage-capacity relationship is most accurate when the fridge is not running and the battery temperature is at 25°C.
- By measuring the voltage, we can estimate the amount of energy remaining in the battery.
- Changes in temperature, battery age and general battery health can influence this relationship and therefore result in inaccurate capacity measurement.
- Normal battery operation takes place between 12.0 and 12.6 volts.
- Depending on the manufacturer’s specifications a normal car’s alternator charges between 13.7 and 14.2 volts.
- A battery should not be discharged below 11.8 volts as a general rule. A “deep-discharged” battery should be recharged as soon as possible to prevent permanent damage.

Low Voltage Battery Protection

The Electronic Control Unit will cut-out at the LOW / MEDIUM / HIGH selected setting. Once the compressor has cut-out, it will not restart (cut-in) until the voltage rises.

The table below reflects the set points.

Battery Protection	12 VOLT		24 VOLT	
	Cut-out	Cut-in	Cut-out	Cut-in
LOW	9.6	10.9		
MED	10.4	11.7	22.8	24.2
HIGH	11.3	12.5	24.6	26.0

Note: these values are measured at the Electronic Compressor Driver input. It is important to note that poor / thin wiring and bad connections to the battery can cause a large voltage drop. When this occurs the Fridge switches off and will re-start again on a repeat cycle “hunting”.

NOTE: When connecting the fridge for the first time, it will look at the cut-in voltage.

- If the battery protection is set on “High” the initial cut in voltage will be 12.5.
- If the battery is not fully charged the Fridge will not start. Simply select “Low” to start.
- When selecting “Low” the Fridge will operate within a voltage supply of 9.6-31.5Vdc.



When using the unit in a 24-volt application do not select battery protection “LOW” as this may completely drain the battery bank. (Causing permanent damage to the batteries)

Operating your Fridge

Dynamics of Temperature Settings

The compressor is controlled by the digital thermostat. It has a unique Multi - Speed (2,000 - 3,500 rpm) capability which makes it ideal for use in all mobile applications up to an angle of 35 degrees. It can function efficiently in extreme conditions where it is not uncommon to have ambient temperatures above 40°C.

Inner Bin / Cooling Compartment / Thermostat Control

To control temperature, the thermostat sensor must be placed in a position in order to take an accurate temperature reading.

For practical purposes National Luna has elected to place this temperature sensor behind the metal surface forming the interior compartment of the Fridge/Freezer. Thus the switching on and off of the compressor will be controlled by the compartment surface area temperature.

The inner volume of the cooling bin (i.e. core/centre temperature) will take time to “pull down” to equalise the compartment temperature. (In practice it is common that the set temperature will be within 3°C of the core temperature).

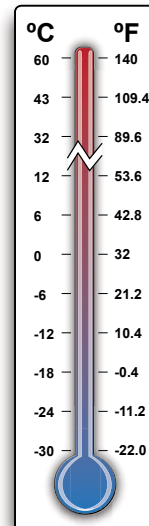
Ambient temperatures surrounding the Fridge must also be taken into consideration. Very high ambient temperatures will affect the running time of the fridge. (e.g. The Fridge will run longer to maintain or reach the target temperature setting.)

Temperature Guidelines

The following table is a guideline to setting the correct temperature range for different foodstuffs.

Recommended choice of temperatures	
Fresh fruits & vegetables Dairy products Smoked / prepared meats	3°C to 6°C
Cold beverages	0°C to 4°C
Short-term frozen meats	-6°C to -11°C
Frozen meats and fish Ice cream / frozen desserts	-18°C

Conversion Chart



Celsius vs Fahrenheit



National Luna Single Compartment Range: Models: NL40/52/55/65/80/125

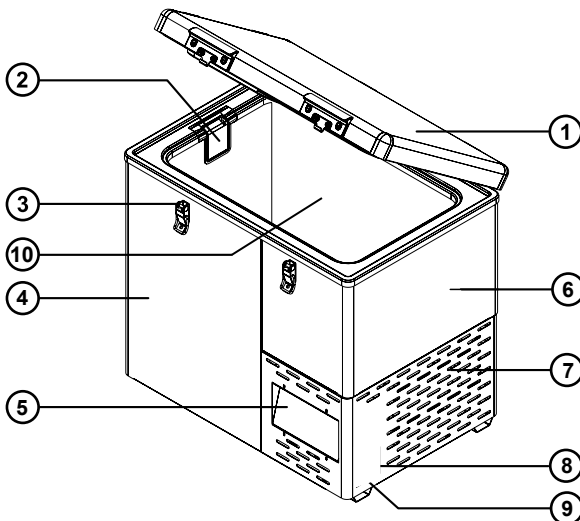
Operating your Single Compartment Fridge

Developed for performance at high ambient temperatures, minimum power consumption and high operating efficiency, these single compartment fridges are recognised as the most powerful in the world.

With the aid of an integrated electronic thermostat these units can be accurately set as a fridge or as a freezer.

Getting to know your portable Fridge

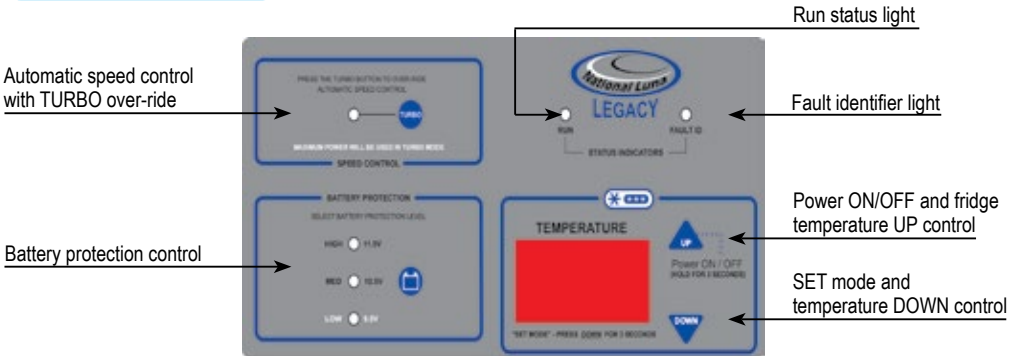
Single Compartment (NL40/52/55/65/80/125)



1. Lid
2. LED Interior light
3. Lid locking latches
4. Cabinet exterior
5. Control panel
6. Carry handles
7. Compressor area
8. AC input
9. DC input with fuse (15A)
10. Cooling Compartment
(Evaporator)

Operating your Single Compartment Fridge


Main Control Panel



On / Off Control



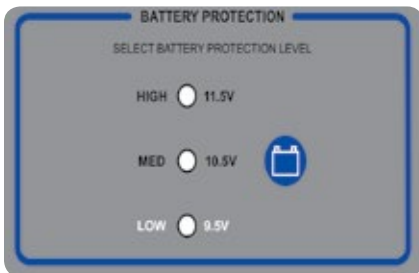
The refrigerator can be turned **ON** and **OFF** via the control panel.

Press and hold the  button for 3 seconds to turn the fridge **ON** or **OFF**.

If power to the refrigerator is interrupted, it will default to **ON** automatically.


Note: When the fridge is switched off, the interior light will still function if the unit is connected to a power source.

Battery Protection Settings



The refrigerator is equipped with a multi-level battery protection circuit.

The user has the choice of three voltage levels at which the compressor will shut down to protect against excessive battery discharge. (See page 9)

To change the protection level, press and hold the  button until the preferred level is reached.



Selecting the **“Low”** cut-out setting can cause excessive discharge resulting in damage to the battery.

Note: When changing the protection level the compressor will stop and restart 1 minute later (compressor start delay). When powered by an AC source, the battery protection level can be changed, but will only affect operation when the DC source is used.

Operating your Single Compartment Fridge

Smart Compressor Speed Control

This Fridge is fitted with a Smart Compressor Speed Control function which will vary the speed of the compressor in order to conserve power and optimise performance.



On initial plug-in, the compressor will have a one minute time delay before starting.

At the start of each cycle the Fridge will automatically run at low speed for 3 minutes to equalize gas pressure in the system.

- **Logic 1 (Setting the compartment temperature in a range of +20°C to -11°C).**

The compressor will operate at 3 speeds: low 2,000 rpm, medium 2,750 rpm and high 3,500 rpm. When the inner compartment temperature is warm, the Fridge will automatically run at full speed to bring the inner compartment temperature down as fast as possible. It will then step down to medium speed to reach the set temperature point where the fridge will then switch off. The temperature will then be maintained at low speed.

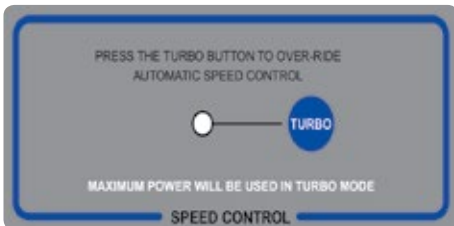
This logic makes the Fridge operate and maintain the desired compartment temperature under all ambient temperature conditions optimising performance and efficiency.

Should the temperature of the fridge contents change, such as when fresh foodstuffs are added, the compressor will automatically speed up to cool the new contents.

- **Logic 2 (Setting the compartment temperature in a range of -12°C to -30°C).**

When temperatures are set below -11°C, the Smart Compressor Control will operate at high speed to bring temperature down as fast as possible to the desired set point. Thereafter the temperature will be maintained at medium speed.

Speed Control Setting



For situations where maximum cooling power is required, press and hold the “Turbo” button until the indicator is illuminated.

This will bypass the automatic control and force high speed operation.

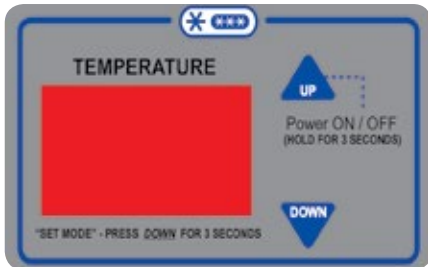
Selecting the “Turbo” mode will override the Smart Compressor Speed Control function and the unit will run at maximum speed



Using the TURBO function may increase power consumption

Operating your Single Compartment Fridge

Setting the Temperature



The digital thermostat fitted to this refrigerator allows accurate setting of the desired cooling temperatures. Temperatures can be selected between +20°C and -30°C in 1°C increments.

When powering up the fridge the first time, the temperature inside the fridge will be reflected on the display. (NOTE: the previously set temperature will be in memory)

To select the new cooling temperature, press and hold the **DOWN** button until the display starts to flash. (The previous set temperature will be displayed).

Press **UP** or **DOWN** to raise or lower the desired temperature. The thermostat will accept the new setting and exit the setting mode 10 seconds after the last button was pressed. (It will now remember the new set temperature).

The temperature display will reflect the inner compartment temperature prior to the new setting. Provided the new setting is colder, the compressor will then switch on and cool the fridge further to the set point. (During this time the run indicator light will be displayed).

Indicator Lights



Status indicators will identify the current operation of the refrigerator.

- RUN** - This indicator will be illuminated whenever the fridge Compressor is running and the compartment is being cooled.
- SOLID** - ● The Compressor is running.
- FLASH** - ● ½ second on, ½ second off... Compressor start up delay. There is a 1 minute delay before the compressor starts
- FLASH** - ● 1 second on, 1 second off... Compressor slow down cycle. The Compressor slows down to low speed before stopping (30 seconds)
- FAULT ID** - ● This indicator is used to identify fault conditions that may occur with the refrigerator such as low power supply. This indicator will flash a pre-determined number of times every 4 seconds when a particular fault occurs (see page 20).

Operating your Dual Control Fridge

The Single door / Double door fridges in this Legacy range have only one compressor, but due to National Luna's unique Dual Control technology, the fridge and freezer compartments can be set independently. This is like having two fridges in one.

Single Door (NL50/60/90)

By reducing the fridge side insulation to 42mm thickness, National Luna offers a fridge/freezer to meet the demand for maximum fridge capacity where space is limited.

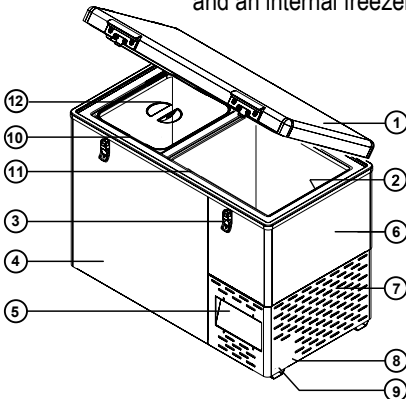
The freezer compartment has a separate internal lid. This prevents cold air escaping from the freezer when the main lid is opened, adding to the efficiency & ensuring stable temperatures within. Although the compartment temperatures can be independently set, it is recommended for the efficient functioning of the unit that the compartment with the thicker insulation (with internal freezer lid) be set as the colder freezer compartment.

Double Door (NL72/110)

The double door fridges have 2 independent lids to ensure that the minimum amount of energy is lost when opening a door. Both compartments have 60mm insulation to aid energy efficiency and this allows the compartments to be set independently without any efficiency restraints.

Single Door Range (NL50/60/90)

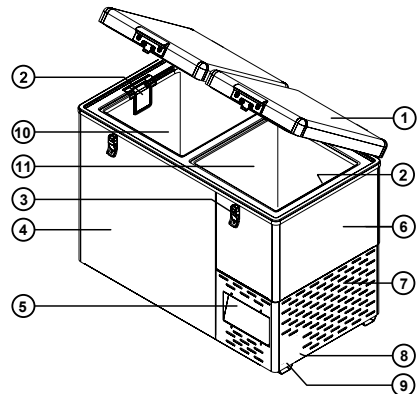
This has one lid covering both compartments and an internal freezer lid.



- 1. Lid
- 2. LED Interior light
- 3. Lid locking latches
- 4. Cabinet exterior
- 5. Control panel
- 6. Carry handles
- 7. Compressor area
- 8. AC input

Double Door Range (NL72/110)

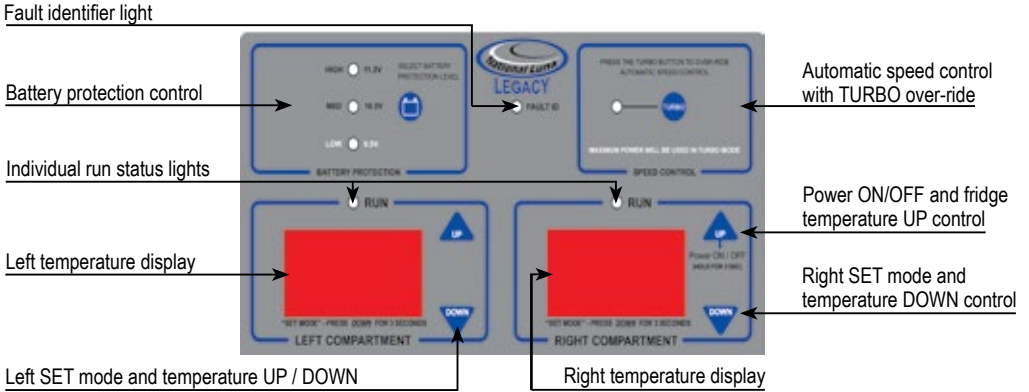
This has two lids, one for each compartment.



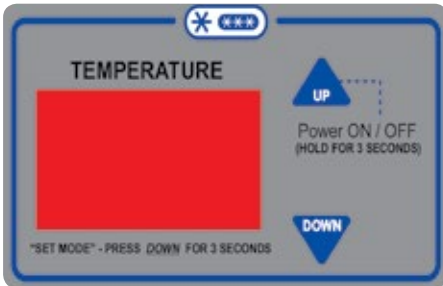
- 9. DC input with fuse (15A)
- 10. Left Compartment
- 11. Right Compartment
- 12. Internal Freezer Lid

Operating your Dual Control Fridge

Main Control Panel



On / Off Control



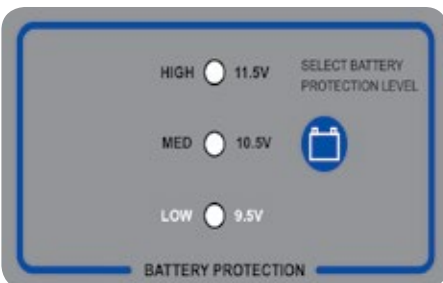
The refrigerator can be turned **ON** and **OFF** via the control panel.

Press and hold the  button for 3 seconds to turn the fridge **ON** or **OFF**.


If power to the refrigerator is interrupted, it will default to **ON** automatically.

Note: When the fridge is switched off, the interior light will still function if unit connected to a power source.

Battery Protection Settings



The user has the choice of three voltage levels at which the compressor will shut down to protect against excessive battery discharge.

To change the protection level, press and hold the  button until the preferred level is reached.

(Refer to page 9).

Whenever the battery protection setting is changed, the compressor will stop and the 1 minute compressor start delay will be active.

Operating your Dual Control Fridge

Smart Compressor Speed Control

This Fridge is fitted with a Smart Compressor Speed Control function which will vary the speed of the compressor in order to conserve power and optimise performance.



On initial plug-in, the compressor will have a one minute time delay before starting.

At the start of each cycle the Fridge will automatically run at low speed for 3 minutes to equalize gas pressure in the system.

LOW Speed:

If both compartments are set to above 0 degrees.

The compartment temperatures are within 7 degrees of set temperature.

MEDIUM Speed:

If the compartment with the coldest setting is set between 0 and -10 degrees.

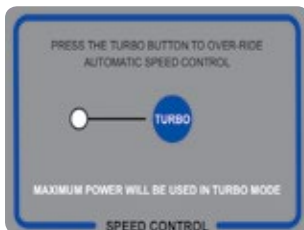
The compartment temperatures are within 7 degrees of set temperature.

HIGH Speed:

If any compartment is set to below -10 degrees.

The compartment temperature is more than 7 degrees higher than the set temperature.

Speed Control Setting



For situations where maximum cooling power is required, press and hold the “Turbo” button until the indicator is illuminated.

This will bypass the automatic control and force high speed operation.

Selecting the “Turbo” mode will override the Smart Compressor Speed Control function and the unit will run at maximum speed



Using the TURBO function may increase power consumption

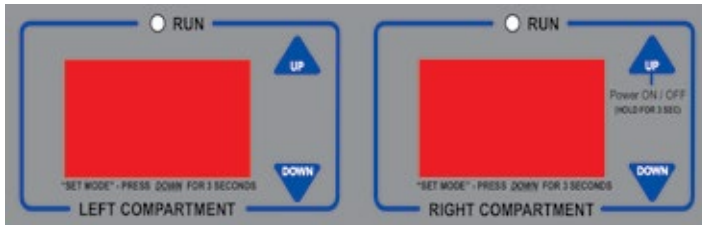
Operating your Dual Control Fridge


Setting the Temperature





NB - Set one thermostat at a time

Dual Control Refrigerators have two thermostats allowing individual temperatures to be selected for each of the cooling compartments.



To select the cooling temperature, press and hold the  button until the display starts to flash.




Press  or  to raise or lower the desired temperature. The thermostat will accept the new setting and exit the setting mode 10 seconds after the last button was pressed. The same procedure is used on both thermostat controls. (NOTE: You can only set one thermostat at a time).

Minimum Temperature Settings

National Luna Model	Left Compartment	Right Compartment
50	-18	-24
60	-24	-18
72	-24	-24
90	-24	-18
110	-24	-24

Indicator Lights

Status indicators will identify the current operation of the refrigerator. (see main control panel on page 16)

- RUN** - This indicator will be illuminated whenever the fridge Compressor is running and the compartment is being cooled.
- SOLID** - ● The Compressor is running.
- FLASH** -  ½ second on, ½ second off... Compressor start up delay. There is a 1 minute delay before the compressor starts
- FLASH** -  1 second on, 1 second off... Compressor slow down cycle. The Compressor slows down to low speed before stopping (30 seconds)
- FAULT ID** -  This indicator is used to identify fault conditions that may occur with the refrigerator such as low power supply. This indicator will flash a pre-determined number of times every 4 seconds when a particular fault occurs (see page 20).

Dual-direction Lid (Models: NL50 & NL52 only)

A special feature of the NL50 and NL52 is the ability to change the direction in which the lid opens.

The most common configuration is the front-opening direction (shown on the right).

If the application prevents the lid from opening fully or the refrigerator is installed long ways into a vehicle, it may be advantageous to use the side-opening configuration.

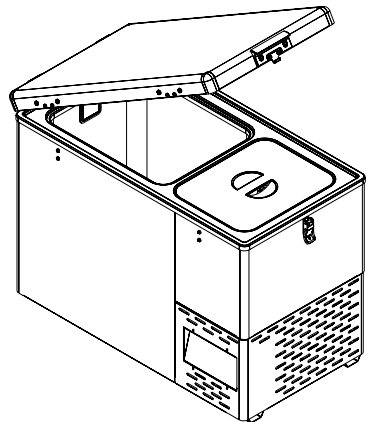
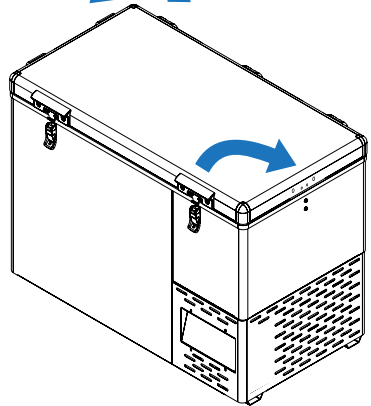
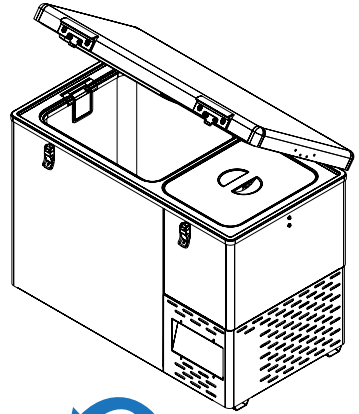
The Fridge is supplied in the front-opening configuration. In order to change the lid direction, follow these steps :

1. Close the lid. Remove both front latches and lid handles.
2. Re-fit one of the latches and lid handles to the alternative latch positions on the side of the refrigerator. (Keep the spare parts safe)
3. Remove all three hinges from the rear of the refrigerator. Also remove the hinge cover plates from the alternative hinge locations.
4. Re-fit two of the hinges on the side of the refrigerator.
5. Align the lid and ensure that it closes fully before tightening the screws.
6. Keep the spare hinge and screws in a safe place.

The Fridge will now be in the side-opening configuration

NOTE: Take care not to apply excessive pressure when locating the screws to the inside retaining nuts. (They can be pushed too far back or incorrectly angled).

Tip - The optional protection jacket has a side pocket which is ideal for keeping the spare hinge and latch parts.



Trouble Shooting

Indicator Lights

Status indicators will identify the current operation of the refrigerator.

- RUN** - This indicator will be illuminated whenever the fridge Compressor is running and the compartment is being cooled.
- SOLID** - ● The Compressor is running.
- FLASH** - ☀ ½ second on, ½ second off... Compressor start up delay. There is a 1 minute delay before the compressor starts
- FLASH** - ☀ 1 second on, 1 second off... Compressor slow down cycle. The Compressor slows down to low speed before stopping (30 seconds)
- FAULT ID** ☀ This indicator is used to identify fault conditions that may occur with the refrigerator such as low power supply. This indicator will flash a pre-determined number of times every 4 seconds when a particular fault occurs.

FAULT DESCRIPTION

NUMBER OF FLASHES

- 1 ☀ Low voltage. This is shown when the DC supply voltage is low. The battery could be flat, wiring losses are too high or there is a poor connection to the power source.
- 2 ☀ Fan over-current cut-out. There is a problem with the ventilation fan. It is possible that the ventilation fan is damaged.
- 3 ☀ Motor start error. The compressor has not started successfully. This can happen in extreme environments where the refrigerator is heavily loaded & temperature is very high.
- 4 ☀ Minimum speed error. The motor cannot maintain a minimum speed of 1900 rpm. This can be the result of an Electronic Compressor Driver failure.
- 5 ☀ Thermal cut-out. The electronic circuitry has over-heated. This happens in very hot environments. This can occur when the fridge is over-loaded with warm contents and the ambient temperature is high. The electronics will re-set when the temperature has dropped.
- 6 ☀ Electronic Compressor Driver hardware failure.

Trouble Shooting

In the event of unusual or undesired operation, consult the table below before contacting a service agent.

PROBLEM	POSSIBLE CAUSE	REMEDIAL ACTION
The fridge will not run when connected to 12V, but only when connected to 230V mains.	12 Volt polarity reversed. The battery is discharged. The DC supply has inadequate wiring, causing voltage loss. (see page 8)	Check polarity to battery is correct. Recharge the battery. Ensure all connections are secure. Ensure supply has 4mm ² wire or thicker and that the vehicle's body is not used as an earth.
The Fault ID light is flashing once every 4 seconds.	Fridge is initially connected to a battery that is not fully charged.	Select "Low" on battery protection (see page 9)
The ventilation fan is noisy or not running.	The ventilation fan is blocked or damaged. There is excessive dust or dirt build-up on the fan.	Check the ventilation fan for obstructions. Ensure sufficient space is allowed around the ventilation area. (page 6)
The Fault ID light is flashing twice every 4 seconds.	Fan damaged.	If the fan is broken, return the refrigerator to an authorised agent for repair (see page 23).
The Fault ID light is flashing three times every 4 seconds.	The compressor failed to start correctly. High pressure due to over-load or Electronic Compressor Driver failure.	Under high pressure conditions this fault will rectify itself automatically when gas pressures equalise. Continuous 3-flash conditions may require Electronic Compressor Driver replacement by an authorised service agent. (see page 22)
The Fault ID light is flashing four times every 4 seconds.	The compressor is not maintaining the correct minimum speed.	Continuous 4-flash conditions may require Electronic Compressor Driver replacement by an authorised service agent. (see page 22)
The Fault ID light is flashing five times every 4 seconds.	Compressor area is over-heated. The cooling fan is in-operative. Ambient temperature very high. Fridge over-loaded.	Check fan. Check for inadequate ventilation (see page 6) Wait for ambient temperature to drop. (see page 20)
The Fault ID light is flashing six times every 4 seconds.	Electronic Compressor Driver failure (controller detects abnormal parameters.)	Replace NL25-C3 Electronic Compressor Driver (see page 22)
The thermostat display is showing " Prf "	The internal temperature probe is faulty, damaged or disconnected.	Contact a National Luna service agent for a probe replacement.

General Maintenance

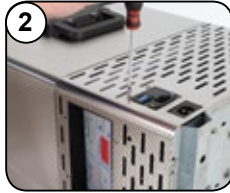
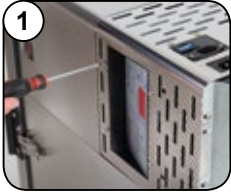


Disconnect the Power Supply

Failure to disconnect the power supply may result in electrical shock or personal injury.

Removal of Side Cover

Tip refrigerator so that the grill area is at the top. (Pic 1) Remove the screws from the face plate (4x M3 screws) and from the power inlet area (2x M3 screws - Pic 2). Then remove the screws from the base plate (6x M5 screws - Pic 3). The grill will now slide away easily. (Pic 4)



Removal of the Electronic Compressor Driver

It will be necessary to remove the colour coded wiring from the electronics using a pair of long nosed pliers (Pic 5). Using a screw driver, remove the mounting screw that holds the Electronic Compressor Driver (Pic 6). Remove the Electronic Compressor Driver and the 3 pin coupler as shown (Pic 7). When re-connecting new electronics take care to adhere to the wire colour coding. (Pic 8)

Incorrect connection may cause irreparable damage to the electronics



Replacing the DC inlet fuse

See pic 10 for DC removal and replacement of the blue 15 Amp automotive blade fuse.



Replacing the AC Power supply

Disconnect the cables and slide out the power supply to replace.



General Maintenance

Replacing the Temperature Probe

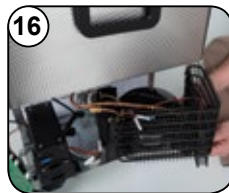
The temperature probe (Pic 11) is inserted into the refrigerator box and clips onto the face plate PCB. A soft putty compound is pressed around the probe cable to prevent condensation / water ingress. Ensure that the new probe is inserted to the same depth as the original probe.



Cleaning the Condenser / Replacing the Fan

Fluff and dust can collect around the fan and condenser area which can choke the air flow and affect the fridge performance (Pic 15).

The fan is attached to the condenser unit. In order to access the fan, the compressor has to be removed. Loosen the compressor mounting bolts (Pic 14) then proceed to swing the compressor outwards (Pic 16). Remove the fan and replace (Pic 17).



Removing & Replacing the Interior LED Light

Using a small screw driver, push up the clip that holds the LED housing in place. (Pic 19). Unclip the wires and replace the unit (Pic 20)



General Maintenance

Door Seal and Adjustment (Loose Latch Condition)

This refrigerator utilises a multi-cavity door seal which gives exceptional sealing capability. Under hot conditions, and after loading the fridge, the door could be “sucked” closed. (A vacuum is formed inside the Fridge causing difficulty to open and a temporarily loose latch condition).

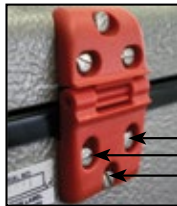


The material used tends to be soft and pliable under warm conditions and may harden during cold/winter conditions tending to retain it's compressed state.



(The door latch can be slightly loose under this condition). By carefully using a hair dryer the seal can be softened and returned to it's expanded state.

It is very simple to adjust the door lid hinges at the rear of the fridge to compensate for this “play/loose door latch condition”. Loosen the screws of the door hinges on the main body of the fridge (bottom part of the hinge) Lightly depress the back of the door lid evenly on it's length and re-tighten the screws. The door latches will now be tight.



Loosen, adjust lid,
and re-tighten screws.

Removing and Replacing Multi-Cavity Door Seal

Over time the door seal adopts and moulds/compresses itself into a fixed shape.

Simply pull the seal from a corner and remove. One can clean the seal and place it in the sun to soften the material. It can also be softened using a hair dryer to attain it's uncompressed state. Refit the seal by simply pressing it back in place.

Care and Cleaning

Your refrigerator should be cleaned in the following manner, both on installation and when defrosting. It is important that you keep the inside and outside of your refrigerator/freezer clean to prevent bacteria and odours from forming.



Remove all food and **disconnect the power source before cleaning.**

Do not use any ammonia based cleaning products as this may have an adverse chemical reaction with plastic components.

Do not dry the fridge in direct sunlight.

Interior:

Wash the interior of the refrigerator with a mild household cleaner (dishwashing liquid) or 2 tablespoons of bicarbonate of soda diluted in 250ml of warm water. Rinse with warm water and dry.

Fridge / Freezer Odours:

Place an open container of Bicarbonate of Soda into your fridge or freezer to absorb odours. Stir every two weeks and replace every two months.

Exterior:

Wash the exterior with the same solution as for the interior.

N.B. DO NOT use a garden hose to wash the refrigerator exterior as this could jet water into the electronics.

DO'S

- Routine simple and gentle cleaning
- Use cleaners showing "Suitable For Stainless Steel"
- Employ repeated Routine Cleaning rather than an aggressive single cleaning

DON'TS

- Use coarse abrasive powders
- Use metallic scourers (or brushes with metal bristles)
- Use the "Silver Cleaners"
- Use any ammonia based cleaning agents

Stainless Steel - (Grade 430)

Because of its reputation for durability, Stainless Steel is sometimes assumed to be indestructible, and therefore subjected to misuse or even abuse. Care should be taken to avoid such "abnormal" use.

- **Avoid prolonged contact with heavily spiced or salty food, raw bloody meat, some salad dressings, citrus juice (especially lemon juice), etc.**
- **Do not leave ordinary steel or cans in contact with stainless steel under damp conditions as an electrolytic reaction occurs and causes stains.**

ROUTINE CLEANING: Stainless Steel's best friends are quite simply soap, or mild diluted detergent in warm water, applied with a soft cloth or synthetic sponge. Occasionally the use of a fine synthetic scourer (green "Scotch-Brite"™) or a brush with nylon bristles may be used. Rinse well, dry with a soft cloth.



NATIONAL LUNA LIMITED WARRANTY **SOUTH AFRICA (Only)**



This National Luna Warranty supersedes any other advertised Guarantee or Warranty provided with this appliance by any wholesaler or retailer.

National Luna warrants this product to be free from defects in materials and / or workmanship under normal use and service to the original purchaser subject to the following :

1. At any time within THREE YEARS from the date of purchase by the original purchaser, National Luna will at its discretion replace or repair (the part only) without cost to the owner, through an authorised service agent, any part found to be defective by National Luna.

Where parts are replaced by an authorised service agent, the labour account for the work done will be for the owner's account.

2. This warranty does not apply to light bulbs, fuses, cooling fans or items where the length of life depends on the amount of use and care given.
3. This warranty is valid in South Africa only.
4. National Luna may consider a warranty void if modifications have been made to this appliance which may cause undesirable or hazardous operation or may be the cause of the malfunction of this product.
5. National Luna shall not be responsible for any damages of any kind resulting from incorrect voltages or faults with regards to power supply which fall outside of the appliance operating specifications.
6. National Luna shall not be responsible for damage to the appliance caused by negligent use, storage of hazardous chemicals, use of corrosive substances, fire, flood, civil-disturbances, lightning or any other natural phenomenon.
7. Warranty returns to the factory for repairs - in the event where the unit has been shipped to the factory for repairs, transport costs will be for the owners account.
8. National Luna will not accept any responsibility for the consequential loss or damage caused by, or due to the malfunctioning of this appliance.
9. National Luna shall not be held responsible for any injuries to persons caused by the incorrect or negligent usage of this appliance.
10. Repair work to be done in terms of this warranty must be referred to National Luna for written authorisation before any work is carried out.
11. National Luna reserves the right to refuse repair or service under warranty if the Warranty registration card or original proof of purchase cannot be produced.
12. Proof of purchase and purchase date must be presented with submission of a warranty claim. All refrigerators have a unique serial number.

(Removal of the serial number on the appliance will render this warranty void).

NATIONAL LUNA LIMITED WARRANTY INTERNATIONAL

This National Luna Warranty in South Africa cannot be applied outside the South African borders for practical reasons.

1. National Luna has a world wide distributor network. These distributors import products and carry the warranty (at their cost) in line with the various countries conditions of sale.
2. Cross border customs and duties apply. A National Luna manufactured product that is returned to the factory in South Africa will have the South African warranty applied. However, all transport costs incurred will be for the purchaser's account.
3. It is important to note that a private purchase of a refrigerator in South Africa and exported will not carry a warranty. Any labour repairs and parts required would incur costs in foreign currency and be for the owner's account.
4. In the event of a National Luna refrigerator being fitted as standard equipment in caravans and trailers and subsequently being exported from South Africa, the warranty must be carried by the persons responsible for importing into a country other than South Africa.
5. It is recommended that National Luna products be purchased from the authorised importer of that particular country who would carry the applicable warranty and back-up service.



8 YEAR LIMITED COMPRESSOR WARRANTY



1. The National Luna compressor has a 3-year manufacturer's warranty.
2. Correct completion and submission of the Warranty registration card supplied with this booklet allows for an additional 5-year warranty to be provided by National Luna on the compressor.
3. The warranty applies only to household & leisure use.
4. This extended warranty does not cover the product when used in a commercial application.
5. National Luna will at its discretion replace or repair (the part only) without cost to the owner, however, **the labour account for the work done will be for the owner's account.**

For tracking and warranty purposes, please fill in the information below:

Serial No : _____

Dealer's name / Stamp:

Model : _____

Date purchased : _____

Invoice No : _____



PORTABLE REFRIGERATION



Safety Precautions

The appliance 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 being supervised must not to play with the appliance.
- Appliance shall not be exposed to rain
- Do not store explosive substances such as aerosol cans with a flammable propellant in appliance.
- This appliance is intended to be used in:
 - Staff kitchen areas in shops, offices and other working environments
 - Farm houses and by clients in hotels, motels and other residential type environments
 - Bed and breakfast type environments
 - Catering and similar non retail applications.
 - Suitable for camping use

Disposing of your Old Appliance

Electrical and electronic appliances often contain materials which, if handled or disposed of incorrectly, could be potentially hazardous to human health and to the environment. They are, however, essential for the correct functioning of your appliance. Please do not therefore dispose of it with your household waste. Please dispose of it at your local community waste collection / recycling centre and ensure that it presents no danger to children while being stored for disposal. The plug must be rendered useless and the cable cut off directly behind the appliance to prevent misuse. Take care not to damage the pipework at the back of it before or during transportation to an authorised collection depot. In this way, refrigerant in the pipework and oil in the compressor will be contained, and will not leak out into the environment.

SANS 60335-1:2018 Ed 3,1
IEC 60335-1:2016 Ed 5,1

SANS 60335-2-24:2014 Ed 5,1
IEC 60335-2-24:2012 Ed 7,1



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